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Smoking and Sight Loss: Implications for Health Promotion and Empowerment

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Cigarette smoking is a risk for sight loss. Its various toxins are known to harm various parts of the anatomical parts of the eye. The number of people who smokes continue to increase causing a major public health issue which needs addressing. Public awareness is important to highlight its impact on health and sight. The healthcare professionals play an important role in empowering people to quit the habit. Cigarette quitting does improve health and quality of life.

Aim

The aim of this article to explore the association of smoking as a risk factor to sight loss and the implication of health promotion as a useful strategy to help individuals feel empowered and to give up the habit**.**

Introduction and Background.

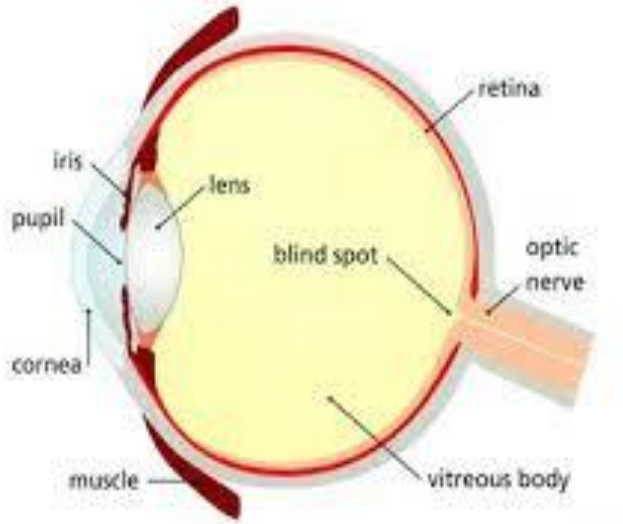
Cigarette smoking is a well-recognised major risk factor for a wide range of diseases such as cardiovascular, respiratory and malignant diseases. Many people are unaware that smoking also affects vision and can cause blindness despite the presence of valid evidence and public health campaigns to quit smoking (RNIB, 2012; Zhu, Lee, Zhuang, Gamst, & Wolfson, 2012; Evans, Fletcher, & Wormald, 2005; Kelly, Thornton, & Lyratzopolous, 2004; Solberg, Rosner, & Belkin 1998). Smoking can lead to many potential eye disorders including cataract and age-related macular diseases (AMD). Cope (2014) and RNIB (2012) identify that smokers are five times more likely than non-smokers to develop AMD which is the leading cause of blindness. Cigarette smoking is an important factor in the causation of pathogenesis and progression of several diseases of the eye. The smoke that is inhaled and the ash particles from a lighted cigarette are harmful to the body and the structure of the eye. Smoking is a significant yet preventable cause of eye diseases and sight loss (WHO, 2012; Solberg et al., 1998). Public awareness and knowledge about smoking, its harmful effect on the eyes and adequate support to smokers to quit smoking can maintain eye health (WHO, 2012; Kennedy, Spafford, Parkinson, & Fong, 2011). Healthcare professionals must take the initiative in applying health promotion strategies to help people to quit the habit to promote and maintain eye health.

This article outlines the structure and function of the eye. It explores the prevalence of sight loss amongst smokers, the chemical compounds present in tobacco including their toxic effects on sight and the health professionals' role in health counselling and health promotion. A conclusion summarises the key areas of the discussion.

Structure and function of the eye

Smoking does affect various anatomical parts of the eye, thus a brief overview of the structure and function of the eye is included. The toxins found in tobacco are known to harm sight. A cross-sectional view of the eye is shown in Figure 1.

Figure 1. Cross-sectional view of the eye



(Source: www.moorfields.nhs.net)

The main structures and brief a brief functions of the eye are summarised below.

The **cornea** is the anterior transparent outer surface of the eye. It is about 0.5 mm thick and has 5 distinct layers comprising of epithelium, Bowman's membrane, stroma, Descemet's membrane and inner endothelial layer. It acts as a protective barrier against pathogens and it refracts light rays. It contributes to 75% of the eye's total focussing power. It bends the incoming light onto the lens. Tears provide immunological protection and refractive properties to the cornea.

The **sclera** forms the posterior white outer surface of the eye. It is a tough membrane and its thickness is about 1 mm. It gives shape to the eye, and it protects the inner structure of the eye. The six extra-ocular muscles blend with it about 5 to 6 mm from the corneal junction and these muscles help to move the eyes in various directions.

The **iris** gives the eye its colour which is genetically determined. It is made up of 3 layers of connective tissue and muscle fibres: endothelium, stroma and the epithelium. The main function of the iris is to control light entering the eye. In bright light the constrictor muscles of the iris contract, thus constricting pupil to prevent excessive light entering the retina. In dim light the dilator muscle contracts, thus dilating the pupil to allow more light into the eye. The **pupil** is the opening at the centre of the iris that lets light in the eye. It changes size in response to light levels.

The **ciliary body** is next to the iris and it plays an important part in aqueous production and lens accommodation. The **choroid** lies behind the ciliary body and is pigmented and vascular. It absorbs light rays, thus improving visual efficiency. Its small blood vessel nourishes the macula and the photoreceptors.

The **len**s is a transparent structure of about 5 mm thick with a diameter of about 9 mm and is situated directly behind the iris made up of proteins called crystallins. The lens focuses light

onto the retina. It is flexible and its curvature is controlled by the suspensory ligaments under the influence of the parasympathetic nervous system.

The **vitreous humour** is a clear gel, which fills the centre of the eyes. It is made up largely of water, hyaluronic acid and collagen fibrils to give it its consistency. It gives form and shape to the eye and helps to keep the retina in place.

The **retina** is the inner neurosensory layer. It contains 3 layers of nerve cells including the outermost layer of sensory photoreceptor cells that capture light rays and convert them into electrical impulses which are transmitted by the optic nerve to the brain. There are two types of photoreceptors: rods and cones. Each retina comprises of about 125 million rods responsible for peripheral vision and function best in dim light. There are about 7 million cones in each eye around the macula, and are more densely concentrated in the fovea. Cones are essential for vision in bright light and for seeing colours and details.

The **retinal pigment epithelium** is the outer layer of the retina which nourishes the rods and the cones.

The **macula** is situated at the centre of the retina. It is the focus for incoming light rays and as such is responsible for central vision and the ability to see detail. Its diameter is about 1.5mm. The **fovea** is a small pit of around 0.3 mm near the centre of the macula which contains the highest concentration of cone photoreceptors, and has no rod photoreceptors.

The **optic nerve** is the second cranial nerve that transmits visual information in the form of electrical impulses from the retina to the brain. The photoreceptors are not present in the optic nerve. The optic nerve head creates a blind spot in the field of vision. This is normally not noticed because the vision of one eye overlaps with that of the other eye.

Epidemiology and prevalence of smoking

There is epidemiological evidence that smoking is a major cause in the pathogenesis and progression of several eye diseases and blindness particularly AMD, cataract and Grave's ophthalmopathy (Cope 2014). Cigarette smoking has become the most prevalent form of drug dependence and there is evidence of serious damage to eye health (NHS England, 2019). Tobacco kills 1,500 people a week so helping people to quit when admitted to hospital helps them, their families and the taxpayer to save thousands of lives (Selbie, 2019); furthermore, non-tobacco users also suffer tobacco-related illnesses by inhaling second-hand smoke and coming into contact with the spit of oral smokeless tobacco users or with tobacco leaves during farming or manufacturing. Tobacco in any form kills and causes ailments of different forms affecting millions of people yearly (WHO, 2016). WHO (2018b) reports the estimated and projected prevalence of smoking in all age groups from 2000 to 2015 and 2020 to 2025 respectively is presented in Table 1.

Table 1. Age-specific estimated and projected global prevalence rates 2000–2025 (Source: WHO 2018b)

	Estimated prevalence (%)				Projected prevalence (%)	
Age group (years)	2000	2005	2010	2015	2020	2025
15-24	19.1	17.1	15.7	14.3	13.1	12.3
25-34	27.0	24.3	21.9	20.2	18.8	17.2
35-44	32.0	29.0	26.5	24.1	22.0	20.6
45-54	33.2	30.1	27.4	25.4	23.5	21.5
55-64	29.6	26.8	24.6	22.7	21.1	19.9
65-74	24.4	22.1	20.0	18.4	17.3	16.2
75-84	19.4	17.4	16.0	14.7	13.6	12.7
≥ 85	15.3	14.0	12.4	11.5	10.7	10.0

Table 1 shows that the prevalence of tobacco use is highest among people aged between 45 – 54 years and that the next five years there will be most likely a consistent reduction in smoking. WHO (2018a) further reports that tobacco smoking is one of the biggest public health threats globally, killing more than 7 million people each year. More than 6 million of those deaths are the result of direct tobacco use while around 890,000 are the result of non-smokers being exposed to second-hand smoke.

RNIB (2016) reports that although smoking rate is slowly declining in the UK but around 11 million people still smoke. Public Health England (2017) report that in 2015 the estimated smoking-related cost to the NHS in England amounts to £2.6 billion and they recommend innovative measures to support the development of the new Tobacco Control Plan for England. The use of smokeless tobacco also poses a substantial problem world-wide (Mehrotra & Sinha, 2018). Smokeless tobacco is classified as a type of tobacco product that is used by means other than smoking such as chewing, sniffing or placing the product between the gum and the cheek or lip. Smokeless tobacco products are produced in various forms such as chewing tobacco, snuff, and dissolvable tobacco products. It is estimated that around 357 million people use smokeless tobacco, which is more prevalent in South-East Asia (Malhotra & Sinha 2018). Additionally, many people are not aware that one hour of a shisha smoking session is equivalent to smoking 100 cigarettes. The retina of a heavy smoker looks ten years older than of a non-smoker (RNIB 2016). Smokeless tobacco such as vaping also contains harmful toxins that are injurious to sight and may also induce cancer (Varlet, Farsalinos, Augsburger, Thomas, & Jean-Francois, 2015; Pankow et al., 2017).

Chemical compounds in cigarettes and their harmful effects

The various toxins found in cigarettes contribute to vasoconstriction, reduced oxygen availability and chronic inflammation. Smoking is a significant, yet preventable, cause of eye diseases. It has been shown to be a risk factor for many common and severe eye diseases such as age-related macular degeneration, glaucoma, and cataract, which can lead to irreversible blindness (RNIB, 2012). Pipe smokers are less likely to inhale than cigarette smokers as pipes produce more side stream smoke (Rodenstein & Stanescu, 1985). Pipe smoking causes more harm to the lens due to the condensation of tobacco products into the eyes and also by continually raising the lens temperature (Cheng et al., 2000).

There are over 4,000 active substances in tobacco smoke and most of these are harmful to health (Kennedy et al., 2011). It contains numerous compounds with oxidative properties and these may cause cataract, AMD, Graves' ophthalmopathy and uveitis (Cope, 2014). Table 2 shows some of the harmful chemicals in cigarettes and their effects on smokers.

Table 2. Some harmful compounds in tobacco and their effects on smokers

Compounds in tobacco	**Effects**
Nicotine	Vasoconstrictor and addiction
Tar	Carcinogenic and increases oxidative stress
Nitrosamines	Carcinogens and harmful to health
Polycyclic aromatic hydrocarbons	Toxic, mutagenic and carcinogenic
Hydrogen cyanide	Toxic by-product , poisonous substances harmful to nervous system, respiratory system, cardiovascular system and the thyroid glands
Formaldehyde	Carcinogenic and strong irritant to mucus lining
Carbon monoxide	Colourless and poisonous gas , reduces oxygen supply to cells
Heavy metals and toxic mineral elements such as: cadmium, aluminium, lead, mercury and arsenic	Carcinogenic, toxic and poisonous elements

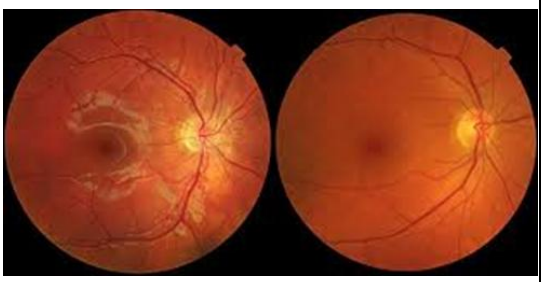
How cigarette smoking affects sight

The chemicals in tobacco reduce the body's ability to protect itself by increasing the levels of oxidative radicals and decreasing the level of antioxidants in the body (Handa, Woo, Wagle, Htoon, & Au Eong, 2011). Therefore, the body ageing process is accelerated, including the eye. High blood pressure, directly caused by smoking, is a risk factor for macular degeneration (Evans et al., 2005). Smoking causes narrowing of the blood vessels in the retina, thus reducing the oxygen uptake reaching the photoreceptors in the macula. The cyanide in smoke has a detrimental effect on the lens protein, thus it increases the risk of cortical, nuclear and posterior subcapsular cataracts at an earlier age. Smokers who smoke 20 or more cigarettes daily are twice as likely to develop cataract. It also doubles the risk of advanced diabetic retinopathy in diabetic patients because of weak retinal blood capillaries (Kanski & Bowling 2011). Anterior ischaemic optic neuropathy is a condition where the blood flow to the optic nerve head is reduced, resulting in neuronal damage at an earlier age in smokers (Kelly et al., 2004). Heavy smokers have a fourfold increased risk of cystoid macular oedema which results in poor vision as well as colour disturbance. Antenatal smoking is associated with poor stereovision and squint in the baby due to the toxins present in smoke. Passive smoking inhaled by children can alter the tear film composition, thus exacerbating dry eye syndrome and allergic eye conditions (Kanski & Bowling 2011).

The fume particles irritate the conjunctiva (Kenawy, Clark, & Votruba, 2008). Nicotine is a vasoactive compound which can induce vasospasm of the posterior ciliary arteries, resulting in anterior ischemic optic neuropathy. The presence of carbon monoxide may interfere with lipid homeostasis, thus increasing platelet aggregation and clotting which may reduce retinal blood

flow and visual disturbance. The common eye complications associated with smoking are shown in Figure 2.

Figure 2: Some common eye complications associated with smoking.

1. Cataract 	Cataract is an opacity of the crystalline lens (Watkinson & Seewoodhary, 2008). Several studies have highlighted the tobacco-smoking associated risk of cataract formation. Tobacco smoke contains heavy metals, such as cadmium, lead, iron and copper that accumulate in the lens and cause damage (Cheng et al., 2000). Iron precipitates the release of more toxic oxygen free radicals with subsequent oxidative damage. Those who smoke 15 cigarettes or more daily are up to three times more likely to develop cataract as non-smokers which in effect is dose-dependent. Lens changes occur due to oxidative damage to the lens (Kanski & Bowling 2011). Smoking is associated with nuclear sclerosis which is one of the most common types of cataract (RNIB 2012). Cataract formation causes gradual blurring of vision, but deteriorates rapidly in smokers due to increased absorption of more ultraviolet and visible light rays (Kanski & Bowling 2011). Patients complain of glare, difficulties with night driving and the appearance of multiple images in one eye, floaters, haloes around bright lights and inability to see well in sunlight (Watkinson & Seewoodhary 2008). Colour disturbance occurs in cataract and some patients experience reduced sensitivity to contrast.
2. Age-related macular degeneration Right eye- normal retina and macula Left eye – showing age-related macular degeneration 	Age related macular degeneration (AMD) is a common cause of sight loss. More than half of people who are visually impaired in the UK have lost their sight due to AMD (Macular Society, 2017). If a smoker has AMD, the condition will progress faster if they continue to smoke. There are 2 types of AMD, dry and wet type. The dry type is a slow progressive degenerative process which leads to cell death and atrophy of the retinal pigment epithelium (Riordan-Eva & Whitchner, 2008). The wet type is less common (Watkinson, 2014). It is aggressive in nature and can lead to severe sight loss in weeks or even days (Kanski & Bowling, 2011). NICE (2008) states that wet AMD occurs faster in smokers than in non-

	smokers. Smokers are most at risk of AMD and smokers who have mutations to the HTRA1 gene are 20 times more likely to develop AMD than non-smokers; it is estimated that one third of all AMD is the result of a combination of genetics and smoking (Macular Society, 2017). The tar in cigarette smoke contributes to the formation of drusens, which are fatty deposits in the retina. Riordan-Eva and Whitchner (2008) identify the following early signs of AMD: • Objects appear to change shape, size or colour • Objects appear to move or disappear • Vision is centrally blurred • Lines appear distorted and/wavy • Dark spots appear in central vision • An area of blindness can block out several words at normal reading distance • Difficulty seeing objects in bright sunlight • Glare
3. Graves Ophthalmopathy 	Tobacco smoking may have a number of effects on the thyroid gland as tobacco ingredients competively inhibit iodine uptake and organifaction in the gland (Thornton, Kelly, & Harrison, 2007; Bertelsen & Hegedus,1994). Organifaction is the incorporation of iodine into the hormone molecule. Benzpyrene , a major constituent of tobacco and the effect of smoking on the sympathtic nervous system are also thought to affect thyroid function. The pathogenic mechanism underlying Graves disease is thought to be autoimmune. The T lymphocytes react with one or more antigens shared by the thyroid and orbit resulting in a destructive inflammatory response. The disease is associated with swelling of the retrobulbar muscles and surrounding fatty tissues within the orbit (Cope, 2014). According to British Thyroid Foundtion (n.d.) smokers with Graves' disease are about two times more likely to develop thyroid eye disease (TED) and heavy smokers are eight times more likely to develop TED. Continuing to smoke following diagnosis is harmful and progressive affecting

	the efficacy of therapy, including radioiodine therapy or steroids (Cope, 2014). The clinical manifestations of Graves' Ophthalmopathy are: • Upper lid retraction • Swelling • Redness • Conjunctivitis • Bulging eyes with blurred vision and watery eyes • Photophobia • Serious risk of vision loss from corneal exposure or damage to optic nerve.
4. Dry eyes 	Active smoking is associated with symptoms of dry eyes (Kenawy et al., 2008) Smoking tends to reduce tear production and causes dry eye symptoms (Cope, 2014). This does make contact lens wearing problematic in smokers. Dry eye predisposes the patients to corneal dryness, conjunctivitis, corneal infection and corneal opacity (Watkinson, 2014). Health education is essential. Dry causes ocular irritation, burning sensation, blurred vision, and discomfort. Untreated dry eyes can lead to corneal abrasion, corneal infection, corneal scarring, corneal perforation and sight loss.

Global initiative to reduce tobacco use

The World Health Organisation (WHO) Framework Convention on Tobacco Control (WHOFCTC) tobacco control provides a clear roadmap to help countries to reduce the prevalence of smoking in both males and females (WHO, 2005b). This initiative was to protect present and future generations from the devastating health, social, environmental and economic consequences of tobacco consumption and exposure to tobacco smoke. In spite of the continued presence of the tobacco industry and marketing of tobacco this initiative helped move towards the global voluntary target of 30% relative reduction in tobacco use. Article 20 of the treaty emphasises to integrate tobacco surveillance programmes into national, regional and global health surveillance programmes so that data can be compared and analysed at the regional and international levels in order for implement appropriate action to reduce tobacco consumption.

The WHO member counties adopted the MPOWER package (Table 2) recommended by WHO FCTC (2005a) for the application of smoke reduction measures with the following principles:

Table 2: The six key principles of WHO FCTC (2005b)

1. Monitor tobacco use and prevention policies (Article 20)
2. Protect people from tobacco smoke (Article 8)
3. Offer help to quit tobacco use (Article 14)
4. Warn about the dangers of tobacco (Articles 11 and 12)
5. Enforce bans on tobacco advertising, promotion, and sponsorship (Article 13)
6. Raise taxes on tobacco (Article 6).

Health Promotion

Health promotion is a key driver in reducing smoking related health problems including ocular conditions. Health professionals need to educate the public about the impact of smoking on eye health and sight. By increasing their knowledge about the consequences of smoking and smoking cessation strategies, health professionals can encourage and support the smokers who want to quit. All smokers who develop ocular discomfort or sight problems should be identified for treatment, health counselling and health promotion.

Yach (2018) emphasises the need for more research to end smoking and its health effects to address the impact of reduce the demands for tobacco. It is important to focus on smokers as the experience of smoking is multifaceted and deeply personal. Therefore the health professionals must reflect on the smokers' experience, identifying their needs and what they want as they try to quit. Yach (2018) highlights three main categories of experiences and challenges of smokers: (1) Physical i.e., intense need and cravings; (2) Behavioural i.e., habit and ritual and (3) Emotional i.e., pleasure and calming stress, anger and anxiety. To help the smokers to quit or to reduce smoking health professionals should be aware of:

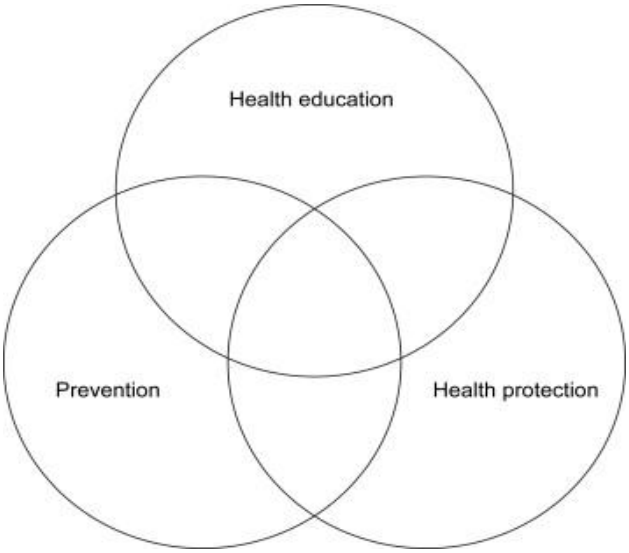
- Aware of the unique experiences of smokers, and to assess what support they need.
- Develop or identify tools to help smokers quit or reduce their consumption.
- Explore and use funding for research to evaluate risk of cigarette smoking and the effects of harmful products.
- Support innovation for effective products and services to help smokers quit.

Cope (2014) identifies that many smokers tend to deny their habit or significantly under-report their cigarette consumption. The health professionals should be meticulous and competent when assessing the patients in the care setting. It is important to assess the smokers' knowledge of eye health effects of smoking.

The US Department of Health and Human Services (2008, cited in Cope 2014) report that less than 3 minutes of counselling by healthcare providers has been shown to have increased quit rates by 30%. Counselling can enrich the healthcare professional work with patients to improve quit rates and help discourage people from starting to smoke (Rennard & Daughton, 2014).

Active listening and reflection will help the healthcare profession to adopt a humanistic perspective of the nature of therapeutic relationships: this involves a recognition of the patient's needs and understanding of his or her life situations, value systems and cultural norms from within the client's frame of reference. Health counselling and health promotion are interrelated. Tannahill framework of health promotion is useful when applied effectively. Tannahill (2009) introduces three key areas in the framework: (a) health education, (b) health prevention and (c) health protection as shown in Figure 3.

Figure 3— The three spheres of Tannahill (2009).Health Promotion model



Health education includes the provision of educational leaflets on smoking and its impact on eye health. Kennedy et al (2016) report that health warning labels (HWL) on tobacco products is an effective method to educate smokers and non-smokers about the harmful effects of tobacco use. The healthcare professional asks smokers about smoking, advises them of the dangers of exposure to second hand smoking, provides evidence-based information on how to quit and supports them to choose the best pathway when making a decision (Zhu et al., 2012). Referring the smokers to smoking health care agencies is helpful as they provide useful guidance on cigarette quitting and cessation, e.g. directing the patient to the NHS smoke free website (http://smokefree.nhs.uk. cited in Cope 2014). The stop smoking support groups provide information, advice, encouragement and support to empower smokers through self-reflection, peer coaching and peer support. Seeking advice from Action on Smoking and Health (ASH) is resourceful to provide practical help and advice to smokers. Therefore, smokers' self-efficacy by empowerment is crucial.

Prevention of ill ocular health entails informing people how cessation of smoking can prevent eye complications. Klein and Klein (2008) recommend that changes in lifestyle and healthy eating may reduce the prevalence of smoking related nuclear and cortical cataracts. More research evidence and consistent data is required to advocate for changes in lifestyle other than smoking cessation to prevent discomfort and sight loss.

Cigarette smoking increases the production of free radicals in the body resulting in damage to cells; smokers should be advised to incorporate a diet containing vitamins which helps neutralise free radicals and prevent tissue damage (Martin, 2018). Therefore, advising on diets including vitamins and antioxidants to maintain healthy immune system is crucial to maintain ocular health.

Health protection strategy ensures smoking cessation support is available to smokers who want to quit and to inform them of the law regarding smoking in public places, e.g. in restaurants, clubs, pubs, cinemas in order to protect non-smokers from the dangers of second-hand smoking. Smoking in confined spaces such as in a car or any enclosed area must be avoided to reduce the negative effect of smoking. Non-smokers such as children and pregnant women must not be exposed to cigarette toxins to prevent health complications (Public Health England, 2015).

Conclusions

Smoking is a major public health issue resulting in eye problems that may progress to sight loss. The healthcare professional is in a good position to ask smokers about their smoking behaviour, provide relevant information and to help them quit a harmful habit. The smokers must be directed to the available resources such as the NHS smokefree website and telephone helplines which encourages self management and efficacy of quitting smoking on a permanent basis. The health promotion tool provides an excellent guide to empower smokers. Collaborative partnership working with relevant agencies is recommended when supporting smokers. Although this may not influence every smoker to seek help, it could instigate a determination for many smokers to seek advice and make an attempt to stop smoking. Cessation of smoking will not only improve the smokers' eye health, but it will also improve their general wellbeing, thus reducing their risk of developing other smoking related health problems resulting in a better quality of life.

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References

Bertelsen, J.B. & Hegedus, L. (1994). Cigarette smoking and the thyroid galnd. *Thyroid*, *4*, 327-331.

British Thyroid Foundtion (nd). Thyroid eye disease and smoking:information for patients. http://www.btf-thyroid.org/projects/teamed/235-ted-and-smoking-information-for-patients

Cheng, A.C.K., Pang, C.P., Leung, A.T.S., Chua, J.K.H., Fan, D.S.P. & Lam, D.S.C. (2000). The assocaition between cigarette smoking and ocular diseases. *Hongkong Medical Journal*, *6*(2), 195 -202.

Cope, G. (2014). The effects of smoking on the eye: the role of the ophthalmic nurse. *International Journal of Ophthalmic Practice, 5*(5), 173- 177.

Evans, J.R., Fletcher, A.E. & Wormald, R.P.L. (2005). 28,000 Cases of age related macular degeneration causing visual loss in people aged 75 years and above in the United Kingdom may be attributable to smoking. *British Journal Ophthalmology*, 89, 550-553. doi: 10.1136/bjo.2004.049726

Handa, S., Woo, J., Wagle, A. , Htoon, H. & Au Eong, K. (2011). Awareness of blindness and other smoking related diseases and its impact on motivation for smoking cessation in eye patients. *Eye*, *25*(9), 1170-1176.

Kanski, J. & Bowling, K. (2011). *Clinical ophthalmology. A systematic approach* (7th Ed,). London: Elsevier.

Kelly, S.P., Thornton, J. & Lyratzopolous, G. (2004). Smoking and blindness: strong evidence for the link but public awareness lags. *British Medical Journal*, *328*, 537-538.

Kenawy, N., Clark, D. & Votruba, M. (2008). Ocular side-effects of tobacco smoking: a literature review. Eyenews

Kennedy, R.D., Hammond, D., Spafford, M.M., Douglas, O., Brûlé J., Geoffrey, T. Fong, G.T. & Schultz, A.S.H. (2016). Educating smokers about the risk of blindness–insights to improve tobacco product health warning labels. *Tobacco Induced Diseases*, *14*, 30, 1-7. DOI 10.1186/s12971-016-0094-7

Kennedy, R.D., Spafford, M., Parkinson, M. & Fong, G.T. (2011). Knowledge about the relationship between smoking and blindness in Canada, the United States, the United Kingdom, and Australia: Results from the International Tobacco Control Four-Country Project. *Optometry*, *82*(5), 310–317. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4528643/pdf/nihms708222.pdf -accessed on 15/01/2019

Klein, B.E.K. & Klein, R. (2008). Lifestyle exposures and eye diseases in adults. *American Journal of Ophthalmology*, *144*(6), 961–969.

Macular Society (2017). Smoking and sight loss. Andover, Macular Society. www.macularsociety.org

Martin, T. (2018). How smoking depletes your body of vitamins. https://www.verywellmind.com/smoking-and-vitamin-depletion-2825319

Mehrotra, R. & Sinha, D.N. (2018). Global challenges in smokeless tobacco control. *Indian Journal of Medical Research, 148*(1), 1–3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6172914/ - accessed on 15/02/2019

NHS England (2019). NHS long term plan will help problem drinkers and smokers. https://www.england.nhs.uk/2019/01/nhs-long-term-plan-will-help-problem-drinkers-and-smokers/ Accessed on 10/01/2019

National Institute for Health and Care Excellence (2008). *Ranibizumab and pegaptanib for the treatment of age-realted macular degeneration* .Technology appraisal guidance, 155. London: NICE.

Pankow, J.F., Kim, K., McWhirter, K.J., Luo, W., Escobedo, J.O., Strongin, R.M., Duell, A.K. & Peyton, D.H. (2017). Benzene formation in electronic cigarettes. *PLOS ONE, 12*(3), e0173055. doi:10.1371/journal.pone.0173055

Public Health England (2017). Research analsyis-cost of smoking to the NHS in England https://www.gov.uk/government/publications/cost-of-smoking-to-the-nhs-in-england-2015/cost-of-smoking-to-the-nhs-in-england-2015 (accessed on 18 / 02/ 2019).

Public Health England (2015). Health matters: smoking and quitting in England. https://www.gov.uk/government/publications/health-matters-smoking-and-quitting-in-england/smoking-and-quitting-in-england Accessed on 28/02/2019

Rennard, S.I. & Daughton, D.M. (2014). Smoking cessation. *Clinical Chest Medicine, 35*(91), 165 – 176.

Riordan-Eva, P. & Whitchner, J. (2008). *Vaughan and Asbury's general ophthalmology*. (17th Ed.) New York, NY: Lange Medical Books/McGraw-Hill.

Rodenstein, D.O. & Stanescu, D.C. (1985). Pattern of inhalation of tobacco smoke in pipe, cigarette and never smoke. *American Review of Respiratory Disease, 132,* 628-632.

Royal National Institute of Blind People (RNIB 2016). Understanding age-related macular degeneration. Available at: https://www.rnib.org.uk/sites/default/files/APDF_Understanding_AMD.pdf

Royal National Institute of Blind (RNIB 2012). The science behind smoking. *NB The eye health and sight loss magazine for professionals.Issue, 77*, 22- 25.

Selbie, D. (2019) NHS long term plan will help problem drinkers and smokers. https://www.england.nhs.uk/2019/01/nhs-long-term-plan-will-help-problem-drinkers-and-smokers/ Accessed on 10/01/2019

Solberg, Y., Rosner, M. & Belkin, M. (1998). The association between cigarette smoking and ocular disease. *Survey of Ophthalmology, 42*(6), 535-547.

Tannahill, A. (2009). Health promotion: the Tannahill model revisited. *Public Health*. 123, 396-399.

Thornton, J., Kelly, S.P. & Harrison, R.A. (2007). Cigarette smoking and thyroid eye disease: a systematic review. *Eye, 21*, 1135–1145.

Varlet, V.V., Farsalinos,K., Augsburger, M., Thomas, A. & Jean-François, E. (2015). Toxicity of refill liquids for electronic cigarettes. *International Journal for Environmental Research and Public Health, 12*, 4796-4815.

Watkinson, S. & Seewoodhary, R. (2008). Ocular complications associated with diabetes mellitus. *Nursing Standard, 22*(27), 51-57.

Watkinson, S. (2014). *Older people with visual impairment : clinical management and care*, Keswick, M&K.

World Health Organization (2018a). Tobacco - key facts.
https://www.who.int/news-room/fact-sheets/detail/tobacco accessed on 10/02/2019

World Health Organization (2018b). WHO global report on trends in prevalence of tobacco smoking 2000–2025. WHO, Geneva.
http://www.wpro.who.int/mediacentre/releases/2018/who_tobacco_trends.pdf - accessed on 07/01/2019

World Health Organization (2016). Get ready for plain packaging. WHO Press: Geneva.
http://www.who.int) accessed on 03/01/2019

World Health Organization (2012). WHO global report: mortality attributable to tobacco. WHO: Geneva
http://www.who.int/tobacco/publications/surveillance/rep_mortality_attributable/en/, accessed 7 Dec 2018).

World Health Organization (2005a). WHO Framework convention on tobacco control. Geneva: World Health Organization;
(https://apps.who.int/iris/bitstream/handle/10665/42811/9241591013.pdf, accessed 7 February 2019).

World Health Organization (2005WHOb). World Health Organization framework convention on tobacco Control.
https://www.who.int/fctc/en/ - accessed on 15/12/2018

Yach, D. (2018). Foundation for a smoke-free world.
https://www.smokefreeworld.org Accessed on 28/02/2019.

Zhu, S.H., Lee, M., Zhuang, Y., Gamst, A. & Wolfson, T.(2012). Interventions to increase smoking cessation at the population level: how much progress has been made in the last two decades? *Tobacco Control, 21*, 110e118.
doi: 10.1136/tobaccocontrol-2011-050371