

**Advising modifiable lifestyle changes and
public health. The role, knowledge, and
education of UK optometrists.**

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Doctor of Optometry

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Thesis Abstract

Advising modifiable lifestyle changes and public health. The role, knowledge, and education of UK optometrists.

Nicola Julie Milhench, Doctor of Optometry, 2023

Improvements in life expectancy are starting to stall, which is accompanied by a reduction in quality-of-life due to the effect of non-communicable diseases (NCD) (Raleigh, 2021) and eye conditions. Many of which can be improved by modifying lifestyle choices (JBS3,2014). UK government initiatives have been designed to address this growing healthcare concern (Patel *et al.*, 2020).

People visit UK optometrists when they are in good and poor health, including those who do not see a general practitioner. A person's risk of NCDs and eye conditions can be identified via questioning during a routine sight test (The College of Optometrists, 2021). Currently this information is not routinely used beyond the association with the eye examination.

One ongoing UK government initiative, Making Every Contact Count, encourages primary care healthcare professionals to discuss modifiable lifestyle changes (Public Health England, 2016) with patients. The optometric profession does not have specific guidelines for modifiable lifestyle change counselling, therefore the overall aim of this thesis was to determine if optometrists have the skills and knowledge to advise patients in this way and whether it is appropriate for them to do so.

The findings from the systematic review indicated no previous study had assessed these questions regarding UK optometrists. In the present study the NUTCOMP questionnaire, adapted for UK optometrists, indicated a lack in confidence and competence regarding lifestyle modification counselling, an agreement it was within their scope of practice and a desire for further education. A Delphi Analysis to investigate the preferred methods of learning by UK optometrists, indicated a desire for multi-faceted education with in-person and on-line learning both in theory and practice. Therefore this thesis has identified that with appropriate support and training optometrists could have the skills and knowledge to participate actively in modifiable lifestyle change counselling.

Key words: Optometry, nutrition, smoking, non-communicable diseases, curriculum, NUTCOMP, Delphi Analysis.

Dedication

To C.M, E.M, and G.M.

Acknowledgements

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My heartfelt thanks go to my family, who, without their support I would not have been able to complete this thesis. In particular I wish to thank my husband and mother and my two boys, Elliott and George who have been supportive and understanding beyond their years.

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List of Abbreviations

ABDO	Association of British Dispensing Optometrists
af	All Fields
AHRQ	Agency for healthcare Research and Quality
AIO	Association of Independent Optometrists
ALA	Alpha-linolenic acid
AMD	Age-related Macular Degeneration
AOP	Association of Optometrists
AREDS	Age related eye disease study
BMI	Body Mass Index
BSc	Bachelor of Science degree
CET	Continuing education training
CI	Confidence Interval
CINAHL	Cumulative Index to Nursing and Allied Health Literature
CNV	Choroidal neovascularisation
CoO	College of Optometrist
COVID-19	Coronavirus Disease
CPD	Continuing professional development
CVD	Cardiovascular Disease
DED	Dry Eye Disease
DEQ	Dry eye questionnaire
DEW	Dry Eye Workshop
DHA	Docosahexaenoic acid
Dip Tp	Professional Diploma in Therapeutics
DM	Diabetes Mellitus
DR	Diabetic Retinopathy
EBSCO	Elton B. Stephens Co

EFSA	European Food Standards Agency
EHEW	Eye Health Examination Wales
EPA	Eicosapentaenoic acid
FAF	Fundus autofluorescence
FDA	Food and Drugs Association
FQ	Fully Qualified
GI	Glycaemic Index
GOC	General Optical Council
GOS	General Optical Service
GP	General Practitioner
HBP	High Blood Pressure/ Hypertension
HDAS	Healthcare Database Advanced Searches
HDL-C	High-density Lipoprotein Cholesterol
HLOP	Healthy Living Optical Practice
ICS	Integrated Care System
IOP	Intraocular pressure
IP	Independent prescriber
JBI	Joanna Briggs Institute
LDL-C	Low-density Lipoprotein Cholesterol
LHS	Life and Health Sciences
LOC	Local Optical Committee
LOCSU	Local Optometric Committee Support Unit
MECC	Making Every Contact Count
MECS	Minor Eye Conditions Service
MOptom	Master of Optometry
MSc	Master of Science degree
NCD	Non-Communicable Disease
NHS	National Health Service
NHSHC	National Health Service Health Check

NICE	National Institute for Health and Care Excellence
NIH	National Institute of Health
NUTCOMP	Nutrition Competence
OCT	Optical coherence tomography
OR	Odds Ratio
OW	Optometry Wales
PCOS	Polycystic ovary syndrome
PhD	Doctor of Philosophy
PICo	Population, Interest, Context
PIS	Participant Information Sheet
Prof. Cert. Diabetes	Professional Certificate in Diabetes
Prof. Cert. Glaucoma	Professional Certificate in Glaucoma
Prof. Cert. Low Vision	Professional Certificate in Low Vision
Prof. Cert. Med. Ret.	Professional Certificate in Medical Retina
Prof. Cert. Paediatrics	Professional Certificate in Paediatrics
Prof. Dip. Glau	Professional Diploma in Glaucoma
Prof. Higher Cert. Glaucoma	Professional Higher Certificate in Glaucoma
QALYs	Quality-adjusted life years
RAO	Retinal artery occlusion
REC	Research Ethics Committee
RNIB	The Royal Institute for the Blind
RPE	Retinal pigment epithelium
RSPH	Royal Society for Public Health
RVO	Retinal vein occlusion
STEMI	ST-segment elevation myocardial infarction
T1DM	Type One Diabetes Mellitus
T2DM	Type Two Diabetes Mellitus
TBUT	Tear break up time
TFOS	Tear Film and Ocular Surface Society

UK	United Kingdom
UKNHCC	UK Nutrition and Health Claims Committee
USA	Unites States of America
UV	Ultraviolet
VA	Visual Acuity
WCO	World Council of Optometry
WECS	Welsh Eye Care Services
WHO	World Health Organisation

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Chapter 1 - The current situation in the UK regarding optometry, non-communicable diseases, ocular conditions, and government initiatives.

Members of the public visit an optometrist in both good and poor health for advice regarding their eyes and ocular health. Optometrists can detect signs of non-communicable diseases (NCD) within a routine sight test. The effects of NCDs can lead to a reduction in quality of life (Raleigh, 2021) and the risk and effect of some NCDs can be reduced with modifications to lifestyles. This chapter reviews the current literature to detail the role of optometrists in the UK and the rest of the world, the types of NCDs and ocular conditions that affect large proportions of the population, and the strategies that have been adopted by the UK government to address the effect of NCDs on the population.

1.1 The role of Optometrists

Optometry is an autonomous and statutory regulated healthcare profession involved in the services and care of the eye and visual system, and the enhancement of visual performance (Millodot, 2000). In the United Kingdom (UK), ophthalmic opticians, which are also referred to as optometrists, are primary care professionals within the community, trained to recognise abnormalities and health conditions of the eye, prescribe and fit glasses and contact lenses, and if necessary, refer to a general practitioner (GP) or hospital eye clinic for further investigation (The College of Optometrists, 2021). Many people who may consider themselves in good health will visit an optometrist, especially after the age of 40 years, even if these people may not regularly visit their GP, often despite governmental strategies for five-yearly health checks being encouraged for this age group (Patel *et al.*, 2020).

Around the world optometrists have varying levels of training and responsibility. The World Council of Optometry (WCO) has previously produced a definition of the different levels of optical services ranging from entry level one and increasing in complexity up to level four (Naroo and Grit, 2009). They have also identified the level individual countries work within (Thomas *et al.*, 2011). In the UK, optometrists work at level four of these standards (Shneor *et al.*, 2021). The WCO define level four as 'Ocular Therapeutic Services - dispensing, refraction, prescription, diagnosis of eye disease using diagnostic drugs, and treatment of eye disease using therapeutic drugs' (Naroo and Grit, 2009). Level four is currently the highest level defined by the WCO (Naroo and Grit, 2009), although Kiely and Chappell (2015) reported American optometrists could lead to a further level, level five, because some take on minor surgeries and administer injections (Kiely and Chappell, 2015). Level one is classed as 'Optical Technology Services' and includes dispensing (Naroo and Grit, 2009). Dispensing is the practice of fitting and supplying spectacles and low vision aids considering a patient's lifestyle, vocation, and vision (Association of British Dispensing Optometrists, 2019). Level two is 'Visual Function Services' which is defined as level one with the addition of refraction (measuring and correcting the dioptric power of an eye (Millodot, 2000)) and prescription (Naroo and

Grit ,2009). Level three is 'Ocular Diagnosis Services' with two sub-categories, 'without drugs' which develops level two to include screening for eye disease and 'with drugs' which develops level two to include diagnosis of eye disease using diagnostic drugs (Naroo and Grit, 2009). Lastly, level four is 'Ocular Therapeutic Services' which is level three with the addition of the '*use of pharmaceutical agents and other procedures to manage ocular conditions/disease*' (Naroo and Grit, 2009).

Optometrists in the UK are therefore equipped and trained to detect ocular changes relating to certain systematic conditions, on some occasions these changes can be detected before the patient is aware they have the condition, for example type two diabetes mellitus (T2DM). UK optometrists are also trained to detect eye conditions, some of which can be caused by lifestyle and environmental factors.

1.2 Chronic conditions affecting the ocular system.

1.2.1 Diabetes Mellitus

Diabetes mellitus (DM) is a metabolic disease (Hyman *et al.*, 2014; American Diabetes Association, 2003) primarily with disorders of metabolism of glucose (Millodot, 2000; American Diabetes Association, 2003a), as well as lipid and protein metabolism (Bartlett *et al.*, 2008), which can lead to abnormalities in multiple organs (Bener *et al.*, 2018) in the form of long-term complications of diabetes. Poor glycemic control and longer disease duration leads to an increased risk of microvascular disease, affecting the kidneys (nephropathy), eyes (retinopathy) (Lian *et al.*, 2019) and limbs (neuropathy) (American Diabetes Association, 2003b; Bartlett *et al.*, 2008; Ali *et al.*, 2013; Nathan *et al.*, 2019) and macrovascular disease with the cardiovascular (Nathan *et al.*, 2019), cerebrovascular and peripheral vascular systems affected (Brownlee, 2001; American Diabetes Association, 2003b; Ali *et al.*, 2013; Lian *et al.*, 2019).

There are multiple types of DM, with the most prevalent two being type one and type two DM. Type one diabetes mellitus (T1DM) typically has an onset in childhood and the patient is dependent on insulin (Millodot, 2000) and T2DM, which usually occurs later in life and is associated with obesity (Millodot, 2000). T2DM can be treated with lifestyle and diet, or lifestyle, diet and medication including insulin (NICE, 2022a). Both T1DM and T2DM can affect the eye with diabetic retinopathy (DR), diabetic maculopathy, rubeosis, xanthelasma, ptosis (Millodot, 2000), cataract (Millodot, 2000; National Eye Institute, 2022), and open angle glaucoma (National Eye Institute, 2022). The focus of this study is regarding lifestyle modifications and chronic or ocular conditions, therefore T2DM is more relevant to this study.

The Blue Mountains Eye Study (Mitchel *et al.*, 1998) reported a prevalence of DR of 35.7% in those with known T2DM and 15.8% in those who were unaware that they had T2DM. Diabetes was the cause for certificate of visual impairment (CVI) registration in three per 100,000 people aged over 12 in 2017/18 (Rahman *et al.*, 2020).

Optometrists play an important role for patients when considering diabetes. DR can be asymptomatic, and the first signs of diabetes could be detected by an optometrist. As part of a routine sight test optometrists normally enquire about general health, medication, family history (The College of Optometrists, 2021), ethnicity, gender, and age, this information can help identify those at greater risk of developing diabetes (Gray *et al.*, 2010) see table 1.2.1.

Table 1.2.1 - Risk factors for type two diabetes in alphabetical order.

Factor	Associated risk
Age	Risk increases over 25 if you are African-Caribbean, Black African, Chinese or South Asian. Risk increases over 40 if you are white. (Fletcher, 2002)
Diet	Low fibre, high glycaemic index (GI) can cause a rapid increase in blood glucose levels and may increase the risk of being overweight or obese. (NICE, 2023). Overweight and obese are defined by the World Health Organisation (WHO) as ' <i>abnormal or excessive fat accumulation that may impair health.</i> ' (WHO, 2021a). Overweight is calculated to be a BMI of 25 to 29 and obese is a BMI of 30 and over (WHO, 2021a)
Ethnicity	Increased risk in people of South Asian descent and African-Caribbean or Black African descent. (Fletcher, 2002)
Family History of DM	More likely to get T2DM if a primary relative has DM. (Fletcher, 2002)
Gestational diabetes	A history of gestational diabetes increases a woman's risk of DM seven times. Children born to mothers with gestational diabetes are six times at risk of developing DM (NICE, 2023)
Heart attack or Stroke	These conditions share common risk factors and having a heart attack can increase your risk for T2DM (NICE, 2017b)
Hypertension	You have an increased risk of you have ever had high blood pressure (Fletcher, 2002; Bellou, 2018)
Metabolic syndrome (a group of risk factors for cardiovascular disease (CVD) and T2DM commonly occurring together (Alberti, 2009))	Commonly associated with insulin resistance (NICE, 2023)
Obesity, high waist measurement and inactivity	Increases risk of T2DM (Fletcher, 2002; NICE, 2023; Bellou, 2018)
Polycystic ovary syndrome (PCOS)	Can increase risk of T2DM (NICE, 2023)
Smoking	This is associated with a higher risk of T2DM (Bellou, 2018)

Some optometrists may also ask about diet, alcohol intake, smoking and sleep patterns, which could help to calculate a patient's risk factors for developing DM and diabetic eye disease. DM can affect the cerebrovascular system (Brownlee, 2001; Church, 2003; Ali *et al.* 2013; Lian *et al.* 2018) in the form of a transient ischaemic attack (TIA) (mini-stroke), which can present with a loss of vision and potentially asymptomatic visual field loss, therefore an optometrist also has a role in identifying those at risk of a stroke (Miller, 2020), be it from DM or otherwise and refer them appropriately.

It is well recognised that improved glycemic control is associated with a reduction in the onset and progression of microvascular complications (American Diabetes Association, 2003; Nathan, 2019) with evidence that reducing blood pressure (BP) (American Diabetes Association, 2003) and reducing cholesterol, reduce the incidence of vascular diseases (Cholesterol Treatment Trialist's (CTT) Collaborators, 2010). These three factors can be helped by the food and lifestyle choices we make, for example a healthy diet, alcohol consumption, smoking, inactivity (JBS3, 2014a; NHS, 2022a), and caffeine consumption (NHS, 2019a). Guidelines for individuals regarding modifiable risk factors are available from Diabetes UK (Dyson *et al.*, 2018) and National Institute for Health and Care Excellence (NICE) (NICE, 2022a). Guidelines for health professionals are produced by Scottish Intercollegiate Guidelines Network (SIGN) (SIGN, 2017) and NICE (NICE, 2022a), The College of Optometrists have not produced any specific diabetic modifiable lifestyle guidelines for optometrists.

1.2.2 Hypertension

Hypertension/ high blood pressure (HBP) is defined as systolic blood pressure higher than 140mm Hg or a diastolic pressure more than 90mm Hg (JBS3, 2014a; Public Health England, 2020a; NICE, 2022b) and if untreated can increase the risk of heart disease (Erden and Bicakci, 2012; Kjeldsen, 2018; NHS, 2019a; Public Health England, 2020a; Tackling and Borhade, 2022), heart attacks (Erden and Bicakci, 2012; NHS, 2019a; WHO, 2021b; Tackling and Borhade, 2022), strokes (Erden and Bicakci, 2012; Kjeldsen, 2018; NHS, 2019a; Public Health England, 2020a; WHO, 2021b), kidney disease (Erden and Bicakci, 2012; Kjeldsen, 2018; NHS, 2019a; Public Health England, 2020a), heart failure, peripheral arterial disease, aortic aneurysms, vascular dementia (NHS 2019a) and hypertensive retinopathy (Erden and Bicakci, 2012).

HBP is prevalent in one-third of United States of America (USA) adults (Tackling and Borhade, 2022), 26.2% of United Kingdom (UK) adults (Public Health England, 2020a) and around 30%-45% in different European countries (Kjeldsen, 2018). There are some factors that increase the risk of HBP that individuals cannot change, for example, age, ethnicity, family history, medical conditions, and medications (NHS, 2019a) and these are often asked about in a routine sight test to help identify an individual's risk of hypertensive retinopathy. There are other risk factors that can be altered by

lifestyle choices that are made, for example diet (too much salt, not enough fruit and vegetables, too much caffeine increase the risk), weight (being overweight/obese increases risk), exercise (not enough can increase the risk), alcohol (too much increases risk), smoking (this increases the risk), and sleep (not getting enough or having disturbed sleep) (NHS, 2019a). Apart from smoking, which must be asked about in Scotland the other factors are not always asked about in a routine eye examination.

In a routine eye examination, an optometrist has a unique view of the vascular system that cannot be seen in other parts of the body. The direct view of the blood vessels in the retina can highlight the extent and duration of hypertension (Tackling and Borhade, 2022) with two-thirds of hypertensive patients showing signs of retinopathy (Erden and Bicakci, 2012). The clinical signs include narrowing or constriction of retinal arterioles, tortuosity of retinal arterioles, sclerosis, haemorrhages, exudates, cotton wool spots, papilloedema and retinal oedema (Kanski, 2002; Erden and Bicakci, 2012; Tackling and Borhade, 2020), with the early signs being present when the patient is asymptomatic. Therefore optometrists and a routine sight test can lead to a referral for suspect HBP, to be confirmed by sphygmomanometry, which is more reliable and specific at diagnosing HBP than ophthalmoscopy (Schubert, 1998).

1.2.3 Cardiovascular diseases (CVDs)

CVDs are a group of conditions affecting the heart and the vasculature leading to 32% of all global deaths of which 85% were due to heart attack and stroke (WHO, 2021b) and is '*one of the main causes of death and disability in the UK*' (NHS, 2022b). There are many shared common risk factors with T2DM and CVD, both in terms of stroke and heart attack (JBS3, 2014a) and as reported in Chapter 1.2.2, hypertension is a risk factor for CVDs (Erden and Bicakci, 2012; JBS3, 2014a; Kjeldsen, 2018; NHS, 2019a; Public Health England, 2020a; WHO, 2021b; Tackling and Borhade, 2022). As with HBP and T2DM there are modifiable risk factors, for example unhealthy diet (JBS3, 2014a; WHO, 2021b), high cholesterol (JBS3, 2014a), physical inactivity, smoking (JBS3, 2014a; WHO, 2021b) and harmful use of alcohol (WHO, 2021b) and other factors that cannot be changed, for example family history, ethnicity, age and sex (NHS, 2022b). The buildup of fatty deposits within the arteries that can lead to CVD can also affect the eyes (NHS, 2022b) in the form a retinal vein occlusion (RVO) (Yau *et al.*, 2008; Scott, 2020) or retinal artery occlusion (RAO) (Scott, 2020a), which therefore also have HBP as a modifiable risk factor (Kanski, 2002; Scott, 2020; The College of Optometrists, 2022a). Non-modifiable risk factors for RVO include raised intraocular pressure (IOP), periphlebitis (Kanski, 2002, The College of Optometrists, 2022a), age (The College of Optometrists, 2022a), hypermetropia and congenital anomaly of the central retina (Kanski, 2002). The outcomes of CVDs affecting the eyes can vary greatly from transient vision loss to permanent vision loss and as such the guidelines for optometrists regarding RVO indicate urgent referral to an ophthalmologist and GP (The College of Optometrists, 2022a) and an emergency referral (less than 12 hours) for a

RAO due to the risk of stroke (The College of Optometrists, 2021). There are no specific College of Optometrists guidelines to advise a patient in manners to prevent CVDs.

When considering a healthy balanced diet there are studies that have looked into specific aspects of foods for example Gopinath *et al.* (2020) identified a favourable association between a higher intake of specific flavonoid subclasses and retinal microvascular profile, Demetz *et al.* (2014) reported a favourable association between omega-6 polyunsaturated fatty acids including arachidonic acid and plasma low-density lipoprotein cholesterol (LDL-C) and high-density lipoprotein cholesterol (HDL-C). Kaushik *et al.* (2009) reported greater retinal venular caliber with high glycemic index (GI) and low cereal fiber (CF) diets and Kaushik *et al.* (2010) reported vascular protective effects of fish consumption, although without general guidelines these very detailed associations could become overwhelming for patients and practitioners. McEvoy *et al.* (2013) and Gopinath *et al.* (2013) investigated the effect of a general diet, rather than individual food properties with respect to retinal vascular caliber. McEvoy *et al.* (2013) identified three major diet patterns 'healthy', 'unhealthy' and 'snack and beverage' and found no evidence of association between the diet pattern and retinal vessel caliber and on the contrary Gopinath *et al.* (2013) reported 'higher diet quality' was associated with better retinal microvascular health.

1.3 Ocular conditions, environmental factors, and lifestyle changes.

Aspects of the eye's retinal health can be directly linked to vascular health and the common risk factors of systemic conditions that affect vascular health can clearly be linked to ocular health. The effects of diet and lifestyle modifications on ocular conditions may be less direct and clear.

1.3.1 Age-related Macular Degeneration (AMD)

AMD is a degenerative condition affecting the photoreceptors of the macular area (Millodot, 2000). It is a significant and widespread condition (Buschini *et al.*, 2015) associated with age for which there is currently no cure and has been reported as a public health problem (Buschini *et al.*, 2015). In the UK 4.8% of the population aged over 65 years have AMD and this rises to 12.2% in those aged 80 years or more (Chakravarthy *et al.*, 2013). There are two main subcategories of AMD, non-neovascular AMD (also described as dry AMD) which accounts for 80% of AMD cases (Buschini *et al.*, 2015) and neovascular AMD (also described as wet or exudative AMD) which is the cause of vision loss in 75% of AMD cases (Buschini, *et al.*, 2015). Dry AMD is characterised by drusen (Buschini *et al.*, 2015) and geographic atrophy in the retinal pigment epithelium (RPE), photoreceptors and choriocapillaris causing a gradual cell loss and gradual reduction in vision (Salimiaghdam *et al.*, 2019). Neovascular AMD is characterised by the formation of choroidal neovascularization (CNV) (Chakravarthy *et al.*, 2013) which in turn leaks blood, lipids, and fluids within the sub-RPE or subretinal space leading to scar formation. Oxidative stress and activation of the immune system are thought to play an important role in AMD (Buschini, *et al.*, 2015). Both forms

of AMD lead to a reduction in central vision and the largest risk factor is age (Buschini *et al.*, 2015). For dry AMD, modifying a person's lifestyle to manage risk factors including; smoking (Khan *et al.*, 2006; Chakravarthy *et al.*, 2010; Buschini *et al.*, 2015; The Royal College of Ophthalmologists, 2021), body mass index (BMI) (Buschini *et al.*, 2015; The Royal College of Ophthalmologists, 2021), physical activity (Buschini *et al.*, 2015), alcohol consumption (Buschini *et al.*, 2015; Chapman *et al.*, 2019), and diet (The Royal College of Ophthalmologists, 2021) is the only form of treatment (Buschini *et al.*, 2015).

Dietary recommendation guidelines for AMD including antioxidants to prevent damage caused by oxidative stress (Buschini *et al.* 2015), have been proposed with the 'Age-Related Eye Disease Study' (AREDS)/AREDS2 recommending the use of the following antioxidants and nutrients; vitamin C (500mg), vitamin E (400 international units IU), beta-carotene (15mg) or lutein (10mg) and zeaxanthin (2mg), zinc (80mg) and copper (2mg) (NIH, 2020). High intake of omega-3 fatty acids (alpha-linolenic acid (ALA), docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA)) and fish have also been reported to be associated with a reduction in AMD and needs to be balanced correctly with the intake of omega-6 fatty acids (Chapman *et al.*, 2019). The proposed benefits regarding lutein, zeaxanthin, *meso*-zeaxanthin, and DHA and the improvement in ocular performance have been challenged and rejected by the European Food Standards Agency (EFSA) and the UK Nutrition and Health Claims Committee (UKNHCC) (EFSA NDA Panel, 2018; UKNHCC, 2021). Chapman *et al.* (2019) reported consumption of vegetable oil products containing trans-fats should be kept low and a low-GI diet to be beneficial for those at high risk of AMD. A Western diet with a higher intake of red-meat, processed meat, high-fat dairy products, fried potatoes, refined grains and eggs is discouraged when considering AMD risk, in favour of a Mediterranean or Oriental diet (Chapman *et al.*, 2019).

Smoking has been shown to increase the risk of AMD dependent on the amount smoked and when someone stopped (Khan *et al.*, 2006). Khan *et al.* (2006) reported an odds ratio (OR) of 2.75 (95% confidence interval (CI) 1.22 - 6.20) for AMD for those who smoked more than 40 pack years (defined as daily tobacco consumption (cigarette packs smoked per day) multiplied by smoking duration in years (Bernaards, 2001)) compared to non-smokers and 1.87 OR (95% CI 1.03 - 3.40) for passive smokers (defined as living in a house with a smoker for more than five years) compared to non-smokers. They also reported smoking cessation led to a reduction in OR in those who had stopped less than 20 years ago and a further reduction on those who stopped more than 20 years ago (Khan *et al.* 2006).

The elements of modifiable risk factors for AMD are many and detailed, and the results of studies looking at specific substances are not always conclusive or in agreement. Unfortunately, the College of Optometrists have not provided a guideline for modifiable lifestyle changes for optometrists

regarding AMD, therefore the NICE guidelines (NICE, 2018) are a source of guidance which optometrists can use. These appear to be general guidance without mentioning specific antioxidants and supplements as mentioned previously in this chapter with a referral to a dietitian not an aspect of the guidance (NICE, 2018). The National Health Service (NHS) website regarding AMD directs people to the Government Eatwell Guide (NHS, 2022c) (see figure 1.4) which is a general guide to a healthy diet and may not appear condition specific to a patient or practitioner.

1.3.2 Cataracts

Cataract is the loss of transparency of the natural lens (Millodot, 2000). There are multiple types, with the most common being diabetic cortical cataract and age-related nuclear cataract (Braakhuis *et al.*, 2019). The risk factors for diabetes have already been covered in section 1.2.1. and so the same risk factors will influence diabetic cortical cataract. With respect to age-related nuclear cataracts, a diet high in fruits and vegetables, Vitamin C, zeaxanthin, lutein and multivitamin supplements has been reported to reduce the progression (Braakhuis *et al.*, 2019). A link between smoking and an increase in cataract formation was identified in a literature review by DeBlack (2003), in studies by Wang *et al.* (2016) and Hammond *et al.* (1999), and reported by the NHS (NHS, 2020). This link persists even after smoking cessation (Hammond *et al.*, 1999) and therefore optometrists should educate their patients regarding the risks of smoking and cataract formation (DeBlack, 2003). Drinking too much alcohol is also reported to increase the risk of age-related cataracts (NHS, 2020). The NICE guidelines regarding cataracts focus on management of a cataract rather than prevention, they do not discuss reduction in risk factors for cataract formation (NICE, 2017a) and neither do The College of Optometrists.

1.3.3 Dry Eye Disease (DED)

Dry eye disease (DED) is a common disorder of the tear film and ocular surface (Yang *et al.*, 2015; Yoon *et al.*, 2016) affecting between 2.7%-75% of the population (Chia *et al.*, 2003; Stapleton *et al.*, 2017; Verjee *et al.*, 2020,). Variable prevalence was reported across different studies depending on the DED criteria used, for example clinical signs, symptoms or both signs and symptoms (Stapleton *et al.*, 2017) and the population investigated. Reported prevalence in adults aged 18-34 years of 2.7% (Farrand *et al.*, 2017) with an increase shown with each decade of life there after (Stapleton *et al.*, 2017; The College of Optometrists, 2022b). A higher prevalence consistently reported in women (Stapleton *et al.*, 2017; The College of Optometrists, 2022b) and people of Asian ethnicity (The College of Optometrists, 2022b).

There are two main subcategories, aqueous deficient and evaporative, although they often occur simultaneously (Foulks *et al.*, 2015). Craig *et al.* (2017) created the Tear Film and Ocular Surface Society (TFOS), Dry Eye Workshop (DEW) two (TFOS DEWS II) definition for dry eye encompassing the multifactorial nature of the disease where there is a loss of homeostasis of the tear film leading to

ocular discomfort and visual disturbance. The symptoms of DED can include, grittiness, itchiness, pain, red eye, foreign body sensation, lacrimation and blurred vision (Verjee *et al.*, 2020) with the ability to damage the cornea (Yoon *et al.*, 2016), and the condition can be aggravated by vitamin A deficiency and tobacco smoke (The College of Optometrists, 2022b). The diagnosis of DED has been reported by Um *et al.* (2018) to increase the OR of depression by 1.32 (95% CI 1.11 - 1.57) and suicidal ideation by 1.24 (95% CI 1.05 – 1.48) (Um *et al.*, 2018).

A meta-analysis by Giannaccare *et al.* (2019) and a literature review by Roncone *et al.* (2010) indicate supplementation with omega-3 fatty acids may be effective in the treatment for dry eye disease, which was also reported by Optiz *et al.* (2015). Other lifestyle modifications that have been suggested include vitamin D supplements (Galor *et al.*, 2014), increased physical activity, positive thinking (Kawashima *et al.*, 2018) and reduced screen time (Verjee *et al.*, 2020). The College of Optometrists guidelines include modification of local environment with consideration of pollutants and drying atmospheres and a weak recommendation for omega-3 fatty acids due to low level of evidence (The College of Optometrists, 2022b).

1.3.4 Glaucoma

Glaucoma is a condition with atrophy and excavation of the optic disc leading to visual field loss with the most common form, open-angle glaucoma, affecting 0.5% to 2% of the population over 40 years (Millodot, 2000). Studies have looked at the effect of lifestyle modifications in relation to glaucoma in a similar manner to other ocular conditions. Garcia-Medina *et al.* (2015) investigated the effects of oral antioxidant supplementation with and without omega-3 fatty acids compared to no oral antioxidant supplements and found no significance difference between the groups. In 2018, Wang *et al.*, suggested that an increase in omega-3 fatty acids EPA and DHA was associated to a lower likelihood of glaucoma although total polyunsaturated fatty acids could also lead to a higher risk of glaucoma. Other dietary options, such as fruit and vegetables high in vitamin C and A have been suggested to possibly be associated with a reduced risk of glaucoma in African-American women (Giacconi *et al.*, 2012). Wang *et al.* (2013) reported a different result, with no association found with vitamins A and E and a protective effect of vitamin C, although this paper relied on self-reported consumption and glaucoma diagnosis and therefore, may be affected by inaccurate recollections which could influence the results. Green leafy vegetables have also been studied with regard to glaucoma and a greater intake of dietary nitrate and was reported to have a positive association with a lower risk of glaucoma (Kang *et al.*, 2016), tea has also been suggested to have a modest association with a lower risk of glaucoma but not any other flavonoids in a Caucasian population (Kang *et al.*, 2018), although this study relied on self-reporting of dietary intake which could influence the final results. The effect of exercise on glaucoma is not confirmed, with a study finding an increase in glaucoma prevalence with vigorous exercise (Lin *et al.*, 2017) and another suggesting an increase in exercise was associated with a reduction in visual field loss (Lee *et al.*, 2019). Smoking

was shown to be associated with glaucoma in a dose-response relationship in a Caucasian population (Pérez-de-Aecelus *et al.*, 2017).

The indications of lifestyle modifications helping with glaucoma progression and risk are less conclusive than other eye conditions. There are no lifestyle modifications from the NHS, and Glaucoma UK advise lifestyle modifications that are good for general health rather than anything specific for glaucoma (Glaucoma UK, 2021). Further research in this area will no doubt continue.

1.4. Lifestyle Modifications Advice

Current research is assessing specific dietary components which could help with these life changing chronic and ocular conditions, although in general the advice given to the general population tends to be more generic which, although may sound simplistic, contains the specific dietary substances required and is potentially easier to understand and follow. There is one supplement formulation that reports evidence from randomised control trials and advised for those with moderate AMD (AREDS 2 Research Group, 2013) although the original formulation AREDS was not suitable for current or former smokers due to the beta-carotene and a risk of lung cancer, the AREDS 2 formulation omitted the beta-carotene and added lutein and zeaxanthin as a carotenoid substitute to reduce the risk of lung cancer (AREDS 2 Research Group, 2013) although the claims for anti-oxidant and ocular performance were rejected by the EFSA and UKNHCC (EFSA NDA Panel, 2018; UKNHCC, 2021) and The Royal College of Ophthalmologists' guidelines for AMD state;

'There is insufficient evidence to prescribe dietary supplements routinely in patients with AMD or for the prevention of AMD, eating a diet rich in leafy green vegetables and fresh fruit is recommended' (Chakravarthy *et al.*, 2013 p.1429)

Therefore, the current UK NHS guidelines direct the adult population to the Eatwell Guide (see figure 1.4) (NHS, 2022c), advise to reduce alcohol intake to no more than 14 units a week over three or more days (NHS, 2021a), be active for at least 150 minutes of moderate intensity exercise a week spread over four to five days at least (NHS, 2012b) and stop smoking to help with health conditions.

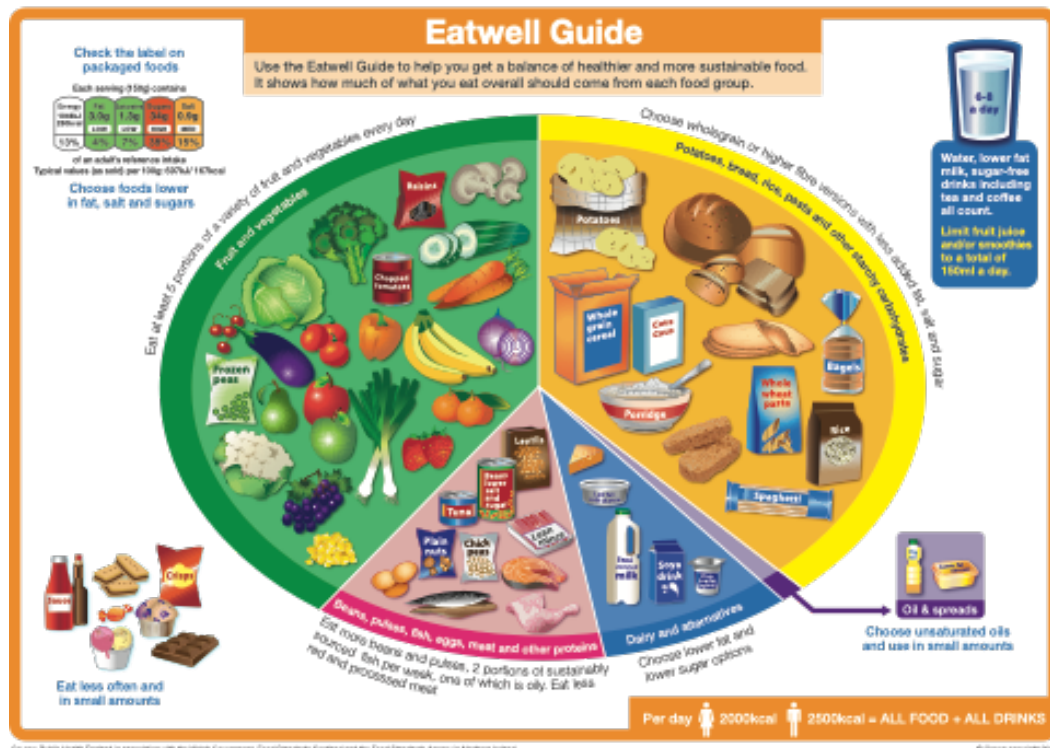


Figure 1.4 The Eatwell Guide Public Health England in association with the Welsh government, Food Standards Scotland, and the Food Standards Agency in Northern Ireland. Crown copyright (Public Health England, 2018b). Use the Eatwell Guide to help you get a balance of healthier and more sustainable food. It shows how much of what you eat overall should come from each food group (Public Health England, 2018b).

1.5 The current situation.

The UK government has developed guidelines to help promote healthy lifestyles and this has occurred because an awareness of the complexity of multiple public health problems has been increasing (Bagnell *et al.*, 2019) and although life expectancy has increased over the last 40 years (Buxton, 2021) due to better health care and hygiene, healthier lifestyles, nutrition and reduced child mortality (Brown, 2015; Raleigh, 2021), the pace has slowed over the last decade (Buxton, 2021). The King’s Fund report, states that healthy life expectancy (the number of years lived in good or very good health) has increased, but not as much as life expectancy (Raleigh, 2021). Therefore, the quantity of years we live is not necessarily the most important factor if we do not have quality in those years, and The King’s Fund report indicates that an individual now experiences more years in poor health (Raleigh, 2021). These years in poor health include conditions which are NCDs (chronic disease), these are a specific risk factor of poor health in old age (World Health Organization Regional Office for Europe, Available at: <https://www.euro.who.int/en/health-topics/Life-stages/healthy-ageing/data-and-statistics/risk-factors-of-ill-health-among-older-people> (Accessed: 22nd January 2022)) and conditions which lead to sight impairment (Bunce *et al.*, 2010). In the Americas between 2007 and 2009 more than 70% of deaths of those aged 70 and older were attributed to NCD (Pan American Health Organization, 2011) and in Europe as many as 86% of

deaths have been attributed to NCDs (World Health Organization Regional Office for Europe Available at: <https://www.euro.who.int/en/health-topics/Life-stages/healthy-ageing/data-and-statistics/risk-factors-of-ill-health-among-older-people> (Accessed: 22nd January 2022)). NCDs include cancer, CVD, respiratory illness, DM (Pan American Health Organization, 2011) and mental disorders (World Health Organization Regional Office for Europe, Available at: <https://www.euro.who.int/en/health-topics/Life-stages/healthy-ageing/data-and-statistics/risk-factors-of-ill-health-among-older-people> (Accessed: 22nd January 2022)) and can reduce quality of life. As discussed earlier in this chapter, DM and CVDs are NCDs that can also affect our vision, leading to an increased risk of vision loss in an ageing population and modifiable lifestyle factors have been suggested to contribute to these NCDs.

The identified reduction in disease/disability free years is not equal across society. A government report 'Advancing our health: prevention in the 2020's' (Department for Public Health and Primary Care, 2019), identified that those in more deprived areas not only die younger but also spend more years in poor health. The inequality also exists across ethnicity, gender, sexuality and having a disability, with many people experiencing multiple disadvantages (Department for Public Health and Primary Care, 2019) for example a third of those registered with a visual impairment in England are also known to have hearing, mental health, and physical disabilities (National Health Service Digital, 2021). A visual impairment affects instrumental activities of daily living (National Academies of Sciences, Engineering, and Medicine, 2016) such as reading (for example medication instructions, ingredient lists, bank statements etc.), facial recognition, manipulating small items (National Academies of Sciences, Engineering, and Medicine, 2016), driving and mobility (for example navigating a cluttered or crowded street and using stairs), therefore visual impairment can greatly affect an individual's ability to live independently. The Blue Mountains Eye Study suggested visual impairment showed a relative risk for nursing home admission of 1.8 (95% CI 1.1 – 2.9) in a population aged over 49 years and that this risk increased with each additional line of letters lost (Wang *et al.*, 2003). Blindness due to DR or diabetic maculopathy was the main cause of severely sight impaired (SSI) registration in the working age population in 2000 (Liew *et al.*, 2014) and the second most common in 2010 (Liew *et al.*, 2014). The risk of NCDs increases with age as does the number of people registered with a sight impairment. For some individuals these factors maybe unrelated, for other individuals their sight impairment and NCD are connected and influenced by poor lifestyle choices such as poor nutrition, smoking, physical inactivity, and alcohol misuse (World Health Organization Regional Office for Europe, Available at: <https://www.euro.who.int/en/health-topics/Life-stages/healthy-ageing/data-and-statistics/risk-factors-of-ill-health-among-older-people> (Accessed: 22nd January 2022)).

To lose one's vision is a situation a lot of people would not welcome at any point in life, and a loss of sight not only impacts the individual, but also their friends and family, and society (National

Academies of Sciences, Engineering, and Medicine, 2016) including a financial impact on both private and public funds (Pezzullo *et al.*, 2018). Those who seek active employment with a visual impairment often experience barriers to employment not experienced by those without a visual impairment. The Royal National Institute for the Blind (RNIB) reported in 2015 that only 27% of those registered with a visual impairment of working age were in paid employment or self-employed, this was compared to about 73% of the UK general population (Slade and Edwards, 2015). When considering the larger affects, the cost of vision loss and eye disorders including factors such as direct medical costs, loss of productivity and monetising quality-adjusted life years (QALYs), the financial loss was between £13.5 to £18.3 billion in the UK in 2013 (Pezzullo *et al.* 2018). The number of people registered with a Certificate of Visual Impairment (CVI) in England as of the 31st of March 2020 was 276,690 people, of which 266,550 were adults, including 193,700 who were 65 years and older (National Health Service Digital, 2021). This figure includes those registered as sight impaired (SI) and those registered as SSI. This total equates to 37 people per 100,000 population were registered as visually impaired (National Health Service Digital, 2021). In the last 30 years the number of CVI registrations of individuals aged 65 years or older was increasing until it reached a peak in March 2003 with 243,280 individuals registered, since then each subsequent data set has shown a decline (National Health Service Digital, 2021). The peak average life expectancy of both males and females was presented in data collected in 2019 by the King's Fund and is calculated as 81.72 years, this figure turned to a decline in 2020 to be 80.64 years, this decline has been attributed to the Coronavirus Disease (COVID-19) pandemic (Raleigh, 2021). Therefore, the curve of the CVI registration graph does not match the curve of the life expectancy curve. The reduction in CVI registrations may be attributed to the licensing of anti-vascular endothelial growth factor (VEGF) compound in the USA in 2004 and in Europe in 2006 (Bloch *et al.* 2012), although if this was the only factor influencing the decline in CVI registrations, the impact would have occurred a few years later. Another factor to affect these figures is the voluntary nature of data collection. The figures include those that have been issued with a CVI by an ophthalmologist and have also agreed to be included in their Local Authority's register. Therefore, this number is a starting point, with many more who are unregistered or registered but do not give permission for their registration to appear on the Local Authority's register. A study of ophthalmologists working in the West Midlands in 2003 found 45% of patients eligible for registration were unregistered (Barry and Murray, 2005).

1.5.1 UK Government Initiatives

The Nuffield Council on Bioethics designed an intervention ladder indicating a progression of intervention moving from individual freedom to state intervention (Hepple *et al.*, 2007). The policies and strategies in sections 1.5.1.1 to 1.5.1.3 cover a range of these with 'guide choice through disincentives' being the most state directed in the form of taxes (Hepple *et al.*, 2007). With smoking cessation, responsible alcohol use, nutrition and physical activity policies they have all involved 'provide information', the first step on the ladder (Hepple *et al.*, 2007).

1.5.1.1 Diet

The Eatwell Guide (figure 1.4) is not the only government initiative to address the current health situation of the UK, and since its inception and the COVID-19 pandemic the government started a new campaign to help people manage, and if appropriate lose weight and cut their risk of COVID-19 and other serious illnesses (Public Health England, 2020). It is called the Better Health campaign and is part of the government's new Obesity Strategy (Public Health England, 2020).

1.5.1.2 Smoking

In February 2003 a ban on tobacco advertising through print and broadcast media, billboards, the internet, direct mail, product placement, promotions, free gifts, coupons and sponsorship occurred in the UK (Harris *et al.*, 2006), leaving the only place for advertising to be point of sale. Point of sale advertising was then phased out between 2012 and 2015 (Ford *et al.*, 2020). In November 2007 a smoking ban in public places was introduced in the England, the last of the four countries of the UK to adopt such a policy with Scotland leading the way, followed closely by picture warnings on cigarette packing in October 2008 and then leading to standardised packaging eight years later (Seccombe, 2016). The smoking ban was reported to show an immediate reduction in ST-segment elevation myocardial infarctions (STEMI) (JSB3, 2014a). The initiative, Stoptober was a mass quit smoking drive first delivered in October 2012 and is still used each year (Seccombe, 2016). This drive to reduce smoking in the UK saw a reduction in smoking over about 40 years from almost 50% of people smoking to 16.9% of adults (Seccombe, 2016). In 2010 the Secretary of State produced a White Paper shifting power to local communities to enable them to improve the community's health throughout life with 'ring-fenced funding and incentives, professionally-led and focused on evidence' (Secretary of State for Health, 2010).

1.5.1.3 Alcohol

Alcohol consumption has been reported to have increased steadily since the early 1980's until 2008 when a decline was seen (Public Health England, 2019). Alcohol duty consultation in the UK opened in March 2020 with a plan to improve the current system to simplify tax, reduce burdens and improve public health as well as other reasons (Whately, 2021). The consultation reported problems with the current duty system with relation to health, including taxing drinks differently depending on strength or volume. The current situation creates an incentive for producers to increase the strength of their drinks and does not incentivise the development of low alcohol products (Whately, 2021). It has been reported that heavy drinkers systematically purchase stronger and cheaper alcoholic beverages and are more likely than lighter drinkers, to swap between alcoholic products due to cost rather than switch away from alcohol altogether (Griffith *et al.*, 2017). It was suggested that a taxation strategy that encourages people to choose lower alcohol strength drinks can reduce alcohol related harm (Whately, 2021).

1.5.1.4 Health checks and support

In 2009 the NHS launched the NHS Health Checks (NHS HC) every five years, for those aged 40-74 years old with the aim to reduce CVD risks and events (Robson *et al.*, 2016; Patel *et al.*, 2020; Tanner *et al.*, 2022). In the years from 2012 to 2017 this service was attended by, on average, 52.6% of those invited (Patel *et al.*, 2020) and 45.9% in the year 2018-19 with large regional variations (Tanner *et al.*, 2022). The program has been reported to increase the detection of individuals at risk of CVD (Tanner *et al.*, 2022). A calculator is also available to the public on the NHS website to calculate the heart age of anyone between 30 to 95 with advice about lifestyle changes to improve their heart age (NHS, 2019b). Local pharmacies can offer a smoking cessation service and HBP case-finding (Pharmaceutical Services Negotiating Committee, 2013). These services, websites, guidelines, videos, and apps, will not help the population if they do not know they are available, or if the population as individuals do not know they are at risk and need to engage with the service and advice. This aspect has been identified and addressed with the 'Making Every Contact Count' (MECC) initiative which is '*an approach to behaviour change that uses the millions of day-to-day interactions*' that individuals already have with health professionals (Public Health England, 2016). Optometrists are one of the healthcare professionals that patients will interact with when well, as well as when they have a concern with their sight and it is a service which cannot be carried out virtually, instead requiring face-to-face interaction.

1.6 Eye examinations within the UK

In England most optical practices hold General Ophthalmic Services (GOS) contracts with National Health Service (NHS) England, to deliver core primary care services to the public (Local Optometric Committee Support Unit, Available at: <https://www.locsu.co.uk/what-we-do/policy/general-ophthalmic-services/> (Accessed 22nd January 2022)). The mandatory services the optical practice, and in turn the optometrist, is contracted to provide within the GOS contract are to '*test the sight of a person to determine if they need an optical appliance*' (General Ophthalmic Mandatory Services Contract, 2010), '*perform such examinations of the eye for the purpose of detecting injury, disease or abnormality in the eye or elsewhere as the regulations may require*' (Opticians' Act, 1989) and '*refer the patient to an ophthalmic hospital, inform the patient's doctor or GP practice that it has done so*' (General Ophthalmic Mandatory Services Contract, 2010). Members of the public in England, Wales and Northern Ireland are entitled to a free sight test under the core primary care services discussed above if they are; 'under 16, 16,17 or 18 and in full-time education, 60 or over, registered as partially sighted or blind, diagnosed with diabetes or glaucoma, 40 years or over and your mother, father, sibling or child has been diagnosed with glaucoma, have been advised by an ophthalmologist that you're at risk of glaucoma, a prisoner on leave from prison, or eligible for an NHS complex lens voucher' (National Health Service, 2020). Those who themselves, their partner or someone they are dependent on if under 20 years of age are in receipt of 'income support, income-related employment

and support allowance, income-based jobseeker's allowance, pension credit guarantee credit, universal credit and meet the criteria' (Association of Optometrists, How sight tests are funded in the UK. Available at: <https://www.aop.org.uk/our-voice/media-centre/resources-for-journalists/how-sight-tests-are-funded-in-the-uk> (Accessed 22 January 2022.; National Health Service, 2020) or if they are entitled to or named on 'a valid NHS tax credit exemption certificate, you qualify if you get Child Tax Credits, Working Tax Credits with a disability element, and have income for tax credit purposes of £15,276 or less or a valid NHS certificate for full help with costs' (Association of Optometrists, How sight tests are funded in the UK. Available at: <https://www.aop.org.uk/our-voice/media-centre/resources-for-journalists/how-sight-tests-are-funded-in-the-uk> (Accessed 22 January 2022); National Health Service, 2020). The remainder of the populations that are not entitled to an NHS funded sight test, pay for a private sight test (Association of Optometrists, How sight tests are funded in the UK. Available at: <https://www.aop.org.uk/our-voice/media-centre/resources-for-journalists/how-sight-tests-are-funded-in-the-uk> (Accessed 22 January 2022)). Those who reside in Wales are also entitled to a free eye test if they have, an eye problem that needs urgent attention, sight in one eye only, a hearing impairment or are profoundly deaf, retinitis pigmentosa, been referred by their GP because they think they have an eye problem or are of Black or Asian ethnicity (Welsh Government, 2018) as part of the Eye Health Examination Wales (EHEW) scheme (Association of Optometrists, How sight tests are funded in the UK. Available at: <https://www.aop.org.uk/our-voice/media-centre/resources-for-journalists/how-sight-tests-are-funded-in-the-uk> (Accessed 22 January 2022)). In Scotland, since April 2006 all UK residents are entitled to an NHS funded eye examination (Association of Optometrists, How sight tests are funded in the UK. Available at: <https://www.aop.org.uk/our-voice/media-centre/resources-for-journalists/how-sight-tests-are-funded-in-the-uk> (Accessed 22 January 2022)).

In England, Wales and Northern Ireland, the GOS sight test fee is currently £22.14 (AOP, 2022). In 2006 a report by Nick Bosanquet stated the cost to provide a sight test was £37 and at the time the GOS sight test fee was £18.39 (Bosanquet, 2006 p.2). According to the Bank of England, since Nick Bosanquet's report in 2006 inflation has increased and therefore the cost to provide a sight test in 2023 would be calculated to be £59.20 and if the GOS fee had increased in-line with inflation it should be between £28.80 to £30.40 in 2023 (Bank of England, 2022) rather than the £22.14 that it is. In Scotland the fee is £37 for those under 60 years of age and £45 for those over 60 years of age for a primary eye examination (PEE). If symptoms present themselves during the PEE that require investigation, then a supplementary eye examination (SEE) fee of £21.50 can also be claimed (Association of Optometrists, How sight tests are funded in the UK. Available at: <https://www.aop.org.uk/our-voice/media-centre/resources-for-journalists/how-sight-tests-are-funded-in-the-uk> (Accessed 22 January 2022)). In Wales the Eye Health Examination (EHE) carries a fee of £60 (Association of Optometrists, How sight tests are funded in the UK. Available at: <https://www.aop.org.uk/our-voice/media-centre/resources-for-journalists/how-sight-tests-are-funded-in-the-uk>

in-the-uk (Accessed 22 January 2022)) and if further investigations are required following a GOS sight test or a private sight test an optometrist can claim a fee of £40 (Association of Optometrists, How sight tests are funded in the UK. Available at: <https://www.aop.org.uk/our-voice/media-centre/resources-for-journalists/how-sight-tests-are-funded-in-the-uk> (Accessed 22 January 2022)). The range of NHS funded examinations for a patient requiring further investigations is £21.71 in England and Northern Ireland to £61.71 in Wales. This range in fees across the devolved nations can lead to a range of care available to patients within primary care. In England there is not one centralised more extensive test, as in Scotland and Wales, instead is it up to each individual Integrated Care System (ICS).

The different local ICSs commission a variety of extended primary eye care services above and beyond the GOS sight test (Association of Optometrists, <https://www.aop.org.uk/our-voice/media-centre/resources-for-journalists/how-sight-tests-are-funded-in-the-uk> (Accessed 22 January 2022)) as they deem suitable for their community. These can include;

- Coronavirus (COVID-19) Urgent Eyecare Service – CUES. A service to ensure people can access urgent eye care within primary care, reducing the demand on GPs, pharmacies and the hospital eye service (HES) (Primary Eyecare, 2020)
- Minor Eye Conditions Service (MECS). A service to triage, manage and prioritise patients presenting with minor eye conditions to ophthalmic practice (Local Optometric Committee Support Unit, Available at: <https://www.locsu.co.uk/what-we-do/pathways/> (Accessed 22/01/2022)). This service is supported by a Wales Optometry Postgraduate Education Centre (WOPEC) course (Wales Optometry Postgraduate Education Centre, https://www.locsu.co.uk/wp-content/uploads/Files/WhatWeDo/Training/WOPEC_Training/LOCSU-WOPEC-Modules-Booklet-2019.pdf (Accessed 22/01/2022)).
- Integrated Cataract (pre- and post-operative). A service to provide end-to-end care pathway for people presenting a cataract at a sight test who are keen to be considered for surgery (Local Optometric Committee Support Unit, Available at: <https://www.locsu.co.uk/what-we-do/pathways/> (Accessed 22/01/2022)). This service is supported by a WOPEC course (Wales Optometry Postgraduate Education Centre, https://www.locsu.co.uk/wp-content/uploads/Files/WhatWeDo/Training/WOPEC_Training/LOCSU-WOPEC-Modules-Booklet-2019.pdf (Accessed 22/01/2022)).
- Children's Vision (Paediatrics). A service for early intervention and management of poor vision in an integrated service model, delivered within primary care practice (Local Optometric Committee Support Unit, Available at: <https://www.locsu.co.uk/what-we-do/pathways/> (Accessed 22/01/2022)). This service is supported by a WOPEC course (Wales Optometry Postgraduate Education Centre, https://www.locsu.co.uk/wp-content/uploads/Files/WhatWeDo/Training/WOPEC_Training/LOCSU-WOPEC-Modules-Booklet-2019.pdf (Accessed 22/01/2022)).

- Glaucoma Referral Filtering and Monitoring. A service to reduce the number of individuals being referred for specialist investigation and to increase the number being managed within primary care (Local Optometric Committee Support Unit, Available at: <https://www.locsu.co.uk/what-we-do/pathways/> (Accessed 22/01/2022)). This service is supported by a WOPEC course (Wales Optometry Postgraduate Education Centre, https://www.locsu.co.uk/wp-content/uploads/Files/WhatWeDo/Training/WOPEC_Training/LOCSU-WOPEC-Modules-Booklet-2019.pdf (Accessed 22/01/2022)).
- Healthy Living Optical Practice (HLOP). A service focused on improving the health and wellbeing of the population to reduce local health inequalities (Local Optometric Committee Support Unit, Available at: <https://www.locsu.co.uk/what-we-do/pathways/> (Accessed 22/01/2022)). This service is supported by the Royal Society for Public Health (RSPH) level two Understanding Health Improvement qualification (Royal Society for Public Health, 2019).
- Low Vision. A service to provide adults with sight loss quicker access to a low-vision assessment and support closer to home (Local Optometric Committee Support Unit, Available at: <https://www.locsu.co.uk/what-we-do/pathways/> (Accessed 22/01/2022)). This service is supported by a WOPEC course (Wales Optometry Postgraduate Education Centre, https://www.locsu.co.uk/wp-content/uploads/Files/WhatWeDo/Training/WOPEC_Training/LOCSU-WOPEC-Modules-Booklet-2019.pdf (Accessed 22/01/2022)).
- Maculopathy Referral Filtering and Monitoring. A service to improve the efficiency and accuracy of case-finding for AMD. (Local Optometric Committee Support Unit, Available at: <https://www.locsu.co.uk/what-we-do/pathways/> (Accessed 22/01/2022)). This service is supported by a WOPEC course (Local Optometric Committee Support Unit, 2021).
- Medical Retina Monitoring. A service to allow patients to be seen within the community for annual monitoring. This service is supported by Local Optometric Committee Support Unit (LOCSU) Clinical Management Guideline (CMG) (Local Optometric Committee Support Unit, Available at: <https://www.locsu.co.uk/what-we-do/pathways/> (Accessed 22/01/2022)).
- People with Learning Disabilities. A service to improve local access to eye care for individuals with learning difficulties (Local Optometric Committee Support Unit, Available at: <https://www.locsu.co.uk/what-we-do/pathways/> (Accessed 22/01/2022)). This service is supported by a WOPEC course (Wales Optometry Postgraduate Education Centre, https://www.locsu.co.uk/wp-content/uploads/Files/WhatWeDo/Training/WOPEC_Training/LOCSU-WOPEC-Modules-Booklet-2019.pdf (Accessed 22/01/2022)).

These services usually require further education along with support, and each ICS will negotiate contracts and fees for these services, which leads to a variety of services available within primary care across England. In 2010 the Secretary of State for Health produced a White Paper shifting

power to local communities to enable them to improve the community's health throughout life with 'ring-fenced funding and incentives, professionally-led and focused on evidence' (Secretary of State for Health, 2010), indicating funding was potentially available for these services. In Scotland the PEE is promoted as 'more than just a sight test', providing a general eye health check to detect conditions such as DM, HBP, CVD, tumours, dementia, arthritis, cataract, suspect glaucoma and ocular hypertension (Scottish Government, <https://www.gov.scot/policies/primary-care-services/eyecare/> (Accessed : 29 March 2023)). Within these conditions are NCDs and conditions which lead to sight impairment (Bunce and Wormald, 2006). This link between NCDs and sight impairment could suggest optometry is suited to help patients with these conditions.

Optometrists are qualified and registered following achievement of core competencies defined by The College of Optometrists and regulated by the General Optical Council (GOC). If nutrition advice, smoking cessation and responsible alcohol use are not part of the competencies set by these bodies optometrists may require further education to be an effective part of the MECC program.

1.7 Optometry training and standards

The College of Optometrists set the core competencies an optometrist must pass to qualify. In this list of competencies there is no specific mention of modifiable risk factors, lifestyle choices, smoking cessation, nutrition, physical activity or responsible alcohol use. The competency that could relate to this part of an optometrist's education is '1.1.1 Obtains relevant history and information relating to general health, medication, family history, work, lifestyle and personal requirements.' (The College of Optometrists, <https://www.college-optometrists.org/qualifying/a-career-in-optometry/what-is-an-optometrist> (Accessed: 14th August 2022)). Within The College of Optometrists Guidance for Professional Practice there also is not any guidance regarding nutrition, physical activity or responsible alcohol use. When considering an individual with DM there is not any guidance to ask about their blood glucose or an active lifestyle. Guidance A50 within '*conducting the routine eye examination*' advises an optometrist should normally ask and accurately record whether a patient smokes, stating this is a requirement of the GOS in Scotland (The College of Optometrists, 2021). The GOC create the standards for practice and accredit all undergraduate optometry courses, although within their standards they do not specifically mention modifiable risk factors and the responsibility of an optometrist (General Optical Council, 2016a). The pathway to becoming a qualified optometrist is currently under change with the previous 'scheme for registration' being replaced by new Education and Training Requirements (ETR) with a new Clinical Learning in Practice (CliP) to replace the pre-registration year (The College of Optometrists, [https://www.college-optometrists.org/qualifying/education-and-training-requirements/clinical-learning-in-practice-\(clip\)](https://www.college-optometrists.org/qualifying/education-and-training-requirements/clinical-learning-in-practice-(clip)) (Accessed: 06 March 2023)). This has included the development of indicative guidance for the new ETR' (SPOKE, https://www.college-optometrists.org/coo/media/media/documents/spoke/project-1-indicative-guidance-01_04.pdf (Accessed: 06 March 2023)) which state for an outcome for

registration for optometrists to be '*O6.6 engages with population and public health initiative and understands how population data should inform practice and service delivery – knows how*' (SPOKE, https://www.college-optometrists.org/coo/media/media/documents/spoke/project-1-indicative-guidance-01_04.pdf (Accessed: 06 March 2023) p43). This was the outcome that most closely matched to lifestyle modification advice.

1.8 Study Rationale

It has been identified that NCDs affect an individual's quality of life and often these NCDs are influenced by modifiable lifestyle choices for example an increase in physical activity and reductions in smoking, BP and cholesterol were reported to have caused a reduction in mortality by 34% between 2000 to 2007 (JSB3, 2014a). The UK government has many policies in place to aid the population to live healthier for longer, although some aspects of these policies will require individuals to be advised regarding the risk their lifestyle presents to their health, and then advice and guidance to help them make any adjustments they wish to pursue. Front-line healthcare workers have been requested to help patients with modifiable lifestyle choices. At present there is not clear guidance within the standard optometry education and professional guidance regarding the position of optometry in this specific public health initiative. Therefore, the aim of this study is to investigate the self-perceived knowledge and skills of the optometric workforce regarding modifiable lifestyle advice and whether it is appropriate advice for an optometrist to be giving. If a knowledge gap is identified this study will also investigate how best to address the knowledge gap, if there is indeed a desire to address it.

Chapter 2 – Ocular lifestyle modifications: Perceived knowledge and competence – Do optometrists believe it is appropriate and how well are they equipped to offer effective support to those with chronic illness? A Systematic Review.

2.1 Introduction to Systematic Review

This qualitative descriptive systematic review was conducted following published methodological guidance, edited by Boland, Cherry and Dickson (2017). The aim of the systematic review was to identify current research regarding the knowledge, skills and confidence of UK optometrists relating to modifiable lifestyle choices, that could influence a person's quality of life and their risks regarding NCDs.

2.2 Scoping Search

A scoping search was conducted to develop the research question, define the population, interest, context (PICO) and the search words.

2.2.1 Scoping Search Methodology

The scoping search was carried out between the 4th of July and the 15th of August 2020 using the keywords; Optometry, Optometrist, Optician, Dispensing Optician, Dispensing Optometrist, Ophthalmic professional, Eye Care Specialist, Ophthalmologists, Contact Lens Optician, Ophthalmic Optician, diet, lifestyle advice, nutrition, food supplements, dietary, weight loss, chronic disease management, exercise, ultraviolet (UV) light protection, education, training, continuing education training (CET), and continuing professional development (CPD). The searches were carried out using the whole date range of each database up until the day of the search in Ovid Medline, PubMed, Web of Science and PROSPERO.

2.2.2 Scoping Search Results

A total of 1089 papers (see appendix 2.2.2) were found and after reviewing titles and abstracts of the full text, only 11 were determined to be relevant. Considering intervention, most papers (about 73%) were based on smoking cessation. Papers that discussed perceived knowledge and practice were often a guide to practice or to develop services rather than considering intervention. Papers regarding DM and HBP were generally educational rather than considering a practitioner's perceived knowledge. The papers that did address a practitioner's perceived knowledge and practice were usually regarding DED, AMD, and smoking. More papers were identified regarding other professionals groups, for example pharmacists (Alkharfy, 2010; Douglas *et al.*, 2019), healthcare professionals (Awad *et al.*, 2010; Bhamra *et al.*, 2019), ophthalmologists (Martin, 2017), physicians (Green, 1999; Heaton *et al.*, 2003; Pizzimenti, 2009; Adams *et al.*, 2010; Leeman *et al.*, 2011; Torabi *et al.*, 2011; Wilechansky *et al.*, 2016; Aspry *et al.*, 2018; Katz, 2018), dietitians (Arcand *et al.*, 2005), nurses (Kostas, 1980; Hyun *et al.*, 2009; Jarl *et al.*, 2014), mental health occupational therapists

(Mahony *et al.*, 2012) and dentists (Touger-Decker, 2010; Scardina and Messina, 2012; Taylor *et al.*, 2014; Raindi *et al.*, 2015) rather than optometrists. One paper regarding pharmacists in Northern Ireland (Douglas *et al.*, 2019) addressed many of the aspects within pharmacy that this systematic review aimed to review in optometry. Papers that did address optometrists were often based in the USA.

2.2.3 Scoping Search Conclusion

Most relevant papers reported quantitative data and the data were practitioners' opinions, therefore a PICO (The Joanna Briggs Institute, 2014) table would be the most appropriate to develop the searches for the systematic review.

2.3 Systematic Review

2.3.1 Systematic Review Methodology

Chapter 2.2.3 indicated a PICO table was the most appropriate tool for the systematic review. The PICO table developed is shown in table 2.3.1.

Population: The population was chosen to be the fully qualified optometric workforce, incorporating contact lens opticians, dispensing opticians, and ophthalmic optometrists to encompass all professionals who would have an encounter with a patient regarding their vision within optometry practice and who may be in the position to be asked about lifestyle change or offer guidance regarding lifestyle changes within optometric practice. Papers that are solely regarding others working within eye care, for example ophthalmologists, nurses and orthoptists will be excluded. These professions will be excluded because they do not usually work within optometric practice and often work in secondary care which could influence their perceived knowledge and competence and create non-comparable data. The position of secondary care could also influence the perception of a professional's role. This could highlight interesting data, although it is not to be addressed by this piece of research. Pre-registration optometrists and optometry students are also excluded from the review because their experience of patient interactions will be limited and possibly biased towards their fellow students.

Table 2.3.1 PICO table *Indicating the review question and search criteria.*

Review Question:	Ocular Lifestyle Modifications: Perceived Knowledge and Competence – Do optometrists believe it is appropriate and how well are they equipped to offer effective support to those with chronic illness?
P (Population)	Optometric Workforce
I (Interest)	Perceived knowledge, role and competence regarding lifestyle modification support for chronic and ocular illness
Co (Context)	Clinical practice in the UK and other anglophone countries with a similar scope of optometry practice to the UK, (WCO Level four).

Interest: Papers discussing nutrition in the form of supplements or diet, smoking, UV exposure and activity levels will be included when regarding an optometrist's knowledge, perceptions, education, and role in patient care. Chronic illness affecting eyes and ocular illnesses affecting those 18 years old and over, which have lifestyle modifications as a known management option, with regards to an optometrist's knowledge, perceptions, education, and role in patient care will also be included.

Context: The scoping search indicated limited papers from the UK, therefore including papers from around the world will be beneficial. As previously discussed, optometry is a profession that varies in its role and responsibility across the world. Optometry in the UK is classed as WCO level four (Shneor *et al.*, 2021), optometrists in Australia and New Zealand are trained to level four (Padilla and di Stefano, 2009; Shneor *et al.*, 2021) as well as optometrists in Canada (Shneor *et al.*, 2021) and the USA (Shneor *et al.*, 2021). All of the aforementioned countries are English speaking. Colombia also has WCO level four optometrists and is Spanish speaking. To avoid the potential of a language bias which may occur from Colombian papers because they may have only been translated into English if they were considered successful (Boland *et al.*, 2017), only English-speaking countries with optometrists qualified to WCO level four will be included. Papers will be included if they are peer-reviewed. All dates will be included for the database used for all papers except those regarding AMD. Papers written about AMD before 2005 will be excluded. The date exclusion criteria for AMD are due to the introduction of the treatment for AMD with pegaptanib. This treatment was approved by the Food and Drugs Association (FDA) in December 2004 for neovascular AMD (Kim and D'Amore, 2012) and altered the management of AMD greatly. This factor was discussed, and it was felt to be a pragmatic clinical decision because material produced prior to the introduction of pegaptanib would no longer be clinically relevant and this would add additional variance and heterogeneity to the data if it were to be included in this review.

2.3.2. Systematic Review Search Strategy

The initial searches were carried out between 16th of January 2021 and 21st of March 2021. The following databases were searched: PubMed, Ovid Medline, Web of Science Core Collection, Scopus, Cochran, Cumulative Index to Nursing and Allied Health Literature (CINAHL), EBSCOhost, MEDLINE and Healthcare Database Advanced Searches (HDAS). The searches were all encompassing from each database and used Boolean terms in the most basic form. The searches were defined by choosing keywords for each section of the PICO structure and combining them with 'AND' in every combination. The chosen words are shown in table 2.3.2a and an adapted PRSIMA flow chart of the searches are detailed in appendix 2.3.2. In total 80,982 papers were found (before deduplication). Many of these papers were unrelated to the systematic review indicating the search was too broad, leading to an unmanageable number of records. The unrelated papers included

papers regarding animals for example, therefore the search strategy was reviewed and altered in a more additive combined manner, see table 2.3.2 b. This refined search strategy applied Boolean

Table 2.3.2a Initial search strategy – Indicating the words chosen and the search criteria they meet.

PICO sections			
	Population	Interest	Context
Chosen Keywords	Optomet*	Diet*	Advice
	Optici*	Supplement*	Education
	Eye Care Specialist*	Weight Loss	Training
		Chronic Disease Management	Continuing Education and Training
		Exercise	Continuing Professional Development
		UV Light Protection	Knowledge
		Nutrition	Competenc*
		Lifestyle	Experience
		Health	Scope of Practice
		Smoking	
		Alcohol	

terms more effectively to increase the efficiency of the searches. The final search was performed between the 27th of June and the 17th of July 2021 using Web of Science, National Institute for Health and Care Excellence (NICE), HDAS, Ovid Medline, EBSCO and PubMed. All papers found were exported to Endnote X9 and duplicates were removed using a Mac Pages spreadsheet and Endnote X9 de-duplicating software.

2.3.3 Inclusion and exclusion criteria.

An inclusion/exclusion table was written and piloted on ten percent of the remaining papers. In Endnote X9, papers can be ordered in multiple possible ways, therefore to prevent bias within the exclusion/inclusion pilot, which may have given an unclear result to the pilot, numbers were randomly generated from www.random.org (Randomness and Integrity Services, <https://www.random.org> (Accessed: 29th July 2021)) until 112 unique papers had been selected. The title and abstract (when required) were screened using the inclusion/exclusion criteria (see table 2.3.3). The pilot confirmed that the inclusion/exclusion criteria was viable. The papers were assessed against the inclusion/exclusion criteria table by one-member of the research team. Any queries were discussed with the rest of the research team. The reference sections of the included papers were reviewed to see if any further appropriate papers could be identified, these additional papers were also subject to the exclusion/inclusion criteria review.

Table 2.3.2 b Reviewed search strategy – indicating the terms used and the formation of the search string.

Search Strategy Reference	Search Term (af = all fields)
1	diet*.af
2	nutri*.af
3	food.af
4	("nutri*"OR food).af
5	supplemen*.af
6	4 AND 5.af
7	antioxid*.af
8	5 AND 7.af
9	AREDS.af
10	omega-3.af
11	smoking cessation.af
12	alcohol cessation.af
13	UV light protection.af
14	1 OR 2 OR 3 OR 6 OR 8 OR 9 OR 10 OR 11 OR 12 OR 13
15	eye health.af
16	eye profess*.af
17	optom*.af
18	optici*.af
19	15 OR 16 OR 17 OR 18
20	Educat*.af
21	lifestyle.af
22	public health.af
23	inform*.af
24	train*.af
25	advi*.af
26	scope of practice.af
27	20 OR 21 OR 22 OR 23 OR 24 OR 25 OR 26
28	14 AND 19 AND 27

2.3.4 Methodology of synthesis

The research question for this systematic review is based upon concepts that are already accepted (knowledge, skills, education, clinical practice, optometry) and therefore the purpose of the

systematic review is to extract information from the available studies with which to summarise the current position with respect to the practice of the optical workforce. This leads to an integrative form of synthesis (Boland *et al.*, 2017). Within the research question the knowledge, skills and confidence of optometrists are reviewed therefore interventions within healthcare are part of the study. Within this research project as a whole, there is the potential to develop an educational intervention if the need is confirmed. These factors lead to a thematic synthesis (Boland *et al.*, 2017) being the most appropriate synthesis technique.

Table 2.3.3 Inclusion/Exclusion criteria – table summarising the inclusion and exclusion criteria used to refine search.

Ocular Lifestyle Modifications: Perceived Knowledge and Competence – Do optometrists believe it is appropriate and how well are they quipped to offer effective support to those with chronic illness		
PICo – Population: optometric workforce. Interest: perceived knowledge, role and competence regarding lifestyle modification support for chronic illness. Context: Clinical practice in USA, UK, Ireland, Australia, Canada and New Zealand.		
	Inclusion criteria	Exclusion Criteria
Population	Qualified optometric workforce	Solely regarding or combined data including: Pre-qualification optometric workforce Nurses Ophthalmologists Other health professionals
Interest	Lifestyle modifications i.e., diet, nutritional supplements, smoking, activity levels, alcohols, and UV exposure. Chronic illnesses affecting the eyes or sight	
Context	Clinical optometry practice for adults	Animal studies Studies involving children
Setting	USA, UK, Australia, Ireland, Canada and New Zealand	All other countries
Language	English	All other languages
Time frame	All available except for AMD	AMD papers dated before January 2005.

The final papers were taken through the three-stage process of thematic synthesis; line-by-line coding of each paper, defining descriptive themes from the coding and finally generating analytical themes (Harden and Thomas, 2022). In stage one, statements were taken from the results section, discussions and author interpretations and given codes using a Mac Numbers (version 12.0 (7033.0.134)) spreadsheet. Stage two required developing descriptive themes that the line-by-line coding identified, referring back to the original text to maintain context of each statement and

grouping them as they were stated within context, without further interpretation or analysis (Harden and Thomas, 2022). The final stage required reviewing the descriptive themes and organising these into analytical themes to address the original review question (Graham *et al.*, 2020; Harden and Thomas, 2022).

2.3.5 Data Extraction

An a priori plan was developed for the data extraction of both quantitative and qualitative data loosely based on the Nutrition Competence (NUTCOMP) questionnaire (Ball and Leveritt, 2015). The NUTCOMP questionnaire is a validated questionnaire that has been used in many studies to

Table 2.3.5 Data extraction questions (* taken from NUTCOMP questionnaire (Ball and Leveritt, 2015), italics are unfulfilled questions.)

Analyses	Exclusion criteria	Knowledge of drug and food interactions*	Sponsorship
Additional notes	Full text/abstract only	Knowledge of national guidelines*	What are the specific objectives?
Age of the population.	Gender of the population	Knowledge of relationship between nutrition and eye health*	What is the study design?
<i>Are there linked publications?</i>	<i>How body composition impact illness*</i>	Level of nutrition education*	What type of research?
Authors	How many years of experience as an optometrist*	Limitations of the study	When was the study conducted?
<i>Confidence about body systems*</i>	Inclusion criteria	Number of participants	Where was the study conducted?
<i>Confidence in interpreting biological data*</i>	Is the journal peer-reviewed?	Occupation*	Which conditions are addressed?
Data analysis tool used	Is there adequate information to advise patients?	Primary outcome	Year of publication
Data reported	Journal title	Qualifications*	
Details regarding discussion between optometrist and patient*	Knowledge about body systems*	Secondary outcome	

investigate the competence, confidence, attitude and training regarding nutrition care and healthcare professionals (Ball and Leveritt, 2015; Al-gassimi *et al.*, 2020; Nayda *et al.*, 2021). An iterative process allowed for refinement and improvement within the data extraction. The a priori plan required refinement to prevent inadequate data collection for meaningful synthesis, the restricted nature of the original data collection plan could also have led to a bias within the data collected due to the varied nature of the studies that were reviewed. Wider, more encompassing questions were derived from the studies and added to the basic data extraction. Table 2.3.5 shows all the data collection aspects investigated.

2.3.6 Quality Assessment

A quality assessment review was carried out after data extraction to allow for a better understanding of the papers and the reliability and accuracy for each study. A quality assessment tool was developed after reviewing a few examples for cross-sectional studies, The National Institute of Health (NIH) quality assessment tool for cross-sectional studies, The Joanna Briggs Institute (JBI) Critical Appraisal Checklist for analytical cross-sectional study, The Appraisal tool for Cross-Sectional Studies (AXIS tool), and The Agency for Healthcare Research and Quality (AHRQ) Methodology Checklist for Cross-Sectional/ Prevalence Study (Ma *et al.*, 2020). The final quality assessment tool reviewed the appropriateness and accuracy of the chosen methodology, the limitations, biases, and conclusions made, and the ethics of the paper, appendix 2.3.6 shows the quality assessment tool used. The aspects that were assessed included clear aims and objectives, appropriate study design, clearly defined and appropriate population, acceptable response rate, quality assurance assessments, clearly defined, described and appropriate methodologies, data and statistical significance, justifiable discussion and conclusion, limitations adequately addressed, ethics approval and conflicts of interest declared.

2.4 Results

The refined search terms produced 1409 papers, 296 duplicates were removed, and 1082 papers removed during screening, citation searching identified a further 11 papers. These final 31 papers were reviewed using the inclusion/exclusion criteria resulting in a further 11 papers to be removed (see appendix 2.4 for the reasons they were removed), leaving 20 papers (see figure 2.4 for PRISMA flow chart). The final 20 papers were assessed using the quality assessment tool. Each aspect of the quality assessment tool was scored with the higher score indicating a better overall quality of paper. Most studies were very similar in the quality, with 60% scoring more than 77% and 40% of the included papers scoring between 78% and 81%. Using this assessment tool, the highest scoring paper scored 94% (Lorenatto *et al.*, 2019). The common struggles faced by the focus groups, interviews and questionnaires, were response rates and self-selection bias. The low response rates can in turn lead to a non-response bias. This is often the nature of voluntary questionnaires, interviews and focus groups. Not all papers reported a response rate, some papers

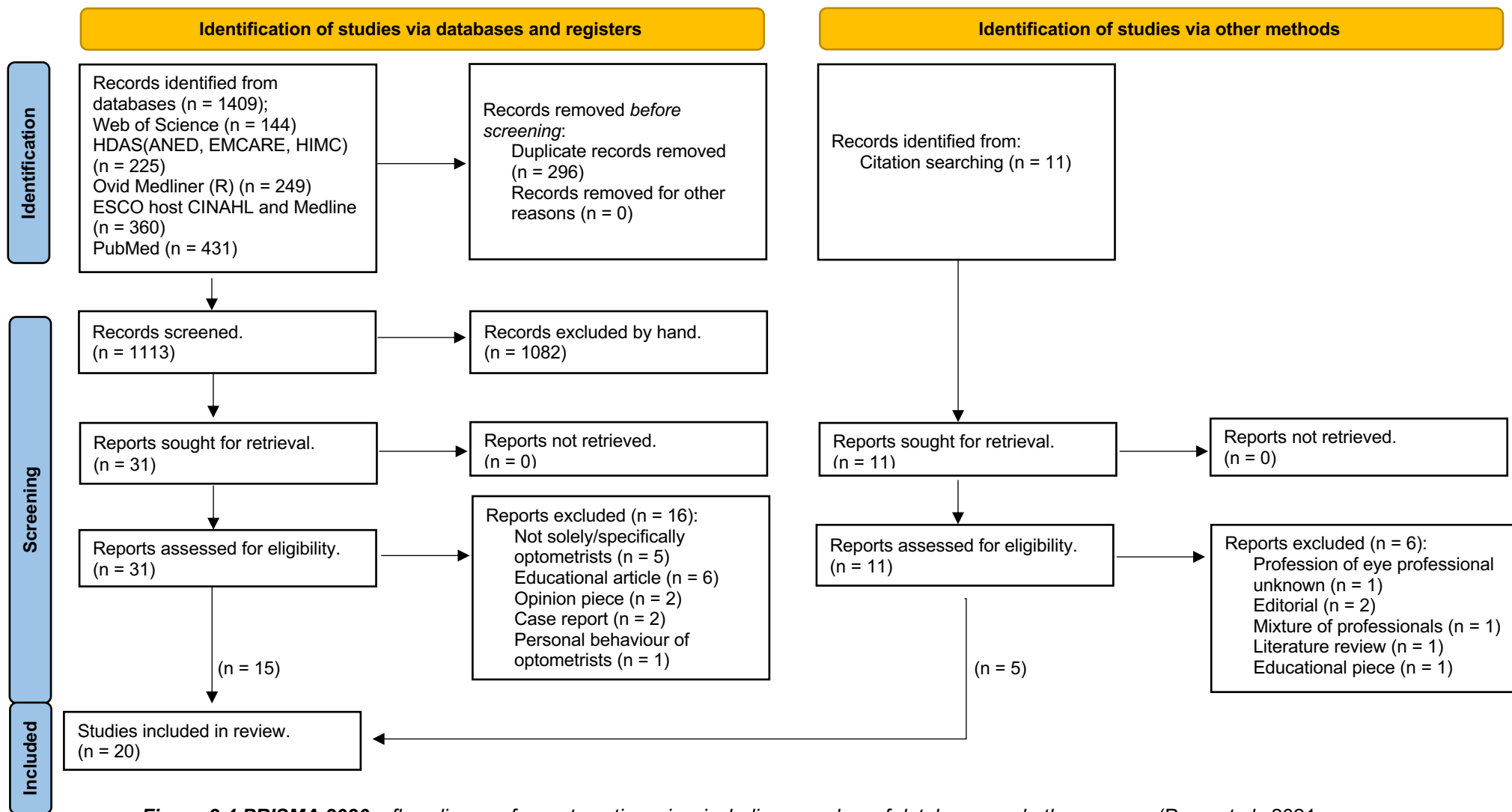


Figure 2.4 PRISMA 2020 – flow diagram for systematic review including searches of databases and other sources (Page et al., 2021)

were unable to state a response rate because the total available population was unknown. The largest response rate was 71.8%, reported by Thompson *et al.* (2007) with the mean response rate of the remaining papers calculated to be 23.8%. The WHO require an overall response rate of at least 75% as a minimum standard for their surveys (Üstün *et al.*, 2005) and Fincham (2008) reported a response rate of 60% should be the goal for surveys, and for pharmacy the response rate is expected to be more than or equal to 80%. All papers discussed the limitations of the response rate. Following the quality assessment all papers were retained due to the interpretive nature of the analysis and all papers having a relevance with their quality being considered in the interpretation.

The overall trends and patterns from the analysed papers are shown in table 2.4, which identifies the study design, sampling methodology, the country involved, the lifestyle change, or condition discussed and the quality assessment score for each paper. The practice populations studied in the most part were Australian (Downie *et al.*, 2013; Downie and Keller, 2015; Downie *et al.*, 2016; Ly *et al.*, 2017; Jalbert *et al.*, 2020; Zhang *et al.*, 2020; Gocuk *et al.*, 2021) and the UK (Graham *et al.*, 2010; Loughman *et al.*, 2011; Lawrenson and Evans, 2013; Lawrenson *et al.*, 2015; Downie *et al.*, 2016; Lorencatto *et al.*, 2019; Thompson *et al.*, 2007) with seven papers each. In total the papers included 911 Australian optometrist participants and more than 2568 UK optometrist participants, the Loughman *et al.* (2011) participants have not been included in this total participant count because they reported 724 participants, this included optometrists in UK and Ireland and the response rate for each country was not stated. The aspect of lifestyle change studied the most was smoking with ten papers and a total of 3854 optometrist participants (Thompson *et al.*, 2007; Kennedy *et al.*, 2011; Brûlé *et al.*, 2012; Lawrenson and Evans, 2013; Kennedy *et al.*, 2014; Downie and Keller, 2015; Lawrenson *et al.*, 2015; Landis *et al.*, 2017; Lorencatto *et al.*, 2019; Sahli *et al.*, 2020). The condition most studied was AMD with nine papers and a total of 3720 optometrist participants (Larson and Coker, 2009; Loughman *et al.*, 2011; Lawrenson and Evans, 2013; Kennedy *et al.*, 2014; Downie and Keller, 2015; Lawrenson *et al.*, 2015; Ly *et al.*, 2017; Jalbert *et al.*, 2020; Gocuk *et al.*, 2021). Only one paper investigated optometrists' opinions and practice advising about lifestyle factors in general including smoking, alcohol, diet and physical activity (Sahli *et al.*, 2020). The target population for the Sahli *et al.* (2020) study was relatively small, n=140, covering the area of Western New York, USA. In the UK the largest study to look at lifestyle changes in primary care optometry, considering barriers, enablers, current practice, and education was by Lorencatto *et al.* (2019) and focused on smoking (Lorencatto *et al.*, 2019), with 408 participants. The line-by-line coding process was carried out and this developed ten key descriptive themes which in turn were divided into two analytical themes: 'appropriateness' and 'knowledge/skills'. The ten descriptive themes are detailed below with the number of relevant papers shown in brackets.

2.4.1 Techniques/Tests (6/20)

To assess for certain eye conditions requires specific tests and techniques. Some of which fall into the core competencies of an optometrist and the standard list of suggested equipment for a routine

Table 2.4 Summary of each study included – details of location, participants, findings, sampling, study design and quality assessment score.

Author	Geographic location	Participants (Population)	Main findings (Interest and Context)	Study Design	Quality Score
Brule, J., Abboud, C. and Deschambault, É. (2012)	Canada	288 Optometrists (51% response rate)	Smoking: 16%- 76% ask about smoking depending on clinical status. Minority discussed cessation with patients who smoke. Optometrists believe smoking cessation is within their role. Barriers reported as lack of knowledge in counselling, cessation drugs, patient motivation, time, following up, assessing who wishes to quit, written literature. About half wish to improve knowledge, half resources and articles about cessation.	Simple random sampling used to determine, 600 registered members of the Ordre des Optométristes du Québec in 2010. Postal self-administered questionnaire. Questionnaire based on validated questionnaires.	61%
Downie, L.E. and Keller, P.R. (2015)	Australia	283 Optometrists (6.7% response rate)	Smoking: Less than 50% ask patients about smoking and less so in younger practitioners. Most of those who ask, advise about cessation. Barriers reported are that it is a GPs responsibility, time, too intrusive, already sufficient patient awareness of risks. Diet and supplements: Less than 2/3 ask about diet, about half ask about supplements. Many advise supplements for AMD, DED and eyelid twitching . Knowledge: journals (non-peer and peer reviewed journals, colleagues, clinical trials, marketing, personal impression).	A web-link for an e-survey was sent via email to all members of Optometry Australia in November 2013. 45 questions based on previous dry eye questionnaire.	86%
Downie, L.E., Keller, P.R and Vingrys, A.J. (2013)	Australia	144 Optometrists and ophthalmologists (22% response rate). Members of Cornea and Contact Lens Society of Australia (CCLSA).	DED: Expertise and knowledge: 75% correctly named techniques relating to DED. Diagnosis: Patient symptoms most important, less than 4% use DEQ. Treatment: Mainly non-preserved lubricants and lid hygiene. Many advise an increase in Omega-3. Knowledge: CET, undergrad and post-grad training, peer-reviewed articles, colleagues.	A web-link for an original e-survey was sent via email to all members of Cornea and Contact Lens Society of Australia in July 2012. Ten questions forced choice.	64%

Table 2.4 Summary of each study included (continued) – details of location, participants, findings, sampling, study design and quality assessment score.

Author	Geographic location	Participants	Main findings	Study Design	Quality Score
Downie, L.E., Rumney, N., Gad, A., Keller, P.R., Purslow, C. and Vingrys, A.J. (2016)	UK and Australia	317 Optometrists (response rate 21% Australia, 17% UK response rate). CCLSA and British Contact Lens Association (BCLA).	DED: Expertise: Similar level of knowledge and exposure between the two countries. Diagnosis: Patient symptoms important to about 75%, followed by tear break up time (TBUT). Management: Eyelid hygiene and lubricant drops most common in both countries. Increase Omega-3 advised.	A web-link for a previously used e-survey was sent via email to all optometrist members of Contact Lens Society of Australia and British Contact Lens Association in winter.	67%
Gocuk, S.A., Lee, J., Keller, P.R., Ayton, L.N., Guymmer, R.H., McKendrick, A.M., Downie, L.E. (2021)	Australia	15 Optometrists at two major Australian clinical education conferences.	AMD: Confidence: post audit most improvement shown in knowledge of risk factors, asking patients about these risk factors and early diagnosis. Counselling: improvement in smoking cessation and nutrition seen post-audit. Tests: Amsler use increased for intermediate AMD. Optical Coherence Tomography (OCT) requests increased. Knowledge: self-improvement nominated smoking, nutrition and Amsler tests	Survey about demographics and confidence of AMD. Audit tool MaD-CCAT, analytical feedback, then re-audit. Promoted to optometrists attending Southern Reginal Congress and the Western Australian Vision Education meeting in 2018.	81%
Graham, J.E., McGilligan, V.E., Berrar, D., Leccisotti, A., Moore, J.E., Bron, A.J., and Moore, T.C.B. (2010)	Worldwide (1.64% from each Egypt, France, Germany, Ireland, Malaysia, and New Zealand. 90.16% from UK)	38 Optometrists, 23 Ophthalmologists (7.4% response rate)	DED: Diagnosis: patient symptoms most commonly used. Not many use DEQ. Treatments: tear supplements and lid hygiene were the most common.	A web-link for a modified previously used questionnaire was sent via email to 178 practitioners outside of the UK and 650 practitioners within the UK in 2007. The detail of population selection is not stated. Anonymous survey using forced choice and Likert scale.	44%

Table 2.4 Summary of each study included (continued) – details of location, participants, findings, sampling, study design and quality assessment score.

Author	Geographic location	Participants	Main findings	Study Design	Quality Score
Jalbert, I, Rahardjo, D., Yashadhana, A., Liew, G., and Gopinath, B. (2020)	Australia	67 Optometrists and 10 ophthalmologists and 1 low vision rehabilitation officer	AMD: Barriers: top three, cost/funding, understanding/denial, discipline silos. Enablers: top three, education, access, shared care model	Seven focus groups of 65 optometrists with one facilitator, individuals ranked their perceived top 5 barriers and enablers. In-depth interviews with 10 ophthalmologists and 2 optometrists, auto recorded, transcribed and analysed with NVivo. Semi-structured interviews based on research and issues raised during focus group. Focus groups had three CPD points, monetary compensation and light refreshments. Purposive, snowballing and maximum variation sampling used to recruit ophthalmologists and optometrists registered to practice in Australia in 2016.	81%
Kennedy, R.D., Spafford, M.M, Douglas, O., Brûlé, J., Hammond, D., Fong, G.T., Thompson, M.E. and Schultz, A.S.H. (2014)	Canada	850 Optometrists (19% response rate)	Smoking: knowledge: top three ocular diseases believed to be associated to smoking AMD, ocular surface disease, cataracts. Assessment: most ask about smoking at initial visit, 8% never ask. More likely to ask if there are signs of smoking or clinical conditions linked to smoking. Counselling: More than half explain the ocular risks of smoking and advise to quit. Most don't have printed information to give patients and advise they see their GP. Barriers: top three; insufficient knowledge of services, time, lack of educational materials.	A web-link for a bilingual e-survey was sent via email to all practising Canadian optometrists in 2012. The 45-item questionnaire had been piloted in 2009.	81%

Table 2.4 Summary of each study included (continued) – details of location, participants, findings, sampling, study design and quality assessment score.

Author	Geographic location	Participants	Main findings	Study Design	Quality Score
Kennedy, R.D., Spafford, M.M., Schultz, A.S.H., Iley, M.D., and Zawada, V. (2011)	Canada	11 Optometrists (22% response rate) 18 fourth year optometry students (60% response rate)	Smoking: Current practice: Optometrists ask about half of new adult patients about smoking. All aware of risks of smoking on ocular health. Patients who smoke are generally advised to quit, no one gave advice of how to quit. Barriers: perceived role and patients' knowledge of harm. Lack of tools, time and knowledge of local resources and financial incentives. Opportunities: Practitioners 'open to change', fear of blindness being motivational tool, and access to patients.	A pilot study involving 4th year optometry students from the University of Waterloo School of Optometry and 12 interested optometrists from a list of 51 practices in the Waterloo region in the most recent phonebook in 2009. A discussion of nine questions followed by prescribed question probes.	64%
Landis, Z.C., Rolius, R., and Scott, I.U. (2017)	America	148 faculty members, 19 fellows, 102 residents, 23 optometrists (21.25% overall maximum response rate, although total population unknown so could be smaller)	Not much information about optometrists alone. Smoking: 70% always ask about smoking (this is more than ophthalmologists), 39% always advise cessation.	A web-link for an e-survey was sent via email to each co-ordinator of ophthalmology residency programmes accredited by the Accreditation Council for Graduate Medical Education . Likert questions. Not stated if questionnaire had been used before.	69%
Larson, T. and Coker, J. (2009)	USA	127 optometrists (42.3% response rate)	Nutrients: Knowledge: most optometrists were moderately or very informed about the relationship between lutein and zeaxanthin and the eye. Mainly from professional journals, professional materials and meetings, less from pharmaceutical companies and colleagues. Most felt they had sufficient information to advise patients. Most reported issuing information material to patients. Barriers: to not giving material, unable to obtain, limited research, prefer to answer direct questions.	A 20-item newly designed postal survey was sent to a random sample of 300 optometrists from the 794 optometrists licensed in Wisconsin in May 2003.	78%

Table 2.4 Summary of each study included (continued) – details of location, participants, findings, sampling, study design and quality assessment score.

Author	Geographic location	Participants	Main findings	Study Design	Quality Score
Lawrenson, J.G. and Evans, J.R. (2013)	UK	1414 optometrists (16.2% response rate) 54 ophthalmologists (6% response rate)	Dietary advice: Most always gave advice to those with AMD , and over half advised those at risk. Most advised supplements to those with AMD worse in one eye. A third advise supplements for prevention (more so in optometrists than ophthalmologists).The supplement used in the AREDS trial was the least likely to be recommended (ophthalmologists more likely to recommend AREDS supplements than optometrists). Smoking and AMD: a third take smoking history for new patients, half advise smokers of the link to sight loss, a third advise cessation. Ophthalmologists ask more patients and advise more to quit than optometrists. Knowledge: Professional journals and conference presentations most common.	Previously used e-survey (£100 incentive of vouchers.) An invite was included in news bulletins sent to members of the College of Optometrists and the Royal College of Ophthalmologists, UK in 2012.	89%
Lawrenson, J.G., Roberts, C.A. and Offord, L. (2015)	UK	26 optometrists (32% response rate)	Smoking and AMD: Knowledge: over three quarters were aware of link. Practice: 4% regularly took a smoking history, 12% offered cessation advice, 88% did not know how to refer. Barriers: patient: practitioner relationship, how to raise the subject, time. Intervention: All aspects improved following intervention but to a maximum of 55% in practice.	A web-link for an e-survey was sent via email to all members of Shropshire Local Optical Committee (LOC) in December 2013, with 10 forced choice questions. Unknown if questionnaire was validated.	64%

Table 2.4 Summary of each study included (continued) – details of location, participants, findings, sampling, study design and quality assessment score.

Author	Geographic location	Participants	Main findings	Study Design	Quality Score
Lorencatto, F., Asif, S., Francis, J.J., Harper, A.M. and Lawrenson, J.G. (2019)	UK	408 Optometrists (34% response rate)	Smoking: Knowledge: Most aware of link between smoking and ocular health. Most felt inadequately trained to advise on cessation, did not patient information or guidance information. Current practice: Just over a third ask new patients if they smoke. A minority advised all smokers to quit. If a patient expressed interest in quitting most would direct patient to their GP. Barriers: intruding on patient choices, time, knowledge. Enablers: ideally placed to discuss with patients, practical skills training, establishing professional norm.	A web-link for an e-survey was sent via email to a random sample of 1200 members of the College of Optometrists, UK from the 9000 members in June 2015. 40 questions. Not validated, informed by content of previous studies.	94%
Loughman, J., Nolan, J.M., Stack, J. and Beatty, S.. (2011)	UK and Ireland	724 optometrists (8.2% response rate)	AMD: Amsler grid most widely used technique. Most advised supplements to those with AMD, and almost three quarters advised them to those at risk, usually driven by presence of atrophy, drusen and pigmentary changes.	A web-link for an e-survey of 11 questions was sent via email to all members of The Association of Optometrists in Ireland and the College of Optometrists in the UK. Validation of questionnaire not mentioned.	44%
Ly, A., Nivions-Smith, L., Zangeri, B. and Kalloniatis. M. (2017)	Australia and New Zealand	127 Australian optometrists (2.67% response rate) 87 New Zealand optometrists (12.6%) responded fully.	AMD: Knowledge: most considered their knowledge and competency to be above average or higher in clinical optometry and diagnosing and managing AMD. Most use visual acuity, amsler grid, symptoms and fundus appearance to diagnose. Awareness of guidelines was 11% to 30%. Supplements in AMD management was rated low.	A web-link for a new 30 question e-survey was sent via email to all members of Optometry Australia, the New Zealand Association of Optometrists and Centre for Eye Health (Australian cohort) in 2015.	78%

Table 2.4 Summary of each study included (continued) – details of location, participants, findings, sampling, study design and quality assessment score.

Author	Geographic location	Participants	Main findings	Study Design	Quality Score
Sahli, M.W., Ochs-Balcom, H.M., Moeller, S.M., Brady, W.E., Tolford, T.W. and Millen, A.E. (2020)	New York	42 Optometrists (31% response rate)	Current practice: Most ask about smoking, diabetes, medication, alcohol, supplements, and blood pressure. Less than 25% ask about dietary intake, physical activity, weight, and height. Advise about smoking and nutrients more than alcohol and physical activity. If lifestyle advice was offered, it was usually due to conditions and patients were advised most commonly to see their GP. Barriers: lack of time, training, knowledge, belief it would make a difference.	A new 15 to 21 question postal survey was sent to optometrists practising in Western New York region, USA in 2013. Incentive of lottery draw was offered.	78%
Thompson, C., Harrison, R.A., Wilkinson, S.C., Scott-Samuel, A., Hemmerdinger, C. and Kelly, S.P.. (2007)	UK	509 optometrists (71.8% response rate)	Smoking: Current practice: Less than 10% ask about smoking routinely. 23% advised cessation usually by referral to GP. Barriers: not within their role, time, forgetting. Those more recently qualified thought smoking history was more relevant and assess motivation to stop. Enablers: Improve knowledge, training on cessation, direct referral to cessation service.	A validated postal 14 question survey was sent to optometrists registered with the GOC and practising in north-west England in 2005.	78%
Xue, A.L., Downie, L.E., Ormonde, S.E. and Craih, J.P.. (2017)	New Zealand	174 optometrists (26% response rate) 29 ophthalmologists (26% response rate)	DED: Knowledge: interest declared by 67% of optometrists. Tests commonly used tear break up time TBUT, schirmer test, tear meniscus. Patient symptoms was the most important test. Less than 5% use DEQ. Management: non-preserved lubricants, eyelid hygiene, omega-3 fatty acid intake increase. Education: CET conferences, peer reviewed journals.	A web-link for a new of 20 question e-survey (adapted from questionnaire by Downie <i>et al.</i> (2013)) was sent via email to 614 optometrists by the New Zealand Association of Optometrists, the Cornea and Contact Lens Society of New Zealand, and Specsavers Optometrists in 2015.	78%

Table 2.4 Summary of each study included (continued) – details of location, participants, findings, sampling, study design and quality assessment score.

Author	Geographic location	Participants	Main findings	Study Design	Quality Score
Zhang, A.C., Singh, S., Craig, J.P. and Downie, L.E. (2020)	Australia and New Zealand	132 Australian optometrists and 74 New Zealand optometrists (response rate not reported, possibly 3.2% with possibly 6500 practicing optometrists in area surveyed).	<p>Nutrients: current practice: Most ask patients about their diet, mainly regarding supplements. Half sometimes give dietary advice. Most advise consumption of omega-3 fatty acid.</p> <p>Barriers: insufficient evidence, not within their scope of practice, no clinical benefits seen, advise other intervention instead. Knowledge: Half did not know there was a biological difference between plant based and marine based omega-3, most did not know the ideal ratio of omega-3 to omega-6 in the human diet. A small percentage would advise the patient to discuss omega-3 with their GP. CET, under-grad education and clinical experience were most common evidence sources.</p>	A web-link for a new 39-item (previous pilot) e-survey was distributed to optometrists via Optometry Australia and associated early career networks, Cornea and Contact Lens Society of Australia, New Zealand Association of Optometrists, and Cornea and Contact Lens Society, New Zealand and at professional education conference in 2019.	86%

eye examination (The College of Optometrists, 2021) others are seen as additional techniques and equipment.

Regarding DED, less than half of optometrists reported using Schirmer Test (Graham *et al.*, 2010; Xue *et al.*, 2017), grading scales, Keratograph (Xue *et al.*, 2017) tear meniscus height, phenol red test, dry eye questionnaire (DEQ), Tearscope™ (Graham *et al.*, 2010; Downie *et al.*, 2013; Xue *et al.*, 2017), Placido-disc, and interferometry (Downie *et al.*, 2013; Xue *et al.*, 2017), to appropriately assess tear stability and volume. The most commonly reported test to assess tear stability was tear break up time (TBUT) (Graham *et al.*, 2010), reported by 89% (Xue *et al.*, 2017), this was also one of the top three diagnostic procedures for DED according to optometrists (Downie *et al.*, 2013), with the other two being patient symptoms (Graham *et al.*, 2010; Downie *et al.*, 2013; Xue *et al.*, 2017) and corneal fluorescein staining (Downie *et al.*, 2013) or meibomium gland evaluation (Xue *et al.*, 2017). These top four tests for diagnosing DED all use core knowledge and standard equipment. Tear hyperosmolarity has been stated to be highly specific for diagnosis of DED (Tomlinson *et al.*, 2006) although Downie *et al.* (2016) reported less than eight per cent of optometrists used this technique and Xue *et al.* (2017) reported even less optometrists using it. Both papers suggested this could be due to testing techniques, knowledge, and cost of the service (Downie *et al.*, 2016; Xue *et al.*, 2017).

Regarding AMD, the techniques listed in order of preference in Loughman *et al.* (2011) for detecting AMD were Amsler grid (35%), fundus photography, measurement of macular pigment (16%), ophthalmoscopy, Volk examination, risk assessment and optical coherence tomography (OCT). In addition to the above techniques, Ly *et al.* (2017) also reported using visual acuity and refraction, slit lamp fundoscopy, and colour vision. Less than 50% of practitioners reported using OCT, retinal photography, fundus autofluorescence (FAF), auto-perimetry, contrast sensitivity and photostress testing (Ly *et al.*, 2017). Amsler grid, colour vision testing, ophthalmoscopy, visual acuity and refraction, slit lamp and visual field equipment are all suggested standard equipment (The College of Optometrists, 2021). The auto-perimetry and colour vision testing are considered relevant for AMD but not used (33% and 32% respectively) (Ly *et al.*, 2017) and not referred for (17% and 13% respectively) (Ly *et al.*, 2017). Fundus photography, measurement of macular pigment, OCT, FAF, contrast sensitivity and photostress testing are all additional testing techniques, with the exception of macular pigment measurement (for which the information was not reported in these papers) they were all considered relevant (97% to 99%,-, 100%, 99%, 53%, 51% respectively) (Ly *et al.*, 2017) and referred for if they were not accessible in practice at the following rates; OCT 38%, FAF 38%, modified retinal photography 19%, photostress testing 15% and contrast sensitivity nine per cent (Ly *et al.*, 2017). Macular pigment measurement is a technique which can take about 20 minutes to produce the scientific community's gold standard result with previous commercial versions not producing similar results, 16% of respondents reported measuring macular pigment (Loughman *et*

al., 2011). Once more the more popular tests are the ones considered part of the standard testing equipment with exception of advanced imaging (OCT and FAF).

2.4.2 Clinical responsibility (6/20)

'*Optometrists seem to be willing to become collaborators in smoking cessation interventions*' was concluded by Brûlé *et al.* (2012). Kennedy *et al.* (2014) reported 99.3% optometrists agreed they should educate patients about smoking related eye conditions with 80.5% of practitioners reporting they should take an active role in helping patients to quit smoking (Kennedy *et al.*, 2014), or 65% to recommend for their patients to stop smoking (Brûlé *et al.*, 2012). This response was smaller in the Lorencatto *et al.* (2019) paper with 51.8% reporting optometrists were ideally placed to discuss smoking cessation and 47.1% expressed it was a 'small part of their role'. Downie and Keller (2015) and Thompson *et al.* (2007) reported a different position regarding an optometrist's role in smoking cessation, in which many optometrists reported smoking cessation was a medical issue and the responsibility of the patient's GP (Downie and Keller, 2015) and '*it was not considered to be their professional role*' by 35% (Thompson *et al.*, 2007 p391). Kennedy *et al.* (2011 p769) reported a generally similar standpoint from their informants, stating '*cessation advice was inconsistent with their role as an optometrist*' and '*informants saw addressing smoking as the responsibility of family practitioners*'. One informant in the Kennedy *et al.* (2011 p770) paper reported "*Should optometry as a profession [refer smokers to cessation services]? I think the answer would be, yes.*"

With regard to nutrition, Downie and Keeler (2015) suggest it is more complicated, with the perception that dietary assessment is '*complex and beyond the scope of routine practice for optometrists*'. One informant in the Kennedy *et al.* (2011 p769) paper reported '*educating patients about risk factors, including smoking, was within their scope of practice and there were parallels with other behavioural counselling efforts including ultraviolet exposure and nutrition*'.

2.4.3 Patient enquiries (15/20)

Knowing the manner in which optometrists enquire about lifestyle modifications could indicate more accurately what is clinically happening as opposed to opinions of clinical responsibility.

When considering smoking the proportion of optometrists who regularly ask about smoking varies greatly from 2% to 98% (2% of follow up appointments (Thompson *et al.*, 2007), 4% unspecified (Lawrenson *et al.*, 2015), 6% of new appointments (Thompson *et al.*, 2007), 16% unspecified (Brûlé *et al.*, 2012), 21% unspecified (Gocuk, 2021), 21% of follow up patients (Lawrenson and Evans, 2013), 28% of follow up appointments, 32% of new appointments (Lawrenson and Evans, 2013), 35% of new appointments (Lorencatto, *et al.*, 2019), 47% unspecified (Downie and Keller, 2015), about half of new appointments (Kennedy *et al.*, 2011), 55% of new patients (Kennedy *et al.*, 2014), 70% unspecified (Landis *et al.*, 2017) to 98% unspecified (Sahli *et al.*, 2020)). Some of the studies reported situations that increased the frequency that practitioners asked about smoking, for example

a higher number reported asking about smoking status when presented with smoking related eye conditions 56% (Kennedy *et al.*, 2011) and 69% (Brûlé *et al.*, 2012) or a risk of smoking related eye conditions 76% (Brûlé *et al.*, 2012) or a chronic health condition associated with smoking, 27% (Kennedy *et al.*, 2011). Downie and Keller (2015) reported the age of the practitioner was an influencing factor, with older practitioners more likely to ask than younger practitioners, although this was not confirmed by Lorencatto *et al.* (2019) who found the number of years an optometrist has been qualified did not affect the frequency they asked. Conversely, Thompson *et al.* (2007) reported those who had been qualified more than five years were more likely to indicate a smoking history was irrelevant. The practitioner's own smoking status has not been shown to affect whether they ask about smoking or not (Lorencatto *et al.*, 2019). Gender was not a significant factor in the Downie and Keller (2015) study, although Kennedy *et al.* (2014) reported women were more likely to assess their patients' interest in quitting smoking. Geographic location was important for recording smoking status in the UK, with optometrists in Scotland more likely to ask (Lorencatto *et al.*, 2019). This is most probably because in 2004 it became a requirement for optometrists in Scotland to record smoking status (Thompson *et al.*, 2007). Geographic location in Australia was not found to be a significant factor by Downie and Keller (2015).

When considering nutrients and dietary supplements Downie and Keller (2015) reported 62% of optometrists surveyed counselled their patients about diet and 55% routinely asked about nutrients. In general, geographic location or therapeutic qualifications were not reported to affect the outcomes, although it was suggested that older practitioners and those who were personally taking nutritional supplements were more likely to counsel their patients about diet and female practitioners were more likely to enquire about nutritional supplements (Downie and Keller, 2015). When recommending supplements, Downie and Keller (2015) reported supplements were recommended by most practitioners most commonly for AMD (91%), DED (64%) and eye lid twitching (4%) with more recommendations made by younger practitioners. Downie *et al.* (2013) also reported nutritional advice for DED, more than 50% to 70% of the optometrists surveyed recommended supplements for DED and 40% to 49% recommended dietary changes in Australia. In 2016 Downie *et al.* reported a higher proportion of UK optometrists recommended an increase in dietary omega-3 than Australian optometrists or mild DED. Nineteen percent of Australian optometrists surveyed advised increasing dietary intake of omega-3s compared to 31% of UK optometrists, which Downie *et al.* (2016) reported as being statistically different (Downie *et al.*, 2016). There was no statistical difference between the two countries for more severe forms of DED or for using omega-3 supplements for any severity of DED (Downie *et al.*, 2016). The aforementioned studies reported higher levels of nutrition guidance than by Gocuk *et al.* (2021) who identified for AMD in their pre-audit data, 11% of respondents recorded dietary behaviours and 20% recorded nutritional supplementation. With respect to dietary and nutritional advice and recommendations for people living with AMD the frequencies are higher. Lutein and zeaxanthin supplements, increased dietary intake in spinach and

oily fish, zinc supplements, and multivitamin supplements for those diagnosed with AMD was reported to be, 79% to 81% (Larson and Coker, 2009), 68% to 93% (Lawrenson and Evans, 2013), 91% (Loughman *et al.*, 2011). For those at risk of AMD the frequencies were lower in all studies, 67% to 79% (Larson and Coker, 2009), 34% to 54% (Lawrenson and Evans, 2013), 73% (Loughman *et al.*, 2011). Multivitamins were also advised for those at risk of cataracts (35%) and those diagnosed with cataracts (33%) (Larson and Coker, 2009).

2.4.4 Education (10/20)

When considering education, four sub themes developed; sources of current education, a need and/or desire for further education, results of specific educational interventions and current curriculums and educational intervention mediums.

The sources of education were reported to be; continuing education conferences (Lawrenson and Evans, 2013; Downie *et al.*, 2016; Xue *et al.*, 2017), undergraduate education (Lawrenson and Evans, 2013; Downie *et al.*, 2016), post-graduate education (Lawrenson and Evans, 2013), industry-sponsored education (Larson and Coker, 2009; Lawrenson and Evans, 2013; Downie *et al.*, 2016), professional journals (Larson and Coker, 2009; Lawrenson and Evans, 2013) both peer-reviewed (Downie *et al.*, 2016; Xue *et al.*, 2017) and non-peer-reviewed optometric publications (Downie *et al.*, 2016), professional meetings (Larson and Coker, 2009), material published by professional organisations (Larson and Coker, 2009), National Eye Institute (Larson and Coker, 2009), colleagues (Larson and Coker, 2009; Lawrenson and Evans, 2013), TV (Larson and Coker, 2009), newspapers (Larson and Coker, 2009), radio (Larson and Coker, 2009), non-profit organisations (Larson and Coker, 2009; Lawrenson and Evans, 2013), personal experience (Lawrenson and Evans, 2013) and the internet (Larson and Coker, 2009). This is a large variety of education sources, some are peer reviewed with scientific evidence, as reportedly desired in the Loughman *et al.* (2011) paper and others with less scientific evidence. Both peer-reviewed and non-peer reviewed publications were reported, and Xue *et al.* (2017) suggested the low number using peer-reviewed publications in their report could be due to the limited journal access without significant subscription cost in private practice. The effect of post-graduate education could possibly be seen in the Downie *et al.* (2016) paper where they reported more optometrists in Australia prescribed topical corticosteroids and more optometrists in the UK referred for ophthalmological care regarding steroids. They concluded this could be a reflection of optometrists' further education with about a third of Australian optometrists endorsed for prescribing ocular medication compared to about two per cent of UK optometrists (Downie *et al.*, 2016).

Many papers reported a positive desire for further education. Kennedy *et al.* (2014) reported most respondents wanted to learn more about how to help patients quit smoking, many wanted to learn about smoking and ocular health (Loughman *et al.*, 2011; Kennedy *et al.*, 2014) and '79% of

optometrists interested in learning how to provide smoking prevention and cessation advice' (Kennedy *et al.*, 2014 p774), 56% thought they would benefit from training on smoking cessation (Loughman *et al.*, 2011), 48% wished to improve their knowledge about smoking cessation (Brûlé *et al.*, 2012) and 47% reported wanting practical skills training (Lorenatto *et al.*, 2019). Many papers reported their studies indicate a need for further training and development over many areas of optometry;

There is potential to improve practitioner awareness of DEQ in both Australia and UK. (Downie *et al.*, 2016).

'The finding argues strongly for the development of clear international guidelines to ensure best practices approaches.' (Downie *et al.*, 2016 p147).

'Training could also help raise awareness amongst optometrists of potential issues and challenges related to advising on cessation and how to overcome these.' (Lorenatto *et al.*, 2019 p17)

'It is clear from this survey that AMD continues to present a challenge to the optometry community.' (Loughman *et al.*, 2011 p141)

'It is important that optometric and ophthalmic bodies and organisations, and NHS commissioners now work in partnership to ensure that training in smoking cessation-related issues for optometrists is offered.' (Thompson *et al.*, 2007 p392)

'Implementation of the Dry Eye Workshop II outcomes by eye care clinicians, to ensure the appropriate translation to research evidence into practice, may prove integral to achieving further gains in the provision of clinical care to dry eye sufferers.' (Xue *et al.*, 2017 p200)

'findings ... highlight insufficiencies in training and educational materials' (Brûlé *et al.*, 2012 p603).

These papers all indicated a need and a want for further education regarding conditions with potential lifestyle modifications as treatment. The paper by Lawrenson *et al.* (2015) investigated the next step and produced an educational intervention regarding optometry and smoking. The results from their intervention were an improved knowledge of the link between smoking and AMD, and an increased likelihood to take a smoking history and provide smoking cessation advice (Lawrenson *et al.*, 2015). They also reported an increase in the knowledge of how to refer a patient regarding smoking cessation, although more than half were still unaware of the exact manner of referral after the educational intervention (Lawrenson *et al.*, 2015). Lorenatto *et al.* (2019 p17) reported *'Optometrists who received formal training in smoking cessation were significantly more likely to advise patients who smoke on cessation.'* (Lorenatto *et al.*, 2019).

When considering a design for further education the papers in this review Downie *et al.* (2016) and Kennedy *et al.* (2014) both reported education needed to be multi-faceted with a need for the education and practice to be evidence based with better translation between research and practice (Lawrenson and Evans, 2013; Kennedy *et al.*, 2014; Downie *et al.*, 2016). Lorenatto *et al.* (2019) investigated current topics in smoking cessation training, and they reported *'the relationship between smoking and eye disease was the most common topic'*, and *'practical delivery of smoking cessation interventions in clinic settings'* and *'smoking cessation medications'* were the least covered topics (Lorenatto *et al.*, 2019 p10).

2.4.5 Specialist Interest (5/20)

Many papers reported the effects of optometrists with a declared specialist interest or further post-graduate education, particularly regarding therapeutics. In most cases those with a self-declared specialist interest or further qualifications were more likely to self-report higher competencies (Ly *et al.*, 2017), were more knowledgeable about nutrition and DED (Zhang *et al.*, 2020), reported a greater use pharmaceutical interventions (Xue *et al.*, 2017), and used more and newer diagnostic techniques (Downie *et al.*, 2013). Xue *et al.* (2017) was the only paper in this study to report a correlation between a self-declared interest and knowledge. Jalbert *et al.* (2020) reported that it is unclear which optometrists have which specialist interest and therefore difficult to know which optometrist is appropriate to refer a patient to.

2.4.6 Knowledge (15/20)

When regarding current knowledge most optometrists were confident in their knowledge regarding the risks of smoking and ocular health (Kennedy *et al.*, 2011; Brûlé *et al.*, 2012; Kennedy *et al.*, 2014; Lawrenson *et al.*, 2015; Lorencatto *et al.*, 2019), AMD (Ly *et al.*, 2017; Gocuk *et al.*, 2021), lutein and zeaxanthin (Larson and Coker, 2009), tear film knowledge (Downie *et al.*, 2013; Downie *et al.*, 2016), DED (Xue *et al.*, 2017), and the potential side effects of omega-3 (Zhang *et al.*, 2020).

Knowledge was lower relating to smoking cessation skills and management process (Kennedy *et al.*, 2011; Kennedy *et al.*, 2014; Lorencatto *et al.*, 2019), smoking with regard to eye conditions other than AMD (Kennedy *et al.*, 2014), AMD supplements with a couple of papers mentioning the supplements being advised did not match the scientific evidence at the time (Loughman *et al.*, 2011; Lawrenson and Evans, 2013), measuring macular pigment, with a couple of practitioners reporting measuring macular pigment using a technique that is unable to measure macular pigment (Loughman *et al.*, 2011), and AMD care (Jalbert *et al.*, 2020).

2.4.7 Barriers (10/20)

As identified in sections 2.4.4 and 2.4.6 knowledge and education were reported to be affecting the management of eye conditions with an association to lifestyle modifications. Other barriers have been identified to be; time (Thompson *et al.*, 2007; Kennedy *et al.*, 2011; Brûlé *et al.*, 2012; Downie and Keller, 2015; Lawrenson *et al.*, 2015; Lorencatto *et al.*, 2019; Sahli *et al.*, 2020), belief it would make a difference (Brûlé *et al.*, 2012; Sahli *et al.*, 2020), lack of evidence (Sahli *et al.*, 2020), patient being unreceptive (Kennedy *et al.*, 2011; Brûlé *et al.*, 2012; Lorencatto *et al.*, 2019; Sahli *et al.*, 2020), outside scope of practice (Thompson *et al.*, 2007; Downie and Keller, 2015; Zhang *et al.*, 2020), lack of patient educational material/public awareness (Kennedy *et al.*, 2011; Brûlé *et al.*, 2012; Kennedy *et al.*, 2014; Lorencatto *et al.*, 2019; Jalbert *et al.*, 2020), sufficient public awareness (Downie and Keller, 2015), insufficient reimbursement (Kennedy *et al.*, 2011; Brûlé *et al.*, 2012; Kennedy *et al.*, 2014; Jalbert *et al.*, 2020), effect on patient: practitioner relationship (Brûlé *et al.*,

2012; Downie and Keller, 2015; Lawrenson *et al.*, 2015), questions regarding direct referrals (Thompson *et al.*, 2007; Jalbert *et al.*, 2020), difficulty to offer follow up (Brûlé *et al.*, 2012), and lack of practice guidelines/clinical tool (Kennedy *et al.*, 2011; Brûlé *et al.*, 2012; Downie and Keller, 2015; Lorencatto *et al.*, 2019).

2.4.8 Enablers (6/20)

The lack of knowledge and skills was reported as a barrier and the provision of knowledge and skills training as an enabler (Lorencatto *et al.*, 2019) as well as practitioner confidence (Gocuk *et al.*, 2021). Time, although seen as a barrier for many, others considered it to be an enabler for optometrists when compared to the length of appointments with a GP (Kennedy *et al.*, 2011). Insufficient reimbursement was seen as a barrier (Kennedy *et al.*, 2011; Brûlé *et al.*, 2012; Kennedy *et al.*, 2014; Jalbert *et al.*, 2020;), therefore adequate funding was a reported enabler (Lorencatto *et al.*, 2019; Jalbert *et al.*, 2020). In section 2.4.5 it was reported that Jalbert *et al.* (2020) raised a concern of knowing who had the required specialist knowledge to refer to and to follow on from that a shared care model was reported as an enabler (Jalbert *et al.*, 2020). Other reported enablers were access (Jalbert *et al.*, 2020), establishing a professional norm (Lorencatto *et al.*, 2019), research (Jalbert *et al.*, 2020) and public awareness campaigns (Kennedy *et al.*, 2011).

2.4.9 Treatment (17/20)

Optometrists' current treatment choices can indicate their knowledge and current position regarding lifestyle modification advice and their patients. Regarding smoking cessation two optometrists referred for hypnosis (Kennedy *et al.*, 2011), others recommended nicotine replacement therapy (Kennedy *et al.*, 2014; Lorencatto *et al.*, 2019; Sahli *et al.*, 2020), discussed cessation (Thompson *et al.*, 2007; Brûlé *et al.*, 2012; Lawrenson and Evans, 2013; Kennedy *et al.*, 2014; Lawrenson *et al.*, 2015; Lorencatto *et al.*, 2019), referred to another health provider (Thompson *et al.*, 2007; Brûlé *et al.*, 2012; Kennedy *et al.*, 2014; Lorencatto *et al.*, 2019; Sahli *et al.*, 2020;), referred to a cessation centre (Thompson *et al.*, 2007; Brûlé *et al.*, 2012; Kennedy *et al.*, 2014; Lorencatto *et al.*, 2019; Sahli *et al.*, 2020), referred to an internet site promoting cessation (Brûlé *et al.*, 2012), offered patient educational materials (Brûlé *et al.*, 2012; Kennedy *et al.*, 2014; Lorencatto *et al.*, 2019; Sahli *et al.*, 2020) provided recommendations about smoking behaviour (Thompson *et al.*, 2007; Lawrenson and Evans, 2013; Kennedy *et al.*, 2014; Downie and Keller, 2015; Lorencatto *et al.*, 2019; Sahli *et al.*, 2020; Gocuk *et al.*, 2021) and suggested exercise (Kennedy *et al.*, 2014).

Regarding AMD patients were advised about smoking as mentioned in the previous paragraph and to consult their GP or pharmacist (Zhang *et al.*, 2020), recommended nutritional supplements (Larson and Coker, 2009; Loughman *et al.*, 2011; Lawrenson and Evans, 2013; Downie and Keller, 2015; Ly *et al.*, 2017; Sahli *et al.*, 2020; Zhang *et al.*, 2020; Gocuk *et al.*, 2021), dietary advice (Larson and Coker, 2009; Lawrenson and Evans, 2013; Ly *et al.*, 2017; Sahli *et al.*, 2020; Zhang *et*

al., 2020; Gocuk *et al.*, 2021), alcohol consumption (Sahli *et al.*, 2020), exercise (Sahli *et al.*, 2020), provided with an Amsler grid (Ly *et al.*, 2017; Gocuk *et al.*, 2021), low vision services and ophthalmology referral (Gocuk *et al.*, 2021) and gave out patient education materials (Larson and Coker, 2009; Ly *et al.*, 2017)

Regarding DED patients were advised about lid hygiene (Graham *et al.*, 2010; Downie *et al.*, 2013; Downie *et al.*, 2016; Xue *et al.*, 2017), recommended nutritional supplements (Graham *et al.*, 2010; Downie *et al.*, 2013; Downie and Keller, 2015; Downie *et al.*, 2016; Sahli *et al.*, 2020; Zhang *et al.*, 2020), change dietary intake (Downie *et al.*, 2013; Downie *et al.*, 2016; Sahli *et al.*, 2020; Zhang *et al.*, 2020), smoking cessation (Sahli *et al.*, 2020), alcohol consumption (Sahli *et al.*, 2020), exercise (Sahli *et al.*, 2020) artificial lubricants (Graham *et al.*, 2010; Downie *et al.*, 2013; Downie *et al.*, 2016; Xue *et al.*, 2017) with preservative free options advised for those with more severe disease (Downie *et al.*, 2013; Downie *et al.*, 2016; Xue *et al.*, 2017), prescribed corticosteroids and anti-inflammatory drops (Downie *et al.*, 2013; Downie *et al.*, 2016; Xue *et al.*, 2017) prescribed by optometrists with a therapeutic qualification, omega-3 supplementation (Downie *et al.*, 2016; Xue *et al.*, 2017), punctal plugs (Graham *et al.*, 2010; Xue *et al.*, 2017) scleral contact lenses (Downie *et al.*, 2016) and referral to ophthalmology (Downie *et al.*, 2016).

2.4.10 Counselling (6/20)

The paper by Sahli *et al.* (2020) surveyed practitioners' opinions regarding lifestyle advice in general and they reported the median amount of time providing lifestyle advice for a patient was four and a half minutes, with the type of advice ranging from being given to all, to being condition based (Sahli *et al.*, 2020). Gocuk *et al.* (2021) reported an improvement in counselling in multiple areas of lifestyle changes following an audit and educational intervention. Education and training may help address concerns regarding counselling in practice '*telling people to eat more fruit and vegetables and low GI food and some nuts ... sounds generic, like how can that possibly work*' this was a quote from the Jalbert *et al.* (2020 p9), and other papers report a lack of knowledge of counselling (Brûlé *et al.*, 2012) and '*counselling to be a medical issue*' (Downie and Keller, 2015 p6). Kennedy *et al.* (2011) although, reported that informants saw advising about tobacco use, was similar to counselling about other behavioural aspects of eye care including UV exposure and nutrition with relation to eye conditions and was therefore within their scope of practice.

2.5 Thematic synthesis of results

The ten descriptive themes were amalgamated into two analytical themes as shown in figure 2.5. This also indicates some of the descriptive themes overlap the two analytical themes when considering the position of the UK optometric workforce and their perceived knowledge, role and competence regarding modifications of lifestyle choices to support chronic and ocular illnesses. The descriptive themes: tests/techniques, patient enquiries, barriers and enablers have aspects that fall

within both analytical themes. With new research and developments in eye care, new testing techniques and equipment are developed. The new instrumentation is not stated within the standard list of suggested equipment for a routine eye examination (The College of Optometrists, 2021) and therefore questions the appropriateness of the tests and requires further training to complete the new tests and so it sits within both themes. Patient enquires indicated a wide range of practice, the reasons for this could be related to appropriateness and/or knowledge and therefore it was also considered to sit within both themes. The final descriptive themes to sit within both analytical themes were barriers and enablers.

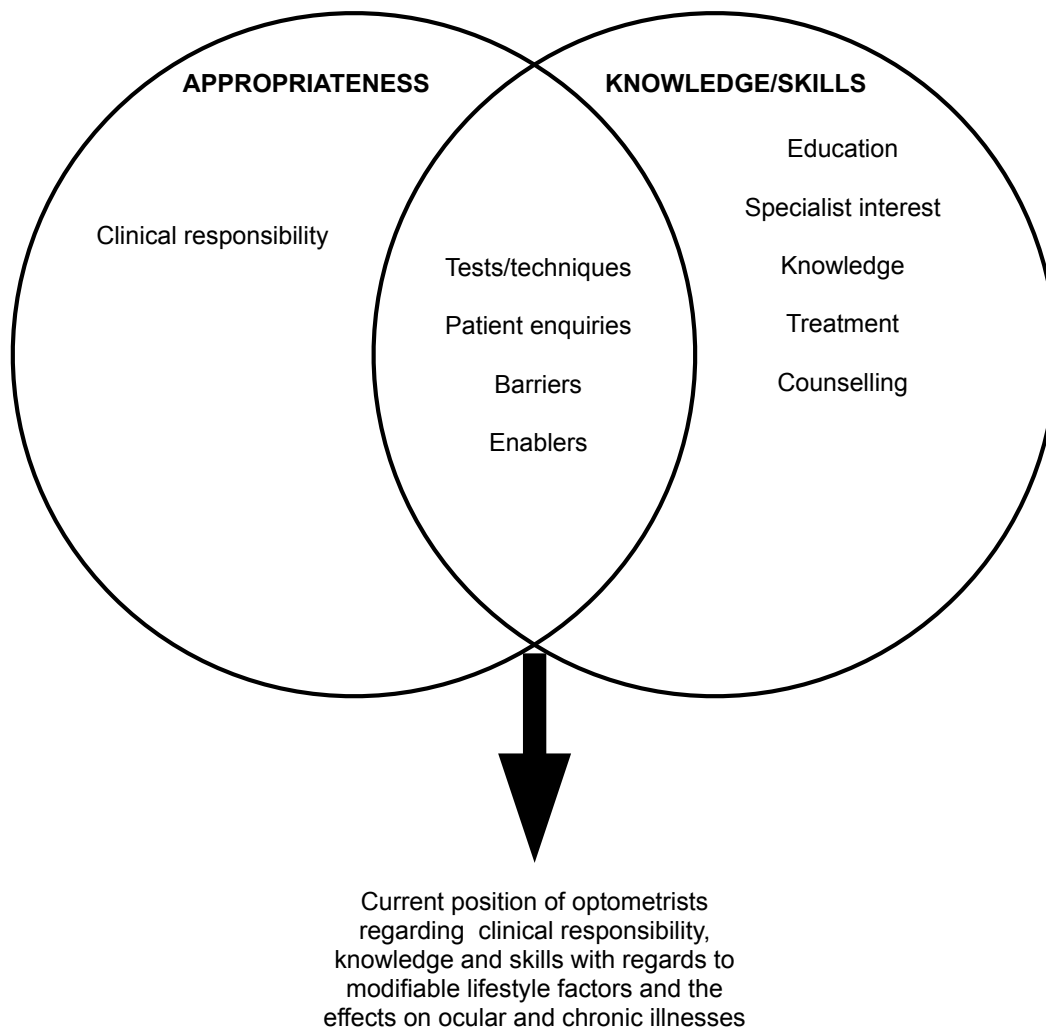


Figure 2.5 Theme diagram - Analytical themes grouped/overlapped to create descriptive themes.

2.6 Discussion

The results of the systematic review, as suggested by the scoping search, confirmed limited results from the UK only (25% of papers), and these papers only reviewed AMD and smoking. The two papers' addressing the UK and other countries discussed DED and indicated a similar knowledge

among the UK and Australian optometrists (Downie *et al.*, 2016). The information from the systematic review included papers regarding level four optometrists from the UK, USA, Australia, Ireland, Canada and New Zealand, which allows for a more detailed review than using those from the UK only. The information obtained also highlights that this situation is not limited to the UK.

2.6.1.Appropriateness

When considering the papers within the review the tests and techniques required for diagnosing and managing DED are within the standard equipment and techniques for optometrists with or without pharmaceuticals depending on qualifications and competency. With regards to AMD, optometrists have the ability to detect and manage AMD to a certain level with standard equipment. The development of OCT and macular pigment measurements are outside the standard equipment list although, they can form part of an optometrist's armoury if used with correct training. Loughman *et al.* (2011) reported optometrists using the wrong equipment for macular pigment measurements. False positive clinical results leading to referrals have been stated to cause anxiety for patients (Prasad *et al.*, 2001). If an optometrist uses equipment and technology outside the standard list of equipment it is important to ensure they have received adequate training to use the equipment appropriately.

With the majority of respondents in these studies reporting that optometrists have a role in supporting smoking cessation with their patients, it would indicate optometrists feel it is appropriate for the profession to support a patient in this role, although current practice does not reflect this desire and there appears to be a greater discrepancy between those that do or do not feel it is appropriate for an optometrists to perform this role and those that are currently participating actively in this role.

The papers indicate optometrists are discussing nutrition and supplements with patients for DED and AMD depending on the patient's clinical presentation and, that supplements are being advised, although the evidence behind the use of supplements is currently low and disputed. This would indicate optometrists feel it is appropriate for them to advise in this manner and wish to promote lifestyle changes, although a lack of knowledge and reliance on multiple sources of data with a varying evidence base might question if this advice is appropriate in its current form.

Being outside the scope of practice was raised as a barrier (Thompson *et al.*, 2007; Downie and Keller, 2015; Zhang *et al.*, 2020) along with lack of professional guidance (Kennedy *et al.*, 2011; Brûlé *et al.*, 2012; Downie and Keller, 2015; Lorencatto *et al.*, 2019), educational material (Kennedy *et al.*, 2011; Brûlé *et al.*, 2012; Kennedy *et al.*, 2014; Lorencatto *et al.*, 2019; Jalbert *et al.*, 2020), and public awareness (Downie and Keller, 2015) which could give the impression that this work is not supported by the professional body and government. The effect on the patient: practitioner

relationship could be a cause for concern if practitioners feel this work is not supported and therefore not expected by the patient. With the government creating the MECC concept, this barrier to appropriateness could be addressed with professional support and a public awareness campaign (Kennedy *et al.*, 2011) which was mentioned as an enabler along with establishing a professional norm (Lorenatto *et al.*, 2019) and having the time, which one optometrist reported '*We have tons of time with people and counselling is our best tool and... we tend to do a lot of it*' (Kennedy *et al.*, 2011 p769).

In summary within optometry there appears to be a potential appropriateness for lifestyle modification advice, with correct support from professional and government bodies in public awareness, professional guidance, and training.

2.6.2 Knowledge and Skill

The range in the number of practitioners enquiring about smoking was much greater than the number who ask about supplements, although this could be a reflection on their being a greater number of papers and from more locations regarding smoking than supplements and the participants for the DED questions in the Downie *et al.* papers in 2013 and 2016 were from a sub-group of optometrists with a specialist interest in the anterior segment and therefore may not accurately represent the practice of the rest of the optometry population. Most of the papers regarding supplements relied on self-reported behaviour and these reported a higher level of nutritional advice than the results of the clinical audit and so it must be considered that some of the self-reported behaviour may not be a true representation of clinical practice but rather the impression a practitioner has of their work or the impression they wish to project of their work even in an anonymous setting.

A desire for further education was clear within the papers and a large range of source data was used by participants. Lawrenson *et al.* (2015) and Lorenatto *et al.* (2019) indicated an improvement of knowledge with specific training with Downie *et al.* (2016) and Kennedy *et al.* (2014) reporting training with many different types of learning methodologies that was researched based was more desirable (Lawrenson and Evans, 2013; Kennedy *et al.*, 2014; Downie *et al.*, 2016). Ly *et al.* (2017) and Xue *et al.* (2017) indicated higher self-reported competencies and increase knowledge was present in those with further qualifications and/or a specialist interest in a subject. Knowledge was reported with confidence for the health risks and clinical effects of lifestyle changes, although when it came to the practicalities of managing an appropriate referral or knowing how to counsel someone to stop smoking the confidence and, by association the skills, were lower suggesting the current education may not be covering these specific areas to a high enough level to evoke confidence within the practitioners.

2.7 Conclusion

This systematic review identifies a need and desire for further education regarding lifestyle changes with the appropriate support and public awareness from governing bodies and the government to reinforce the appropriate nature of this service within an optometry practice. The limitations of many of these papers with self-reporting and self-selection bias must be considered and this could affect the results in two ways; there is a potential that these papers attract those with a specialist interest which would bias the results to appear more confident and knowledgeable than the population as a whole. The other outcome could be those who strongly feel this is not an area for optometrists to work in could be attracted to the studies and influence the results to indicate this service is not appropriate for optometrists to participate in. The multiple papers reviewed and the multiple geographic locations of these papers all producing a similar general theme reduces the potential effect of these biases. A desire for multi-modal educational events based on research with professional guidelines was also clear from this review.

Chapter 3 – A questionnaire (NUTCOMP) to investigate the competence, confidence, and attitudes of the UK optometric workforce regarding nutrition within general optometric practice.

3.1 Introduction to NUTCOMP questionnaire.

Life expectancy is increasing (Buxton, 2021) although not at the same rate as healthy life expectancy (Raleigh, 2021) indicating more people are living longer in poor health (Department for Public Health and Primary Care, 2019). The primary cause of disability is NCDs (Saleem *et al.*, 2015) and individual's diet and lifestyle choices have an impact on NCD rates (Afshin *et al.*, 2019) as described in detail in Chapter One. Optometrists often ask about lifestyle choices and general health in a routine consultation and are in an optimal position to talk to patients/clients about modifiable lifestyle risks, although Chapter Two identified there has not been a study investigating the self-reported confidence and competence of UK optometrists regarding a multitude of lifestyle changes, and the lifestyle changes that have been reported on have identified a knowledge gap. Optometrists might be physically and practically in a good position to discuss nutrition and other health aspects with their patients/clients, but it is important to know if optometrists agree that they are the correct profession for this service.

Questionnaires have been used in other professions to assess knowledge, skills, and confidence of a profession in nutrition care (Ball and Leveritt, 2015; Kim *et al.*, 2016; Al-gassaimi, *et al.* 2020; Kiss *et al.*, 2020; Nayda *et al.*, 2021; Conway *et al.* 2022; Kelly *et al.* 2022). A questionnaire was therefore chosen as the methodology to assess knowledge, skills, and confidence of the UK optometric workforce regarding nutrition in practice. An original questionnaire could have been created for this project, although this would have prevented comparison to other professions. There are many nutrition knowledge questionnaires currently in use in research and therefore choosing a previously validated questionnaire is preferable to creating an original questionnaire. Liou and Cheng (2014) developed and validated a clinical competence questionnaire demonstrating good reliability with a Cronbach's alpha of 0.98 although this didn't include nutrition. In 1999, Parmenter and Wardle developed a 'general nutrition knowledge questionnaire for adults', this paper also returned a good Cronbach's alpha of 0.70-0.97 although this questionnaire was directed towards the health and knowledge of the individual rather than a professional group. Ball and Leveritt (2015) developed 'a validated questionnaire to measure the self-perceived competence of primary health professionals in providing nutrition care to patients with chronic disease' which also returned a good Cronbach's alpha of 0.98, good validity by comparing dietitians and speech pathologists and a test-retest reliability of 0.95 for the whole questionnaire. The NUTCOMP (Ball and Leveritt, 2015) questionnaire, unlike the others (Parmenter and Wardle, 1999; Liou and Cheng, 2014) was directed to primary care professionals regarding the care given to their patients which matched the requirements of this study. The Ball and Leveritt (2015) questionnaire has also been used in other

professions which will allow a comparison to be drawn between optometry and other professions. These other studies which have investigated the attitudes towards nutrition care in other professions are mainly positive including fitness trainers (Kiss *et al.*, 2020), psychologists (Nayda *et al.*, 2021), physicians (Al-gassaimi, *et al.*, 2020), pharmacists (Kelly *et al.*, 2022), and dietitians (Ball and Leveritt, 2015), although speech pathologists scored the lowest mean score (Ball and Leveritt, 2015) along with all professions in the Kim *et al.* (2016) paper.

When considering the UK optometric workforce, the profession's confidence regarding nutrition skills and knowledge, communication regarding nutrition, and their attitude toward nutrition care need to be investigated to identify the profession's potential to provide nutrition care to their patients/clients.

The aim of this study was to identify the skill, competence, confidence, and attitudes of the UK optometric workforce with regards to nutrition advice for their patients/clients using the validated NUTCOMP questionnaire adapted for UK optometric practice.

3.2 Methodologies

3.2.1 Sample

This study recruited a sample of the UK optometric workforce, including, but not limited to, optometry assistants, receptionists, optometrists, opticians, academics, and medics to anonymously complete a self-administered on-line, standardised, validated questionnaire to assess self-perceived knowledge, skills, communication and attitude relating to nutrition care for eye care patients/clients between November 2020 and March 2021.

3.2.2 Survey

Following ethics approval from the Aston University Life and Health Sciences (LHS) Research Ethics Committee (REC ID 1628), the validated NUTCOMP questionnaire developed by Ball and Leveritt (2015) and adapted for UK optometric practice for the purpose of this study, was hosted by online surveys run by JISC, and distributed to the optometric UK workforce. Participant recruitment was conducted by direct invitation through personal contacts, social media (Aston University's Twitter), professional networks (Association of Optometrists (AOP), Association of Independent Optometrists (AIO), Aston University alumni, LOCSU and Optometry Wales (OW)), professional publication (Optometry Today) and a random sample of 1000 members of the College of Optometrists (CoO). The responses to the questionnaire were anonymous therefore no targeted reminders were sent, although the different channels of communication were used subsequently therefore some professionals would have received notification of the questionnaire from multiple channels over the winter of 2020-2021, which could have acted as a reminder. To expand our reach, all participants were encouraged to share/repost on social media and invite others within the optometric workforce.

The online questionnaire was based on a previously validated questionnaire (Ball and Leveritt, 2015) and adapted for use in the UK optometric practice. The original NUTCOMP questionnaire comprised of 42 questions, presented in seven different sections. The seven sections were Consent, (1) Nutrition Knowledge, (2) Nutrition Skills, (3) Nutrition Communication and Counselling, (4) Attitudes Towards Nutrition Care, (5) Previous Nutrition Education and Training and (6) Demographics (Ball and Leveritt, 2015) the questions were a mixture of closed questions, Likert scale questions, multiple choice, and free text questions.

The adaptations made for the UK optometric workforce included replacing the 'Australian Guide to Healthy Eating' with 'United Kingdom Eat Well Guide' which sets out nutritional guidance' and adding 'including nutritional supplements' to the question 'monitor and evaluate changes over time regarding the food an individual usually eats' (Ball and Leveritt, 2015) for clarity. In total 17 new questions were added totalling 59 questions in the final UK optometry adapted questionnaire, Appendix 3.2.2a shows the final questionnaire used with the adaptations. A participant information sheet was also sent to the participants and is shown in appendix 3.2.2b

3.2.3 Sample Size Considerations

The size of the optometric workforce is unknown because it includes both registered professionals and non-registered staff, such as optometry assistants and receptionists, therefore it is not possible to calculate an accurate sample size. To calculate the minimum potential sample size, three main methodologies were considered, by consensus, comparing to similar studies and using published tables or recognised calculations. It was not possible to use the consensus methodology because the total population was unknown, although expected to be large. The number of registered optometrists at the time of the questionnaire design was used to help determine the minimum required sample size. The number of fully qualified optometrists registered with the GOC at the time of the questionnaire was 16679 (GOC, 2022 – see appendix 3.2.3). Chapter Two identified that similar studies had sample sizes ranging from 160 (Douglas *et al.* 2019) to 317 (Downie *et al.* 2016). When considering the UK optometric workforce, previous studies utilising surveys that had been distributed to a random sample of UK College of Optometrists' members, reported response rates ranging through 24% (Needle, *et al.* 2008), 34% (Lorenatto *et al.*, 2019), and 35% (Dabasia *et al.*, 2014). Using The Research Advisors (2006) sample size table, a sample of between 306 to 322 is suggested for a confidence level of 95% and a 5% margin of error for a population of between 1500 to 2000 and using a sample size calculator (calculator.net, 2022) for the same confidence level and error of margin a sample size of 376 is suggested. To maximise the sample size multiple channels of on-line communication were used for convenience sampling. The most important aspect of the sample for this study is its representativeness of the population rather than to identify group differences. A freedom of information request was made to the General Optical Council (GOC) to

identify the demographics of the population of registered optometrists at the time of the questionnaire. This data will guide the representativeness of the sample (Fincham, 2008).

3.2.4 Statistical Methodologies

Data were analysed using Numbers Software (Version 10.1 for Macs) and JASP 0.16.4 Intel (University of Amsterdam). Levels of self-perceived confidence and attitude for each of the four constructs: (1) Confidence in Knowledge about Nutrition and Chronic Disease, (2) Confidence in Nutrition Skills, (3) Confidence in Communication and Counselling about Nutrition, (4) Attitudes towards nutrition Care and the total score were calculated as detailed by Ball and Leveritt (2015). Each response is given a value reflecting confidence/agreement: the lower the score the lower the self-perceived confidence/agreement, using the following allocations, ('not confident at all/completely disagree' scoring 1, 'not very confident/ somewhat disagree' scoring 2, 'somewhat confident/neither agree or disagree' scoring 3, 'very confident/somewhat agree' scoring 4 and 'extremely confident/completely agree' scoring 5 points). Descriptive statistics were used to describe the sample demographics, using frequency, mean and percentage. Descriptive statistics were also used for normality testing with distribution (histograms, z-skewness and z-kurtosis) and dispersion (standard deviation). The validity of the adapted questionnaire was assessed using Cronbach's alpha and compared to the original Ball and Leveritt (2015) questionnaire. The mean scores of each construct were compared to demographic data using ANOVA test and a post-hoc test was used when a significant difference was identified. The post hoc test used was either Tukey or Bonferroni depending upon the number of groups being compared. To investigate if there was any association between the constructs a Pearson's r test was carried out.

3.3 Results

A total of 259 participants submitted questionnaires, with the questionnaire taking approximately 10.5 minutes to complete. One person did not complete any of the questions, therefore 258 questionnaires were completed partially or in full and used within the analysis. When the calculations allowed, all results were included. Demographic data using descriptive statistics allowed each question to be analysed individually, therefore if an individual question was not completed the results could be calculated in a fair manner. The demographics section was answered by all respondents. The average scores within each context required surveys that were only partially completed for each sector to be removed from the whole sector. If the partial data had been retained and used for each individual question the average data for the whole sector would not have been calculated using the same sample and accurate, comparable averages would not have been possible. In context one 96.5% (n=249) of questions were answered fully, 95.0% (n=245) in context two, 94.2% (n=243) in context three and 97.3% (n=251) in context four, therefore a large percentage answered for each context and therefore the removal of the partially completed questionnaires is unlikely to have an adverse effect on the results.

Question 46 was multiple choice and free text, asking participants to list all the qualifications they have. To allow for analysis these responses were grouped into standard education levels (UK Government, <https://www.gov.uk/what-different-qualification-levels-mean/list-of-qualification-levels> (Accessed: 1st January 2023)).

3.3.1 Demographics

Most respondents reported their profession as optometrist (n=229, 88.76%) with the mean answer for their time in the profession reported as 20-24 years (n=41, 15.89%). The experience of the sample is indicated in figure 3.3.1a with the mean number of years in the profession being 20.00 years (± 12 SD) and the mean time in their current role/occupation being 13.82 years (± 11.13 SD). The variety of professions is shown in table 3.3.1. The majority of respondents identified as female (n=169, 65.50%), aged 35-44 years (n=78, 30.23%). Seventy-five respondents identified as male (32.47%) and five (2.16%) preferred not to state. The age distribution of the sample is shown in

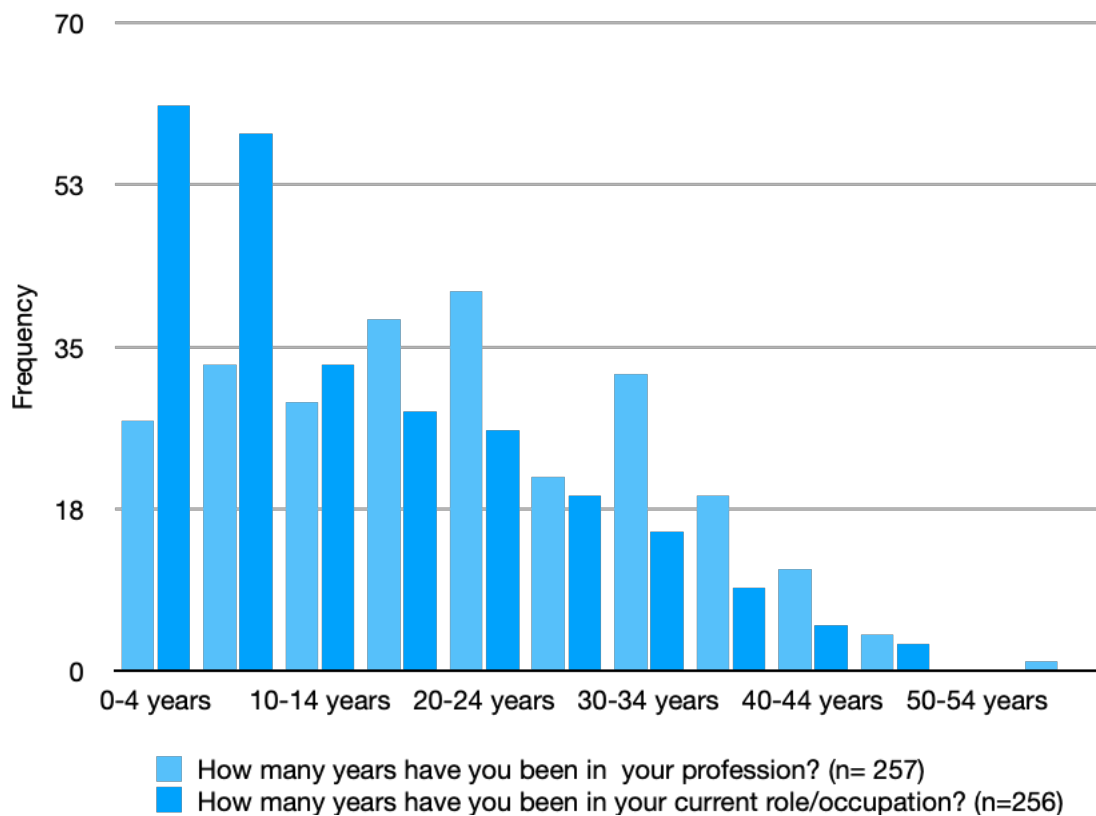


Figure 3.1.1a The number of years of experience of participants in the NUTCOMP questionnaire.

figure 3.3.1b. At the time of the questionnaire, 60.69% of optometrists registered with the GOC reported as female (GOC, 2022), 65.50% of the respondents to the questionnaire reported as female as well. A chi-squared test was preformed to identify if there was a significant difference between gender identification in this study and the figures provided by the GOC (2022). The results showed

the proportion of participants reported as either male or female did not differ between the two populations at a significance level of .05, $\chi^2 (3, N=16095) = 3.50, p = 0.061$.

Table 3.3.1. Demographic Characteristics – The demographics of the participants of the NUTCOMP questionnaire (n=258, percentages are rounded to two decimal places so unlikely to add up to 100).

Profession	n	%	Profession	n	%
Optometrist	229	88.76%	Ophthalmology Resident	1	0.39%
Optometrist Researcher	1	0.39%	Pre-registration Optometrist	4	1.55%
Contact Lens Optician	3	1.16%	Student	1	0.39%
Dispensing Optometrist	14	5.43%	Practice Owner	1	0.39%
Lecturer	1	0.39%	Missing	1	0.39%
Nutritionist Registrar	1	0.39%			

Regarding the number of optometrists with the professional therapeutic qualification (Diploma in independent prescribing, DipTp) there was no significant difference between the participants of the NUTCOMP questionnaire and GOC registrants, at a significance level of .05, $\chi^2 (3, N=16910) = 0.01, p = .935$. These results indicate the optometrists within the sampled population completing the NUTCOMP questionnaire were similar to the population of optometrists registered with the GOC highlighting the relevance of the results.

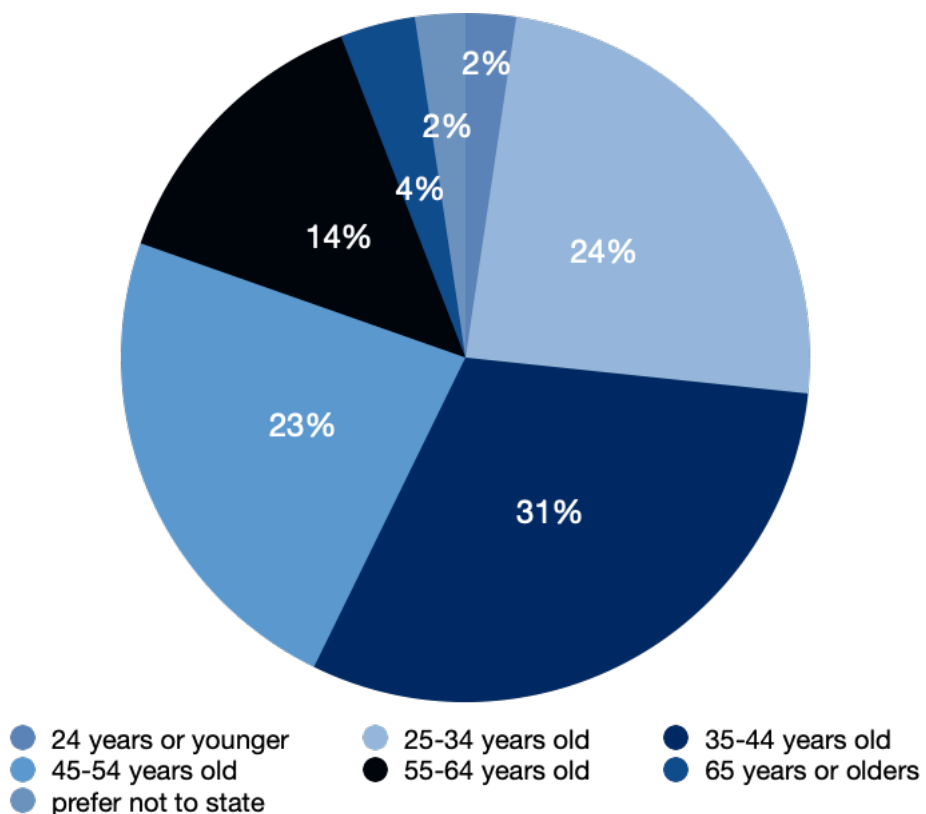


Figure 3.3.1b Age distribution of NUTCOMP questionnaire participants.

3.3.2 Adapted Questionnaire validity

The original NUTCOMP questionnaire (Ball and Leveritt, 2015) was reported to have a high level of internal consistency measured by Cronbach’s alpha. Table 3.3.2 details the Cronbach’s alpha results from the original Ball and Leveritt (2015) paper alongside those calculated for the questionnaire adapted for UK optometrists. The normality of each construct was assessed using Kolmogorov-Smirnov and indicated constructs 1(Confidence in Knowledge about Nutrition and Chronic Disease), 2 (Confidence in Nutrition Skills) and 3 (Confidence in Communication and Counselling about Nutrition) are normally distributed (Construct 1: $D(248) = 0.063, p = 0.279$, Construct 2: $D(245) = 0.065, p = 0.255$ and Construct 3: $D(243) = 0.067, p = 0.221$). Construct 4 (Attitudes towards Nutrition Care) was not able to reject the null hypothesis, suggesting it did not follow a normal distribution, $D(251) = 0.90, p = 0.035$. Figure 3.3.2 demonstrates the skewness of construct 4, in which the z-value of skewness was calculated to be -3.89 confirming it is positively skewed. The data indicated normal kurtosis, with the z-value of kurtosis equal to -0.14.

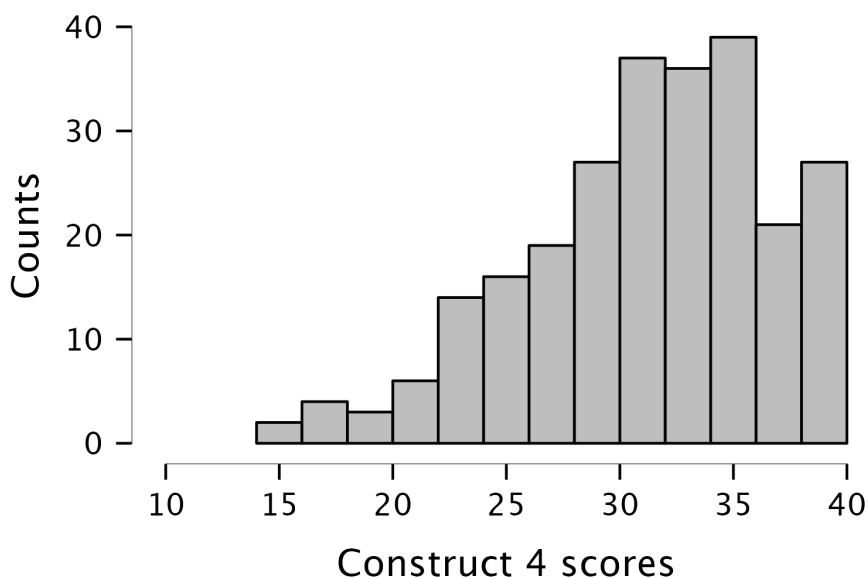


Figure 3.3.2 Histogram for construct four – Attitudes towards Nutrition Care construct four skewness, n=251

Table 3.3.2. Validity of adapted NUTCOMP questionnaire – comparing the internal consistency of the original NUTCOMP questionnaire with the adapted NUTCOMP questionnaire for UK optometrists.

Construct	Internal consistency - Cronbach’s α (number of items).	
	Original Ball and Leveritt (2015) results	UK optometry adapted questionnaire
1. Confidence in Knowledge about Nutrition and Chronic Disease	0.95 (n = 7)	0.884 (n = 9)
2. Confidence in Nutrition Skills	0.98 (n = 11)	0.924 (n = 13)
3. Confidence in Communication and Counselling about Nutrition	0.94 (n = 9)	0.913 (n = 9)
4. Attitudes towards Nutrition Care	0.88 (n = 8)	0.850 (n = 8)
Total	0.98 (n = 35)	0.951 (n = 39)

3.3.3 Construct One - Confidence in knowledge about nutrition and chronic disease

The participants reported the most confidence about nutrition and chronic disease relating to ‘guidelines for nutrition-related management of ocular health’ with an average score of 3.26 (SD±0.76) out of a maximum of 5. Although only 16.28% were ‘aware of any national or professional clinical management guidelines which refer to nutritional management as part of ocular health’ and the question indicating the least confidence, was regarding ‘the most recently published peer-reviewed evidence regarding nutrition and ocular health’ with an average score of 1.71 (SD± 0.87). Figure 3.3.3a visually represents the mean and standard deviation for each question within the construct. Most respondents reported being somewhat knowledgeable of how different body systems are affected by foods and nutrients (62.40%), how nutrients influence development and management of chronic disease (58.14%) and about how an individual’s body composition can impact the development of chronic disease (60.94%), the reported confidence is less when considering how food and nutrients interact with medications (65.49% not

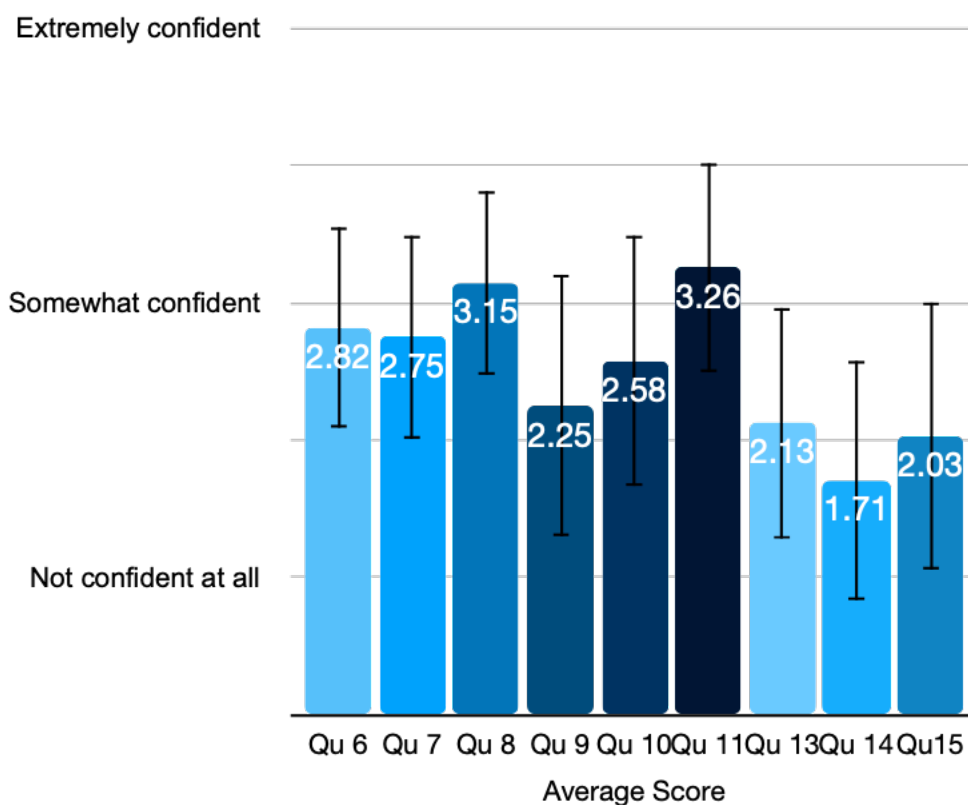


Figure 3.3.3a Construct One. Average question score and standard deviation for each question. Average score and standard deviation for fully completed sections (n=249) for construct 1. The questions are slightly shortened for space. Qu 6 - How different body systems are affected by foods and nutrients. Qu 7 - How foods and nutrients influence the development and management of chronic disease. Qu 8 – How an individual’s body composition can impact on the development of chronic disease. Qu 9 – The United Kingdom Eatwell Guide. Qu 10 – Guidelines for the nutrition-related management of specific chronic diseases. Qu 11 – Guidelines for the nutrition-related management of ocular health. Qu 13 – How foods and nutrients interact with medications. Qu 14 – The most recently published peer-reviewed evidence regarding nutrition and chronic disease. Qu 15 – The most recently published peer-reviewed evidence regarding nutrition and ocular health.

confident and not very confident). This could be a reflection of the respondent's confidence in their knowledge of peer-reviewed evidence regarding nutrition, with 82.35% reporting being 'not' or 'not very' confident regarding the interaction with chronic disease and 65.36% reporting being 'not' or 'not very' confident regarding the interaction with ocular health. With regard to guidelines, the confidence of knowledge and confidence of awareness is greater with more specific ocular health concerns, with 35.41% reporting being very or extremely confident. This in turn is less when specific to chronic disease, with 12.5% reporting being very or extremely confident and the lowest confidence was when asked about the Eatwell Guide in the UK (Figure 1.4) (Public Health England, 2018b) for which only 6.59% were very or extremely confident. The majority of respondents (56.81%) were not aware of any national or professional guidelines. Of those respondents who reported being aware of lifestyle modification guidelines, those produced by The College of Optometrists was stated the most (n=13) closely followed by age related eye disease study (AREDS) (n=10), non-specific AMD (n=9) and NICE AMD (n=7), all other responses were only reported by one or two people as represented in the word cloud in figure 3.3.3b.

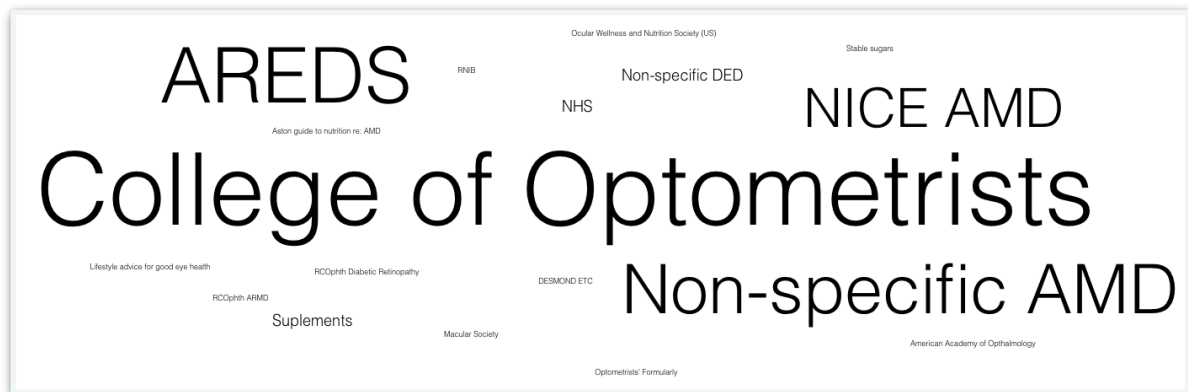


Figure 3.3.3b Word cloud indicating the frequency of which different guidelines were reported. Specific guidelines were reported 55 times with the following break down; College of optometrists = 13, AREDS/AREDS 2 = 10, Non-specific AMD = 8, NICE = 7, NHS, Non-specific DED and pharmaceutical products = 2, and Optometrists Formulary, DESMOND ETC, Aston University, Royal College of Ophthalmologists, Stable sugars, American Academy, Macular awareness, Ocular wellness and nutrition society, Macular society, Lifestyle advice for good eye health and RNIB each = 1.

3.3.4 Construct Two - Confidence in nutrition skills

Interpreting data about height, weight, body composition and biological data (i.e. blood pressure, cholesterol levels) against reference ranges were the two questions that scored the highest for the participants confidence, each with a mean score of 2.68 and standard deviation of ± 1.04 for interpreting height, weight and body composition and ± 1.07 for interpreting biological data. Formulating a meal plan for an individual with chronic disease was the lowest scoring question with a mean of 1.50, ± 0.78 standard deviation and only 14.38% reporting a positive level of confidence. Evaluating change (17.54%) and determining an appropriate food goal (22.04%) also showed low levels of confidence. Respondents were more confident to determine a nutrition goal and strategies with more than half (51.16%) reporting a level of confidence, slightly less (39.21%) were confident to

recommend changes to food choices with regard to chronic illness. Confidence to access the most recent published peer-reviewed evidence was low in 55.64% of respondents.

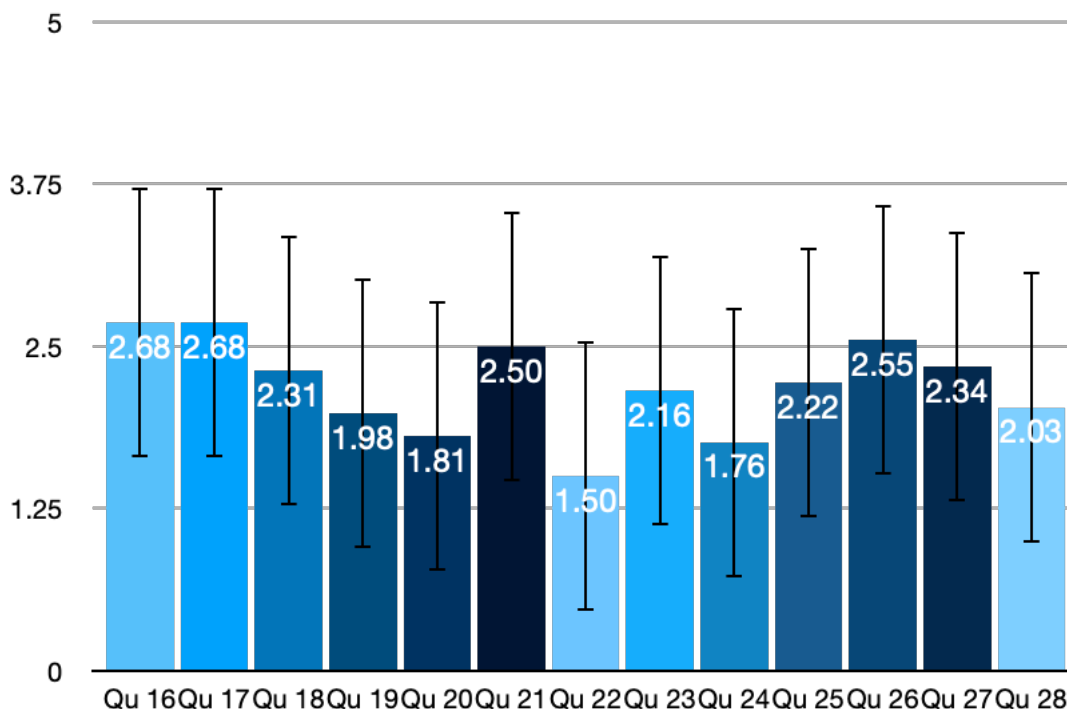


Figure 3.3.4 - Construct Two. Average question score and standard deviation for each question. Figures used from fully completed construct two questions, n=245. Qu 16 - Interpret data about height, weight and body composition against reference ranges, Qu 17 - Interpret an individual's biological data against reference levels, Qu 18 - Collect information on the food that an individual usually eats, Qu 19 - Use the UK Healthy Eating Guidelines, Qu 20 - Determine appropriate food or nutrition goals for an individual with chronic disease, Qu 21 - Determine appropriate nutrition goals and strategies relating to ocular health, Qu 22 - Formulate a meal plan for an individual with chronic disease, Qu 23 - Recommend changes in food choices for an individual with chronic disease, Qu 24 - Monitor and evaluate changes over time regarding the food an individual usually eats, Qu 25 - Monitor and evaluate how dietary changes influence measures of ocular health, Qu 26 - Maintain clear and concise records regarding the nutrition related assessment and advice you provide to individuals, Qu 27 - Access the most recently published peer-reviewed evidence regarding nutrition and chronic disease, Qu 28 - Provide nutrition care that results in improvements in the food that an individual eats.

3.3.5 Construct Three - Confidence in communication and counselling about nutrition

The mean score for each question within this construct scored higher than construct two. The lowest mean score was 2.42 (± 1.03 SD) relating to the participants confidence to work with a patient/client and identify possible ways to improve the food they usually eat and the highest mean score for a question was 3.44 (± 0.97 SD) (Figure 3.3.5) relating to maintaining a non-judgmental attitude in discussions with patients/clients about the food they eat and only 36.19% were not confident they could check a patient's understanding of the influence of food and nutrition on their health. The majority of respondents report somewhat (39.69%) to very (32.68%) confident to demonstrate genuine empathy with patients and a similar number report somewhat (38.67%) to very (36.73%) confident to maintain a non-judgmental attitude in discussions about food. When considering culture, 43.08% were somewhat confident they could discuss food and nutrition with culturally appropriate language and a similar number, 46.48% reported being somewhat confident they could consider

how social, personal, cultural, psychological, and economic factors could affect the food choices of a patient. Although many respondents reported they should encourage patients to seek support from

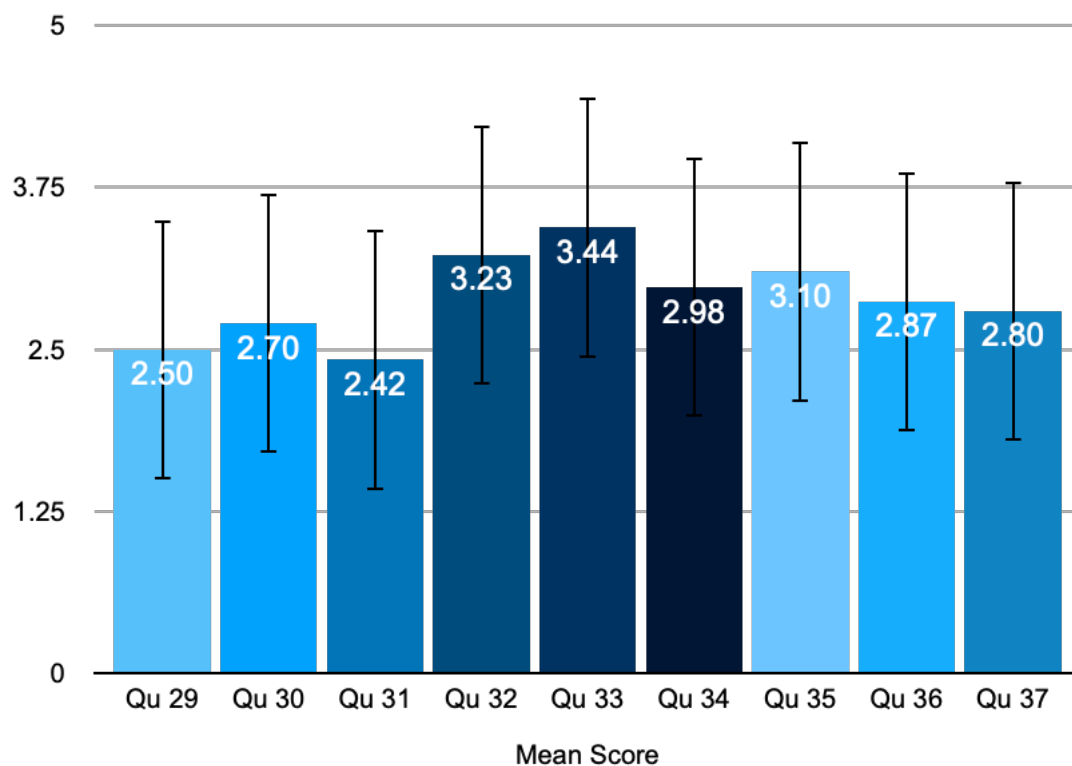


Figure 3.3.5 Construct Three - Average score with standard deviation for each question. Total to fully completed construct Three, n = 243. Qu 29 - Clearly describe what patients/clients can expect from their discussions with you about food or nutrition. Qu 30- Check a patient’s/client’s understanding of the influence of food and nutrients on their health. Qu 31 - Work with patients/clients to identify possible ways to improve the food they usually eat. Qu 32 - Demonstrate genuine empathy to patients/clients about their food-related experiences and goals. Qu 33 - Maintain a non-judgemental attitude in discussions with patients/clients about the food they eat. Qu 34 - Communicate with patients/clients about food and nutrition using culturally appropriate language. Qu 35 - Consider how personal, social, cultural, psychological, and economic factors may influence the foods that a patient/client eats. Qu 36 - Identify individuals who need additional support from other health professionals or services regarding the food they eat. Qu 37 - Communicate with other health professionals about the discussions you’ve had with patients/clients regarding food.

other professionals, 30.07% were not confident they could identify those who needed further support and 36.43% were not confident they could communicate with other professions about the discussions they had with a patient regarding nutrition.

3.3.6 Construct Four - Attitudes towards nutrition care

This construct had the highest mean scores of all of the constructs. Most respondents (n=253) believe it is important to eat healthy foods scoring an average mean score of 4.78 (±0.50SD) (see Figure 3.3.6). It was reported by 96.11% they should encourage patients to eat well if the topic arises with 63.8% strongly agreeing. Less respondents believe they should take every opportunity to encourage patients to eat well with 82.66% agreeing and 31.64% agreeing strongly. When asked if it is an effective use of their time, 21.40% agree, and a similar number 22.75% strongly agree that giving specific nutrition advice to assist those with chronic illness is an effective use of their time. The

lowest scoring question was regarding specific nutritional advice to assist with managing chronic disease being within the respondent’s scope of practice, with a mean score of 3.10 ($\pm 1.23SD$) and

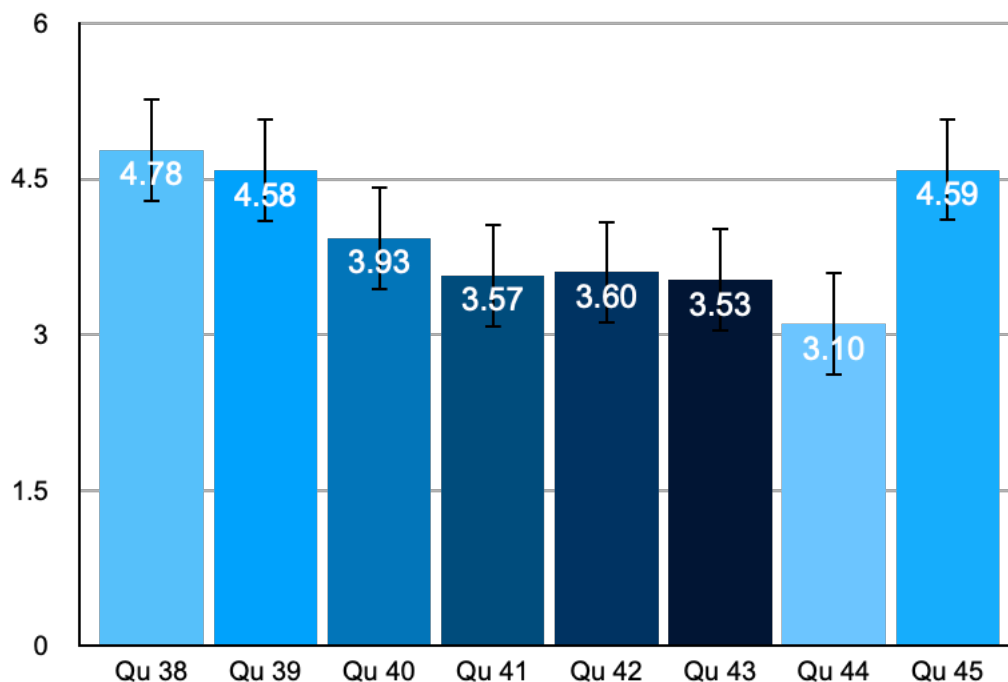


Figure 3.3.6 Construct Four – Average mean score and standard deviation for each question.

Total number of fully completed questionnaires, n=251, Qu 38 - It is important that all individuals usually eat healthy foods regardless of age, body weight and physical activity levels. Qu 39 - If the topic arises, it is important that I encourage my patients/clients to eat healthy food. Qu 40 - It is important that I take every opportunity possible to encourage my patient/clients to eat healthy foods . Qu 41 - Encouraging my patients/clients to eat healthy foods is an effective use of professional time. Qu 42 - Providing specific nutrition recommendations to my patients/clients that can assist with managing their chronic disease is an effective use of my professional time, Qu 43 - Encouraging my patients/clients to eat healthy foods is within my scope of practice, Qu 44 Providing specific nutrition recommendations to my patients/clients that can assist with managing their chronic disease is within my scope of practice, Qu 45 - It is important that I encourage my patients/clients to seek support from other health professionals if I am unable to meet their nutrition-related needs.

33.85% believing specific recommendations is not within their scope of practice. The majority, 93.75% agree they should encourage patients to seek support elsewhere from other professionals if they cannot help.

3.3.7 Nutrition education and training

With regard to nutrition education, most agreed (n=123, 47.67%) or strongly agreed (n=55, 21.32%) that they needed further nutrition education with the majority (n=130, 50.39%) reporting they had completed a course (degree, certificate or other non-degree course) that did not include nutrition content and 160 (62.02%) reported not having engaged with CPD or CET on the topic of nutrition (figure 3.3.7).

3.3.8 Associations between groups and constructs

When comparing the population's demographics and previous nutrition education and training, there was not sufficient evidence to say there was a significant difference between the means of the groups (see table 3.3.8a). A statistically significant difference was identified between the means of

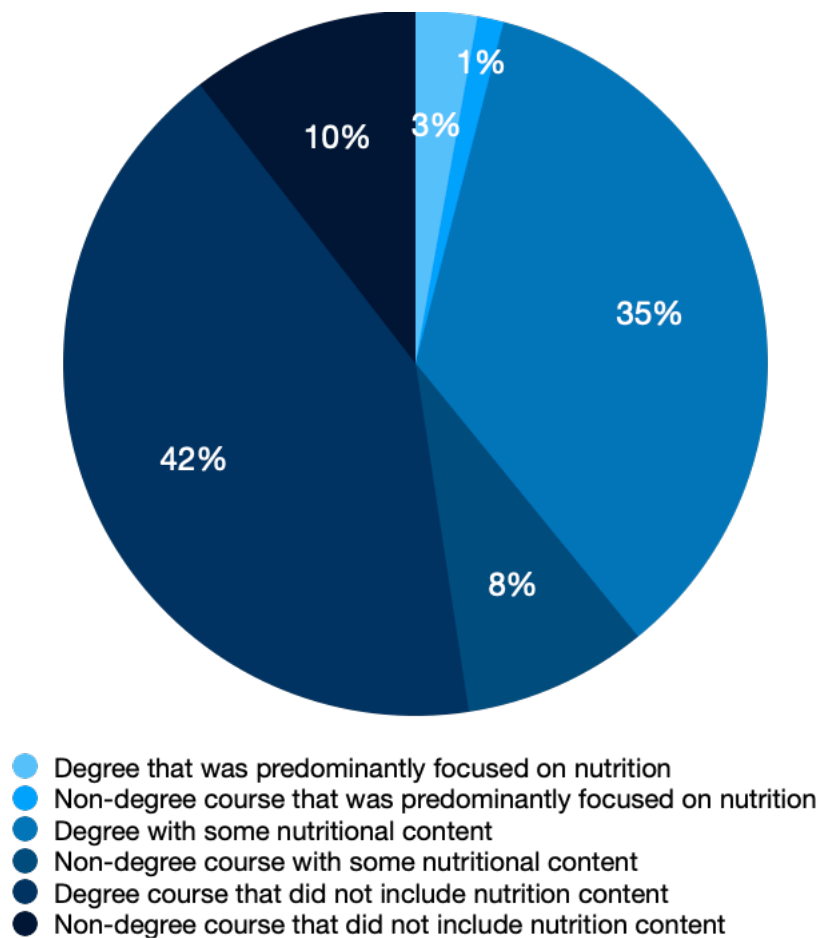


Figure 3.3.7 – Pie Chart indicating respondents' previous nutritional education. Total questions answered, n = 248

the groups regarding confidence in knowledge and nutrition and chronic disease with previous nutrition education ($F(5,232) = [10.926]$, $p < 0.01$) and CPD ($F(1,243) = [11.088]$, $p < 0.001$), table 3.3.8a shows other associations identified with previous CPD showing to be the aspect that has identified significant differences between groups in each construct. A Tukey post hoc test identified the groups with a significant difference within each construct (see figure 3.3.8a-c). The significant aspects highlighted by the Tukey test identify the areas with a significant difference to be the completion of a degree predominantly focused on nutrition and a level 8 qualification. A positive significant correlation of nutrition competence between knowledge, skills, communication and counselling, and attitude was identified by a Pearson's r test (see table 3.3.8b).

Table 3.3.8a - Associations between the workforce's confidence and attitude scores with regard to demographics and education.

Construct	Association with education and demographics	
1. Confidence in knowledge about nutrition and chronic disease (ANOVA)	Age	not significant, $p = 0.521$
	Gender	not significant, $p = 0.736$
	<i>Previous CPD</i>	$(F(1,243) = [11.088], p = 0.001)$
	<i>Previous nutrition education and training</i>	$(F(5,232) = [10.926], p < .001)$
	Qualifications	not significant, $p = 0.192$
	Numbers of years in current profession	not significant, $p = 0.963$
2. Confidence in nutrition skills (ANOVA)	Age	not significant, $p = 0.604$
	Gender	not significant, $p = 0.806$
	<i>Previous CPD</i>	$(F(1,240) = [9.217], p = 0.003)$
	<i>Previous nutrition education and training</i>	$(F(5,230) = [3.802], p = 0.003)$
	Qualifications	not significant, $p = 0.054$
	Number of years in current profession	not significant, $p = 0.884$
3. Confidence in communication and counselling about nutrition (ANOVA)	Age	not significant, $p = 0.185$
	Gender	not significant, $p = 0.816$
	<i>Previous CPD</i>	$(F(1,239) = [4.952], p = 0.027)$
	<i>Previous nutrition education and training</i>	$(F(5,227) = [5.112], p = .001)$
	Qualifications	$(F(2,239) = [4.307], p = 0.015)$
	Number of years in current profession	unable to test
4. Attitudes towards nutrition care (Kruskal-Wallis)	Age	not significant, $p = 0.492$
	Gender	not significant, $p = 0.965$
	<i>Previous CPD</i>	$(H(1) = 8.959, p = 0.003)$
	<i>Previous nutrition education and training</i>	$(H(5) = 11.516, p = 0.042)$
	Qualifications	not significant, $p = 0.279$
	Number of years in current profession	unable to test

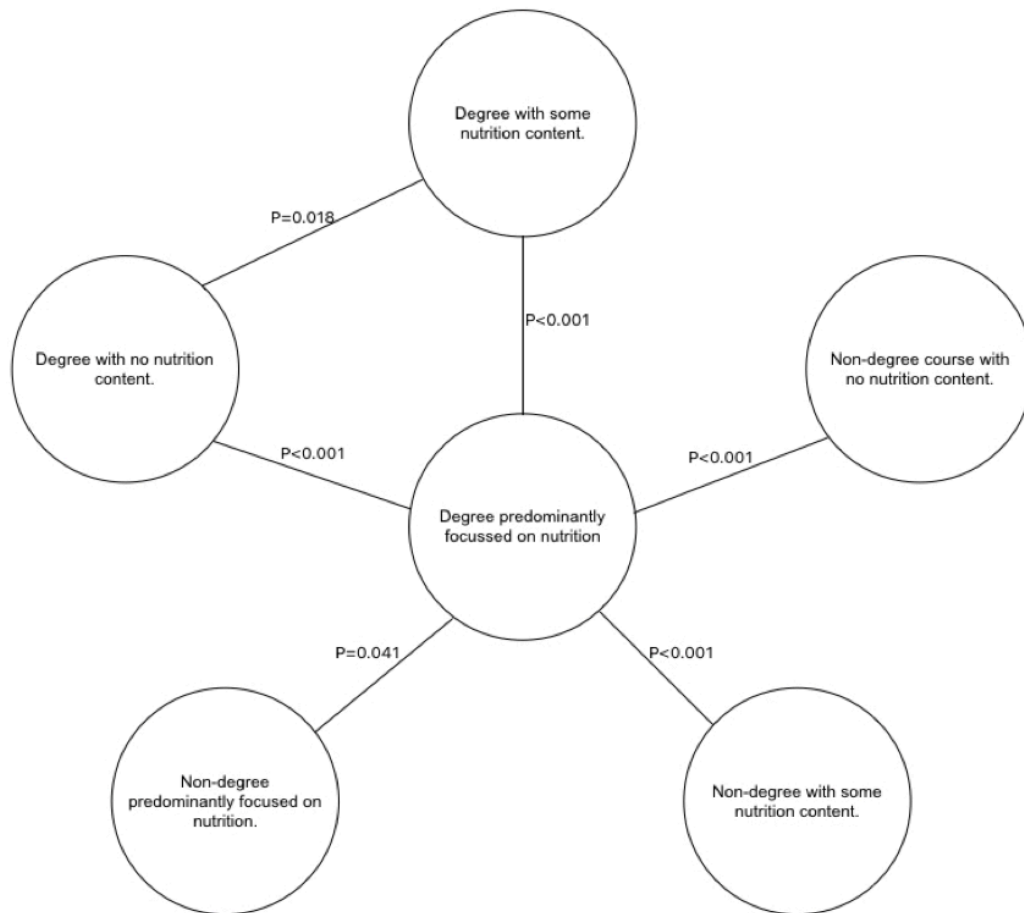


Figure 3.3.8a Tukey post hoc analysis between ‘Confidence in knowledge about nutrition and chronic disease’, and nutritional education. A significant difference was identified by the ANOVA test between these groups. The results of the Tukey analysis are shown. Each group is shown in each circle. The linking lines indicate the group means that are statistically different alongside the p value for each pairing.

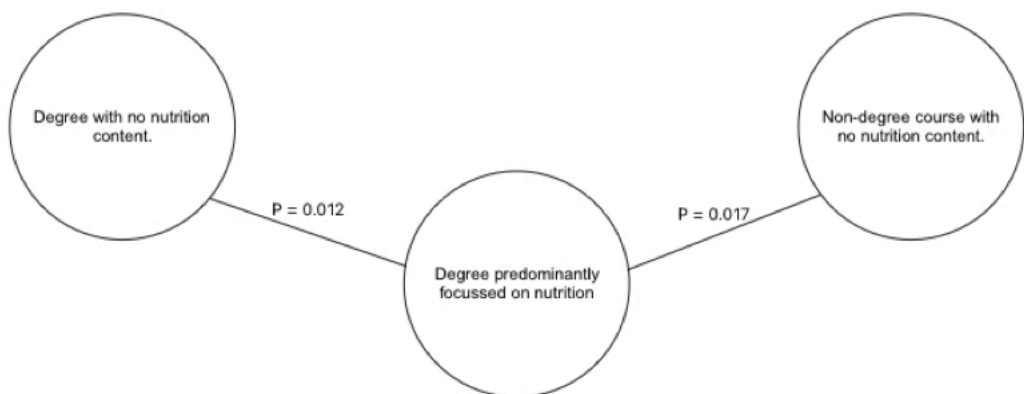


Figure 3.3.8b Tukey post hoc analysis between ‘Confidence in nutrition skills’, and nutritional education. A significant difference was identified by the ANOVA test between these groups. The results of the Tukey analysis are shown. Each group is shown in each circle. The linking lines indicate the group means that are statistically different alongside the p value for each pairing.

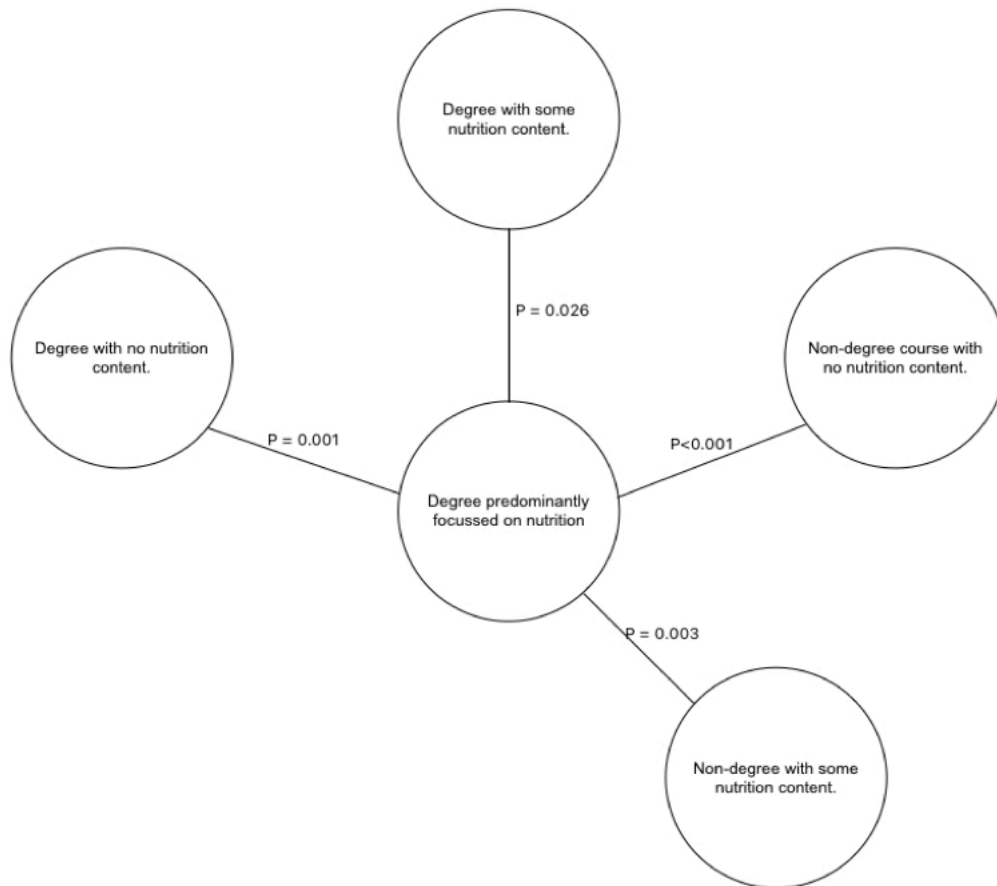


Figure 3.3.8c Tukey post hoc analysis between ‘Confidence in communication and counselling about nutrition’, and nutritional education. A significant difference was identified by the ANOVA test between these groups. The results of the Tukey analysis are shown. Each group is shown in each circle. The linking lines indicate the group means that are statistically different alongside the p value for each pairing.

Table 3.3.8 b Pearson’s r scores comparing each construct.

	Construct 1	Construct 2	Construct 3	Construct 4
Construct 1	-	-	-	-
	-	-	-	-
Construct 2	p < .001	-	-	-
	r (236) = 0.68	-	-	-
Construct 3	p < .001	p < .001	-	-
	r (233) = 0.56	r (230) = 0.71	-	-
Construct 4	p < .001	p < .001	p < .001	-
	r (240) = 0.35	r (237) = 0.39	r (237) = 0.45	-

3.3.9 Associations between different professionals

The NUTCOMP questionnaire has been used in other studies reporting the mean scores for each construct allowing for the results of the UK optometric workforce to be compared to other professions. Figures 3.3.9a to 3.3.9e compare the optometry results from this NUTCOMP questionnaire to the results for psychologists, physicians, speech therapists and dietitians.

Figure 3.3.9a Comparing the mean score for construct one with other professionals

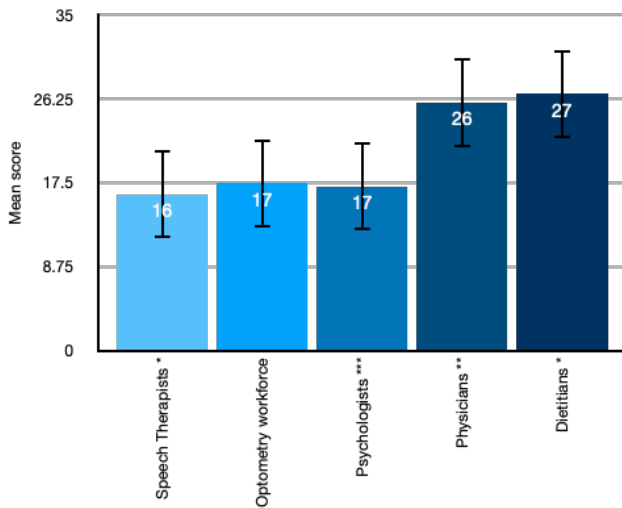


Figure 3.3.9b Comparing the mean score for construct two with other professionals

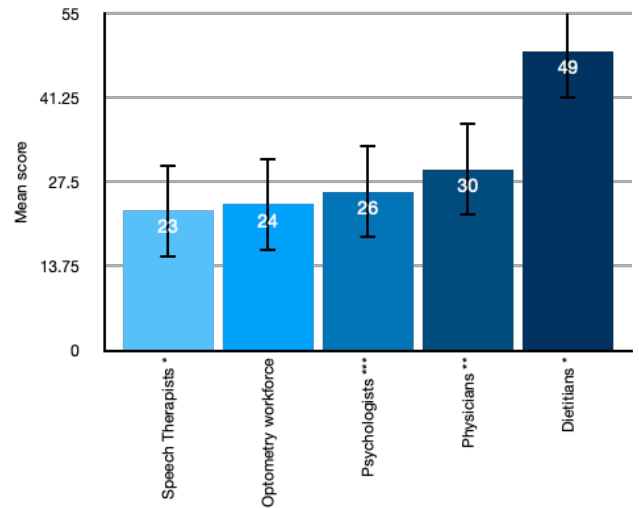


Figure 3.3.9c Comparing the mean score for construct three with other professionals

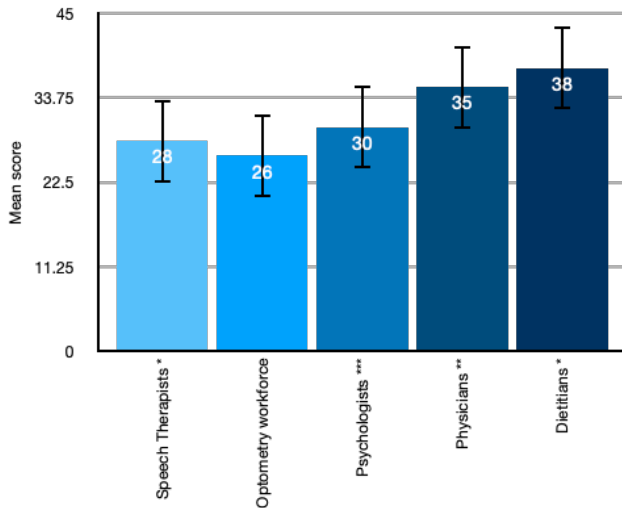


Figure 3.3.9d Comparing the mean score for construct four with other professionals

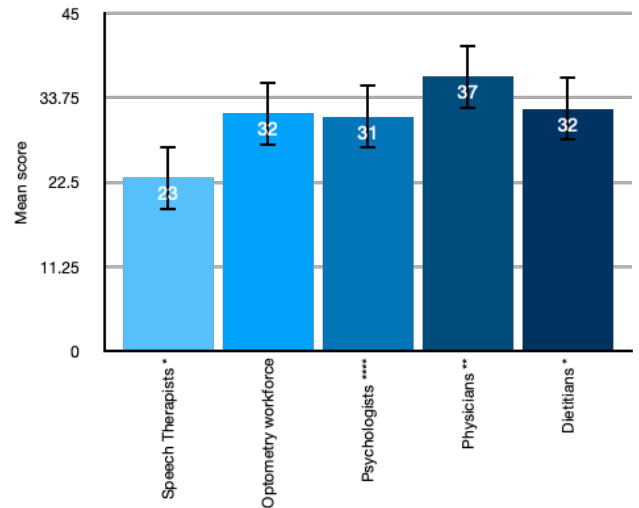


Figure 3.3.9e Comparing the mean total score with other professionals

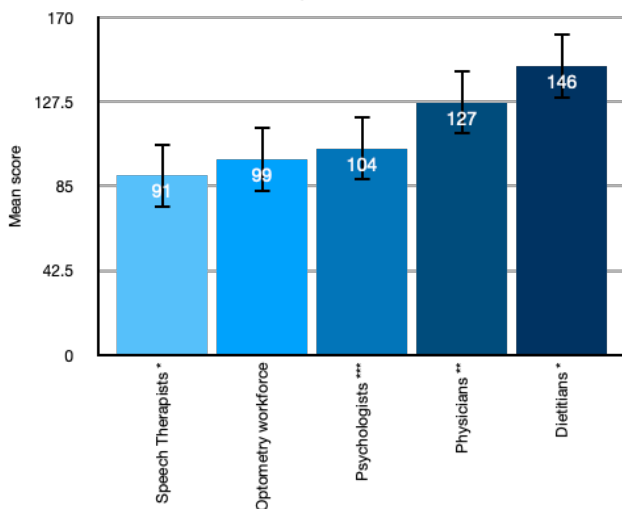


Figure 3.3.9 a-e Comparing the mean scores (rounded to the nearest whole number) for optometrists and other professions for each construct and the NUTCOMP questionnaire as a whole. * Speech therapists and dietitians (Ball and Leveritt, 2015), ** Physicians (Al-gassimi et al., 2020) and * psychologists (Nayda et al., 2021).**

3.4 Discussion

The UK optometric workforce's highest scoring construct was regarding their attitude towards nutrition care and was similar to psychologists (Nayda *et al.*, 2021), physicians (Al-gassimi, *et al.* 2020) and dietitians (Ball and Leveritt, 2015). The majority of optometrists agree it is important for their patients/clients to eat healthy and for them to encourage such behaviour at every opportunity, that it is an effective use of professional time, although the confidence that it is within their scope of practice, is the area of the construct where their confidence reduces. The mean scores for this construct were the only construct results that were not normally distributed, instead the results were left-skewed indicating a similar mindset within the population surveyed. In all three other constructs the mean scores were lower, more similar to speech therapists (Ball and Leveritt, 2015) and psychologists (Nayda *et al.*, 2021) than dietitians (Ball and Leveritt, 2015) and physicians (Al-gassimi, *et al.* 2020), this is to be expected with dietitians in view of diet and nutrition training being mandatory for qualification (Nayda *et al.*, 2021), although Aldubayan *et al.*, (2021) report nutritional courses are optional in medical schools in Saudi Arabia. The results of this study indicate education is the key aspect affecting participants confidence in their skills, knowledge, and communication and counselling about nutrition, with previous CPD, and nutrition education and training being the demographics with a significant association to each construct (table 3.3.8a) in particular completing a degree predominantly focussed on nutrition (Figure 3.3.8a-c), regardless about how long it has been since a participant completed their degree (table 3.3.8a).

It is an optometrist's responsibility and a mandatory requirement of registration to complete CPD (before 2022 optometrists registered with the GOC had to complete CET, this was changed to CPD since 2022). The CPD requirements include acquiring 36 CPD points over a three year period with a minimum of six points in each year (The College of Optometrists, <https://www.college-optometrists.org/professional-development/continuing-professional-development-cpd/introduction-to-cpd> (Accessed 3rd August 2022))The points must be spread across four core domains; Professionalism, Communication, Clinical Practice and Leadership & Accountability and an extra fifth speciality domain for those who hold a speciality registration such as independent prescribing (General Optical Council, 2022a). These domains do not specify modified lifestyle advice or government initiatives directly, although the clinical practice domain specifies 'Keep your knowledge and skills up to date' (General Optical Council, 2022a) which could be seen to include modifiable lifestyle advice as well as many other developments within the profession. Optometrists must also remain up to date with best practices, although the results of this study indicate the majority of those who responded to the questionnaire were not aware of professional guidelines relating to nutrition and not confident about the most recent published peer-reviewed evidence regarding nutrition. This is a similar outcome to other papers regarding lifestyle advice by optometrists in the UK which reported that most supplements recommended in their study did not comply with the results of the AREDS/AREDS2 (Lawrenson and Evans 2013). Downie *et al.*(2016) reported that optometrists

accessed more CET and industry-sponsored education than peer-reviewed journals. In this study only 37.25% had completed CET on the topic of nutrition.

Sixty nine percent of optometrists reported they would benefit from further nutrition education and not many had engaged with nutrition specific CET programmes before, and no one mentioned the HLOP framework with the potential Royal Society for Public Health (RSPH) level 2 Understanding Nutritional Improvement qualification (RSPH, 2019). These findings indicate the importance to create a suitably tailored modifiable lifestyle course to actively engage optometrists.

The results are important to the optometry profession considering the ageing population and the government's position regarding prevention of non-communicable diseases with modifiable lifestyle changes. Identifying the current confidence and competence of the profession in addition to the attitude towards providing nutrition advice within optometric practice will help determine the future of the profession. Positive attitudes towards nutrition advice within optometric practice were identified in construct four with non-normally distributed data showing positive skewness towards agreement with attitudes regarding nutrition care (figure 3.3.2) as shown in other studies with other professions (figure 3.3.9d) (Ball and Leveritt, 2015; Al-gassimi *et al.*, 2020; Nayda *et al.*, 2021). The lowest scoring construct was 'confidence in knowledge about nutrition and chronic disease' which suggests the desire to support patients with modifiable lifestyle changes is present but the confidence in knowledge is currently not at desired level.

3.4.1 Limitations

Limitations of this study include response rate, self-selection and understanding why the optometrists who participated in the NUTCOMP questionnaire have not sought further education before, considering the HLOP programme and many previous CET articles. Although the response rate cannot be stated, the population of participants was a similar demographic to the optometry population at the time of the questionnaire. As with voluntary questionnaires, self-selection bias can lead to skewed results, with people potentially over reporting their competence and confidence, although the results are similar to those achieved by Ball and Leveritt (2015) for speech therapists, therefore self-selection bias may not be a concern with the results. In view of these results a further study into the enablers and barriers to giving lifestyle advice would be beneficial.

The response rate of this study cannot be stated because of the manner in which the questionnaire was delivered and there is not an official record of every person within the optometric workforce. The number of submitted questionnaires (partial and fully completed) was 259 which is similar to other lifestyle-based questionnaires in optometry and other professions, 160 (Douglas *et al.* 2019), 206 (Keaver *et al.* 2018), 206 (Zhang *et al.* 2020), 214 (Ly *et al.* 2017), 283 (Downie and Keller, 2015), 288 (Brûlé *et al.* 2012), and 317 (Downie *et al.* 2016). At the time the questionnaire was distributed,

16679 fully qualified optometrists were registered with the GOC (GOC, 2022) and the College of Optometrists randomly selected 1000 members to receive the questionnaire invite directly. A paper by Lorencatto *et al.* (2019) was also distributed by The College of Optometrists and a random sample of 1200 members was used, they reported a 34% (n=408) response rate. To review the representativeness of the results, 231 participants responded as optometrists when asked about their profession, role, or occupation and this equates to 1.38% of optometrists registered with the GOC in the UK at the time the survey was open. This value is lower than the calculated sample sizes for the UK optometric population and lower than the figures achieved by Lorencatto *et al.* (2019).

Due to the voluntary nature of the questionnaire, it is affected by non-response bias and self-selection bias and so the responses acquired may not be representative of the entire population of optometrists, although the registered speciality data reflects the frequencies of the optical population registered at the time of data collection.

3.4.2 Questionnaire validity

The results for the Cronbach's alpha identified good reliability of each construct including those with additional questions and the whole questionnaire. Constructs one and two had additional questions and the resulting Cronbach's alpha was lower (see table 3.3.2) than those reported by Ball and Leveritt (2015) which could suggest a reduction in validity of the construct with the extra questions, although the Cronbach's alpha result was reduced for all constructs and overall compared to the original Ball and Leveritt (2015) results, indicating the reduction cannot automatically be attributed to the additional questions. All of the Cronbach's alpha results for this study are within acceptable levels as discussed by Streiner (2003) of a minimum of 0.80 for basic research and a maximum of 0.90, after which redundancy is suggested, therefore the reliability of the adaptations is confirmed.

3.5. Conclusion

This study indicates that the majority of optometrists agree they should encourage their patients to eat well, including providing specific nutrition recommendations. They also agree it is within their scope of practice and an effective use of professional time.

When considering providing specific nutrition recommendations in relation to managing chronic disease the results were divided. The current self-perceived confidence regarding nutrition and lifestyle advice shows that few consider themselves to be confident or extremely confident and the majority agree they feel they need further nutrition education. Given the scope of practice is increasing, optometrists are in a good position to provide information to a range of patients and discussing modifiable lifestyle changes is within the GOC optometry standards, investing in the profession to improve confidence and competence to deliver advice in this manner is important. With CPD and CET previously being available, the HLOP course and an apparent increase in nutrition

content in undergraduate courses, it is important to also identify the barriers to delivering advice in practice that are not competence based.

Chapter 4 - A Delphi analysis of a proposed educational intervention regarding nutrition and lifestyle changes within UK optometric practice.

4.1 Introduction

Building on previous chapters, the gap in the UK optometric workforce's knowledge and confidence regarding nutrition skills to assist and support their patients/clients was clearly identified and contextualised by the NUTCOMP questionnaire detailed in Chapter Three. Chapter Three also identified a clear desire within the participants for further education and training, with current offerings not being accessed by many. To address this educational need, the learning requirements of the profession to achieve an increase in confidence regarding nutrition, and the best methodologies to deliver an educational event to meet those requirements must be accurately investigated.

Mogre *et al.* (2016) completed a systematic review regarding educational investigations to improve nutrition competencies of healthcare professionals. In this study they identified the importance to choose '*interventions, which are educationally and clinically relevant to the needs of participants.*' (Mogre *et al.*, 2016). Therefore, to design an educational intervention best suited to the optometrists registered in the UK, a recognised and robust approach and strategy to identify the consensus regarding the educational needs of the profession is required. Nominal Group, Delphi Analysis and Consensus Development Conference are all accepted consensus methodologies commonly adopted to solve problems relating to workforce needs in medicine and healthcare (Fink *et al.*, 1984; Jones, 1995; Bourrée *et al.*, 2008; Manera *et al.*, 2019)

4.1.1 Delphi Analysis

The Delphi Analysis is a technique used for developing professional guidance (Jünger *et al.*, 2017) which has been widely used in healthcare and medicine to collect and analyse information to produce immediate solutions to problems (Fink *et al.*, 1984) for many years, with over 1000 projects reporting using this methodology (de Meyrick, 2003). Delphi Analysis is an iterative multistage process that acquires an anonymous group consensus (Hasson *et al.*, 2008). The original Delphi technique was developed in the 1950's by Norman Dalkey and Olaf Helmer (de Meyrick, 2003; Yousef, 2007; Barrett and Heale, 2020), in 1966 Helmer-Hirschberg reported the Delphi technique to be useful in the compilation of a large number of ideas for possible educational innovations, allowing an anonymous consensus to be determined about elements of a proposed educational event (Helmer-Hirschberg, 1966). Delphi Analysis utilises multiple rounds of questionnaires, in which six to eleven participants (Waggoner *et al.*, 2016) complete independently of each other, allowing this technique the potential to reach a large population and preventing participants from having their opinions potentially influenced by other participants (Barrett and Heale, 2020).

4.1.2 Nominal Group

The Nominal Group technique involves participants independently generating a list of ideas which are then shared and discussed with the group, before being ranked in a structured manner led by a facilitator (Black *et al.*, 1999; Halcomb *et al.*, 2008; Manera *et al.*, 2019; Timmermans *et al.*, 2022). It is comprised of four sections; generating ideas, recording of ideas, evaluation and group discussion, and scoring (Horton, 1980; Vermandere *et al.*, 2013; Timmermans, *et al.*, 2022). The generating ideas section involves each participant in the group (usually seven to ten participants) (Horton, 1980) writing down their individual ideas in a set time limit (Horton, 1980; Vermandere *et al.*, 2013; Manera *et al.*, 2019; Timmermans *et al.*, 2022). The recording of the ideas uses a round robin style methodology with each participant telling the chairperson one of their ideas until all ideas have been collated in one place, this is done without discussion (Horton, 1980; Vermandere *et al.*, 2013; Manera *et al.*, 2019). The free group discussion (Horton, 1980; Vermandere *et al.*, 2013) section then allows each idea to be discussed with the group (Horton, 1980; Manera *et al.*, 2019). The final section involves each participant being asked to rank their top third of ideas on individual cards which are in turn collected together and the individual rankings are collated to give an overall ranking of the ideas (Horton, 1980; Manera *et al.*, 2019). The individual generation of ideas and ranking can reduce the effect of bias from participants with dominating ideas (Manera *et al.*, 2019). It is important for the chairperson to remain neutral and not bias the discussion (Timmermans *et al.*, 2022).

4.1.3 Consensus Development Conference

The Consensus Development Conference brings participants together in an open meeting to listen to evidence before reaching a consensus (Black *et al.*, 1999). This technique does risk a bias due to potentially '*overly vocal*' participants (Waggoner *et al.*, 2016) and does not allow for private decisions but it is reported to promote '*dialogue, debate and discussion*' (Halcomb *et al.*, 2008). Waggoner *et al.* (2016) developed guidelines for a Consensus Development Group, advising between eight to twelve experts with appropriate rigorous statistical analysis suited to the research question.

4.1.4 Post event feedback

Another approach to create an event people wish to attend would be to first create an event from the research already available, and then ask for post-event feedback with which to improve the event for the future. Mogre *et al.* (2016) completed a realist synthesis of educational interventions and reported different methods of educational interventions in nutrition care and how they affected a clinician's knowledge, confidence, and practice in nutrition. They reported interventions that increased knowledge alone, did not always change behaviour and some interventions changed behaviour without significantly increasing knowledge (Mogre *et al.*, 2016). Work by Ockene *et al.* (1995) focused on patient-centred counselling, reported no significant change in participants knowledge, although it did report an increase in counselling skill confidence. The approach employed by Ockene *et al.* (1995) contained various methods of interventions. Mogre *et al.* (2016)

also reported the use of multiple educational methods in most of the studies they reviewed, these findings were agreed by McDonnell and Crehan (2012). Bullock *et al.* (2020) suggested using evidence from rapid evidence synthesis that events with multiple methods are more likely to have an impact. These are some of the methods reported to be beneficial for an education event or for measuring clinical practice regarding nutrition or healthcare workers;

- Observing superiors/opinion leaders modelling care (Mogre *et al.*, 2016; Forstlund *et al.*, 2021)
- Enabling a change to a clinicians' working environment (Mogre *et al.*, 2016)
- Technology-based learning (Benjamin *et al.*, 2008; Mogre *et al.*, 2016). Although Forstlund *et al.* (2021) reported the evidence was very low with regards the effects of interactive educational meetings.
- Specific, locally relevant resource materials and tools. (Moger *et al.*, 2016)
- Non-traditional teaching methods (Bullock *et al.*, 2014; Mogre *et al.*, 2016; Gocuk *et al.*, 2021)
- Patient examination (Shah *et al.*, 2007; Shah *et al.*, 2010; McDonnell and Crehan, 2012)
- Clinical record review/discussion (Shah *et al.*, 2007; Shah *et al.*, 2010; Bullock *et al.*, 2014)
- Educational meetings (Forstlund *et al.*, 2021)

Designing an educational intervention in this manner could lead to a very expensive, extensive programme that does not meet the needs of the optometric workforce. This could be rectified with feedback but there is a risk of losing future participants following a negative response to the first event.

The aim of this section of the thesis was to investigate the preferred method of knowledge acquisition for the UK optometry profession regarding nutrition and lifestyle modification advice using a consensus method.

4.2 Methodology

4.2.1. Consensus Methodology

Ethical approval for this study was applied for in October 2021, when the UK was in the grip of the COVID-19 pandemic and face-to-face interaction was restricted. This affected the choice of consensus development method that could be used.

As stated in section 4.1.4 post-event feedback has potential flaws and was not a method of choice. In view of the COVID-19 pandemic forcing a potential event to be accessed on-line, the preferred event design might not have been possible and therefore the post-event feedback could have been adversely affected and not given a full picture of the participants' requirements.

In view of the need to move the research to investigate the preferred method of knowledge acquisition on-line, the other three types of group consensus needed to be evaluated as an on-line tool. In their original forms the Nominal Group technique and Consensus Development Conference both have an element of face-to-face interaction, therefore it was necessary to see if either of these techniques had been used in an on-line manner and how that compared to the original design.

A literature search using terms; 'nominal group technique' AND 'messaging app', 'nominal group technique' AND 'Voice over IP VoIP Technology', 'nominal group technique' AND 'cloud based video conferencing tool', 'nominal group technique' AND 'communication software', 'consensus development conference' AND 'messaging app', 'consensus development conference' AND 'Voice over IP VoIP technology', 'consensus development conference' AND 'cloud based video conferencing tool', and 'consensus development conference' AND 'communication software' identified 102 potential papers. After removing duplicates and those unrelated to the use of on-line platforms for consensus methods, only one paper remained.

Werner *et al.* (2014) reported six out of ten participants of an on-line consensus conference completed a questionnaire evaluating the conference. Only three of the six who responded had participated in a traditional face-to-face consensus conference and of those two, one '*rated online consensus conferences to be generally equivalent to face-to-face conferences*' (Werner *et al.*, 2014 p854) and one with prior experience of face-to-face consensus conferences '*stated he would have preferred a face-to-face consensus conference*' (Werner *et al.*, 2014 p854). With such small numbers in this pilot study there was not enough evidence to support modifying a consensus development conference to be on-line, or the nominal group technique to be delivered on-line.

The Delphi Analysis was a suitable method to acquire consensus, with previous use on-line multiple times, and accepted to be used in guideline development in healthcare (McMillan *et al.*, 2016), it has the ability reach a large audience geographically, and is the only technique that allows anonymity (Kenney *et al.*, 2005; Barrett and Heale, 2020). Although social desirability risk is usually an aspect for more sensitive topics, for example illicit drug use (Tourangeau and Yan, 2007), some professionals may feel there is a risk of disclosure if they report they are not competent or confident in an area of professional knowledge and others may be tempted to self-promotion and over-report their confidence and competence, therefore anonymity has the potential to encourage participation and improve truthful answering (Booth-Kewley *et al.*, 2007). It would also prevent a potential bias from a dominating opinion within a group discussion. When considering the strengths of a Delphi Analysis and the social restrictions in place at the time, the Delphi Analysis was therefore the consensus method of choice for this study.

To investigate whether a Delphi Analysis regarding optometry had previously been conducted, a literature search combining 'Delphi' AND 'optometry' was performed and from this search, seven relevant papers were reviewed. None of these papers were regarding nutrition and lifestyle changes, education, and optometry. This concluded a Delphi Analysis regarding optometry, nutrition and lifestyle changes, and education would be an original piece of research.

4.2.2 Sample

All consensus methods require a group of experts regarding the topic of discussion as well as potential consumers if possible (Fink *et al.*, 1984). There is no classification for the selection of experts for a Delphi Analysis (Phillips *et al.*, 2014; McMillan, *et al.* 2016). The area of discussion for this Delphi Analysis is appropriate educational interventions regarding nutrition and lifestyle modifications for qualified optometrists in the UK and therefore UK registered optometrists are to be considered the experts in the way they prefer to learn. These are also the same people who would be the consumers of the intervention that the results from this Delphi Analysis will aid to develop. Therefore, the whole population of registered optometrists are the potential total or overall population for this study. Other studies have also included the whole population of a profession as their experts. This Delphi Analysis involves experience of CET which was disrupted in March 2020 due to the COVID-19 pandemic, therefore, to allow for the participants to have had a varied CET experience, optometrists registered with the GOC after December 2018 were excluded.

The sampling method used in Chapter Three for the NUTCOMP questionnaire proved very successful with 259 respondents from all channels and 140 from personal, direct emails to the LOCs, OW and personal contacts. There is not an accepted criterion for a response rate for a Delphi Analysis (Phillips *et al.*, 2014; McMillan *et al.*, 2016) and looking at other papers the values can range from five to 744 (Fiander and Burns, 1998; Murphy *et al.*, 1998; Alexander and Kroposki, 1999; Onwuteaka-Philipsen and Van der Wal, 2001; Reetoo *et al.*, 2005; Rayner *et al.*, 2011; Dreesen *et al.*, 2013; Vermandere *et al.*, 2013; Phillips *et al.*, 2014; van der Maaden *et al.*, 2015; Cooper *et al.*, 2017; Davey *et al.*, 2017). Hogarth *et al.* (1978) reported a group of eight to twelve members leads to group validity and close to optimum results in most cases.

4.2.3 Questionnaire design

The questionnaire tool used in the Delphi Analysis, was formulated using items reported in papers which investigated educational interventions focused upon nutrition and primary care teams. Forsetlund *et al.* (2021) published a Cochrane review identifying multi-factor approaches to educational events could positively influence the effects of the intervention and this was supported by other papers, for example Ockene *et al.* (1995), Levy *et al.* (2011), McDonnell *et al.* (2012), Ray *et al.* (2012), Dacey *et al.* (2013), Mogre *et al.* (2016) and Bullock *et al.* (2020). Levy *et al.* (2011) reported a practical based education programme for staff at all levels in primary care to discuss

nutrition with patients, to be beneficial to all staff involved. The programme reported by Levy *et al.* (2011) included an overview of nutrition, speaking to patients about nutrition, meal planning and nutrition self-management using hands-on training, props, visual aids, and experiential learning instead of didactic lectures (Levy *et al.*, 2011). Ray *et al.* (2012) also reported a positive impact of a multi-factor workshop including lectures, demonstrations, simulations, and small interactive practical sessions. This finding was also reported in the Ockene *et al.* (1995) paper, in which there was a positive response to a training programme where half of the programme was centred on learning counselling and dietary assessment skills. Dacey *et al.* (2013) reported an increase in knowledge following their educational interventions including lectures, didactic sessions, and discussion sessions as well as optional interactive exercise sessions, although there was no significant increase in confidence to discuss weight management with patients. Other styles of CPD can include personal research (although Alnahedh *et al.* (2015) reported that optometrists' have trouble identifying high quality evidence), clinical audit (which Gocuk *et al.* (2021) investigated as an educative tool and reported that it improved documentation of AMD care delivery), and case-based peer discussion (which has also been reported to improve knowledge and reduce professional isolation (Bullock *et al.*, 2014)). From these papers it is apparent there are many styles of learning and potentially including multiple styles will improve the educational outcome of an intervention. The final questionnaires for round one and two (see Appendix 4.2.3a and 4.2.3b) were created from the information acquired from these papers and personal experience of CET.

Following ethics approval from the Aston University LHS REC (REC ID 1841) round one of the self-designed Delphi Analysis was hosted by Microsoft Forms and distributed to optometrists in the UK. Participant recruitment was conducted by direct invitation through personal contacts of the research team, LOCSU and OW. An email containing an invite to participate in the research, participant information sheet (PIS), and consent information (see Appendix 4.2.3c and 4.2.3d) were distributed to the afore mentioned groups. The email invite asked a potential participant to send an email to the research group if they wish to participate. A reply was sent with the link to the questionnaire, the PIS, and the consent. The initial section of the questionnaire contained 'click through' consent. Round one of the Delphi Analysis (see Appendix 4.2.3a) was planned to be open for two weeks in August 2022, although on sending the invites via the LOCSU, many LOCs advised they send monthly newsletters at the start of each month, therefore with ethical approval, round one of the Delphi Analysis was extended to three weeks to allow those who received the information at the start of the month time to participate. Initially it was planned for there to be a week for data analysis and confirmation of the questions for the second round of the Delphi Analysis before round two was sent to the provided email addresses on the 11th of September 2022 with a further two weeks to complete. During this period Queen Elizabeth II passed away and corporate communications were stopped out of respect, therefore round two of the Delphi Analysis was delayed until after the state funeral of Queen Elizabeth II. This further extension was also agreed to by the ethics committee. The

questionnaire was anonymous and so a reminder email was sent to all participants one week after the initial round two questionnaire email was sent, thanking those who had participated and asking those who had not responded to respond before the closing date (see figure 4.2.3).

The request to participate in the Delphi Analysis resulted in eight responses with 100% of participants engaging in both rounds of the Delphi Analysis process. These numbers are within the acceptable response rate for a Delphi Analysis of eight to twelve experts (Hogarth, 1978) although it is on the lower end of acceptable responses. In view of this, ethics approval was sought and given for a validation questionnaire of the original Delphi Analysis. The design of the validation questionnaire (see Appendix 4.2.3f) was an amalgamation of the two rounds of the original Delphi Analysis with the explanation of the consensus reached by the original group given as per round two of the original Delphi Analysis. A confirmatory validation single round cycle of Delphi Analysis was undertaken to review the results of the original Delphi Analysis rounds and add further insight when opinions were divided in the original Delphi Analysis rounds. This Delphi Analysis validation was delivered via personal contacts of the research team. This Delphi Analysis validation was open for three weeks from 1st of February 2023 to 21st February 2023. The data from all three questionnaires were analysed and used to design an educational interaction.

4.2.4 Definition of consensus

The questions within the Delphi Analysis were mostly nominal with participants ranking multiple answers in an order of preference or selecting one option from a multiple choice. There is not a single gold standard methodology agreeing to a set definition of consensus for a Delphi Analysis (Myint *et al.*, 2010; Niederberger and Spranger, 2020) and many papers do not define a consensus level pre-priori. To define a consensus with nominal data other papers have used an arbitrary percentage cut-off from 50% (Stewart *et al.*, 1999) through 66.6% (Myint *et al.*, 2010) to 70% (de Viliers *et al.*, 2005; Cooper *et al.* 2017; Veugelers *et al.*, 2020) or higher (Stewart *et al.*, 1999). An alternative manner to determine consensus is to discard the lowest 30% when ranking options. For this Delphi Analysis the consensus level was decided to be 70%, this cut-off was decided as it is the general consensus found in the published literature.

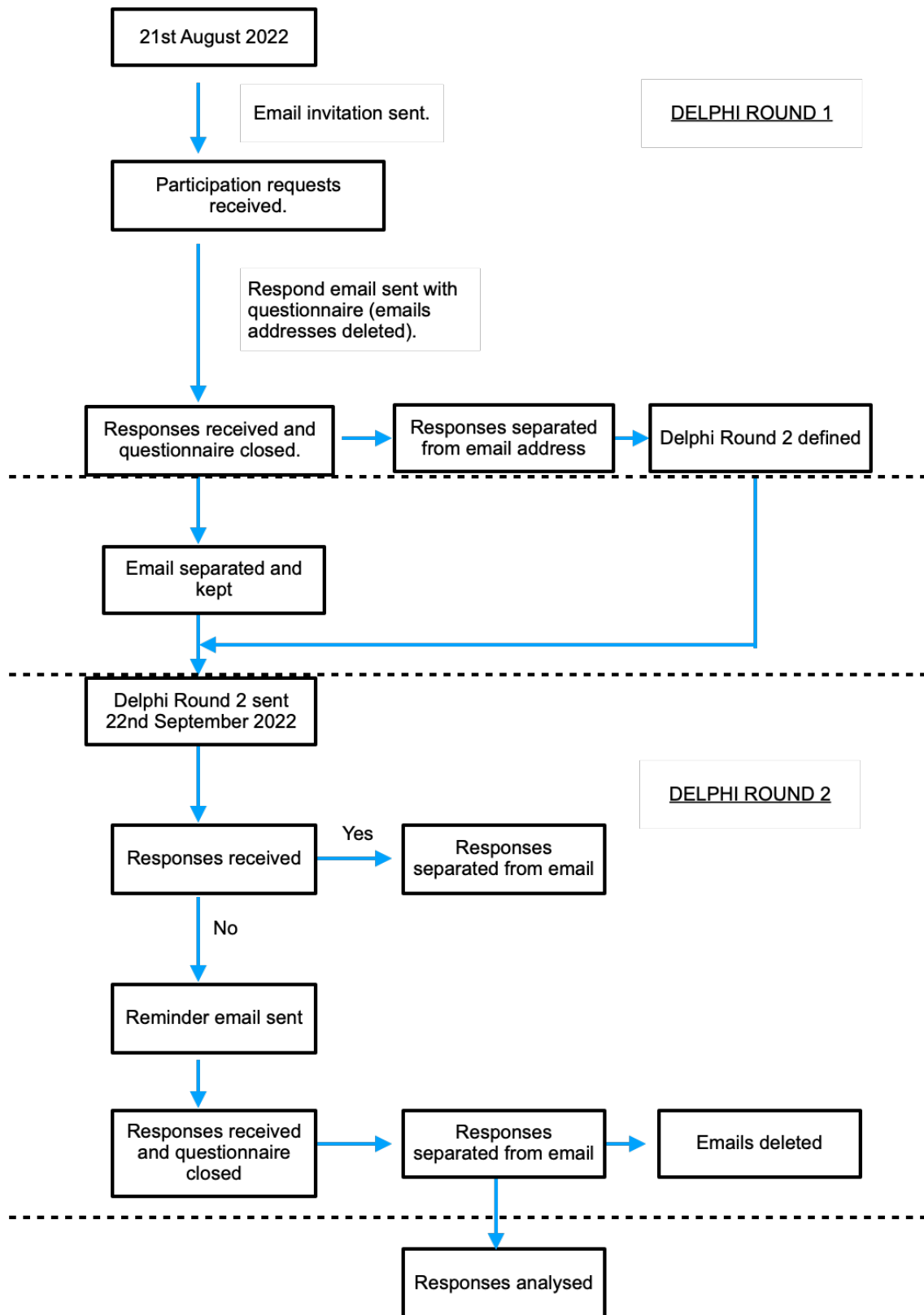


Figure 4.2.3. Delphi Analysis Methodology Flow Chart – The process of the Delphi Analysis comprising of two rounds, indicating each stage and timeline.

4.3 Results

Data were collated and analysed using Numbers Software (version 10.1 for Macs). A total of eight participants completed both rounds one and two of the original Delphi Analysis with frequencies and percentages calculated for all results submitted. The Delphi Analysis validation was completed by 13 participants and these results were used to validate the original Delphi Analysis Rounds and inform consensus, if consensus was not met in the original Delphi Analysis Rounds, figure 4.3 indicates

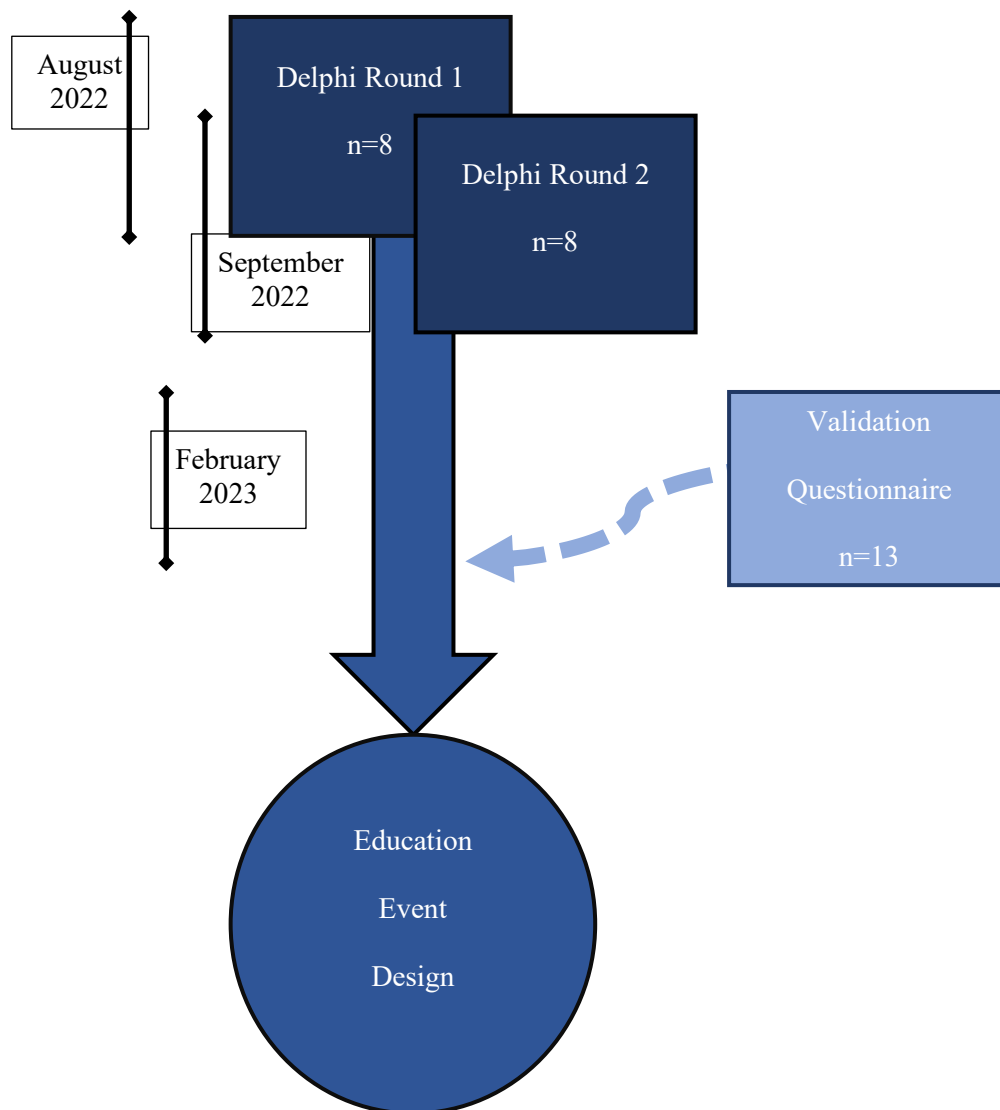


Figure 4.3 Timeline for the Initial Two Rounds of Delphi Analysis and Validation Questionnaire - Indicates the relationship of the three questionnaires within the educational methods enquiry (Delphi Analysis Round One, Delphi Analysis Round Two and Validation Questionnaire). The number of participants is shown in each section. The participants for both rounds of the Delphi Analysis are the same and the Validation Questionnaire are different to the participants of both rounds of the Delphi Analysis.

relationship between the three questionnaires (Delphi Analysis Round One, Delphi Analysis Round Two and Delphi Analysis Validation). All participants were optometrists registered to work in the UK before January 2019.

4.3.1 Delphi Analysis Round One

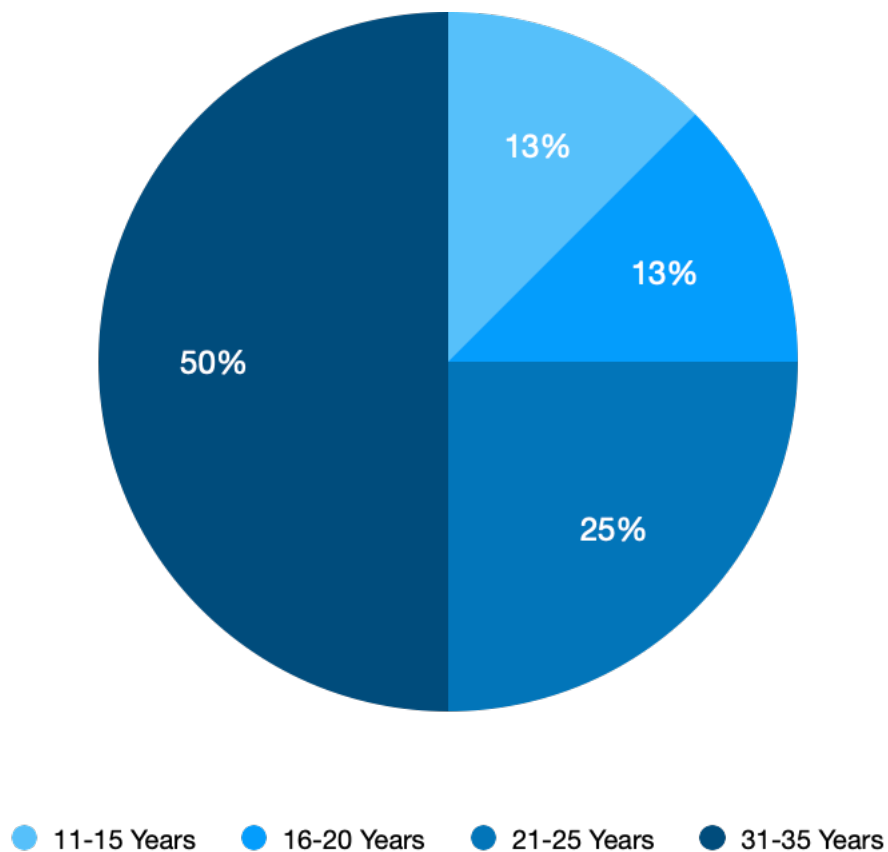


Figure 4.3.1.a Duration participants were qualified in Delphi Analysis Round One – Duration of qualification was asked in five-year groupings from 0-5 years to more than 50 years. The data represented shows the durations for which there was a response.

In total eight optometrists responded to round one and the majority of respondents had been qualified for 31-35 years (see figure 4.3.1a). When asked about differing methods of learning, participants ranked the six options in order (represented in figure 4.3.1.b), these rankings were scored with first place receiving a score of one and sixth place receiving a score of six, the averages of these scores are shown on the chart and the modalities are listed in order of preference. It was a unanimous response regarding the benefits of hearing from a multidisciplinary team with all participants wishing to hear from other professionals regarding nutrition and emotional support. A majority of respondents (n=7, 87.5%) would be prepared to work with/support external groups relating to lifestyle changes with the other participant being unsure. When asked about the types of literature they would find beneficial to refer to after the event, patient information leaflets were the most popular with all participants requesting them, the results for the other types of literature are shown in figure 4.3.1.c.

With the pre-priori consensus level set to 70%, if three or more people disagreed with the statement it would not meet the consensus. A consensus was found for the following opinions, the benefit of hearing from a multidisciplinary team, a request for patient information leaflets and an example of

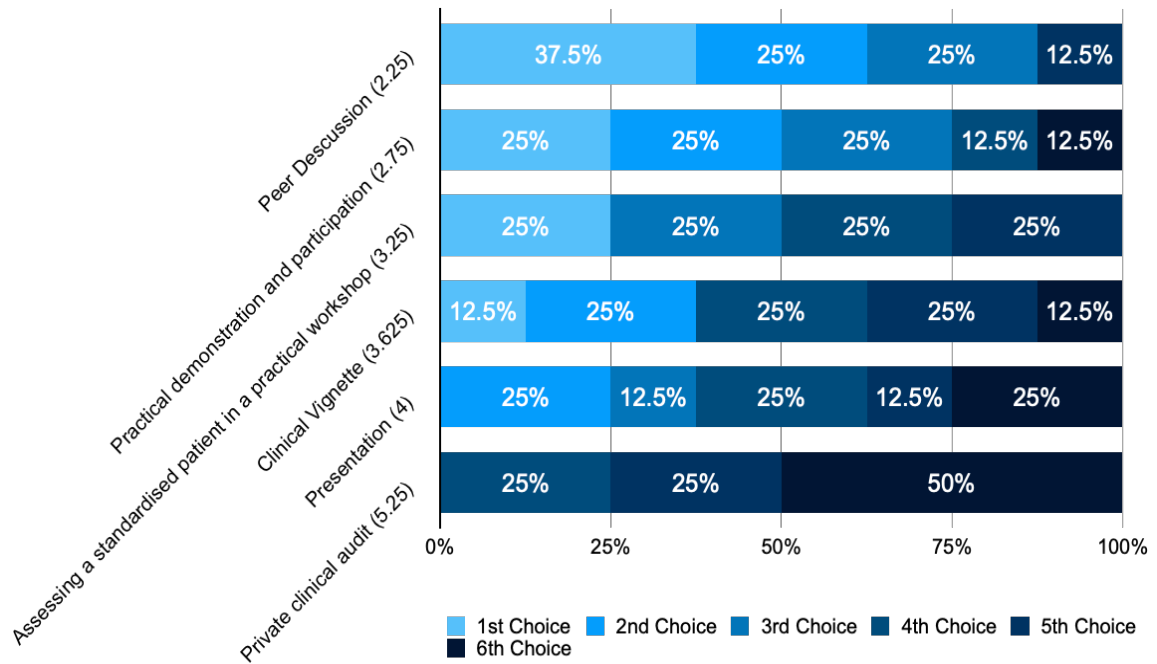


Figure 4.3.1.b Order of preference of learning methodologies in Delphi Analysis Round One - The rankings of each learning methodology, showing the percentage of responses for 1st to 6th choice. The overall average position is written in brackets after each modality.

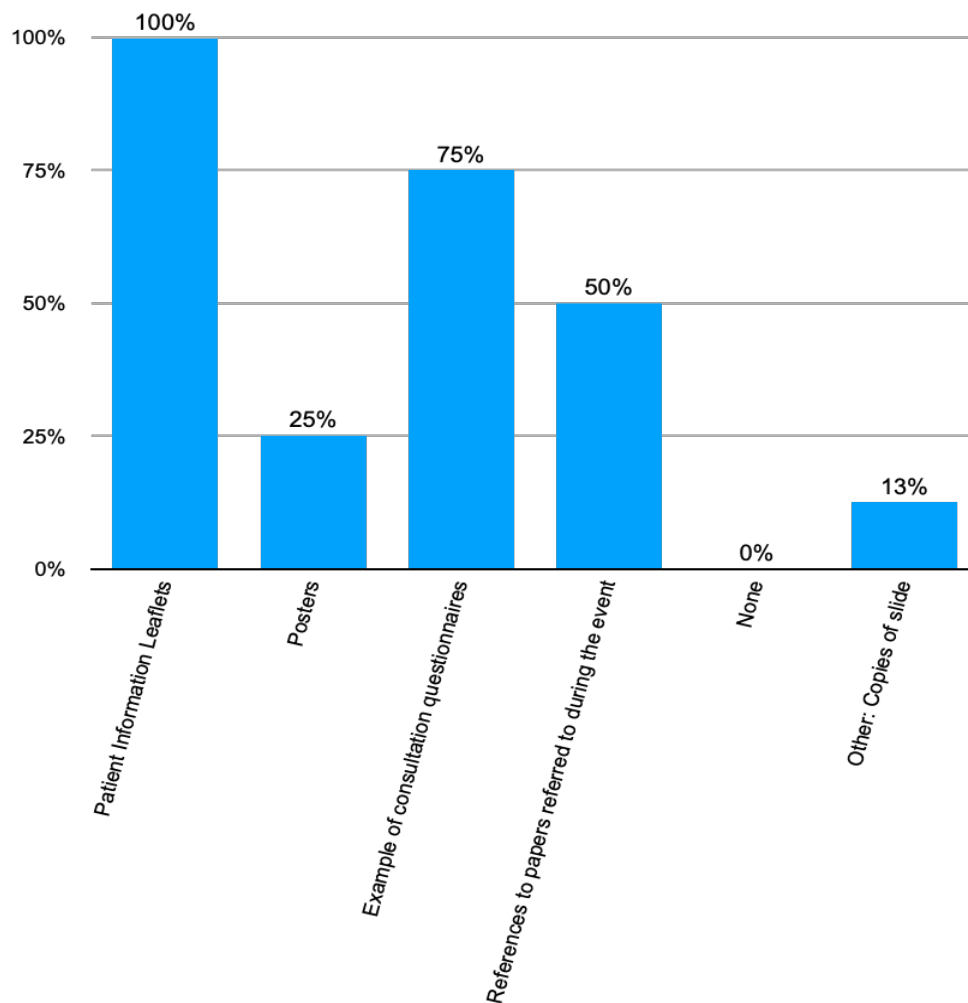


Figure 4.3.1.c Percentage of respondents for each type of literature relating to educational event – Results from Delphi Analysis Round One (total n=8)

consultation questionnaires as forms of post-event literature, and being prepared to work with/support external groups relating to lifestyle changes. Regarding the preference of methods of learning, consensus was achieved with peer discussion in the top three for 87.5% (n = 7) and practical demonstration and participation in the top three for 75% (n = 6), the next highest scoring method was assessing a standardised patient in a practical workshop. Assessing a standard patient in a practical workshop was within the top three for only 50% (n = 4) of participants and therefore did not reach the consensus level. Round Two asked more details about each section to investigate further about the optometrists' responses.

4.3.2 Delphi Analysis Round Two

In round two, all eight participants responded giving a 100% response rate. Peer discussion was the most popular learning method and in round two, participants were not in agreement regarding the manner in which to access and attend a peer discussion. Half (n = 4) of the participants indicated a preference for an in-person peer discussion and 37.5% (n = 3) would prefer an on-line event, one person did not respond. A practical demonstration was the second most popular choice of learning method and in round two the participants were almost unanimous (n = 7, 87.5%) that they would prefer professional patients to assess rather than participants of the educational event to volunteer to be assessed. The biological data and nutritional support the participants thought they would benefit from observing as part of a practical demonstration is shown in figure 4.3.2.a. Regarding assessing a standardised patient in a practical workshop most respondents (n = 6, 75%) preferred to see a different patient at the start to the end of the educational event, one participant preferred to re-assess the same patient and one participant did not want to assess a standardised patient. The clinical vignette had a similar result with half (n = 4) of the respondents preferring to complete a clinical vignette before the event and a different one after the event, of the remaining participants three (37.5%) preferred to complete a clinical vignette after the event and one (12.5%) would prefer to complete one before the event only. All participants were unanimous in the mode of delivery of a clinical vignette, preferring a downloadable copy sent via email. A presentation was the fifth preferred learning method in round one, and in round two a majority of participants (n=6, 75%) would prefer to attend a presentation on-line rather than in person (n=1, 12.5%) and one person did not respond. The least preferred method of learning in round one was a private clinical audit with half of all respondents placing it in sixth position, when asked if they would be prepared to carry out a clinical audit in round two, most (n=7, 87.5%) indicated they were prepared to carry out a private audit of their records before and after the educational intervention of less than 11 clinical records (n=5, 62.5%). In round one all participants agreed it would be beneficial to hear from a multidisciplinary team and in round two the participants indicated which specialists they wanted to hear from (see figure 4.3.2.b). All participants wanted literature to refer to after the educational event and in round two the form of that literature was enquired about. Table 4.3.2 shows how the participants would prefer to receive the literature. When asked about collaborating with external

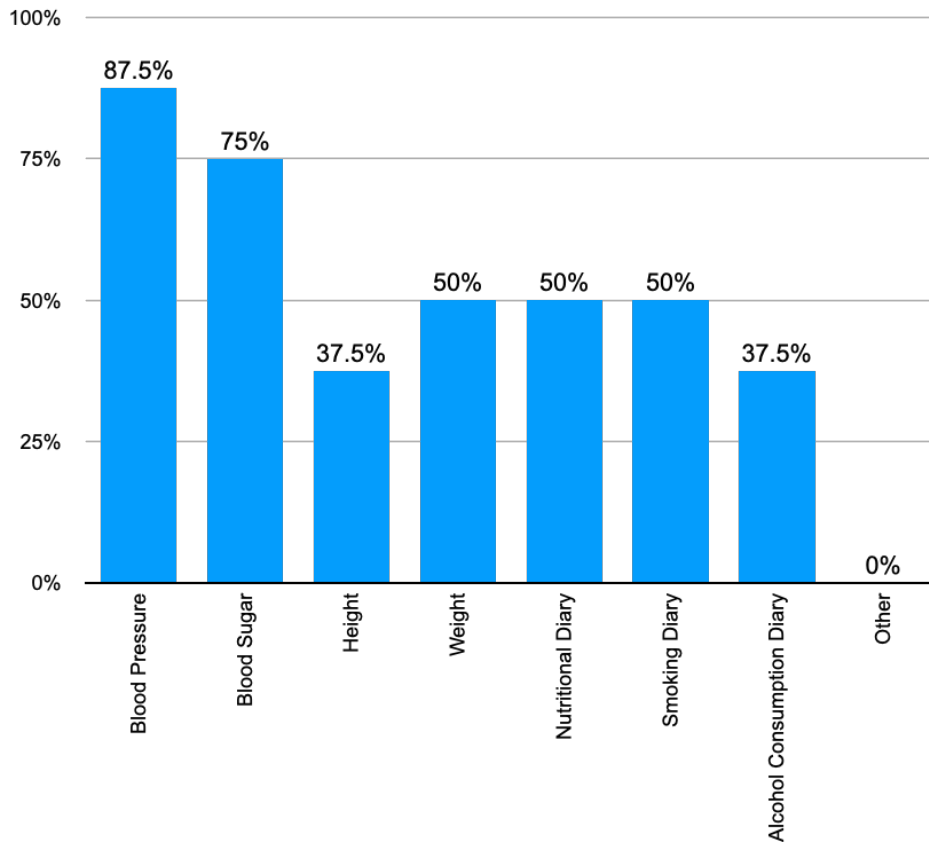


Figure 4.3.2.a Percentage of respondents for each type of biological data and nutrition support as part of a practical demonstration – The results obtained from Delphi Analysis Round Two, total population, n = 8.

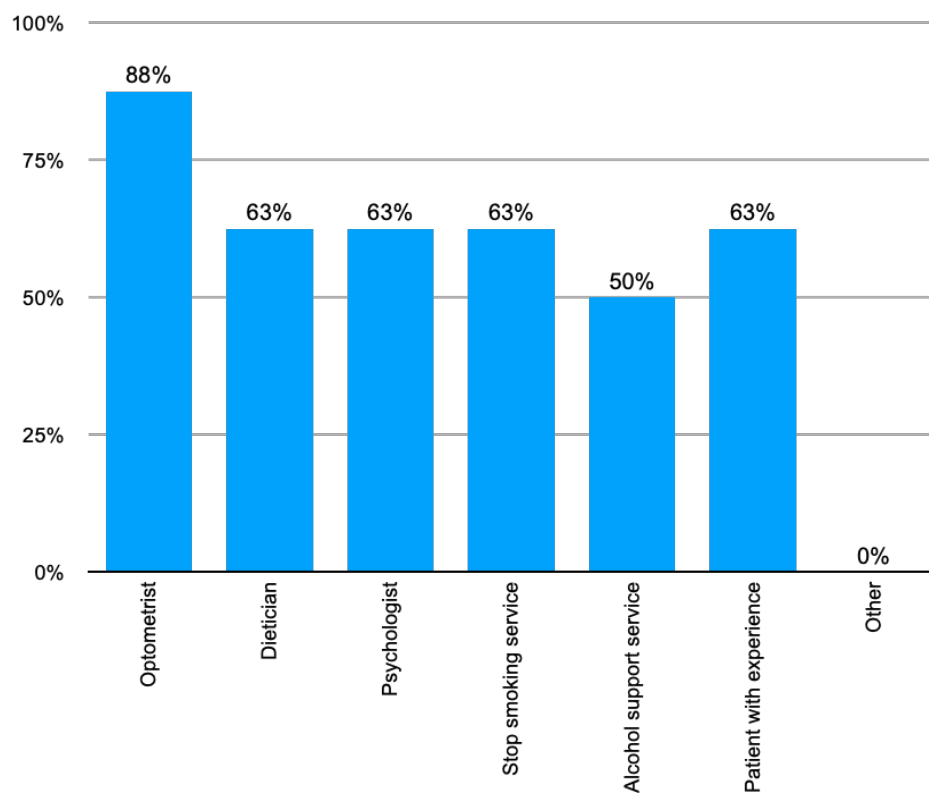


Figure 4.3.2.b Percentage of respondents wishing to hear from each specialist in a multi-discipline presentation at the educational event. Results from Delphi Analysis Round Two, total population, n = 8.

groups to support patients regarding lifestyle changes the form of that collaboration was not agreed upon in the second round. 'Sign posting to external groups' had the most responses (n=3, 37.5%), all other options (allowing support groups access to premises for group meetings when clinics aren't happening, allow a support worker to use a spare clinic room to offer advice to patients at the time of their appointment, all of the above, and 'other' (the other response was 'live support from support worker online through zoom or similar')) had one (n=1, 12.5%) respondent each.

Table 4.3.2 The format participants reported they would like to receive literature after the educational event. Results from Delphi Analysis Round Two, total population, n = 8.

	Hard copies to take away	A link for downloadable copies	Both a downloadable link and hard copies	I prefer not to receive this type of literature
Patient Information Leaflets	0%	25%	75%	0%
Posters	62.5%	37.2%	0%	0%
Consultation Questionnaires	12.5%	62.5%	25%	0%
Reference List	0%	100%	0%	0%

The numbers in **bold** highlight the most common choice for each type of post-event literature.

In round two a consensus was found that the third-place educational event, 'seeing a standardised patient' was desirable for 87.5% (n = 7), and of the seven who wished to see a standardised patient, 71.4% (n = 5) would rather see two different standardised patients. A clinical audit was the least popular approach for learning in round one although no respondents reported that they would not be prepared to carry out a clinical audit with 87.5% (n = 7) confirming they would. However, a consensus was not reached regarding the number of records to audit. Peer discussion was the most preferred method of learning although a consensus could not be reached in the manner to participate in a peer discussion. A consensus was reached for professional patients to participate in the practical demonstrations instead of participants of the event and for blood pressure and blood glucose to be part of the practical demonstration. A consensus was also reached for completing a clinical vignette via email although not when or how many to complete, and an on-line presentation also reached a consensus. A multidisciplinary team format consensus was not reached, the only profession to reach consensus was optometrists (87.5%, n = 7) which would no longer be multidisciplinary.

4.3.3 Delphi Analysis Validation Questionnaire

There were more responses to the Delphi Analysis validation than the first two Delphi Analysis rounds with 13 participants completing the questionnaire in full. The range of qualification duration

was more spread compared to the first two Delphi Analysis rounds with the range being from six to forty years qualified (see figure 4.3.3 a). In the original Delphi Analysis Rounds One and Two, all

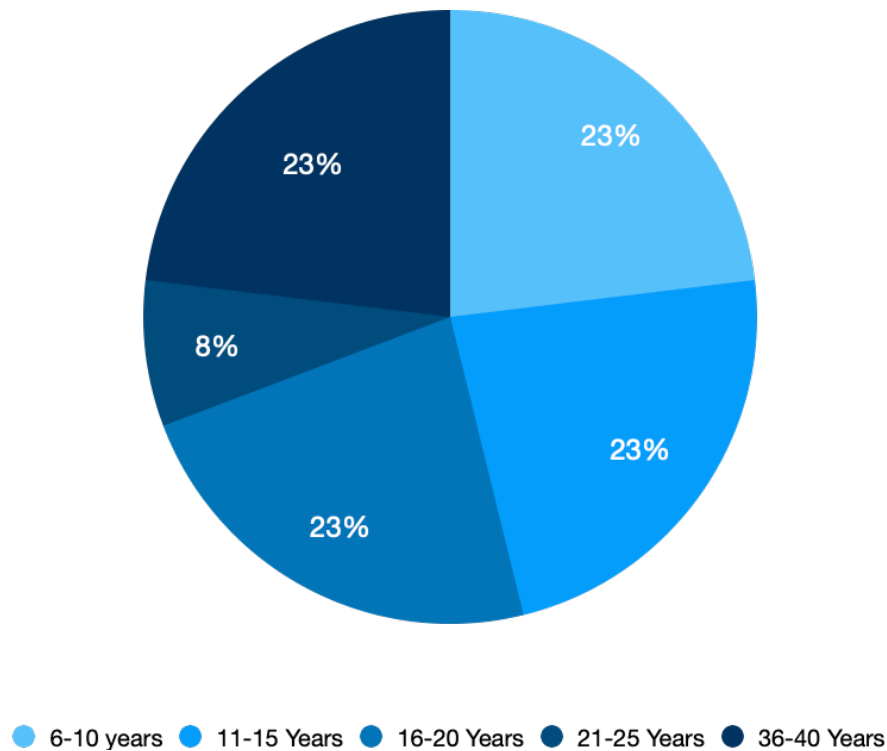


Figure 4.3.3.a Duration participants had been qualified. Duration of qualification reported in the validation questionnaire were asked in 5-year groupings from 0-5 years to more than 50 years. The data represented shows the durations for which there was a response. The total population was n = 13.

participants were working in clinical practice, in the validation questionnaire, one participant (7.69%) reported they were not working in clinical practice.

Comparing the results for the types of educational interventions that people were interested in, the original Delphi Analysis data indicated only one person (12.5%) was not happy to examine a standardised patient, this result therefore reached the consensus to examine a standardised patient. This was confirmed with the Delphi Analysis validation. All participants reported they would examine a standardised patient and these results were not significantly different (comparative difference 22.92). The results regarding a clinical audit reached consensus in the original Delphi Analysis Rounds with the majority willing to participate in a clinical audit (n = 7, 87.5%). The results appeared more spread in the Delphi Analysis validation with less than half wishing to participate (n = 5, 38.5%) which showed a significant difference (comparative error = 35.00) between the number of those wishing to participate. The comparative error indicates if there is statistical significance between two samples, considering the size and response rate for each sample. When the comparative error is less than the difference between the responses there is significance (The Calculator .CO, 2015). The key difference was the number unsure about participating (original Delphi Analysis, n = 1, 12.5% and Delphi Analysis validation, n = 6, 46.15%), with the

difference between those not wishing to participate being zero in the original Delphi Analysis and two (15.38%) in the Delphi Analysis validation. The comparative error between the original Delphi Analysis and the Delphi Analysis validation for those not wishing to participate in an audit was not significantly different (comparative error = 19.61). The number of cases to use in the audit was not significantly different between the two groups (see table 4.3.3.a). The original Delphi showed a consensus of participants wanted to participate in a clinical vignette (n = 8, 100%) which was confirmed with the Delphi Analysis validation (n =12, 92.31%).

Table 4.3.3.a The number of cases to audit for the original and validation groups with details of comparative error and significance. Those who did not want to participate in an audit were removed from these calculations to prevent any bias.

	Number of cases to audit.			
	Less than 11	11-25	More than 25	As many as needed/practical
Original Delphi	n=5, 62.5%	n = 2, 25.0%	n = 0, 0.0%	n = 1, 12.5%
Validation	n = 4, 36.4%	n = 5, 45.5%	n = 2, 18.2%	n = 0, 0.0%
Comparative Error	43.97	42.03	22.79	22.92
Significant	No	No	No	No

The original Delphi Analysis did not reach a consensus about how to arrange the assessment of the standardised patient and the results from the Delphi Analysis validation were more spread than the original with 46% (n = 6) wanting to see the same patient at the start and the end and 46% (n= 6) wanting to see a different patient at the start and the end. A separate factor that did not reach a consensus in the original Delphi Analysis was the preferred method to attend a peer discussion. The Delphi Analysis validation, however, did reach consensus, with 92.31% (n=12) preferring to attend in person rather than on-line. With the results combined of the original Delphi Analysis and the Delphi Analysis validation (total, n = 21), in-person attendance reached consensus (n= 16, 76.19%). A consensus was also not reached for the majority of the practical demonstration aspects and these results were not significantly different in the Delphi Analysis validation(see Figure 4.3.3.b and Table 4.3.3.b), this was also shown with the response regarding when to complete a clinical vignette with no consensus in either questionnaire.

The results were split in both the original Delphi Analysis and the validation questionnaire between completing a clinical vignette before and after the education event, (original Delphi Analysis n= 4,

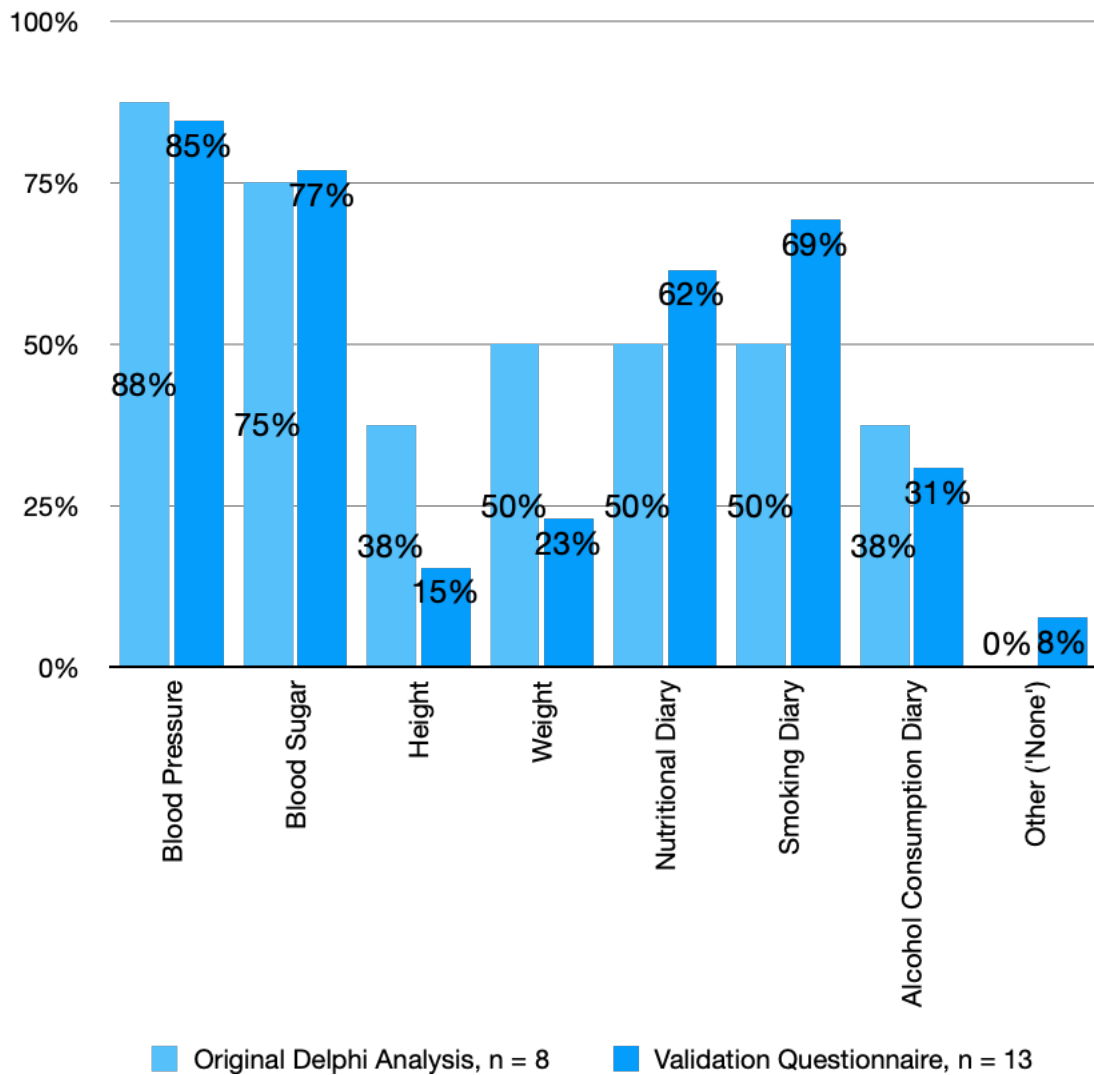


Figure 4.3.3.b Percentage of respondents for each type of biological data and nutrition support as part of a practical demonstration – Comparing the results from the original Delphi Analysis and the validation questionnaire.

Table 4.3.3.b Comparative Error for each practical demonstration option – the frequencies of each practical demonstration compared between the original Delphi Analysis and the validation questionnaire.

		Comparative Error	Significant
Practical Aspect	Blood Pressure	29.73	No
	Blood Sugar	37.73	No
	Height	38.83	No
	Weight	41.52	No
	Nutrition Diary	43.55	No
	Smoking Diary	42.81	No
	Alcohol Consumption Diary	41.99	No
	None	14.74	No

50% and validation questionnaire n= 5, 38.5%), and only completing one after the educational event (original Delphi Analysis n = 3, 37.5% and validation questionnaire n = 5, 38.5%). Regarding which specialists' participants would like to hear from, the original Delphi Analysis met a consensus regarding hearing from an optometrist only, all other professions did not meet the consensus of 70% and the Delphi Analysis validation was not significantly different to the original Delphi Analysis, confirming the original results (figure 4.3.3.c).

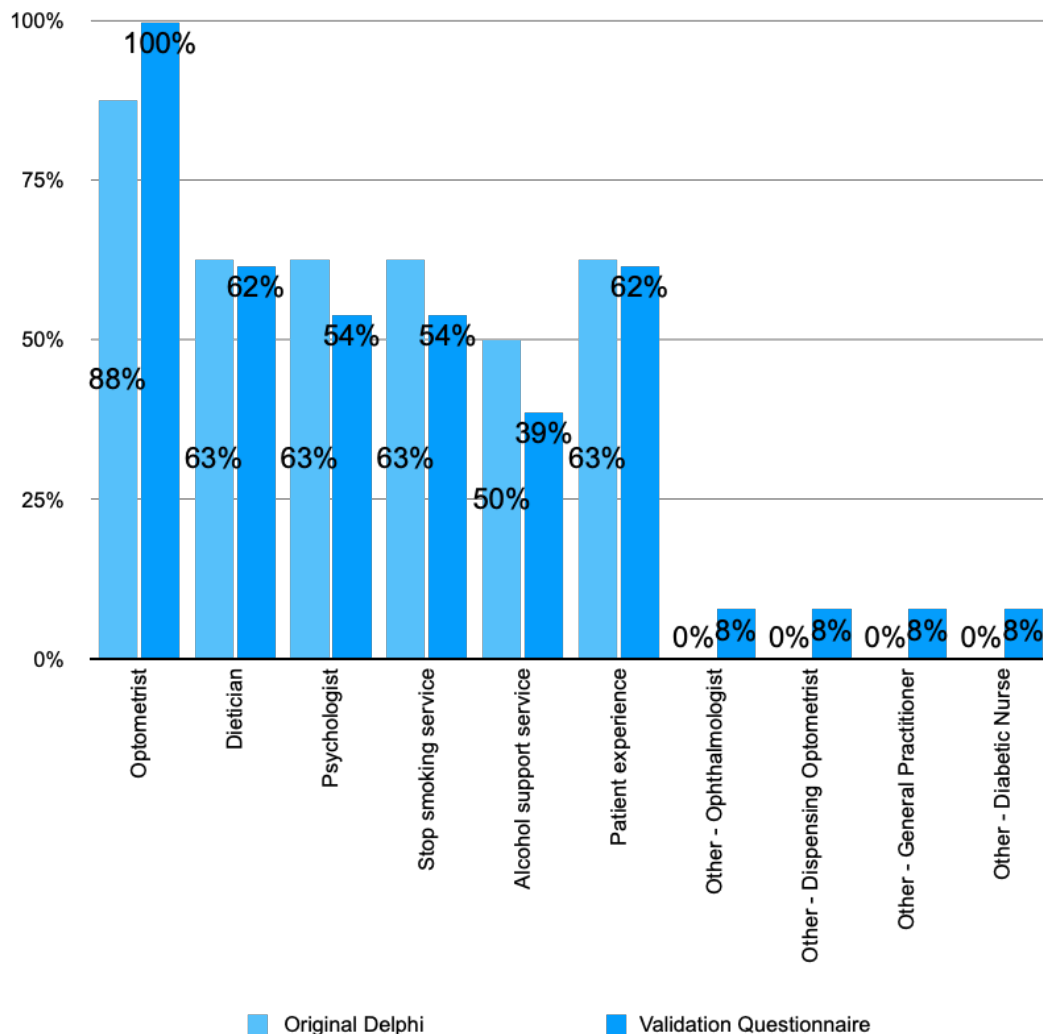


Figure 4.3.3.c Percentage of respondents requesting to hear from each multidisciplinary team member. Comparable data shown from both the original Delphi Analysis and the validated questionnaire.

The original Delphi Analysis reached a consensus about using professional patients for practical demonstrations. The Delphi Analysis validation showed a majority voting for professional patients (n=7, 53.85%), as a stand-alone result this does not reach consensus although the difference between the results of the original Delphi Analysis rounds and the Delphi Analysis validation are not significant (comparative error = 35.49). The manner to receive a clinical vignette reached a consensus in the original Delphi Analysis rounds (100%, n = 8) and confirmed by consensus in the

Delphi Analysis validation (92.31%, n = 12) as well, with the preferred option being 'received via email as a downloadable copy'. The original Delphi Analysis rounds also produced a consensus regarding the manner in which to attend a presentation, the Delphi Analysis validation did not reach the 70% consensus although the majority did confirm the results of the original Delphi Analysis with 61.5% (n = 8) wishing to attend a presentation on-line.

The final question asked participants about post-event literature. The Delphi Analysis validation and the original Delphi Analysis Rounds both reached a consensus regarding participants wishing to receive all types of literature, although the Delphi Analysis validation was not unanimous regarding posters (see Table 4.3.3.c). The consensus in the original Delphi Analysis Rounds wanting hard copies and downloadable copies for the PIL was not confirmed in the Delphi Analysis validation with a significant number of participants (n = 4, 30.8%) in the Delphi Analysis validation requesting hard copies only without the option to download (see table 4.3.3.c). This is the inverse to their request

Table 4.3.3.c The format participants reported they would like to receive literature after the educational event – percentage results are from the validation questionnaire with total n =13.

		Hard copies to take away.	A link for downloadable copies	Both a downloadable link and hard copies	I prefer not to receive this type of literature
Patient Information Leaflets	Percentage	30.8% (n = 4)	23.1% (n = 3)	46.2% (n = 6)	0.0% (n = 0)
	Comparative Error	25.096	37.753	40.130	0.000
	Significance	Yes	No	No	No
Posters	Percentage	23.1% (n = 3)	15.4% (n = 2)	38.5% (n = 5)	23.1% (n = 3)
	Comparative Error	40.625	38.818	26.452	22.912
	Significance	No	No	Yes	Yes
Consultation Questionnaires	Percentage	23.1% (n = 3)	23.1% (n = 3)	53.8% (n = 7)	0.0% (n = 0)
	Comparative Error	32.406	40.625	40.434	0.000
	Significance	No	No	No	No
Reference List	Percentage	7.7% (n = 1)	61.5% (n = 8)	23.1% (n = 3)	7.7% (n = 1)
	Comparative Error	14.492	26.452	22.912	14.492
	Significance	No	Yes	Yes	No

regarding posters, in which the original Delphi Analysis Rounds did not reach consensus, but the majority (n = 5, 62.5%) requested hard copies to take away. In the Delphi Analysis validation, the majority (n = 5, 38.5%) requested downloadable and hard copies with a significant difference. The results regarding the manner in which to receive the consultation questionnaire were different in each group of participants although not significantly different (see table 4.3.3.c).

4.4 Discussion and Education Event Design

The consensus level was set at 70% before proceeding with the original Delphi Analysis Rounds. Considering this outcome, the education event would consist of the following;

- Assessing a standardised patient in a practical workshop at the start of the event and then a different standardised patient at the end.
- Completing a downloadable clinical vignette
- Participating in a clinical audit
- Participating in a peer discussion
- Observing a practical demonstration of a professional patient to measure blood pressure and blood sugar.
- Attending a presentation on-line.
- Hear from a multidisciplinary team including optometrists only.

After the event, optometrists would be prepared to collaborate with external groups relating to modifiable lifestyle changes and would like to take away downloadable and printed patient information leaflets, downloadable reference list, and examples of patient questionnaires.

In practical terms this would create an event with an audit of unknown quantity being completed in advance along with a clinical vignette and attending a presentation which could include the 'multidisciplinary team' of an optometrist. At the event the participants would assess a standardised patient, observe blood pressure and blood glucose measurements being taken, and then assess a different standardised patient before leaving with patient information leaflets and later completing another clinical audit. Although this meets the results of the original Delphi Analysis Rounds, the lack of consensus of 70% for many aspects has the potential to create a learning event that will not be effective or meet the needs of the attendees. One key element is the want of a multidisciplinary team but the only consensus about who should be in the team was an optometrist and the willingness to collaborate with others but not a consensus about which of those other professionals they would want to hear from. These aspects could have occurred through limitations of the questions asked, for example each question could have been considered as a stand-alone aspect or others might have considered them as a whole event, or the detail of the context given to the questions. There is not a current validated Delphi Analysis regarding learning styles in optometry with respect to modifiable lifestyle changes and therefore, this result could be used as a learning tool to produce another Delphi Analysis.

To measure the effectiveness of the Delphi Analysis designed educational event with post-event feedback, audit, clinical vignette or all three will give further details of potential improvement. This further study may also show non-consensus in areas due to participants variable previous knowledge, values, attitudes, and experience influences a person’s learning (Mann, 2011). This Delphi Analysis was not used to define clinical guidelines or treatment regimens that could cause adverse effects if not assessed rigorously and therefore I believe it can have a little more flexibility to interpret all of the information acquired. Considering this, I have reviewed the original data changing the consensus to a majority (more than 50%) agreement (Stewart *et al.*, 1999) and also considering the design when the aspects scoring 30% or less are rejected, both are standards that have been used before, table 4.4 indicates how this change would influence the design. This need for change has become evident following the analysis of all data and with this change comes contradictions that may not have occurred if the lower consensus levels had been set in advance, for example more than 50% (n = 5, 62.5%) would like hardcopies of the posters in round two and no-one said they would not want posters in round two, although in round one only 25% (n = 2) wanted posters. This could indicate a change of preference by the participants, or it could indicate how the structure of the question influences the response.

Table 4.4 Changes to consensus – a table indicating aspects that would be added or excluded if the consensus level was altered.

Aspects meeting >50% consensus	Aspects in the lowest 30%
Post-event literature: reference list, consultation questionnaire and hardcopy of posters.	Post-event literature: copy of slides and posters
Records for audit: Less than 11	Records for audit: 11-25 records and as many as needed. Also uncertain about doing an audit.
Multidisciplinary team members: dietitian, psychologist, smoking cessation service and patient experience	Standardised patient: not seeing one and seeing the same one twice.
	Practical demonstration: height and alcohol consumption diary.
	In person presentation
	Collaborations: live support from support worker online through a video call, allowing support groups to access premises for meetings and allow a support worker to use a spare clinic room.

Considering these aspects, the appearance of the new event would be (writing in italics indicates the changes made);

- Assessing a standardised patient in a practical workshop at the start of the event and then a different standardised patient at the end.
- Completing a downloadable clinical vignette
- Participating in a clinical audit *of less than 11 records*
- Participating in a peer discussion
- Observing a practical demonstration of a professional patient to measure blood pressure and blood sugar.
- Attending a presentation on-line.
- Hear from a multidisciplinary team including optometrists, *dietitians, psychologists, smoking cessation service and patient experience.*

After the event, optometrists would be prepared to collaborate with external groups relating to modifiable lifestyle changes and would like to take away downloadable and printed patient information leaflets, downloadable reference list, and *downloadable* examples of patient questionnaires. Participants would be asked if they would posters and in what form.

The Delphi Analysis validation (n = 13) was written to indicate if the consensus reached by the original Delphi Analysis rounds (n = 8) was agreed upon by a different group of optometrists and the results indicated in most areas there was not a significant difference between the two groups. The area of difference was the manner in which they wished to receive literature. Using the same consensus agreement levels of accepting opinions with more than 50% agreement and rejecting those with less than 30% agreement the results of the validation questionnaire taken as a stand-alone questionnaire would create the following education event design;

- Not seeing a standardised patient at the end of the event only.
- Completing a downloadable clinical vignette
- Participating in a clinical audit: undecided.
- Participating in a peer discussion in person.
- Observing a practical demonstration of a professional patient to measure blood pressure, blood glucose, nutrition diary and smoking diary. Not wanting to observe height and weight measurements.
- Attending a presentation on-line.
- Hear from a multidisciplinary team including optometrists, dietitians, psychologists, smoking cessation service and patient experience. Not enough participants suggested ophthalmologist, dispensing optometrist, GP or diabetic nurse (these figures may have been larger if they had been offered as an option)

After the event, optometrists would be prepared to collaborate with external groups relating to modifiable lifestyle changes by way of signposting and would like to have access to patient information leaflets and posters, both hard copies and downloads of example of consultation

questionnaires and downloadable reference list, and downloadable examples of patient questionnaires.

The Delphi Analysis validation could not meet a consensus regarding seeing a standardised patient or the details of a clinical audit for education, consensus had been met in the original Delphi Analysis Rounds though, therefore the lack of consensus in the Delphi Analysis validation is less important for designing the educational event, although it highlights a variation of opinion within the cohorts questioned which could potentially indicate a lack of experience in these learning methods. The important factor of the Delphi Analysis validation is that it did not disagree with the consensus of the original Delphi Analysis Rounds, and it was only undecided about the finer details. The Delphi Analysis validation confirmed the original Delphi Analysis Rounds regarding clinical vignette, peer discussion, on-line presentation and members of the multidisciplinary team. The practical demonstration included more elements which met consensus in the Delphi Analysis validation with the consensus wanting to observe a nutrition diary (n = 8, 61.54%) and smoking diary (n = 9, 69.23%). In the original Delphi Analysis Rounds these areas scored 50% (n = 4) and only just missed the consensus, therefore these aspects could be included in the training session. A practical demonstration of weight measurement (n = 4, 50%) also just missed the lowered consensus level at over 50% but this aspect should not be included because the results of the Delphi Analysis validation put this aspect (n = 3, 23.08%) lower than 30% and therefore is an aspect to be rejected. This aspect could be included in a presentation in a theoretical manner and still be beneficial to the participants. The section without agreement between the original Delphi Analysis Rounds and the Delphi Analysis validation was the manner in which to receive post-event educational material. The original Delphi Analysis Rounds and the Delphi Analysis validation both reported a strong consensus regarding the desire for the material, but the form was different between the two groups. The original Delphi Analysis Rounds formed a consensus regarding a downloadable reference list and both downloadable and hard copies of the patient information leaflets, 62.5% (n = 5) requested the consultation questionnaire to be downloadable and the posters to be a hard copy to take away which both met the re-defined consensus level. The Delphi Analysis validation confirmed the downloadable reference list otherwise it did not reflect these findings with a spread across all answers for patient information leaflets and posters, and the majority requested both downloadable and hard copies (n=7, 54%) for the consultation questionnaires.

The order of preference of the differing education methods placed clinical audit last, clinical presentation fifth and vignette fourth. In the original Delphi Analysis Rounds, the preferred preference list position for the clinical vignette and the presentation were both very spread and similar. To use the same consensus ratings as the other questions does not work in a preference order because the event would then only be made up of the top 70% or 50% of options which would create a small educational event without the variation of education which is desired (Downie *et al.*,

2016; Kennedy *et al.*, 2014) The aim of this question was to see if any methods were rejected by most, which did not happen. In view of these results, the audit could be left out of the event, although it may prove beneficial as a manner to assess the effectiveness of the educational event. Using a clinical vignette, clinical audit (Gocuk *et al.*, 2021) and a post-event feedback form to evaluate and measure the effectiveness of the event could form part of further research to help improve the learning event.

4.4.1 Strengths and weaknesses

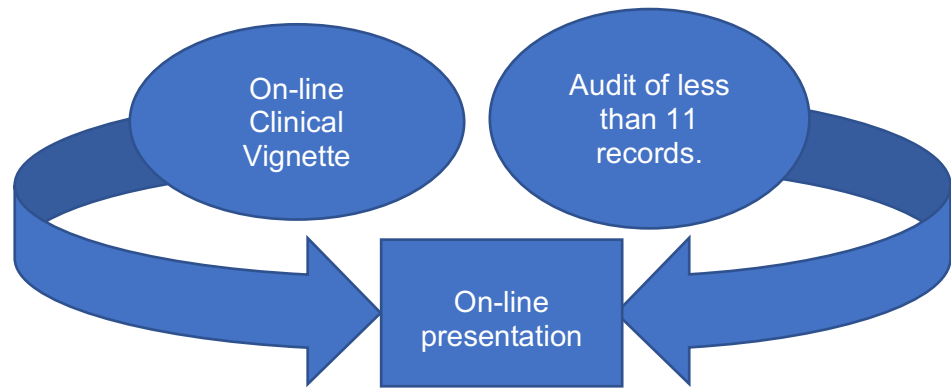
The strengths of this study were the similarities between the results of the original Delphi Analysis Rounds and the Delphi Analysis validation with different duration of experience within each group. The original Delphi Analysis Rounds process allowed for these important opinions to be explored without the expense of hosting an educational event with unwanted aspects. The limitations of the study need to be acknowledged, the main limitation is the inability to assume all optometrists registered in the UK have the same thoughts and opinions as the two populations in this study. The questionnaires were self-administered and so this gives a potential selection bias that only those with an interest, either positive or negative, in modifiable lifestyle factors would respond, if this situation did occur, I would hypothesise that the results obtained would show more polar opinions and less agreement.

4.4.2 Delphi guided educational event.

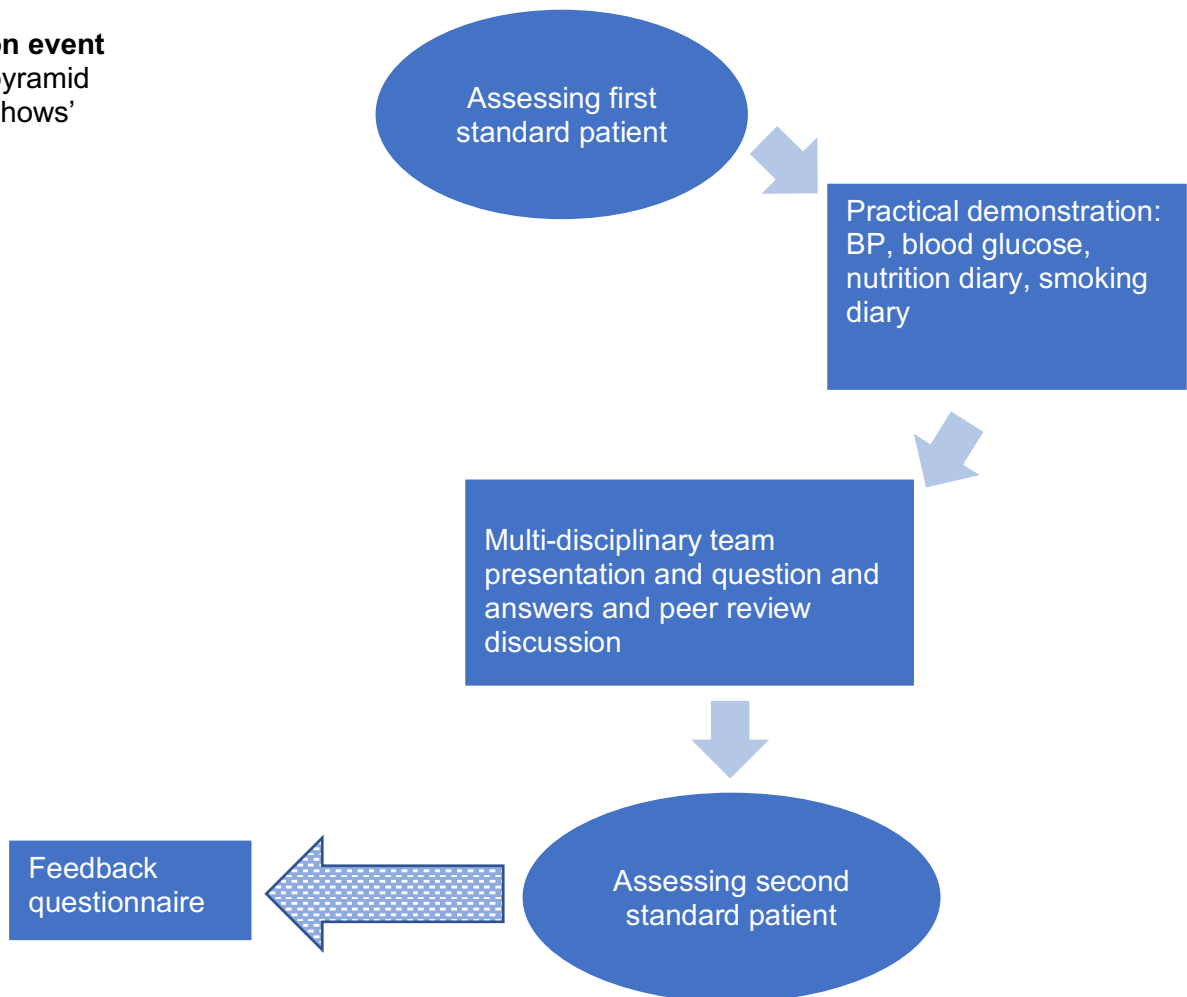
The educational event designed by the outcomes of the original Delphi Analysis Rounds and the Delphi Analysis validation would be a multi-faceted event consisting of on-line and in person education both theoretical and practical with an element of assessment for self-confidence and awareness (see figure 4.4.2). Delphi Analysis has been previously used to determine the professional competencies for the practice of optometry in Spain (Rodriguez-Zarzuelo *et al.*, 2023) and the competencies for glaucoma specialisation to develop a speciality curriculum (Myint *et al.*, 2010).

In advance of the practical event an on-line clinical vignette would be sent to each participant along with a modifiable lifestyle audit tool to carry out an audit of ten records. Once the clinical vignette has been completed a video presentation covering the theory of the benefits of modifiable lifestyle changes and the role of an optometrists along with current guidelines, will be sent for the participant to observe before the in-person event. Three months would be advised for this period. The in-person event would start with assessing a standardised patient for a routine history and symptoms assessment considering modified lifestyle risks, a pre-determined clinical case would be issued for the patient followed by a practical conclusion and advice section considering the clinical information in the case and the information acquired by the participant. The next session would be a presentation and question and answer session from a multi-disciplinary panel of optometrists with

Pre – event
Miller’s pyramid
level 2 ‘knows how’.



In-person event
Miller’s pyramid
level 3 ‘shows’



Post event
Miller’s pyramid
Level 2 ‘knows how’.

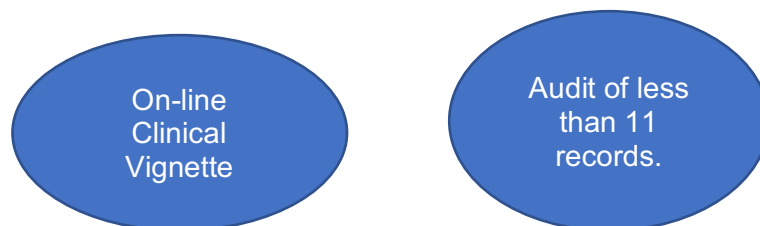


Figure 4.4.2 Flow chart of the Delphi Analysis designed Educational Event. Including Miller’s pyramid levels of clinical competence (Witheridge et al., 2019) to align with Optometry UK Education Strategic Review.

experience in modifiable lifestyle advice (for example a Healthy Living Optical Practice optometrist or someone equally experienced), a dietitian, a psychologist, a patient (with lived experience) and a representative of the local smoking cessation service including a demonstration of a patient questionnaire. The next session would be a practical demonstration of measuring BP, blood glucose, completing a nutrition diary and a smoking diary, followed by a peer discussion and lastly a repeat of the patient assessment that started the day although with a different patient to help participants put into practice the information they have learnt. At the end of the day there would be local modifiable lifestyle groups present to allow for sign posting and local collaborations to be developed to a level each participant is able to accommodate. Participants would be provided with hard copies of posters and patient information leaflets at the end of the event. Directly after the event they would be sent a feedback form and links to the reference list used for the event, patient information leaflets and a patient questionnaire. Three months after the practical event a different clinical vignette would be sent and a request for a further ten cases to be audited. The event would have CPD points available for the participants.

4.5 Conclusion

Identifying the methods in which optometrists wish to learn about modifiable lifestyle changes will form the foundation to develop an educational event that is beneficial to patients, optometrists and other stakeholder groups. This should produce a learning experience that fills a current gap within optometry in the UK. Further research into the effectiveness of the education event would allow the event to be refined to ensure the needs of optometrists and their patients are met.

Chapter 5 – Conclusions and discussions regarding the future of optometric education and services, relating to modifiable lifestyle changes and non-communicable diseases.

5.1 General Summary

It is understood that NCDs can reduce quality of life, economic productivity, and life expectancy (Pan American Health Organisation, 2011; WHO, 2021b). Modifiable lifestyle factors influence the progression of NCDs and making an alteration to lifestyle can increase quality and quantity of life (reducing years living with morbidity) (JBS3, 2014a; Raleigh, 2021). Government initiatives (Public Health England, 2018a), screening programmes (Patel *et al.*, 2020), risk calculators (JBS3, 2014b; ClinRisk, 2018) and advice are all available, although these are not going to help as many people as possible if the public and associated professionals are unable to fully engage, either due to a lack of knowledge, awareness or both.

Optometrists are a group of healthcare professionals that are highly available and accessible within the UK, most local high streets having at least one practice. It is a healthcare service that is required and accessed by many throughout life and especially by those over the age of 40 years, and unlike some other aspects of primary care is typified by it requiring face-to-face interaction. Optometrists in the UK are trained to detect ocular changes relating to certain systematic conditions (Naroo and Grit, 2009; The College of Optometrists, 2021) and obtain a detailed history from a patient about their general health, medication and family history relating to ocular and general health (The College of Optometrists, 2021). Therefore, by documenting this information an optometrist can use this to dismiss or investigate ocular related conditions and are in a physical position to understand the general risk for systematic conditions that a patient might present with. At present there is no formal arrangement to use this information and regular interaction with a patient to help prevent NCDs which appears to mean patient information gathered is not used in the optimal way and therefore there is considerable further potential for offering holistic public health focused services.

5.2 Information obtained from this research.

5.2.1 Current Research Regarding: Ocular Lifestyle Modifications: Perceived Knowledge and Competence – Do optometrists believe it is appropriate and how well are they equipped to be able to offer effective support to those with and at risk of developing chronic conditions?

The results of the systematic review in Chapter Two indicate there have not been large, detailed studies investigating the knowledge, skills, and confidence of optometrists with regards to modifiable lifestyle choices in general. One paper involving 42 optometrists in New York, USA investigated optometrists' practice in advising about lifestyle (Sahli *et al.*, 2020) was identified. There have been condition or lifestyle specific studies (Thompson *et al.*, 2007; Larson and Coker, 2009; Graham *et al.*, 2010; Kennedy *et al.*, 2011; Loughman *et al.*, 2011; Brûlé *et al.*, 2012; Downie *et al.*, 2013; Kennedy *et al.*, 2014; Downie and Keller, 2015; Downie *et al.*, 2016; Landis, 2017; Ly *et al.*, 2017; Xue *et al.*,

2017; Lorencatto *et al.*, 2019; Jalbert *et al.*, 2020; Sahli *et al.*, 2020; Zhang *et al.*, 2020; Gocuk *et al.*, 2021) and from these there is an indication of a need or desire for multi-modal education regarding lifestyle changes (Kennedy *et al.*, 2014; Downie *et al.*, 2016). The need for appropriate support and public awareness from governing bodies and the government was also indicated (Kennedy *et al.*, 2011).

5.2.2 The knowledge, skills, and competence of optometrists in the UK regarding modifiable lifestyle changes and the appropriateness within optical practice.

Indicated by the gap in information represented with the initial systematic review, the NUTCOMP questionnaire was delivered. The NUTCOMP questionnaire identified that most UK optometrists surveyed agreed it falls within their scope of practice to talk to patients about their lifestyle choices and how these are affecting their ocular and general health. The opinion regarding the depth to which optometrists should be involved in this type of care, was divided and the need and desire for further education was clear.

5.2.3 How do optometrists prefer to learn?

In view of a clear desire and need for further education both identified in the systematic review and the NUTCOMP questionnaire, the way in which optometrists wish to learn requires further investigation. Articles, CET and CPD courses had previously been available as well as the HLOP course, although according to their responses most participants in the NUTCOMP questionnaire had not fully engaged with these. Previous CET has been regulated fully by the GOC with only registered providers producing courses, which narrowed the activities available to count towards CET regulations (The College of Optometrists, <https://www.college-optometrists.org/professional-development/continuing-professional-development-cpd/introduction-to-cpd> (Accessed 3rd August 2022)). Looking at historic courses that have previously been available on-line, five articles are still available to read through an authorised CET provider (Limbachia and Bartlett, 2016; Manuchehri, 2016; Asif, 2017; Johnson, 2017; Johnson, 2021). More CET could have occurred that is no longer accessible, especially in the form of conference and peer reviews. For the future, there are currently on-line articles for CPD that optometrists can complete (DOCET, 2022a and b), but with the changes to CPD, now allowing self-directed learning, more avenues of education are available to optometrists outside regulated optometry providers (The College of Optometrists, <https://www.college-optometrists.org/professional-development/continuing-professional-development-cpd/introduction-to-cpd> (Accessed 3rd August 2022)). Further research to understand the lack of uptake of previous CET, CPD and the HLOP course could also aid the design of future educational events. It could be hypothesised that the GOC requirements (GOC, 2021) for CPD may be restrictive to the manner of multimodal education. In view of these findings the design of an educational event is important, to ensure it is attractive to optometrists to give the desire to attend and fulfils the needs of the participants. The Delphi Analysis indicated a multi-modal approach was

required with both theoretical and practical aspects. Participants preferred to participate on-line when possible and would consider audit as a method of learning although peer discussion and practical demonstration were preferred by all.

5.3 Limitations and the future.

The limitations of the research within this study include the response rate for the NUTCOMP questionnaire, the self-selection bias from all questionnaires, and the self-reporting in the NUTCOMP regarding skills and competence. The demographics of the NUTCOMP participants were in line with the demographic profile of the GOC members at the time of the questionnaire which supports the position that the data can be considered to be a representative view of the profession. The Delphi Analysis validation questionnaire reported similar outcomes to the original Delphi Analysis even though the two cohorts who participated had varying levels of experience due to the number of years the participants had been qualified. The results obtained were also not dissimilar to those identified in the systematic review for optometrists across the world.

As with all studies, there are limitations, although the new information acquired within this thesis will help to inform current discussions regarding the future of optometry and increasing access to health care in primary care settings (Policy connect, 2022). A NUTCOMP or similar modifiable lifestyle questionnaire has not been used to ascertain the position of the optometry profession regarding modifiable lifestyle changes before, and this new information can be used to develop future curriculum having identified a knowledge gap. The Delphi Analysis can help define the manner in which optometrists wish to learn, some elements of which can be extrapolated to be used for educational events in general, not just regarding modifiable lifestyle choices. The use of Delphi Analysis within optometry was not evident in the literature search detailed in section 4.2.1 and was a more accessible method of consensus development compared to nominal group technique and consensus development conference when addressing the profession as a whole, needing to cover a large geographic area without in-person interaction (Barrett and Heale, 2020) as discussed in sections 4.1.1 to 4.2.1. This is now not the only Delphi Analysis regarding optometry, since this study commenced, a Delphi Analysis has been used at the University of Valladolid, Spain, to determine a consensus regarding the professional competencies optometrists must acquire in their undergraduate training (Rodriguez-Zarzuelo *et al.*, 2023).

5.3.1 The Future of modifiable lifestyle changes and optometry

To consider the future it is important to start by looking back to the past, namely the 1992 white paper 'Health of the Nation' which was a policy that ran from 1992 to 1997 (Department of Health, archived pre 2010)

https://webarchive.nationalarchives.gov.uk/ukgwa/20130107105354/http://www.dh.gov.uk/prod_cons_um_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4014481.pdf (Accessed: 19

March 2023)) concentrating on promoting good health and preventing ill health in five key areas: *'coronary heart disease, cancers, mental illness, HIV/AIDS and sexual health and accidents'*. (Department of Health, 1994 p4). One of the targets was *'to reduce mean systolic blood pressure in the adult population by at least 5mmHg by 2005.'* (Department of Health, 1994 p16) and it identified a project in Cumbria where optometrists were taking blood pressure readings and working to a protocol after receiving training from local GPs. A paper reviewing the policy indicated it failed due to a few conceptual and process problems and other health situations at the time took priority (Department of Health, (Archived pre-2010) https://webarchive.nationalarchives.gov.uk/ukgwa/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4014481.pdf (Accessed: 19 March 2023)).

Despite this, a significant problem with CVDs remains (Luengo-Fernández *et al.*, 2006) and in 2022 the All-Party Health Group hosted a roundtable called *'Achieving High Street Health'*, looking at ways the High Street *'can offer an alternative for primary care health service provision'* (Policy Connect, 2022) which included Professor Leon Davies, president of The College of Optometrists. This would indicate the role of optometrists within health provision, beyond ocular health, is still being discussed, to potentially have a clearer future vision with a wider scope of practice possibly including a more active position in lifestyle modification advice. During this period the HLOP program was delivered, starting in Dudley in 2014 and moving on to Nottinghamshire, Derbyshire, Manchester and Worcester with 20 to 25 practices registering an interest to participate in HLOP at a launch event prior to 2018 (McCormick, 2018; Brown, 2019; Miller, 2022). McCormick (2018) discussed the process to achieve a HLOP which required an optometrist or manager to attend a day's leadership training and in addition to have at least two members of the practice accomplishing the RSPH Level 2 certificate. Once fully trained, the individual practice would need to approach Public Health England to request for applicable services to be commissioned. The description of this programme appears to answer the need of optometrists for further education regarding modifiable lifestyle changes, although the NUTCOMP questionnaire results indicated no-one had completed the HLOP programme. The link was sent to the LOCs in the areas that provide the HLOP service and therefore there was a potential for an optometrist who had completed the HLOP programme to participate, although with the self-selection process and invite method for the NUTCOMP questionnaire it cannot be guaranteed they were aware of the study. Although the HLOP service has been implemented in multiple areas, it has not become common practice throughout the UK. A scoping review did not identify any papers that had published an audit of the HLOP service to try and explain why other areas have not taken up and embraced these models of service. It could be postulated that cost could be a reason, although the cost of the RSPH Level 2 course does not appear restrictive and the potential benefit within a business of return custom from a patient who could potentially feel more cared for could outweigh this. A second consideration is, it appears to be necessary for an individual

area to approach Public Health England to see if services could be commissioned, the process of which could possibly be a barrier to some, and another barrier could be the refusal of such services. Further research into the benefits and problems of the HLOPs including their impact on other local services for example the GP, pharmacist and local hospital, the impact on patients and optical workforce in the practices involved, and the potential costs or savings the scheme brings to the Health Service in general would be potential future research.

5.3.2 H-GOS conception

Looking at the HLOP and The Health of the Nation they appear to be influenced on a local scale, therefore it could be hypothesised that the direction for change needs to be national, and to come from the governing bodies and central government as opposed to a local level delivering different services dependent upon the geographical location of the practice. A national standard of practice agreed to by the GOC and The College of Optometrists could potentially address the barriers identified in Chapter Two, lack of guidelines/clinical tool (Kennedy *et al.*, 2011; Brûlé *et al.*, 2012; Downie and Keller, 2015; Lorencatto *et al.*, 2019) and the need to establish professional norms (Lorencatto *et al.*, 2019). Following the results from Chapters Two, Three and Four, I propose that there is a need for national governments to commission extended screening services for primary care optometrists to play a more active and supported role in modifiable lifestyle services. To align with the current GOS (General Ophthalmic Service) forms I would propose a service called the H-GOS, health and general ophthalmic service, that would be available to patients not due to their financial situation as many glasses' prescriptions are, but instead free to all over 40 years of age (as per the current NHS Health Checks) (Patel *et al.*, 2020) or younger if required, for certain at risk groups, for example, people aged 25 years to 39 years and of South Asian, Chinese, African-Caribbean, black African and minority ethnic groups with regard to T2DM (NICE, 2017b). It would work as an extended service for both NHS and private patients. It would require optometrists to be trained and registered with the ICS to perform this extended service, it would also allow patients to opt in or out of the extended service. I would encourage for the H-GOS to be the standard service with the option to opt out for patients who feel it is not the place for an optometrist or who do not feel ready to have those personal conversations. Scheduled appointments for other screening services have shown better uptake than more opportunistic processes (Weller *et al.*, 2009). I hypothesise that by having the H-GOS, the GOS and a private sight test would allow for the different services to be accessed at their individually required intervals. At present the NHS Health Check is offered every five years after the age of 40 years (Patel *et al.*, 2020) although a standard sight test is often advised every one to two years (The College of Optometrists, 2021). I would not propose that the H-GOS is used as a stand-alone health screening, rather an addition to a routine sight test. The development of the H-GOS scheme would indicate support for the profession to offer this service and make it more acceptable to patients and optometrists.

5.3.3 H-GOS service design

The initial proposed design of the H-GOS would be a screening and sign-posting service to help reduce the waiting lists of other professionals already offering such services, make it more accessible to more patients and practitioners, and allow its performance to be measured with further research. It would involve documenting weight, height, BP, waist measurement, finger prick tests for cholesterol and blood glucose (Hba1c) when required, alcohol consumption and smoking, in addition to a standard history and symptoms enquiry. Whether these pieces of information could be measured at home or in a private room in the waiting area of the practice or within the testing room would need to be researched. If self-reported results are accurate enough, then I propose patients would have the option to complete an on-line questionnaire, possibly by an app, either at home in advance or in the practice. With technology development these details could automatically populate an electronic patient record (EPR). This information could, with the right permissions, be analysed by risk calculators for example Qrisk@3, a calculator used to predict a person's risk of developing a heart attack or stroke over the next ten years (ClinRisk, 2018), JBS3 risk calculator for prevention of cardiovascular disease (JBS3, 2014b), Calculate your heart age (NHS, 2023), Type 2 Diabetes Know Your Risk (Diabetes UK, <https://www.diabetes.org.uk/preventing-type-2-diabetes/diabetes-risk-factors> (Accessed: 04 March 2023)) or a new one which could be developed, validated and designed to encompass areas of each of these in line with the objectives of public health locally and nationally. This information would then indicate to the optometrist the areas the patient maybe at risk. I propose the optometrist's role would be one of counselling the patient about the results to include assessing their desire and ability to make lifestyle changes (Schwarzer, 2011), followed by discussing any onward referrals for further investigation, for example of high blood pressure or discussing how the patient felt about modifying some lifestyle factors that could be influencing their results and advising or signposting for these. These actions would fit in to the All-Party Parliamentary Group for Health's recent discussion, January 2023, for '*emphasis on education regarding patient self-care*' (Policy Connect, 2023). I would propose this service as a screening process with a finger prick test for cholesterol and HbA1C test when required as occurs with the current NHS Health Check (Patel *et al.*, 2020) and advised by NICE guidelines (NICE, 2017b). The NICE guidelines for T2DM: prevention in people at high risk (NICE, 2017b) already suggest opticians could be a health venue to offer validated self-assessment questionnaires or validated web-based tools with advice on interpretation for stage one risk identification of T2DM (NICE, 2017b). Stage two of risk identification advises trained healthcare professionals should offer HbA1c for those identified at greater risk due to a high-risk score, ethnicity or BMI and I propose optometrists could become part of the trained professionals to deliver this service. This may require further research to see if optometrists are prepared to do a finger prick test with patients and if the GOC feel it is appropriate.

5.3.4 H-GOS training proposal

I propose two forms of training for H-GOS. As an accredited course for those who are already qualified, and part of the undergraduate curriculum for all future optometrists. I propose for the training courses to take the same design in both the undergraduate and the qualified optometrists setting, although adding it to the curriculum would confirm the importance of modifiable lifestyle changes and make it a professional norm. The findings from the Delphi Analysis suggested that the educational event would need to be a multi-faceted including theory and practical delivered both on-line (on-line may or may not be appropriate for undergraduate learning) and in-person.

As previously discussed (Chapter 4.4.2), a clinical vignette would be sent in advance with access to a video presentation once the clinical vignette is completed. The presentation would indicate the need of modifiable lifestyle change discussions with patients and the practicalities of the system including guidelines, risk calculators used (on-line or paper form) and referring or signposting as appropriate. It will also introduce the optometrist to the tests required, advise how the result from each test influences a patient's risk of NCDs and how to ascertain which results indicate the greatest risk factor for the patient and therefore which ones are more important for the patient to understand and consider making changes to alter. The research behind the Eatwell Guide (see figure 1.4) (Public Health England, 2018a) and current healthy living guides (NICE, 2015; NICE, 2017b) for example smoking cessation (NICE, 2021), activity levels (see figure 5.3.4) and safe alcohol

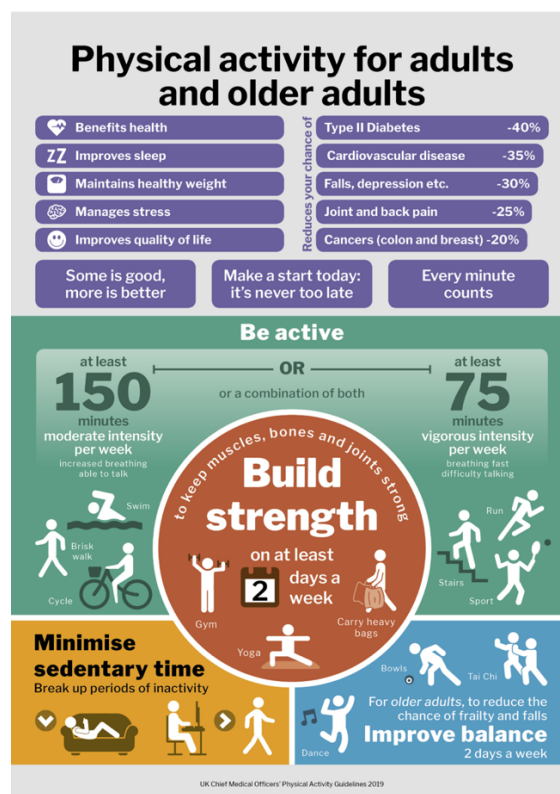


Figure 5.3.4a Physical activity for adults and older adults: 19 years and over – Department of Health and Social Care infographic to explain the amount of exercise adults should be participating in to improve their health (Department of Health and Social Care, 2019)

consumption (Department of Health and Social Care and Office for Health Improvement and Disparities, 2021) will be presented, and it will highlight the research behind current specific vitamins, antioxidants (Buschini *et al.*, 2015; Chapman *et al.*, 2019; NIH, 2020) and flavonoids and how a precise recipe for a tablet has not been agreed on (EFSA NDA panel, 2018; UKNHCC, 2021) and how these aspects can be obtained from a balanced diet (Chapman, 2019). An in-person event would follow, comprising of assessing a standardised patient with regards to lifestyle modifications. The next session would be a presentation with a question-and-answer session from a multi-disciplinary panel as detailed in Chapter 4.4.2, this section will be detailed regarding counselling. Chapters 3.3.4 to 3.3.6 indicated that although optometrists felt they could be empathetic and discuss food intake in a non-judgemental way they were less confident to identify ways for the patient to improve the food they ate. Optometrists will also need to be aware of eating disorders and be mindful of how they talk about food and weight. The presentation from a dietitian will also help in this manner, the British Dietetic Association has produced guidelines for their communications to help end weight stigma and an article about weight stigma and inclusive language to help support patients (Brown, 2022). Psychologists will also be able to guide optometrists through the behaviour change elements of some of these lifestyle modifications. Although the role of an optometrist would be screening and sign-posting patients in this proposed service, they must understand the potential background behind the choices people have made so they can be empathetic and prevent overwhelming a patient and possibly making them feel lectured at rather than listened to and supported. The Delphi Analysis indicated optometrists would like a practical demonstration for measuring BP and supporting the use of tools such as the use of diaries to collect information about behaviours including food intake, alcohol consumption and smoking. Although this was the recommendations of the Delphi Analysis, in this proposed service where an optometrist signposts and refers rather than manages the lifestyle changes, accurate weight and height measurements would be more beneficial than a smoking or nutrition diary. Therefore, I would propose a practical demonstration and competence-based assessments in BP, waist, height, and weight measurements. I propose smoking and alcohol use would be discussed by the local support service who could review the strategies they use in consultation with their patients, so optometrists are aware of the service they are advising their patients to attend. The peer discussion would then follow to allow optometrists to consider the information they have received in terms of real cases, and lastly a second patient assessment, to give the opportunity to use all the tools they acquired through the training and then compare the two interactions they had (see figure 5.3.4b). The event will have CPD points available for the participants. After the original round of accreditations, I would expect there to be a need to be a regular process of reflection which could be included within each CPD cycle. The final aim of this thesis was to determine how optometrists prefer to learn. Proposing an educational event and H-GOS programme to bring standardised modifiable lifestyle counselling to optometry would also require assessment of the skills and knowledge gained to achieve accreditation. The

Pre – event

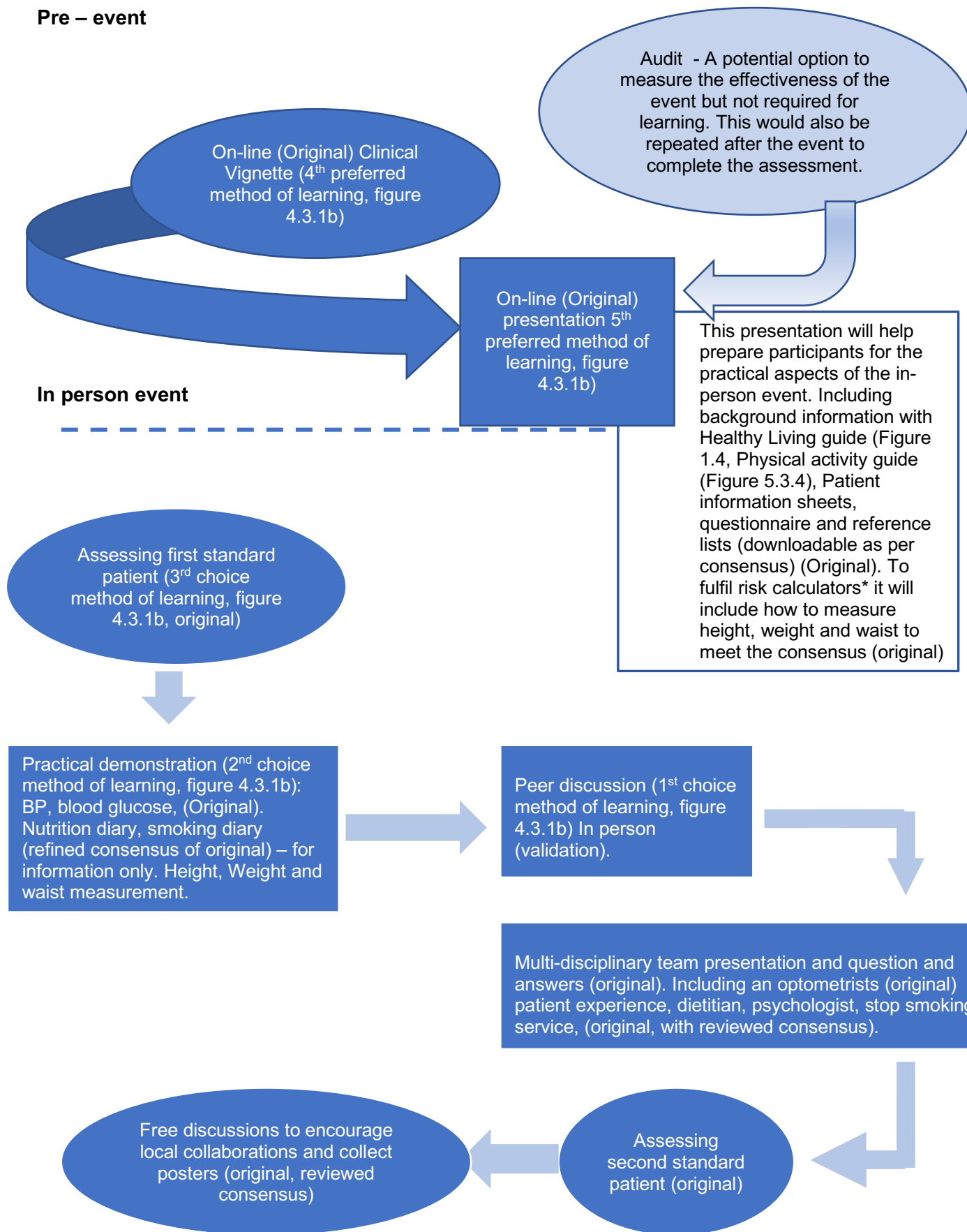


Figure 5.3.4b Flow chart of the H-GOS educational event Key: Original - Original rounds of the Delphi Analysis and original consensus, Validation – data from validated Delphi Analysis questionnaire, * references for risk calculators (Fletcher, ;Bellou, ;JBS3, 2014b; ClinRisk, 2018).

manner of such an accreditation is beyond the scope of this thesis, although I would consider multiple choice questions to test knowledge in the 'knows how' areas (Touissi *et al.*, 2021) and objective structured practical examinations for the 'shows' areas, (Harden and Cairncross, 1980) for example measuring blood pressure and interpreting the results. I would suggest further research into the area of clinical skills and knowledge assessment would be required before designing this element of the service.

5.3.5 Undergraduate education

Further research would need to be conducted to establish the current level of modifiable lifestyle education within optometry undergraduate courses in both the scheme for registration and the new ETR. This information would allow for the current curriculum to be reviewed alongside the current content and identify if there are gaps in the education and or curriculum to allow for the H-GOS scheme to become the professions norm.

5.3.6 Secondary and Tertiary Care

Lastly, I believe further research is required to identify the situation in secondary and tertiary care. This study intentionally investigated primary care optometry, but further research could investigate the same elements within secondary and tertiary care including all teams within a hospital eye clinic. This piece of research could also include the appropriateness of lifestyle advice within the hospital setting considering all the patients should have had contact with an optometrists or GP before entering the Hospital Eye Service. It would also be interesting to investigate if there are any collaborations between dietitians and eye clinics within hospitals and whether there is a need or a desire for this.

5.4 Overall conclusion

This thesis has examined the current position of optometry in the UK and modifiable lifestyle changes, by reviewing and investigating an indication, desire and need for further education to guide patients regarding lifestyle choices. The method by which optometrists preferred to learn was multi-modal, incorporating theory and practice both in-person and on-line with a desire for support in the form of guidance, posters, leaflets, and references (Chapter Two and Four). This study has also indicated that for over a generation the discussion of modifiable lifestyle advice within practice has been active and hopefully with the outcomes of this study and further research the governing bodies can take the step to make a difference.

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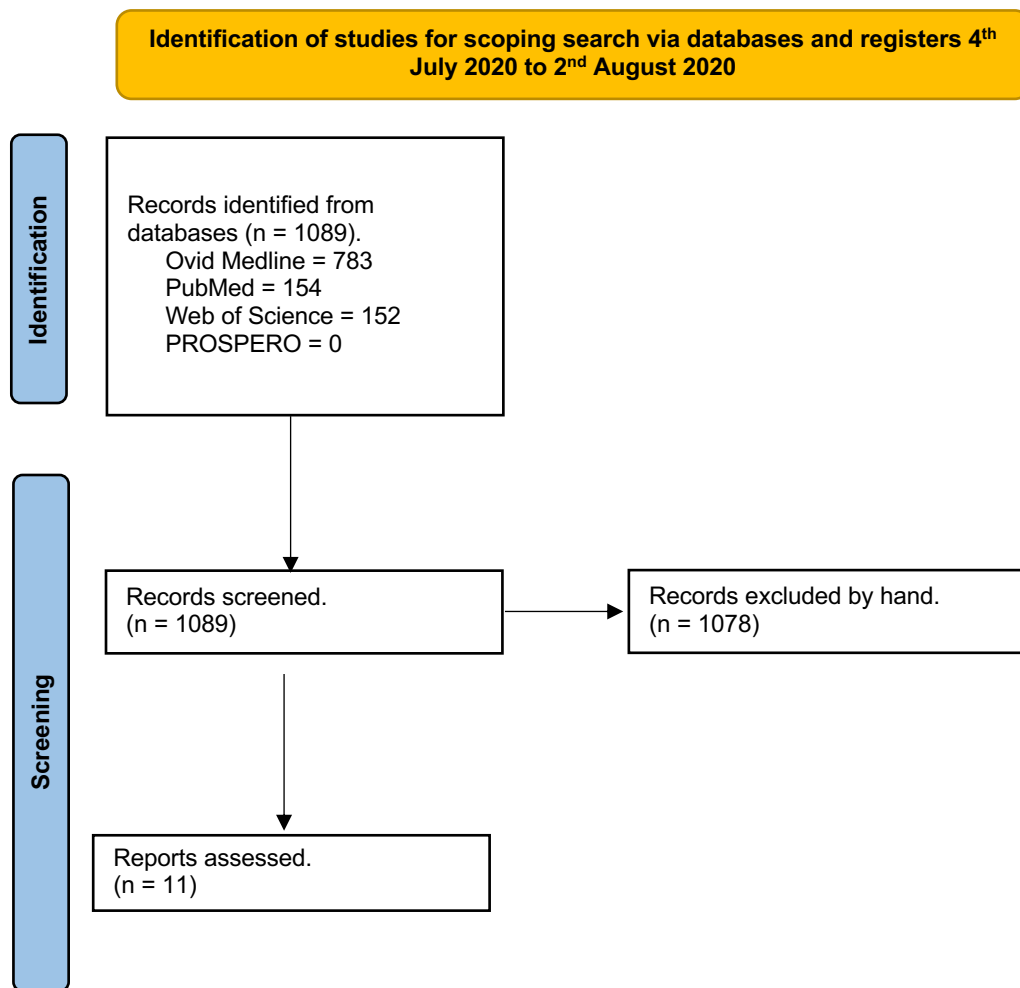
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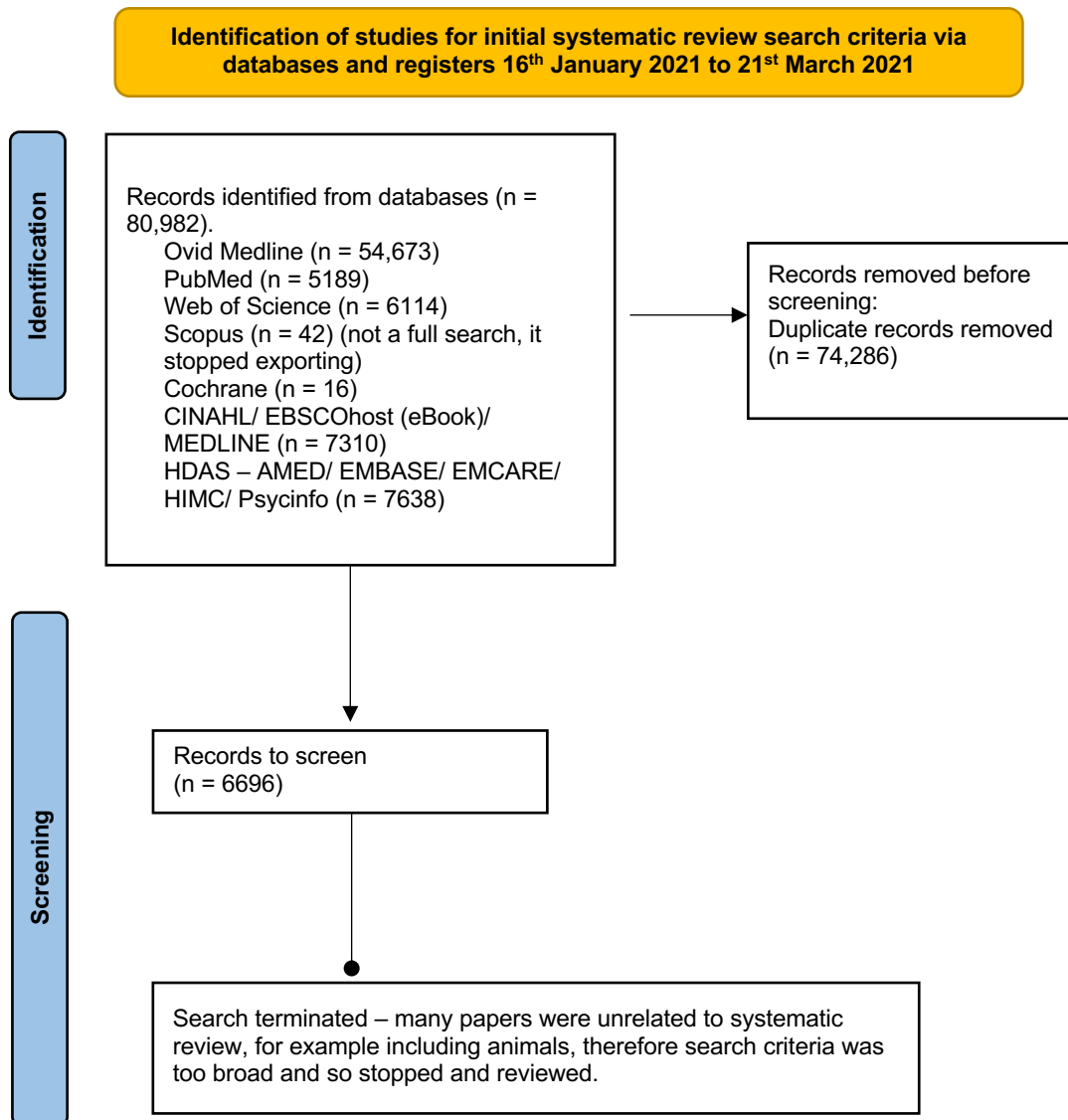
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Appendices

Appendix 2.2.2 PRISMA 2020 adapted – flow diagram for scoping search (Page et al., 2021)



Appendix 2.3.2 PRISMA 2020 adapted – flow diagram for initial systematic review (Page et al., 2021)



Appendix 2.3.6 Quality Assessment Tool

Question	Yes	No	Don't know/ comment
Was the research question/aims/objectives of the study clear			
Was the study design appropriate for the stated aim(s)?			
Was the study population clearly defined?			
Was the sample frame taken from an appropriate population base so that it closely represented the target/reference population			
Was the selection process likely to select subjects/participants that were representative of the target population under investigation?			
Was the response rate acceptable?			
Was the time frame sufficient to expect to provide an acceptable response rate?			
Were any assessments used for quality assurance purposes?			
Were the risk factor and outcome variables measured correctly using instruments/measurements that had been trialled, piloted or published previously?			
Is it clear what was used to determine statistical significance and/or precision estimates?			
Were the methods sufficiently described to enable them to be repeated?			
Were the basic data adequately described?			
Does the response rate raise concerns about non-response bias?			
Were the results presented for all the analyses described in the methods?			
Were the authors' discussions and conclusions justified by the results?			
Were the limitations of the study discussed?			
Were there any funding sources or conflicts of interest that may affect the authors' interpretation of the results?			
Was ethical approval or consent of participants attained?			

Appendix 2.4 Table detailing reasons for excluding papers.

	Paper Reference	Exclusion reason
	Identification of new studies via databases and registers	
1	Anonymous. (2009) 'The rapidly evolving diagnosis and treatment of age-related macular degeneration.' <i>Optometry (St Louis, Mo)</i> . 80(2), pp.101-6.	This paper is anonymous and covers general treatment and rehabilitation. It isn't specific to optometrists.
2	Armstrong, R.A. and Mousavi, M. (2015) 'Overview of Risk Factors for Age-Related Macular Degeneration (AMD).' <i>Journal of stem cells</i> , 10(3), pp.171-91	This paper doesn't include optometry. It discusses risk factors.
3	Asfar, T., Lee, D.J., Lam, B.L., Murchison, A.P., Mayro, E.L., Owsley, C., McGwin, G., Gower, E.W., Friedman, D.S. and Saaddine, J. (2018). 'Evaluation of a web-based training in smoking cessation counselling targeting US eye-care professionals.' <i>Health Education & Behaviour</i> , 45(2), pp.181-189.	This paper is regarding education rather than knowledge, competence and confidence.
4	Downie, L.E., Barrett, C. and Keller, P.R. (2015). 'The personal nutrition-related attitudes and behaviours of Australian optometrists: Is there evidence for an evidence-based approach?'. <i>Nutrition</i> , 31(5), pp.669-677.	This paper is regarding an optometrist's personal behaviour rather than practice and not related to chronic illness.
5	Downie, L.E., Douglass, A., Guest, D. and Keller, P.R. (2017). 'What do patients think about the role of optometrists in providing advice about smoking and nutrition?' <i>Ophthalmic and Physiological Optics</i> , 37(2), pp.202-211.	This paper is regarding patient's opinions.
6	Gopinath, B., Flood, V.M., Kifley, A., Liew, G. and Mitchell, P. (2015). 'Smoking, antioxidant supplementation and dietary intakes among older adults with age-related macular degeneration over 10 years.' <i>PloS one</i> , 10(3), p.e0122548.	This paper is a report regarding patient findings rather than relating to optometrists.
7	Department of Health. (1994) <i>How you can help to improve the health of the nation: an introductory booklet for the primary care team</i> . London: Department of Health	A collection of case studies.
8	Kennedy, R.D. and Douglas, O. (2015). 'Strategies to help patients stop smoking: the optometrist's perspective.' <i>Clinical Optometry</i> , 7, pp.103-113.	This paper is regarding education for optometrists rather than discussing their confidence or competence.
9	Martin, C.J. (2005) 'Update 2005: Type 1 and type 2 diabetes mellitus - Part 1: Diagnosis, Management, and co-management by other health-care professionals.' <i>Clinical and refractive optometry</i> . 16(7), pp206-231.	This article is regarding advice for healthcare professionals, including optometrist, regarding seeing a patient with diabetes. An educative and advice piece rather than new research.
10	McKenzie S. (2007) 'Reaching out to smokers: Optometrist Simon Browning offers his patients a smoking cessation service' <i>Optician</i> pp.16-17.	This is an opinion piece regarding one optometrist's experience.
11	Offord, L. (2008) 'Visual cues to health' <i>Australian Journal of Pharmacy</i> , 89 (1062)	This paper is regarding pharmacists and not optometrists.

12	Poulos, R.G., Boon, M.Y., George, A., Liu, K.P., Mak, M., Maurice, C., Palesy, D., Pont, L.G., Poulos, C.J., Ramsey, S. and Simpson, P. (2021). 'Preparing for an aging Australia: The development of multidisciplinary core competencies for the Australian health and aged care workforce.' <i>Gerontology & geriatrics education</i> , 42(3), pp.399-422.	Involves many specialities without being able to separate optometrists, it is also not solely anglosphere.
13	Register, S.J., Harrington, K.F., Agne, A.A. and Cherrington, A.L. (2016). 'Effectiveness of non-primary care-based smoking cessation interventions for adults with diabetes: a systematic literature review.' <i>Current Diabetes Reports</i> , 16, pp.1-9.	This paper was a literature search regarding smoking cessation, but no papers regarding optometrists were included.
14	Stevens, R., Cooke, R. and Bartlett, H. (2018). 'Testing the impact of an educational intervention designed to promote ocular health among people with age-related macular degeneration.' <i>British Journal of Visual Impairment</i> , 36(2), pp.110-127.	This paper is regarding education for patients.
15	Walls, L.L. and Kleinstein, R. (1980) 'Optometric management of the diabetic patient: Part II--Treatment and office control of the diabetic patient.' <i>Journal of the American Optometric Association</i> , 51(8), pp753-755.	This an opinion piece rather than new research.
16	Willeford, K.T. and Rapp, J. (2012). 'Smoking and age-related macular degeneration: biochemical mechanisms and patient support.' <i>Optometry and Vision Science</i> , 89(11), pp.1662-1666.	This paper is regarding education for optometrists rather than discussing their confidence or competence.
Identification of new studies via databases and registers		
1	Caban-Martinez, A.J., Davila, E.P., McCollister, K.E., Fleming, L.E., Zheng, D.D., Lam, B.L., Dubovy, S.R. and Lee, D.J. (2011). 'Peer Reviewed: Age-Related Macular Degeneration and Smoking Cessation Advice by Eye Care Providers: A Pilot Study.' <i>Preventing chronic disease</i> , 8(6). A147	This paper includes ophthalmologists without clear data that is optometrists only.
2	Liu, L. and Swanson, M. (2013). 'Improving patient outcomes: role of the primary care optometrist in the early diagnosis and management of age-related macular degeneration.' <i>Clin Optom</i> , 5, pp.1-12.	Literature review, not original research.
3	Sheck, L.H., Field, A.P., McRobbie, H. and Wilson, G.A. (2009). 'Helping patients to quit smoking in the busy optometric practice.' <i>Clinical and Experimental Optometry</i> , 92(2), pp.75-77.	This is an editorial advising optometrists about smoking cessation.
4	Veys, J. and Desai, P. (2014) 'Well-being and optometric practice' <i>Optometry in Practice</i> , 15(4), pp. 141-150	Educational article rather than new research.
5	Williamson, J.F., Huynh, K., Weaver, M.A. and Davis, R.M. (2014). 'Perceptions of dry eye disease management in current clinical practice'. <i>Eye & contact lens</i> , 40(2), p.111.	Ophthalmologists as well as optometrists and optometrists can't be separated.

Appendix 3.2.3 Freedom of information request for the GOC.

To: □ Nicola Milhench (Research Student)
 Tue 1/4/2022 2:10 PM
 Hi Nicola,

Hope you are well.

Firstly, I would like to apologise for the delay in responding I had to take some emergency leave.

Case Reference: FOI21-39

Within your email you have made a request for information. This is now being handled under the provisions of the Freedom of Information Act 2000 (the FOIA).

This legislation entitles a requester to recorded information held by a public authority unless an appropriate exemption applies.

Request

In your email you asked for:

“the demographics of optometrists working in the UK. Knowing the details during winter 2020-2021 would be perfect but if that isn’t possible, then the most up to date details (with the date stated) would be helpful.

I would like to know the total number of fully qualified optometrists practising, the percentages for gender of those who identify with/disclose this information, the percentages for age categories and the number who have IP qualification”

Response

I can confirm that we hold information in scope of your request, please see below:

	Total Number of FQ Optoms	% of Gender		Age Category of FQ Optoms
Female	10123	60.69%	20-29	3538
Male	6556	39.31%	30-39	5078
Grand Total	16679	100.00%	40-49	3877
			50-59	2658
			60-69	1311
			70-79	193
			80-90	24
			Grand Total	16679

	Number of IP Optoms	% of IP Optoms
Female	726	60.30%
Male	478	39.70%
Grand Total	1204	100.00%

Next Steps

If you are dissatisfied with this response and wish to request a review of our decision or make a complaint about how your request has been handled, you can write to us at IG@optical.com

Many thanks

Appendix 3.3.2a Final NUTCOMP questionnaire with adaptation for UK optometric workforce. – Writing in italics indicates additions to the original questionnaire and words with a strike through are sections removed from the original questionnaire by Ball and Leveritt (2015).

Consent

	I agree	I do not agree
<i>1. I confirm that I have read and understand the Participant Information Sheet (REC [1628], [Version 2], [21.09.2020]) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.</i>	<input type="checkbox"/>	<input type="checkbox"/>
<i>2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason and without my legal rights being affected. In this case you will only be able to withdraw prior to completing the online questionnaire.</i>	<input type="checkbox"/>	<input type="checkbox"/>
<i>3. I agree to my data relating to me collected during the study being processed as described in the Participant Information Sheet.</i>	<input type="checkbox"/>	<input type="checkbox"/>
<i>4. I agree to my anonymised data being used by research teams for future research.</i>	<input type="checkbox"/>	<input type="checkbox"/>
<i>5. I agree to take part in this study.</i>	<input type="checkbox"/>	<input type="checkbox"/>

Section One: Confidence in Knowledge about Nutrition and Chronic Disease

Please rate how confident you are in your knowledge of...	Not Confident at all (1 point)	Not Very Confident (2 points)	Somewhat Confident (3 points)	Very Confident (4 points)	Extremely Confident (5 points)
1. How different body systems are affected by foods and nutrients	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. How foods and nutrients influence the development and management of chronic disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. How an individual's body composition (including size, shape, weight) can impact on the development of chronic disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. The Australian Guide to Healthy Eating, The United Kingdom Eatwell Guide which sets out nutritional guidance, including number of recommended serves of food groups and serving sizes for different ages and genders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. Guidelines for the nutrition-related management of specific chronic diseases (including type 2 diabetes and cardiovascular disease)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. <i>Guidelines for the nutrition-related management of ocular health (age related macular degeneration, glaucoma, vascular ocular complications, and diabetic retinopathy)</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. How foods and nutrients interact with medications	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. The most recently published peer-reviewed evidence regarding nutrition and chronic disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. <i>The most recently published peer-reviewed evidence regarding nutrition and ocular health</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. <i>Are you aware of any national or professional clinical management guidelines which refer to nutritional management as part of ocular healthcare? (a) If you answered yes, please state the relevant guidelines that you are aware of that refer to nutrition as part of ocular health care.</i>	Yes <input type="checkbox"/>		No <input type="checkbox"/>		Don't know <input type="checkbox"/>

Section Two: Confidence in Nutrition skills

<i>Please rate how confident you are in your ability to ...</i>	Not Confident at all (1 point)	Not Very Confident (2 points)	Somewhat Confident (3 points)	Very Confident (4 points)	Extremely Confident (5 points)
1. Interpret data about height, weight, and body composition against reference ranges	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Interpret an individual's biological data (e.g., blood pressure, cholesterol levels) against reference ranges	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Collect information on the food that an individual usually eats (e.g., diet history, food frequency questionnaire)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. <i>The Australian Guide to Healthy Eating, The United Kingdom Eatwell Guide</i> to evaluate the appropriateness of an individual's food intake	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Determine appropriate food or nutrition goals for an individual with chronic disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. <i>Determine appropriate nutrition goals and strategies (e.g., food based or recommendations using supplements) relating to ocular health</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. Formulate a meal plan for an individual with chronic disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Recommend changes in food choices for an individual with chronic disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Monitor and evaluate changes over time regarding the food an individual usually eats	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Monitor and evaluate how dietary changes influence measures of ocular health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Maintain clear and concise records regarding the nutrition-related assessment and advice you provide to individuals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Access the most recently published peer-reviewed evidence regarding nutrition and chronic disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Provide nutrition care that results in improvements in the food that an individual usually eats	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section Three: Confidence in Communication and Counselling about Nutrition

<i>Please rate how confident you are in your ability to...</i>	Not Confident at all (1 point)	Not Very Confident (2 points)	Somewhat Confident (3 points)	Very Confident (4 points)	Extremely Confident (5 points)
1. Clearly describe what patients/clients can expect from their discussions with you about food or nutrition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Check a patient's/client's understanding of the influence of food and nutrients on their health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Work with patients/clients to identify possible ways to improve the food they usually eat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Demonstrate genuine empathy to patients/clients about their food-related experiences and goals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Maintain a non-judgemental attitude in discussions with patients/clients about the food they eat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Communicate with clients about food and nutrition using culturally appropriate language	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. Consider how personal, social, cultural, psychological, and economic factors may influence the foods that a patient/client eats	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Identify individuals who need additional support from other health professionals or services regarding the food they eat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Communicate with other health professionals about the discussions you've had with patients/clients regarding food	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section Four: Attitudes Towards Nutrition Care

<i>Please rate your agreement with the following statements:</i>	Completely Disagree (1 point)	Somewhat Disagree (2 points)	Neither agree or disagree (3 points)	Somewhat Agree (4 points)	Completely Agree (5 points)
1. It is important that all individuals usually eat healthy foods regardless of age, body weight and physical activity levels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. If the topic arises, it is important that I encourage my patients/clients to eat healthy foods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. It is important that I take every opportunity possible to encourage my patients/clients to eat healthy foods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Encouraging my patients/clients to eat healthy foods is an effective use of my professional time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Providing specific nutrition recommendations to my patients/clients that can assist with managing their chronic disease is an effective use of my professional time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Encouraging my patients/clients to eat healthy foods is within my scope of practice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Providing specific nutrition recommendations to my patients/clients that can assist with managing their chronic disease is within my scope of practice.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. It is important that I encourage my patients/clients to seek support from other health professionals if I am unable to meet their nutrition-related needs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section Five: Previous Nutrition Education and Training (not scored)

1. What qualifications do you have? Please list all that apply.

Bachelor's Degree (BSc)	<input type="checkbox"/>	Higher Education Certificate	<input type="checkbox"/>
Higher Education Diploma	<input type="checkbox"/>	Master's Degree (MSc)	<input type="checkbox"/>
Master of Optometry (MOptom)	<input type="checkbox"/>	Postgraduate Certificate	<input type="checkbox"/>
Postgraduate Diploma	<input type="checkbox"/>	Professional Certificate Glaucoma	<input type="checkbox"/>
Professional Certificate Medical Retina	<input type="checkbox"/>	Professional Diploma Glaucoma	<input type="checkbox"/>
Professional Higher Certificate Glaucoma	<input type="checkbox"/>	Other	<input type="checkbox"/>

1a If you stated other, please state.

2. Which of the following best describes your previous nutrition education?

- I have completed a Certificate or other non-degree course that did not include nutrition content.
- I have completed a Certificate or other non-degree course that included some nutrition content.
- I have completed a Certificate or other non-degree course that was predominantly focused on nutrition.
- I have completed a degree that did not include any nutrition content.
- I have completed a degree that included some nutrition content.
- I have completed a degree that was predominantly focused on nutrition.

3. Have you ever participated in any professional development or continuing education on the topic of nutrition? Yes No

3a If yes, please state.

4. I feel I need further nutrition education to support me in my current role

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

4a If you agree or strongly agree that more nutrition education would be helpful to support you in your role which topics would be useful?

Section Six: Demographic Information

1. What is your profession?
2. *What is your current role/ occupation?*
3. How many years have you been working in this profession? _____ Years
4. *How many years have you been working in this role? _____ Years.*
5. What is your gender?
 - Male
 - Female
 - *Prefer not to state.*
 - *Self-describe. If you answered self-describe, please state.*
6. What is your age range?
 - 24 years or younger
 - 25-34 years
 - 35-44 years
 - 45-54 years
 - 55-64 years
 - 65 years or older
 - Prefer not to say .

Appendix 3.3.2b Participant Information Sheet for NUTCOMP Questionnaire

Self-perceived competence of optometrists, dispensing opticians and optical assistants in providing nutrition care to patients with chronic disease using a validated questionnaire.

Participant Information Sheet

Invitation

We would like to invite you to take part in a research study.

Before you decide if you would like to participate, please take time to read the following information carefully and, if you wish, discuss it with others such as your family, friends or colleagues.

Please ask a member of the research team, whose contact details can be found at the end of this information sheet, if there is anything that is not clear or if you would like more information before you make your decision.

What is the purpose of the study?

The purpose of the study is to establish the self-perceived competence of providing nutritional advice to chronically ill patients by those working in an optometric setting. In addition, we seek to establish how work experience, education and further education may influence this self-perception.

Why have I been chosen?

You are being invited to take part in the study because you are working in the field of optometry.

What will happen to me if I take part?

You will be asked to complete an online questionnaire collecting information on your work experience, education and further education and your self-perceived competence in providing nutritional advice to chronically ill patients (for example those suffering from Diabetes Mellitus, high blood pressure, glaucoma, age related macular degeneration and other chronic conditions).

Do I have to take part?

No. It is up to you to decide whether or not you wish to take part.

If you do decide to participate, click on the link for the online questionnaire (https://aston.onlinesurveys.ac.uk/nutrition-competency-in-optometry_aop). The first questions are designed to take your consent and the questionnaire will only open once you provide consent.

You can discard the questionnaire at any point and information provided up until that point will not be entered into the data analysis.

Prior to pressing the "Submit" button we will ask you again if you are still happy to participate. Unless you press the "Submit" button your data will not be entered.

As all information collected is anonymised, we will not be able to "withdraw" your answers after you have pressed the "submit" button at the end of the survey.

Once you press "Submit" this will constitute your consent in participating in the study.

Will my taking part in this study be kept confidential?

Yes. A code will be attached to all the data you provide to maintain confidentiality.

We do not collect and personal data (name and contact details). Analysis of your data will be undertaken using coded data only.

The data we collect will be stored in a secure document store electronically on a secure encrypted mobile device, password protected computer server or secure cloud storage device.

What are the possible benefits of taking parts?

While there are no direct benefits to you of taking part in this study, the data gained will help to establish the perceived competence of optometrists, dispensing opticians and optical assistants in providing nutrition care to patients with chronic disease. It will further inform the level of nutrition education received and how this impacts on self-perceived competence. The results of this study may provide future training tailored to improve nutritional services to chronically ill patients in optometric settings.

What are the possible risks and burdens of taking part?

There are no risks or burdens beyond your time commitment of answering the questionnaire which should take no longer than 15-20 minutes.

What will happen to the results of the study?

The results of the study may be published in scientific journals and/or presented at conferences. If the results of the study are published, your identity will remain confidential.

A lay summary of the results of the study will be available for participants when the study has been completed upon request.

The results for the study will also be used in Mrs Milhench's Ophthalmic Doctorate thesis.

Expenses and payments

There are no expenses and payments made to participants.

Who is funding the research?

The study is being funded by Aston University, Birmingham, UK.

Who is organising the study and acting as data controller for the study?

Aston University is organising this study and acting as data controller for the study. You can find out more about how we use your information in Appendix A.

Who has reviewed the study?

This study was given a favourable ethical opinion by the LHS Research Ethics Committee.

What if I have a concern about my participation in the study?

If you have any concerns about your participation in this study, please speak to the research team and they will do their best to answer your questions. Contact details can be found at the end of this information sheet.

If the research team are unable to address your concerns or you wish to make a complaint about how the study is being conducted you should contact the Aston University Research Integrity Office at research_governance@aston.ac.uk or telephone 0121 204 3000.

Research Team

Dr Duane Mellor: d.mellor@aston.ac.uk

Dr Rebekka Heitmar: r.Heitmar1@aston.ac.uk ; phone: 0121 204 3853

Thank you for taking time to read this information sheet. If you have any questions regarding the study, please don't hesitate to ask one of the research team.

Appendix A: Transparency statement.

Aston University takes its obligations under data and privacy law seriously and complies with the General Data Protection Regulation ("GDPR") and the Data Protection Act 2018 ("DPA").

Aston University is the sponsor for this study based in the United Kingdom. We will be using information from you in order to undertake this study. Aston University will process your personal data in order to register you as a participant and to manage your participation in the study. It will process your personal data on the grounds that it is for the performance of a task carried out in the public interest (GDPR Article 6(1)(e)). Aston University may process special categories of data about you which includes details about your health. Aston University will process this data on the grounds that it is necessary for statistical or research purposes (GDPR Article 9(2)(j)). Aston University will keep identifiable information about you for 6 years after the study has finished.

Your rights to access, change or move your information are limited, as we need to manage your information in specific ways in order for the research to be reliable and accurate. If you withdraw from the study, we will keep the information about you that we have already obtained. To safeguard your rights, we will use the minimum personally identifiable information possible.

You can find out more about how we use your information at www.aston.ac.uk/dataprotection or by contacting our Data Protection Office at dp_officer@aston.ac.uk.

If you wish to raise a complaint on how we have handled your personal data, you can contact our Data Protection Officer who will investigate the matter. If you are not satisfied with our response or believe we are processing your personal data in a way that is not lawful you can complain to the Information Commissioner's Office (ICO).

When you agree to take part in a research study the information about you may be provided to researchers running other research studies in this organisation and in other organisations. These organisations may be universities, NHS organisations or companies involved in health and care research in this country or abroad.

This information will not identify you and will not be combined with other information in a way that could identify you. The information will only be used for the purpose of research, and cannot be used to contact you.

Appendix 3.3.2c - Background information for participants of NUTCOMP questionnaire

Nutrition is everyone's business, and especially Optometrists.

The role of all health professionals in supporting the public health of our communities, towns and nation are at the heart of [Making Every Contact Count](#). This is not about adding another job to an already busy one, or adding to already full consultations, it is about providing opportunistic advice that is consistent and supports individuals to live a healthy lifestyle. It is simply about engaging individuals in conversations about their health and how they might be able to take steps to improve it. So, who better in the nation's health workforce than Optometrists to have these types of conversation with individuals who come in off our high streets to receive eye care but may also be open to other health ideas.

Why nutrition and eyes?

With the publication of [AREDS study](#), the interest in how nutritional supplements might be useful in age related macular degeneration (AMD) to delay the progression to advanced disease has become particularly important in respect to communication about AMD prevention and management . However, how confident are optometrists if clients/ patients ask about the specific functions of the nutrients which make up the AREDS supplement? Perhaps more importantly, how confident are optometrists in considering whether a client/ patient might benefit from the supplement or could they get the same benefit from their diet. Of course, it is not about giving detailed dietary advice, it can be as simple as asking individuals about if they are thinking about what they eat, perhaps suggesting a few small changes and signposting other services.

It is not just people with AMD who might benefit from support and information about diet, with increasing numbers of people living with diabetes and hypertension who routinely use optometry services, there is a clear role for diet in managing their condition. This is before considering the millions of individuals without health concerns, who due to age related changes in eyesight may seek optometry care. Often these are the same people who the "making every contact count" and "well person clinics" are looking to encourage to improve their lifestyle and diet to reduce their risk of cardiovascular disease. The potential effect of encouraging users of optometry service to make even the simplest of changes, such as just eating 1-2 more pieces of fruit and veg per week would have massive health and cost saving effects to society.

Why this survey?

Although there is clearly a place and potential for an increased role of nutrition in routine practice and business of optometrists, like many health professionals, limited levels of confidence, knowledge and training in this area can be a significant barrier to starting conversations about nutrition with clients/ patients.

Using validated questionnaires used with pharmacists and doctors, we aim in this project to find out how important optometrists feel nutrition is, whether it could add to their practice and identify any potential gaps in knowledge and training. The analysis of these findings will then be used to help inform the design of training packages for optometrists to help support them in having simple conversations about food and nutrition, improving the health of their clients/ patients and community. In the process, it is likely also to enhance the relationship of clients/ patients with their optometrists and so also potentially be good for business.

Appendix 4.2.3a Original Delphi Analysis Round One

A Delphi analysis of a proposed educational event for optometrists - Form 1 (July 2022)

Consent Form

Name of Chief Investigator: Nicola Milhench

1. I confirm that I have read and understood the Participant Information Sheet (Version 4, 6th July 2022) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
2. I understand that my participation is voluntary and that I am free to withdraw at any time during the study, without giving a reason and without my legal rights being affected.
3. I understand that this study is anonymous and that I am not able to withdraw after submitting my answers. I understand all responses will be separated from the associated email address. The original responses will then be deleted to prevent the responses and email addresses being linked.
4. I agree to my personal data and data relating to me collected during the study being processed as described in the Participant Information Sheet.
5. I agree to take part in this study.

By clicking 'next', below, you agree to the statements above and consent to take part in this study. If you are not happy or willing to consent, please close your browser now.

REC ID: 1841, Version 4, 6th July 2022

* Required

1. I agree to the statements above and consent to take part in this study. *

Inclusion criteria and personal data questions

Thank you for participating in this research study to investigate optometrists' preferences with respect to developing an educational event regarding nutritional and lifestyle advice within optometry practice within the UK.

This questionnaire is open to all optometrists working in the UK registered with the GOC. There is a requirement to have registered with the GOC before January 2019 to complete this questionnaire. This is so you have had the opportunity to experience face to face educational events before the COVID-19 pandemic altered the delivery of educational events.

2. Are you registered as an optometrist with the GOC * Yes No

3. Did you register with the GOC before January 2019? * Yes No

4. How long have you been qualified as an optometrist?

0-5 years, 6-10 years, 11-15 years, 16-20 years, 21-25 years, 26-30 years,
31-35 years, 36-40 years, 41-45 years, 46-50 years, 51-55 years, more than 55
years.

5. Do you work in clinical practice seeing patients? * Yes No

6. A Delphi analysis requires at least two rounds of questions. Please enter your email below to facilitate the delivery of the follow-up questionnaire.

Educational Event Design

People all learn in different manners and there are many different styles of continual professional development (CPD). These following questions ask your opinion regarding different aspects of a potential education event.

1. Put these in order of preference for methods of learning CET/CPD (most preferred option first and then in descending order with the least preferred option last).

- Assessing a standardised patient in a practical workshop.
- Clinical vignette.
- Private clinical audit (this would be for your information only, not presented to anyone else).
- Peer Discussion.
- Practical demonstration and participation.
- Presentation.

2. In your opinion, would it be beneficial to hear from a multidisciplinary team (for example other professionals dealing with nutrition and emotional support as well as optometrists)?

Yes No Maybe

3. What type of literature would you find beneficial to refer to after the educational event (select all that apply)?

- Patient information leaflets
- Posters
- Example of consultation questionnaires
- References to papers referred to during the event.
- None. I prefer signposting to allow me to find the information I consider relevant.
- None. I prefer to make my own notes.
- Other

4. If you selected 'other' as your answer to question 9, please enter below the type of literature that you find beneficial.

5. Patients with chronic illnesses and those who wish to make lifestyle changes could benefit from speaking to others outside optometry who specialise in advising and supporting people with specific needs, for example smoking cessation. Would you be prepared to work with/support external groups relating to lifestyle changes?

Yes

No

Maybe

Thank you.

Please review your answers. If you no longer wish to participate in this research study please exit the questionnaire without pressing submit and none of your data will be saved.

This content is neither created nor endorsed by Microsoft. The data you submit will be sent to the form owner.

Microsoft Forms



Appendix 4.2.3b Original Delphi Analysis Round Two

A Delphi Analysis for a proposed educational event for optometrists - Form 2 (March 2022)

The survey will take approximately 6 minutes to complete.

Thank you for completing Form 1. The questions below are follow-on questions from the results from form 1.

Consent Form

Name of Chief Investigator: Nicola Milhench

1. I confirm that I have read and understood the Participant Information Sheet (Version 4, 6th July 2022) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
2. I understand that my participation is voluntary and that I am free to withdraw at any time during the study, without giving a reason and without my legal rights being affected.
3. I understand that this study is anonymous and that I am not able to withdraw after submitting my answers. I understand all responses will be separated from the associated email address. The original responses will then be deleted to prevent the responses and email addresses being linked.
4. I agree to my personal data and data relating to me collected during the study being processed as described in the Participant Information Sheet.
5. I agree to take part in this study.

By clicking 'next', below, you agree to the statements above and consent to take part in this study. If you are not happy or willing to consent, please close your browser now.

REC ID:1841, Version 4, 6th July2022

1.I agree to the statements above and consent to take part in this study. Required to answer. Single choice.

Next

Learning Methods

2.When seeing a standardised patient in a practical workshop, which option do you believe would give you the most benefit? Single choice.

- Seeing a standardised patient at the start of the educational intervention.
- Seeing a standardised patient at the start and then a different standardised patient at the end of the educational intervention.
- Seeing a standardised patient at the start and then the same standardised patient at the end of the educational intervention.
- Seeing a standardised patient at the end of the educational intervention.
- I would not want to see a standardised patient.

3.Gocuk et al. in 2021 wrote about the benefits of clinical audit as an educative tool. Would you be prepared to carry out a private audit of your records before and after the education intervention?

Single choice.

- Yes
- No
- Maybe

4.If you were to participate in an audit of your records, how many records would you be prepared to audit? Single choice.

- Less than 11.

- 11 to 25.
 - 26 to 50.
5. In your opinion what is the best way to participate in a peer discussion? Single choice.
- On-line
 - In person
6. As part of a practical demonstration and participation, what type of patient would you prefer to assess (personal information and data would need to be disclosed)? Single choice.
- All participants to act as patients for each other.
 - Some participants of the educational event to volunteer.
 - Professional patients.
7. As part of a practical demonstration and participation, what practical factors would be beneficial to measure and check against data tables to see the relevance in practice? (Tick all that apply). Multiple choice.
- Blood pressure
 - Blood sugar
 - Height
 - Weight
 - Nutrition diary
 - Smoking diary
 - Alcohol consumption diary
8. When would you prefer to complete a clinical vignette. Single choice.
- Before the educational event
 - After the educational event
 - One before and a different one after the educational event
 - I would rather not participate in a clinical vignette.
9. How would you like to receive a clinical vignette? Single choice.
- A downloadable copy via email
 - A hard copy via post
 - I would rather not participate in a clinical vignette.
10. How do you prefer to attend a presentation? Single choice.
- On-line
 - In person

Multi-Disciplinary Team Working

The consensus to "*Would it be beneficial to hear from a multidisciplinary team?*" was YES.

11. In a multidisciplinary team, which specialists would you like to hear from? (list all that apply). Multiple choice.

- Optometrist
- Dietician
- Psychologist
- Stop smoking service
- Alcohol support service
- Patient experience

Regarding types of literature.

12. What form of patient information leaflets would you prefer? Single choice.

- Hard copies to take away
- A link to allow them to be downloaded.
- Both of the above
- I prefer not to be provided with patient information leaflets

13. What form of posters would you prefer? Single choice.

- Hard copies to take away
- A link to allow them to be downloaded.

- Both of the above.
 - I prefer not to be provided with posters.
14. What form of example consultation questionnaires would you prefer? Single choice.
- Hard copies to take away
 - A link to allow them to be downloaded.
 - Both of the above
 - I prefer not to be provided with consultation questionnaires.
15. In what form would you like to receive a reference list? Single choice.
- Hard copies to take away
 - A link to allow them to be downloaded.
 - Both of the above
 - I would prefer not to be provided with a reference list.
-

External Groups

The consensus to "*Would you be prepared to work with, or support external groups relating to lifestyle changes?*" was YES.

16. If you disagree with the consensus and would like to tell us why, please do so in the box below.

17. What form of collaboration would you be interested in supporting? Single choice.
- Sign posting to external groups.
 - Allowing support groups access to premises for group meetings when clinics aren't happening.
 - Allow a support worker to use a spare clinic room to offer advice to patients at the time of their appointment.

Thank You and Reference

Thank you for participating in this questionnaire and research project. Your time is much appreciated. Please review your answers. By pressing "submit" you are consenting to participate in this research study. If you don't wish to participate in this research study please exit the questionnaire without pressing submit and none of your data will be saved.

Reference:

Gocuk A.S., Lee, J-H., Keller, P.R., Ayton, L.N., Guymer, R.H., McKendrick, A.M. and Downie, L.E.. Clinical audit as an educative tool for optometrists: an intervention study in age-related macular degeneration. *Ophthalmic Physiol Opt.* 2021; 41: 53-77.

Appendix 4.2.3c Participant Information Sheet for Original Delphi Analysis Rounds



A Delphi analysis of a proposed educational intervention regarding nutrition and lifestyle changes within UK optometric practice. **Participant Information Sheet**

Invitation

We would like to invite you to take part in a research study forming part of a Doctor of Optometry project for Nicola Milhench.

Before you decide if you would like to participate, take time to read the following information carefully and, if you wish, discuss it with others such as your family, friends or colleagues.

Please ask a member of the research team, whose contact details can be found at the end of this information sheet, if there is anything that is not clear or if you would like more information before you make your decision.

What is the purpose of the study?

The purpose of the study is to analyse the needs and desires of UK optometrists with respect to developing an educational event regarding nutritional and lifestyle advice within optometric practice. It will enquire about previous education and training experiences to obtain a consensus from practicing optometrists as the experts on their own training needs and desires.

Why have I been invited?

You are being invited to take part in this study because you are an optometrist practising in the UK.

The main inclusion criteria for this research project is:

- You are registered as an optometrist with the GOC before January 2019.
- You are working in practice seeing patients.

What will happen to me if I take part?

You will be asked to complete two online questionnaires collecting information regarding your opinions about what aspects you would find beneficial in an educational event about discussing nutrition and lifestyle changes with patients. You will be asked about your preferred methods of learning and types of literature that you find useful following educational events. It will ask your thoughts about working with or hearing from others outside of optometry, that work in fields relating to nutrition and a patient's experience of chronic illness.

The study is in the form of a Delphi Analysis therefore it consists of two questionnaires, with the answers from the first questionnaire creating the questions of the second questionnaire. Therefore to enable the follow-up questionnaire to be sent, you will be asked to provide a contact email. Your email address will be stored separately to your answers.

If you choose to complete the first questionnaire you are under no obligation to complete the second questionnaire.

Do I have to take part?

No. It is up to you to decide whether or not you wish to take part.

If you do decide to participate, you will be asked to provide consent. You will be provided with a consent statement regarding the use of your data in response to the questionnaire. If you agree to the conditions, please click the 'next' button. This will continue to the questionnaire questions, your completion and submission confirms your consent. If you disagree with the conditions please close your browser.

You can discard the questionnaire at any time up until you submit your answers without giving a reason, by closing your browser and the information provided up until that point will not be entered into the data analysis. Once you press the 'submit' button because your data is anonymised it will not be possible to withdraw it.

Will my taking part in this study be kept confidential?

Yes. A code will be attached to all the data you provide to maintain anonymity. Analysis of your data will be undertaken using coded data. Personal data collected (email address) will only be used for the purposes outlined in this participant information sheet e.g., to send the follow-up questionnaire. The data we collect will be stored electronically on a secure encrypted mobile device, password protected computer server or secure cloud storage device.

To ensure the quality of the research Aston University may need to access your data to check that the data has been recorded accurately e.g. for the purposes of audit. If this is required your personal data will be treated as confidential by the individuals accessing your data.

What are the possible benefits of taking part?

Although you may find participation in this research interesting, there may be no direct benefit to you as a result. However we hope that the findings of this research will help develop further training in nutrition and lifestyle advice in a form that is beneficial and engaging to optometrists. This in turn may alter clinical practice for the benefits of optometrists and their patients.

What are the possible risks and burdens of taking part?

The risk involved with this study is a data leak. To prevent personalised data being leaked, the email address will be separated from the question responses, which will be encoded and be stored electronically as previously described.

The burden of the study is the time taken to read the information and complete the questionnaires. Each questionnaire should take about 5-10 minutes to answer.

What will happen to the results of the study?

The results of this study may be published in scientific journals and/or presented at conferences. If the results of the study are published, your identity will remain anonymous.

A lay summary of the results of the study can be forwarded to you when the study has been completed. Should you wish to receive a copy, please contact a member of the research team." The results of the study will also be used in Mrs Nicola Milhench's Ophthalmic Doctorate thesis.

Expenses and payments

There are no expenses and payments made to participants.

Who is funding the research? The study is being funded by Aston University.

Who is organising this study and how is my data being used?

Aston University is organising this study and acting as data controller for the study. Research data will be used only for the purposes of the study or related uses identified in this Information Sheet or Appendix A.

Who has reviewed the study? T

his study was given a favourable ethical opinion by the University Research Ethics Committee (UREC).

What if I have a concern about my participation in the study?

If you have any concerns about your participation in this study, please speak to the research team and they will do their best to answer your questions. Contact details can be found at the end of this information sheet. If the research team are unable to address your concerns or you wish to make a complaint about how the study is being conducted you should contact the Aston University Research Integrity Office at research_governance@aston.ac.uk or via the University switchboard on +44 (0)121 204 3000.

Research Team

Professor. Nicola Logan: n.s.logan@aston.ac.uk (Supervisor)

Dr Duane Mellor: d.mellor@aston.ac.uk (Supervisor)

Dr Rebekka Heitmar: r.heitmar@hud.ac.uk (Supervisor)

Mrs Nicola Milhench: milhennj@aston.ac.uk (Student)

Thank you for taking time to read this information sheet. If you have any questions regarding the study please don't hesitate to ask one of the research team.



Aston University takes its obligations under data and privacy law seriously and complies with the Data Protection Act 2018 (“DPA”) and the General Data Protection Regulation (EU) 2016/679 as retained in UK law by the Data Protection, Privacy and Electronic Communications (Amendments etc) (EU Exit) Regulations 2019 (“the UK GDPR”).

Aston University is the sponsor for this study based in the United Kingdom. We will be using information from you in order to undertake this study. Aston University will process your personal data in order to register you as a participant and to manage your participation in the study. It will process your personal data on the grounds that it is necessary for the performance of a task carried out in the public interest (GDPR Article 6(1)(e)). Aston University may process special categories of data about you which includes details about your health. Aston University will process this data on the grounds that it is necessary for statistical or research purposes (GDPR Article 9(2)(j)). Aston University will keep identifiable information about you for 6 years after the study has finished.

Your rights to access, change or move your information are limited, as we need to manage your information in specific ways in order for the research to be reliable and accurate. If you withdraw from the study, we will keep the information about you that we have already obtained. To safeguard your rights, we will use the minimum personally identifiable information possible.

You can find out more about how we use your information at <https://www.aston.ac.uk/about/statutes-ordinances-regulations/publication-scheme/policies-regulations/data-protection> or by contacting our Data Protection Officer at dp_officer@aston.ac.uk.

If you wish to raise a complaint on how we have handled your personal data, you can contact our Data Protection Officer who will investigate the matter. If you are not satisfied with our response or believe we are processing your personal data in a way that is not lawful you can complain to the Information Commissioner’s Office (ICO).

When you agree to take part in a research study, the information about you may be provided to researchers running other research studies in this organisation and in other organisations. These organisations may be universities, NHS organisations or companies involved in health and care research in this country or abroad.

This information will not identify you and will not be combined with other information in a way that could identify you. The information will only be used for the purpose of research, and cannot be used to contact you.

Appendix 4.2.3d PIS for Delphi Analysis Validation Questionnaire.



A Validation of a Delphi analysis regarding a proposed educational intervention regarding nutrition and lifestyle changes within UK optometric practice.

Participant Information Sheet

Invitation

We would like to invite you to take part in a research study forming part of a Doctor of Optometry project for Nicola Milhench.

Before you decide if you would like to participate, take time to read the following information carefully and, if you wish, discuss it with others such as your family, friends or colleagues.

Please ask a member of the research team, whose contact details can be found at the end of this information sheet, if there is anything that is not clear or if you would like more information before you make your decision.

What is the purpose of the study?

The purpose of the study is to analyse the needs and desires of UK optometrists with respect to developing an educational event regarding nutritional and lifestyle advice within optometric practice. It will enquire about previous education and training experiences to obtain a consensus from practicing optometrists as the experts on their own training needs and desires.

Why have I been invited?

You are being invited to take part in this study because you are an optometrist practising in the UK.

The main inclusion criteria for this research project is:

- You are registered as an optometrist with the GOC before January 2019.
- You are working in practice seeing patients.

What will happen to me if I take part?

You will be asked to complete an online questionnaire collecting information regarding your opinions about what aspects you would find beneficial in an educational event about discussing nutrition and lifestyle changes with patients. You will be asked about your preferred methods of learning and types of literature that you find useful following educational events. It will ask your thoughts about working with or hearing from others outside of optometry, that work in fields relating to nutrition and a patient's experience of chronic illness.

Do I have to take part?

No. It is up to you to decide whether or not you wish to take part.

If you do decide to participate, you will be asked to provide consent. You will be provided with a consent statement regarding the use of your data in response to the questionnaire. If you agree to the conditions, please click the 'next' button. This will continue to the questionnaire questions, your completion and submission confirms your consent. If you disagree with the conditions please close your browser.

You can discard the questionnaire at any time up until you submit your answers without giving a reason, by closing your browser and the information provided up until that point will not be entered into the data analysis. Once you press the 'submit' button because your data is anonymised it will not be possible to withdraw it.

Will my taking part in this study be kept confidential?

Yes. A code will be attached to all the data you provide to maintain anonymity. Analysis of your data will be undertaken using coded data. The data we collect will be stored electronically on a secure encrypted mobile device, password protected computer server or secure cloud storage device.

To ensure the quality of the research Aston University may need to access your data to check that the data has been recorded accurately e.g. for the purposes of audit. If this is required your personal data will be treated as confidential by the individuals accessing your data.

What are the possible benefits of taking part?

Although you may find participation in this research interesting, there may be no direct benefit to you as a result. However we hope that the findings of this research will help develop further training in nutrition and lifestyle advice in a form that is beneficial and engaging to optometrists. This in turn may alter clinical practice for the benefits of optometrists and their patients.

What are the possible risks and burdens of taking part?

The risk involved with this study is a data leak. No personal identifying data e.g. email address, name is required for this study and all data stored will therefore be anonymous.

The burden of the study is the time taken to read the information and complete the questionnaires. The questionnaire should take about 5-10 minutes to answer.

What will happen to the results of the study?

The results of this study may be published in scientific journals and/or presented at conferences. If the results of the study are published, your identity will remain anonymous.

A lay summary of the results of the study can be forwarded to you when the study has been completed. Should you wish to receive a copy, please contact a member of the research team." The results of the study will also be used in Mrs Nicola Milhench's Ophthalmic Doctorate thesis.

Expenses and payments

There are no expenses and payments made to participants.

Who is funding the research?

The study is being funded by Aston University.

Who is organising this study and how is my data being used?

Aston University is organising this study and acting as data controller for the study. Research data will be used only for the purposes of the study or related uses identified in this Information Sheet or Appendix A.

Who has reviewed the study?

This study was given a favourable ethical opinion by the University Research Ethics Committee (UREC).

What if I have a concern about my participation in the study?

If you have any concerns about your participation in this study, please speak to the research team and they will do their best to answer your questions. Contact details can be found at the end of this information sheet. If the research team are unable to address your concerns or you wish to make a complaint about how the study is being conducted you should contact the Aston University Research Integrity Office at
or via the University switchboard on

Research Team

Professor. Nicola Logan:

Dr Duane Mellor:

Dr Rebekka Heitmar:

Mrs Nicola Milhench

Thank you for taking time to read this information sheet. If you have any questions regarding the study please don't hesitate to ask one of the research team.



Aston University takes its obligations under data and privacy law seriously and complies with the Data Protection Act 2018 ("DPA") and the General Data Protection Regulation (EU) 2016/679 as retained in UK law by the Data Protection, Privacy and Electronic Communications (Amendments etc) (EU Exit) Regulations 2019 ("the UK GDPR").

Aston University is the sponsor for this study based in the United Kingdom. We will be using information from you in order to undertake this study. Aston University will process your personal data in order to register you as a participant and to manage your participation in the study. It will process your personal data on the grounds that it is necessary for the performance of a task carried out in the public interest (GDPR Article 6(1)(e)). Aston University may process special categories of data about you which includes details about your health. Aston University will process this data on the grounds that it is necessary for statistical or research purposes (GDPR Article 9(2)(j)). Aston University will keep identifiable information about you for 6 years after the study has finished.

Your rights to access, change or move your information are limited, as we need to manage your information in specific ways in order for the research to be reliable and accurate. If you withdraw from the study, we will keep the information about you that we have already obtained. To safeguard your rights, we will use the minimum personally identifiable information possible.

You can find out more about how we use your information at <https://www.aston.ac.uk/about/statutes-ordinances-regulations/publication-scheme/policies-regulations/data-protection> or by contacting our Data Protection Officer at

If you wish to raise a complaint on how we have handled your personal data, you can contact our Data Protection Officer who will investigate the matter. If you are not satisfied with our response or believe we are processing your personal data in a way that is not lawful you can complain to the Information Commissioner's Office (ICO).

When you agree to take part in a research study, the information about you may be provided to researchers running other research studies in this organisation and in other organisations. These organisations may be universities, NHS organisations or companies involved in health and care research in this country or abroad.

This information will not identify you and will not be combined with other information in a way that could identify you. The information will only be used for the purpose of research, and cannot be used to contact you.

Appendix 4.2.3f Delphi Analysis Validation Questionnaire

Validation of Delphi Analysis of a proposed educational event for optometrists (Oct '22)

Consent Form

Name of Chief Investigator: Nicola Milhench

1. I confirm that I have read and understood the Participant Information Sheet (Version 5, 19th January 2023) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
2. I understand that my participation is voluntary and that I am free to withdraw at any time during the study, without giving a reason and without my legal rights being affected.
3. I understand that this study is anonymous and that I am not able to withdraw after submitting my answers.
4. I agree to my personal data and data relating to me collected during the study being processed as described in the Participant Information Sheet.
5. I agree to take part in this study.

By clicking 'next', below, you agree to the statements above and consent to take part in this study. If you are not happy or willing to consent, please close your browser now.

REC ID:1841, Version 5, 19th January 2023

1. I agree to the statements above and consent to take part in this study. Required to answer. Single choice.

Next

Inclusion criteria and personal data questions

Thank you for participating in this research study to investigate optometrists' preferences with respect to developing an educational event regarding nutritional and lifestyle advice within optometry practice within the UK.

This questionnaire is open to all optometrists working in the UK registered with the GOC. There is a requirement to have registered with the GOC before January 2019 to complete this questionnaire. This is so you have had the opportunity to experience face to face educational events before the COVID-19 pandemic altered the delivery of educational events.

2. Are you registered as an optometrist with the GOC. Required to answer. Single choice.

- Yes
- No

3. Did you register with the GOC before January 2019? Required to answer. Single choice.

- Yes
- No

4. How long have you been qualified as an optometrist? Single choice.

- 0-5 years
- 6-10 years
- 11-15 years
- 16-20 years
- 21-25 years
- 26-30 years
- 31-35 years

- 36-40 years
- 41-45 years
- 46-50 years
- 51-55 years
- more than 55 years

5. Do you work in clinical practice seeing patients? Required to answer. Single choice.

- Yes
- No

Educational Event Design

People all learn in different manners and there are many different styles of continual professional development (CPD). A Delphi analysis was conducted to produce a consensus between optometrists. These following questions ask your opinion regarding different aspects of a potential education event to aid validation of the Delphi analysis.

Learning Methods

6. When seeing a standardised patient in a practical workshop, which option do you believe would give you the most benefit? Single choice.

- Seeing a standardised patient at the start of the educational intervention.
- Seeing a standardised patient at the start and then a different standardised patient at the end of the educational intervention.
- Seeing a standardised patient at the start and then the same standardised patient at the end of the educational intervention.
- Seeing a standardised patient at the end of the educational intervention.
- I would not want to see a standardised patient.

7. Gocuk et al. in 2021 wrote about the benefits of clinical audit as an educative tool. Would you be prepared to carry out a private audit of your records before and after the education intervention? Single choice.

- Yes
- No
- Maybe

8. If you were to participate in an audit of your records, how many records would you be prepared to audit? Single choice.

- Less than 11.
- 11 to 25.
- 26 to 50.

9. In your opinion what is the best way to participate in a peer discussion? Single choice.

- On-line
- In person

10. As part of a practical demonstration and participation, what type of patient would you prefer to assess (personal information and data would need to be disclosed)? Single choice.

- All participants to act as patients for each other.
- Some participants of the educational event to volunteer.
- Professional patients

11. As part of a practical demonstration and participation, what practical factors would be beneficial to measure and check against data tables to see the relevance in practice? (Tick all that apply). Multiple choice.

- Blood pressure
- Blood sugar
- Height
- Weight
- Nutrition diary
- Smoking diary
- Alcohol consumption diary

12. When would you prefer to complete a clinical vignette? Single choice.

- Before the educational event
 - After the educational event
 - One before and a different one after the educational event
 - I would rather not participate in a clinical vignette
- 13.How would you like to receive a clinical vignette? Single choice.
- A downloadable copy via email
 - A hard copy via post
 - I would rather not participate in a clinical vignette
- 14.How do you prefer to attend a presentation? Single choice.
- On-line
 - In person

Multi-Disciplinary Team Working

The consensus to "*Would it be beneficial to hear from a multidisciplinary team (for example other professionals dealing with nutrition and emotional support as well as optometrists)?"* was YES.

- 15.In a multidisciplinary team, which specialists would you like to hear from? (list all that apply).Multiple choice.
- Optometrist
 - Dietician
 - Psychologist
 - Stop smoking service
 - Alcohol support service
 - Patient experience

Types of literature

Regarding types of literature that would be beneficial to refer to after the educational event.

- 16.What form of patient information leaflets would you prefer? Single choice.
- Hard copies to take away
 - A link to allow them to be downloaded.
 - Both of the above
 - I prefer not to be provided with patient information leaflets
- 17.What form of posters would you prefer? Single choice.
- Hard copies to take away
 - A link to allow them to be downloaded.
 - Both of the above
 - I prefer not to be provided with posters.
- 18.What form of example consultation questionnaires would you prefer? Single choice.
- Hard copies to take away
 - A link to allow them to be downloaded.
 - Both of the above
 - I prefer not to be provided with consultation questionnaires
- 19.In what form would you like to receive a reference list? Single choice.
- Hard copies to take away
 - A link to allow them to be downloaded.
 - Both of the above
 - I prefer not to be provided with a reference list

External Groups

The consensus to "*Would you be prepared to work with, or support external groups relating to lifestyle changes?"* was YES.

- 20.What form of collaboration would you be interested in supporting? Single choice.
- Sign posting to external groups
 - Allowing support groups access to premises for group meetings when clinics aren't happening

- Allow a support worker to use a spare clinic room to offer advice to patients at the time of their appointment.

Thank You and Reference

Thank you for participating in this questionnaire and research project. Your time is much appreciated. Please review your answers. By pressing "submit" you are consenting to participate in this research study. If you don't wish to participate in this research study please exit the questionnaire without pressing submit and none of your data will be saved.

Reference:

Gocuk A.S., Lee, J-H., Keller, P.R., Ayton, L.N., Guymer, R.H., McKendrick, A.M. and Downie, L.E.. Clinical audit as an educative tool for optometrists: an intervention study in age-related macular degeneration. *Ophthalmic Physiol Opt.* 2021; 41: 53-77.
