Visual impairment and Road Safety: Analysis of UK Road Casualties and Contributory Factors

Report for the College of Optometrists

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Executive Summary

Aims and Objectives

To provide evidence for the need for regular eyesight testing to improve road safety.

To use the MAST Online (2014) data analysis tool to investigate the relationship between visual impairment and road collisions using STATS19 casualty data including newly available contributory factor data.

Background

In Great Britain, the majority of adults hold a driving licence and there are currently almost 38 million licence holders, representing 73% of the adult population (Department for Transport 2014a). The proportion of people in the 70 and over age group who hold a driving licence has been steadily increasing year on year, from 15% in 1975 to 62% in 2013 (Department for Transport, 2014a). Consequently, the majority of adults presenting to optometrists are also drivers. Visual impairment is most prevalent among older drivers. For example, cataracts are common yet often remain untreated until local thresholds to qualify for NHS surgery are reached.

The College of Optometrists advises that drivers over 40 should have a vision check every five years, and every two years for drivers over 60 (College of Optometrists 2011a). The driver licensing system in the United Kingdom relies on drivers to check that their eyesight conforms to visual standards, with no requirement to have a sight test. Gov.UK (2015) informs drivers of the UK eyesight rules via their website. However, for most UK drivers it is unlikely that they will check these rules as there is no current reminder to report visual defects until their driving licence requires renewal at age 70 (College of Optometrists, 2014a). In a study of 3000 UK citizens, the College of Optometrists (2011a) reported that one in five drivers admitted to having driven knowing that their vision is poor.

The aim of the current project was to use MAST data to provide insights into the associations between age of driver, accident type and medical and visual impairment. MAST Online is an analysis tool, developed by Road Safety Analysis, and combines national collision data with socio-demographic profiling data for use by road safety professionals. Part of the MAST data is based on statistics collated by police officers at the scene of a road traffic collision (STATS19). The attending police officer has the opportunity to record factors which have contributed to the collision. These include ‘uncorrected defective eyesight’ (contributory factor 504), ‘illness or disability, mental or physical (contributory factor 505), and ‘failed to look properly’ (contributory factor 405). Data on these contributory factors provide an opportunity to explore the relationships between age of driver, type of accident and contributory factors relating to the driver’s vision and health.

It was hypothesized that older drivers would be more likely than younger drivers to be involved in a road collision where visual or medical impairment was a contributory factor.

Method

This study uses data from a number of sources, most of which are made available by the UK Government. The principal source of data is STATS19 which is collected by police officers from forces in England, Wales, and Scotland. Contributory Factor data from STATS19 forms the basis of the main analyses. The datasets used are listed below.

- STATS19
- Contributory Factor Data from STATS19
- English Index of Multiple Deprivation (IMD)
- Welsh Index of Multiple Deprivation (WIMD)
- Scottish Index of Multiple Deprivation (SIMD)
- Experian's Mosaic Public Sector

STATS19 Data

STATS19 is a system which allows police forces to report all personal injury accidents to the Department for Transport. STATS19 does not collect any information about damage-only accidents. Personal injuries are categorised as killed, serious or slight. Definitions are taken from the Reported Road Casualties Annual Report (Department for Transport, 2014a).

Contributory Factor Data

From 2005, all police forces in Great Britain have been reporting contributory factors as part of the STATS19 recording system. The contributory factors system was developed to give insights into why and how road accidents occur. Contributory Factors (CFs) are designed to identify the key actions and failures that led to the collision and to provide data which can be used in accident prevention. Officers are not required to record CFs, and not all police-recorded injury collisions are attended. Contributory factors are largely subjective, reflecting the opinion of the reporting police officer, and are not necessarily the result of extensive investigation. Some factors are less likely to be recorded since evidence may not be available after the event (Department for Transport, 2014b).

Indices of Deprivation

Indices of Multiple Deprivation (2010 for England, 2011 for Wales and 2009 for Scotland) were used to examine associations between deprivation level and collision-involved drivers who were assigned certain contributory factors. Deprivation refers to unmet needs caused by a lack of all types of resources, not only financial.

Experian's Mosaic Public Sector

Experian's Mosaic Public Sector is a cross-channel classification system based on 850 million source records. Mosaic is intended to provide an accurate and comprehensive view of citizens and their needs by describing them in terms of demographics, lifestyle, culture and behaviour.

Procedure

The analysis for this study is based on CF data which is returned on an annual basis to the Department for Transport. The MAST data tool was used to examine seven years of data (2006 to 2013). MAST Online contains complete national STATS19 collision data, including data collected on the circumstances of collisions and the people (both casualties and drivers/riders) involved. STATS19 contains collisions resulting in fatal, serious and slight injuries. All injury severities were included in our analysis.

For the purposes of this analysis we focused on the number of different types of driver who received particular contributory factors. The rationale for this is that one collision could involve two drivers who both received eyesight-related CFs and by only counting one collision and not two drivers we would be underestimating the scale of the problem.

Participants

Four participant groups were identified, based on eyesight requirements for driver licences:

- ‘Normal’ or ‘Group 1’ Drivers – includes cars; taxis; minibuses; motorbikes; goods vehicles 3.5 tonnes maximum gross weight (mgw) and under; and tractors.

- ‘Specialist’ or ‘Group 2’ Drivers – includes buses and goods vehicles over 3.5 tonnes mgw.

- ‘Other’ – includes horses; pedal cyclists; and mobility scooters

- ‘Pedestrians’ – includes injured adult pedestrians

Contributory Factor Analysis

Contributory factors linked to vision, health, impairment or disability were examined. These are listed below:

Drivers/riders

CF405	Failed to look properly
CF406	Failed to judge other person’s path or speed
CF504	Uncorrected, defective eyesight
CF505	Illness or disability, mental or physical
CF705	Dazzling headlights
CF706	Dazzling sun

Pedestrians

CF802	Failed to look properly
CF803	Failed to judge other person's path or speed
CF810	Illness or disability, mental or physical

Driver analysis

MAST Professional enables the data to be analysed by type of driver/rider or pedestrian who was involved in the collision and also the age of each person. It is generally accepted that the incidence of visual problems increases with age. This can be due to natural changes within the eye such as presbyopia, when the lens loses its ability to focus on close objects or eye diseases such as cataract, glaucoma, diabetic retinopathy and age-related macular degeneration (AMD).

There is no single definition of 'older people', but for the purpose of this study we have used age 60 as a cut-off point to define older drivers. We have chosen age 60 for two reasons. Firstly, individuals become eligible for NHS funded sight tests at age 60 on the grounds of age (NHS, 2015) and secondly the College of Optometrists advises drivers age 60 and over to increase the frequency of sight tests from every 5 years (age 40) to every 2 years (College of Optometrists, 2011a). Age 60 was therefore used in the data analysis to investigate if older people are more or less likely to have collisions which involved a contributory factor related to vision or health. Comparisons were made between drivers aged under 60 and drivers aged 60 and over.

Geographical analysis

The geographical information provided by MAST was interrogated to identify which types of road are most prone to crashes involving visual problems. The analysis also looked at which regions of the country drivers lived in. We then attempted to map these to the nine regions of England identified by the Office for National Statistics plus Scotland and Wales. These areas are used by the College of Optometrists for governance purposes (2014b). Northern Ireland was excluded as STATS19 does not cover this region.

Additional STATS19 analysis was carried out at the Local Optical Committee Support Unit (LOCSU) optical area level. Twenty-seven English LOCSU optical areas were identified from the Atlas map of optical variation (LOCSU, 2014). Contributory factor data were analysed for each of these areas, as well as for Scotland and Wales.

Data Analysis

Indices were calculated in order to put findings into context by comparing collision circumstances with collision involvement. If contributory factor analysis was undertaken in isolation, some types of driver could be identified as receiving certain contributory factors less often (or more often) than other types of driver. However, it could be that the type of driver in question is also involved in collisions less often than other types of driver.

Indices were calculated by determining the number of drivers involved in injury collisions in each age group for the condition or contributory factor in question as a percentage of all drivers involved in injury collisions in each age group. This is then multiplied by 100 to create an index. In some cases, the number of drivers who received the contributory factor was used as the base for looking at circumstances where the contributory factor was applied (for example, lighting conditions and weather conditions).

Results

In England, Scotland and Wales, for the period 2006-2013, there were a total of 1,295,540 police-reported injury collisions recorded on STATS19. Of these, 1,008,929 injury collisions were attended by a police officer where at least one contributory factor (CF) was assigned to any party in the collision. This represents 78% of police recorded injury collisions. Subsequent analyses are based on these data.

There is no difference between the rates at which contributory factors are assigned to drivers under and over age 60. Therefore, overall, normal drivers aged 60 and over are no more likely to receive a CF than those under 60. Results for each contributory factor relevant to vision and health are summarised below.

CF405 – Failed to look properly

Of the CFs related to vision, 'Failed to look properly' is the most commonly assigned contributory factor. It was assigned to normal drivers 328,077 times during the seven year study period. Nearly half of all normal drivers in the oldest age groups (75 years and over) received the CF405. Just over one third of specialist drivers received the CF405.

When indices are examined for CF405, drivers aged under 60 are close to the norm, but drivers aged 60 and over are over-represented. There was a significant difference between the age groups with normal drivers aged 60 and over more likely to receive CF405 than younger drivers ($p < 0.01$, Confidence Intervals (CI): 2.20 – 14.65).

CF406 – Failed to judge other person's path or speed

CF406 was assigned to normal drivers 182,435 times during the study period. When indices for normal drivers are examined, drivers aged under 60 are close to the norm (index of 98), but drivers aged 60 and over are over-represented (index of 117). There was a significant difference between the age groups with drivers aged 60 and over more likely to receive CF406 than younger drivers ($p < 0.01$, CI: 1.28 – 5.07).

Normal drivers aged 60 and over were under-represented for night driving where there was street lighting. Older drivers were significantly under-represented during the late evening, night-time and early morning.

CF504 – Uncorrected, defective eyesight

There was a substantial difference between normal drivers aged under 60 and those aged 60 and over for receiving CF504 'Uncorrected, defective eyesight'. Normal drivers aged 60 and over have an index of 640 for receiving CF504 compared to 26 for under 60s. However, over the seven year study period, CF504 was assigned to normal drivers only 1679 times and because of these low numbers, the difference between older and younger drivers did not reach statistical significance ($p = 0.08$, CI: -0.30 - +4.13). The likelihood of being assigned CF504 increases with age, 72% of assignments were to drivers aged 65 and over. When the age cut-off was raised to 65 years, there was a significant difference between the age groups ($p < 0.05$, CI: 0.54 – 4.43). There was no difference in assigning CF504 for men and women aged under 60. Men from the 60 and over age group are slightly more likely to receive CF504.

Normal drivers aged 60 and over were under-represented for night driving both where there was street lighting and in the dark. There was a significant difference in the percentage of older and younger drivers receiving CF504 in the dark, in daylight and at night with street lighting.

When indices are examined, normal drivers aged under 60 are under-represented, but drivers aged 60 and over are extremely over-represented. There was a significant difference between the age groups with drivers aged 60 and over more likely to receive CF504 than younger drivers.

Uncorrected, defective eyesight is **not** an issue amongst specialist drivers (those with more stringent eyesight requirements). Only 0.02% of all specialist drivers involved in police-attended collisions received CF504.

Association between CF405 'Failed to look properly' and CF504 'Uncorrected, defective eyesight'

The relationship between CF405 and CF504 was examined for normal drivers. A very small proportion of all drivers were assigned both CF405 and CF504. Of those assigned CF504, 55% were also assigned CF405. (920/1,679). When the data were examined by age, normal drivers aged 60 and over were more likely than drivers aged under 60 to be assigned both CF405 and CF504.

CF505 – Illness or disability, mental or physical

CF505 was assigned to normal drivers 14,337 times during the study period. There was a highly significant difference between normal drivers aged under 60 and those aged 60 and over for receiving CF505 'Illness or disability, mental or physical' ($p < 0.01$, CI: 2.31 – 10.66). The likelihood of assignment of CF505 increases with age.

Normal drivers aged 60 and over have an index of 410 for receiving CF505 compared to 58 for under 60s. Drivers aged over 60 were more likely to receive CF505 than younger drivers during daylight, but less likely to receive CF505 at night.

CF705 – Dazzling headlights

CF705 was assigned to normal drivers 2855 times during the study period. Normal drivers aged 60 and over were significantly more likely to be assigned CF705 (dazzling headlights) than drivers aged under 60 ($p < 0.01$, CI: 0.11 – 0.41). Older drivers have an index of 175 compared to 90 for under 60s.

CF706 – Dazzling sun

CF706 was assigned to normal drivers 22,246 times during the study period. Dazzling sun was a significant issue for older drivers. There was a significant difference between the age groups, with normal drivers aged 60 and over more likely to receive CF706 than younger drivers ($p < 0.01$, CI: 1.02 – 3.81). Older drivers have an index of 182 compared to 89 for younger drivers. Women from both older and younger age groups are more likely than men to receive CF706 – 118 for under 60s and 112 for over 60s.

Specialist drivers aged 60 and over were slightly more likely than younger specialist drivers to receive CF706.

For both CF 705 (dazzling headlights and CF706 (dazzling sun), the percentage of drivers receiving these CFs rises with age.

Pedestrians

During the study period there were 54,191 pedestrian casualties where CF802 (Failed to look properly) was assigned. There was no difference in the assigning of CF802 by age group.

During the study period there were 18,808 pedestrian casualties where CF803 (Failed to judge vehicle's path or speed), was assigned. Pedestrians aged 60 and over are more likely to receive CF803 than pedestrians aged under 60.

During the study period there were 3559 pedestrian casualties where CF810 (Disability or illness, mental or physical) was assigned. Pedestrians in the 60 and over age group were more likely to receive CF810 than younger pedestrians, with an index of 179 compared to 76 for under 60s.

Index of Multiple Deprivation

For CF405 (failed to look properly), a slightly higher proportion of older drivers than younger drivers fell within the 'less deprived' categories. The difference between older and younger drivers was greatest for CF504 (uncorrected or defective eyesight), with a significantly higher proportion of older drivers in the 'less deprived' 20% and a significantly lower proportion of older drivers in the 'more deprived' 20%. There was little difference between younger and older drivers for other CFs.

Mosaic Profiling

Drivers in Mosaic Groups C (city dwellers) and N (pensioners on low incomes) are having collisions at less than the expected rate, whereas drivers in Groups A (well-off country home-owners), G (people on low-incomes in rural and village locations) and I (urban and suburban residents) are having collisions at more than the expected rate.

Mosaic profiles were linked to CF504 (uncorrected, defective eyesight). Drivers in Group F ('Senior security' well-off retired people) were significantly over-represented for CF504, at almost two and a half times the expected rate for this Group. Similarly, drivers in Group A (well-off country dwellers) received CF504 at over twice the expected rate. Drivers in Group B ('prestige positions' containing well-off retired people and high achieving families), Group G (people on low-incomes in rural and village locations) and Group N (pensioners on low incomes) were also over-represented in receiving CF504.

Regional Analysis

For those aged under 60 years, more drivers from London received CF405 (failed to look) than expected. More drivers from the East and South East of England were assigned CF505 (illness or disability) than expected. More drivers from the East Midlands and North East England received CF706 (dazzling sun) than expected.

For drivers aged 60 and over, more from London received CF405 (failed to look) than expected. More drivers received CF504 (uncorrected, defective eyesight) and lived in the East and South East of England than expected. More drivers from the South East if England received CF505 (illness or disability) than expected. More drivers received CF705 (dazzling headlights) and lived in the East of England, the South East and South West of England.

Local Optical Committee Geographical Analysis

Some areas show higher than expected incidences of CF504 and CF505 regardless of age, such as Devon, Cornwall and Isles of Scilly, East Anglia, and Thames Valley. These figures are not linked to population indices so are provided for information.

Conclusions

The results of this study have shown an association between injury-collisions and visual impairment and health. The hypothesis that older drivers aged 60 and over are more likely to be involved in an injury-collision where visual impairment or illness and disability is a contributory factor was proven.

When compared with population indices, the contributory factors of visual impairment and illness or disability were allocated to a higher than expected proportion of drivers in older age groups and especially to those living in rural or village locations. Despite the availability of NHS funded sight tests, which are free at the point of access for people aged 60 and over, a higher than expected proportion of these drivers, in both comfortably-off and low-income groups, were allocated CF504 (uncorrected, defective eyesight).

The findings of this study support the recommendations of the College of Optometrists (2011a) that drivers should have regular sight tests, and that drivers aged over 60 should have even more frequent sight tests. There was no evidence that drivers aged 40 to 59 were at higher risk of accidents than younger drivers so we recommend that all drivers have regular sight tests. Furthermore, the study findings can inform road safety campaigns featuring the importance of good vision, which can then be targeted at specific groups of drivers. Such campaigns will likely lead to fewer injury-collisions involving visual impairment and thus contribute to road safety.

The profile of the typical driver needing advice on visual impairment and the importance of corrective lenses is a driver aged 60 or over; either male or female; retired; living in a rural or village location with poor public transport; either comfortably-off or on a low income; predominantly living in the East, South East and South West of England.

Recommendations

1. UK Campaign to encourage drivers to have regular sight tests and take responsibility for looking after their eyes.

2. All drivers should have a vision check every five years and every two years for drivers over 60.

3. Propose to Government that drivers aged 70 and over should have a mandatory sight test upon renewal of their driving licence.

4. Research to gain consensus on the best combination of visual tests for driver licensing in the UK, and the intervals between sight tests.

Study Aims and Objectives

To provide evidence for the need for regular eyesight testing to improve road safety.

To use the MAST Online (2014) data analysis tool to investigate the relationship between visual impairment and road collisions using STATS19 Casualty data including newly available contributory factor data.

Background and Introduction

In Great Britain, the majority of adults hold a driving licence and there are currently almost 38 million licence holders, representing 73% of the adult population (Department for Transport 2013a). The proportion of people in the 70 and over age group who hold a driving licence has been steadily increasing year on year, from 15% in 1975 to 62% in 2013 (Department for Transport, 2014b). Consequently, the majority of adult patients presenting to optometrists are also drivers.

A recent Government report highlighted the importance of driver age and health in determining fitness to drive (Hawley, 2010). Clinical guidelines for driving with a medical condition, including visual impairment, vary between countries and the quality of such guidelines is also variable (Rapoport et al, 2015). The DVLA provides guidance for medical practitioners on specific medical conditions which can affect driving ability, and lists the current rules and restrictions for drivers who have these conditions (DVLA, 2014). These guidelines are regularly updated. Older drivers are more likely than younger drivers to have one or more medical condition which may negatively affect driving, and which may even preclude driving (Butcher, 2006, Morgan and King, 1995). The main categories of medical condition are visual impairment; cognitive impairment; neurological impairment; diabetes; and alcohol or drug dependency.

Older drivers have a higher rate of road accidents per mile driven compared to younger drivers (Department for Transport, 2013a). The risk of an accident increases for drivers aged over 70 and especially for drivers aged over 80 (ROSPA, 2013). However, many General Practitioners fail to appreciate that their older patients are often also drivers and thus do not advise them of their fitness to drive (Hawley, 2010). Visual impairment is most prevalent among older drivers, for example, cataracts are common yet often remain untreated until they are serious enough for surgery, meanwhile the sufferer usually continues to drive.

It has been estimated that among drivers aged 80 years and over, one in three has a visual impairment which is below the legally required standard for driving (Taylor et al, 1997). Keeffe and colleagues (2002) in Australia found that although many older drivers with visual impairment limit their driving in adverse conditions, a significant number of drivers do continue to drive with impaired vision. In a study of 3000 UK citizens, the College of Optometrists (2011a) reported that one in five drivers admitted to having driven knowing that their vision is poor.

In 2014 there were 10,785 Optometrists registered with the General Optical Council (GOC) in England (GOC, 2014). Optometrists carry out eye examinations to test sight, identify eye conditions, prescribe and dispense spectacles and fit contact lenses. It is estimated that 21.76 million sight tests were carried out in the UK in the year to 31st March 2012, with 17.939 million of these in England (Optical Confederation, 2013). The NHS funds around 70% of all sight tests in the UK via General Ophthalmic Services (GOS). GOS sight tests are commissioned nationally according to a national tariff with certain groups of the population being entitled to NHS funded sight tests (NHS Choices, 2015).

The College of Optometrists advises that drivers aged over 40 should have a vision check every five years and drivers aged over 60 should have a check every two years (College of Optometrists 2011a). The driver licensing system in the United Kingdom relies on drivers being aware of the visual standards for driving and ensuring that they meet these standards. The number plate test, used during the driving test, remains the sole means of assessing the visual standard for issuing a UK driving licence. Once a driving licence is issued, the driver need not undergo any further formal visual assessment. Some other European countries require licence-holders to have regular visual assessments of fitness to drive (Optician Online, 2010). Table 1 shows the requirements for reassessment of visual standards for drivers (after initial driving test) for countries in the European Union as at 2011 (European Council of Optometry and Optics, 2011).

The UK Government has not fully adopted the EU Commission Directive (2009/113/EC) of the European Parliament and the Council on driving licences (European Commission, 2009). This Directive states that 'all applicants for a driving licence shall undergo an appropriate investigation to ensure that they have adequate visual acuity for driving power-driven vehicles.' Chisholm (2008) noted that in most European countries binocular visual fields are routinely tested among drivers, but this is not a legal requirement in the UK for all drivers. Notably, the Irish College of Ophthalmologists (2011) has welcomed the introduction of the new standards and recommends their adoption.

Gov.UK (2015) informs drivers of the UK eyesight rules and that failure to meet the standards may result in prosecution or a fine. However, for most UK drivers it is unlikely that they will check these rules. This is because once a driving licence has been issued, unless the driver has a specific medical condition which requires notification to DVLA, there is no current reminder to report visual defects until the licence requires renewal at age 70 (College of Optometrists, 2014a). The UK Road Safety and Eye Health Working Group recently recommended that vision be tested by a qualified optometrist every 10 years, possibly to coincide with renewal of the Photocard Driving Licence. However, there is currently insufficient evidence to show that visual impairment contributes significantly to road accidents and casualties.

The aim of the current project was to use MAST data created by Road Safety Analysis (2014) to provide insights into the associations between age of driver, accident type and medical and visual impairment. Part of the MAST data is based on statistics collated by police officers at the scene of a road traffic collision (STATS19, 2014). The attending police officer has the opportunity to record factors which have contributed to the collision. These include 'uncorrected defective eyesight’ (contributory factor 504), ‘illness or disability, mental or physical (contributory factor 505) and ‘failed to look properly’ (contributory factor 405). Data on these contributory factors have only very recently been made available by the Department for Transport and provides the opportunity to explore the relationships between age of driver, type of accident and contributory factors relating to the driver’s vision and health.

Using contributory factors is important as it is not currently possible to link national data on road traffic collisions directly with hospital and health statistics. Similarly, there are no data which link accidents with driver health. Although Hospital Episode Statistics are collected, they are recorded separately from STATS19. There have been some national and local projects to link the casualty records from STATS19 with patient records from HES to provide information on severity levels and injury details. The process for undertaking such matching involves using the personal details from both data sources (including age, gender and postcode) and determining confidence levels for matching. This process has not been undertaken at a national level.

It is appreciated that contributory factors are recorded only when the attending police officer has good reason to believe that the factor was involved in the collision, and thus they are not recorded for all collisions. However, analysis of these contributory factors provides important information on the link between visual or health related impairment and road safety. It also allows the creation of profiles of drivers most at risk of involvement in a visual or health-related road accident.

It was hypothesized that older drivers would be more likely than younger drivers to be involved in a road collision where visual or medical impairment was a contributory factor.

Table 1: Reassessment of Vision Later in Driving Career (Group 1 drivers only)*

Country	**Age of driver and regularity of test**
Austria	No requirement
Cyprus	70 (visual acuity & visual fields by ophthalmologist)
Denmark	70, again at 74 then every 2 years
Estonia	Every 10 Years (at licence renewal) From 65 every 5 years
Finland	45 (visual acuity by optometrist) again at 70 and every 5 years
France	No requirement
Germany	No requirement
Greece	65 every 3 years
Hungary	No requirement
Ireland	At every licence renewal for spectacle wearers. Otherwise at age 70, then every 3 years (but can be more frequent)
Italy	Every 10 Years 50 every 5 years, 70 every 3 years, 80 every 2 years
Latvia	Every 10 years 50-65 every 5 years, 65 every 3 years
Netherlands	70 then every five years (but can be more frequent if an eye condition is present)
Poland	Non-permanent licences are issued for certain visual conditions with an assessment every 1-5 years. Otherwise at age 75
Portugal	60 (by medical practitioner)
Slovakia	60 every 2 years, 70 every year
Slovenia	Can be every 1-5 years if an eye condition is present, Otherwise, age 80
Spain	Every 10 Years. 65 every 5 years
Sweden	No requirement
United Kingdom	No requirement

* Data from ECOO Report (2011) Report on Driver Vision Screening in Europe.

Methods

This study uses data from a number of sources, most of which are made available by the UK Government. The principal source of data is STATS19 which is collected by police officers from forces in England, Wales, and Scotland. Contributory Factor data from STATS19 forms the basis of the main analyses. The datasets used are listed and described below.

Databases used:
STATS19
Contributory Factor Data from STATS19
English Index of Multiple Deprivation (IMD)
Welsh Index of Multiple Deprivation (WIMD)
Scottish Index of Multiple Deprivation (SIMD)
Experian's Mosaic Public Sector

STATS19 Data

STATS19 is a system which allows police forces to report all personal injury accidents to the Department for Transport. STATS19 does not collect any information about damage-only accidents. Personal injuries are categorised as killed, serious or slight. Definitions are taken from the Reported Road Casualties Annual Report (Department for Transport, 2014a) and are listed below:

Killed: Human casualties who sustained injuries which caused death less than 30 days after the accident. Confirmed suicides are excluded.

Serious injury: An injury for which a person is detained in hospital as an "in patient", or any of the following injuries regardless of whether or not they are detained in hospital: fractures, concussion, internal injuries, crushings, burns (excluding friction burns), severe cuts, severe general shock requiring medical treatment and injuries causing death 30 or more days after the accident.

Slight injury: An injury of a minor character such as a sprain (including neck whiplash injury), bruise or cut which are not judged to be severe, or slight shock requiring roadside attention. This definition includes injuries not requiring medical treatment.

An injured casualty is recorded as seriously or slightly injured by the police on the basis of information available within a short time of the accident. This generally will not reflect the results of a medical examination, but may be influenced according to whether the casualty is hospitalised or not. Hospitalisation procedures will vary regionally (Department for Transport, 2014a).

STATS19 records all road accidents involving human death or personal injury occurring on the Highway ('road' in Scotland) and notified to the police within 30 days of occurrence, and in which one or more vehicles are involved. A vehicle is defined as motor vehicles or non-motor vehicles such as pedal cycles and ridden horses on 'public roads', regardless of motor vehicle or pedestrian involvement (STATS20, Department for Transport, 2013a).

STATS19 does not record collisions on private roads, car parks, hospital areas, retail shopping parks, private residential estates, un-adopted roads, service areas, petrol stations, picnic areas or municipal or private parks. All of these areas are likely to be frequented by older drivers and thus any collisions in these places will not be included in the STATS19 data.

The STATS19 form collects a wide variety of information about the accident (such as time, date, location, road conditions) together with the vehicles and casualties involved and contributory factors to the accident (as interpreted by the police). The form is completed at either the scene of the accident, or when the accident is reported to the police. Validity checks and error procedures are carried out locally on STATS19 data. The STATS19 report form and guidance document STATS20 are available from the Department for Transport website (Department for Transport, 2013a).

The STATS19 data are thus subject to the above limitations and are not a complete record of all injury accidents. However, these data are the most detailed, complete and reliable single source of information on road casualties covering the whole of Great Britain (Department for Transport, 2013b).

Contributory Factor Data

From 2005, all police forces in Great Britain have been reporting contributory factors as part of the STATS19 recording system. The contributory factors system was developed to give insights into why and how road accidents occur. Contributory Factors are designed to identify the key actions and failures that led to the collision and to provide data which can be used in accident prevention. STATS20 guidance for police officers states that Contributory Factors (CFs) should only be completed for accidents where a police officer attended the scene and obtained details for the report (Department for Transport, 2012). Officers are not required to record CFs, and not all police-recorded injury collisions are attended. Contributory factors are largely subjective, reflecting the opinion of the reporting police officer, and are not necessarily the result of extensive investigation. Some factors are less likely to be recorded since evidence may not be available after the event (Department for Transport, 2014b). Consequently, CFs should be regarded only as a general guide for identifying factors as possible concerns.

The police report CFs using a form which includes a list of 78 contributory factors (Department for Transport, 2014b). These 78 factors fall into nine categories and these are:

- Road environment,
- Vehicle defects,
- Injudicious action,
- Driver/rider error or reaction,
- Impairment or distraction,

- Behaviour or inexperience,
- Vision affected by external factors,
- Pedestrian only factors (casualty or uninjured) and
- Special codes.

A copy of the form can be found using the following link:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/230590/stats19.pdf

Up to six CFs can be recorded for each collision. Each CF must be attributed to a particular individual who was in some way involved in the crash: usually as a vehicle driver or rider, but sometimes a pedestrian and even occasionally a vehicle passenger. Since multiple CFs can be recorded for a single collision, it is possible that the same CF may be attributed to more than one person involved in the same collision.

Indices of Deprivation

Indices of Multiple Deprivation (2010 for England, 2011 for Wales and 2009 for Scotland) were used to examine associations between deprivation level and collision-involved drivers who were assigned certain contributory factors. The analysis focuses on where the drivers live (as opposed to where they crash) in order to provide an understanding of the types of environment in which they come from. Approximately two-thirds of casualties are injured in the local authority area in which they live, reflecting the movement of road users. For measures such as deprivation, rurality and Mosaic profiling, residency provides information on the type of people involved in the collisions and aids the development of appropriate interventions. It means that the crash location itself is of less importance.

Deprivation refers to unmet needs caused by a lack of all types of resources, not only financial. The English Indices of Deprivation (IMD2010) use 38 separate indicators, organised across seven domains of socioeconomic disadvantage: income, employment, health and disability, education, housing, environment, and crime (Department for Communities and Local Government, 2011). IMD2010 divides England into nine regions. England has been further divided into 32,482 small geographical areas known as Lower Layer Super Output Areas (LSOAs). Each LSOA comprises approximately 1,500 inhabitants and has a unique IMD2010 score calculated from census data across the seven domains.

A comparable methodology is used to determine deprivation levels in LSOAs in Wales (Welsh Index of Multiple Deprivation (WIMD), Welsh Government, 2014) and Data Zones in Scotland (Scottish Index of Multiple Deprivation (SIMD), The Scottish Government, 2015). Data Zones have a slightly smaller average population than LSOAs.

The IMD/WIMD/SIMD scores are continuous measures of deprivation and there is no definitive point on the scale below which areas are considered to be deprived. The deprivation scores are placed into one of ten groups of equal frequency (deciles), ranging from the 10% most deprived areas to the 10% least deprived areas. In this study, the postcode of drivers receiving contributory factors were used to identify their home location LSOA and the relative deprivation level of the area in which they live. Analysis was conducted to compare the numbers of collision-involved drivers from each IMD decile who received each contributory factor with the overall numbers of collision-involved drivers in each IMD decile."

Experian's Mosaic Public Sector

Experian's Mosaic Public Sector is a cross-channel classification system based on 850 million source records. Mosaic is intended to provide an accurate and comprehensive view of citizens and their needs by describing them in terms of demographics, lifestyle, culture and behaviour. The system was devised under the direction of Professor Richard Webber, a leading authority on consumer segmentation, using data from a wide range of public and private sources. It is used to inform policy decisions, communications activity and resource strategies across the public sector. Mosaic 2014 presently classifies the community represented by each UK postcode into one of 15 Groups and 66 Types. The fifteen groups are described in Appendix I. Each Group embraces between 3 and 6 Types. Examples of two groups relevant to our analysis of the STATS19 collision data are Group A 'Country Living' and Group F 'Senior Security'. The Mosaic descriptions of Groups A and F are below (Experian, 2015).

Group A: Country Living (Well-off owners in rural locations enjoying the benefits of country life)

Average age: 66 – 70, Home owners living in rural locations, High car ownership.

"Country Living are well-off homeowners who live in the countryside often beyond easy commuting reach of major towns and cities. Some people are landowners or farmers, others run small businesses from home, some are retired and others commute distances to professional jobs.

"Core Features
Country Living consists of affluent people who can afford to live in pleasant rural locations surrounded by agricultural landscapes. This population is divided between those still in work and retired people.
These people live in attractive, spacious detached homes that are often period properties or named buildings, and the majority are owned.
Incomes are good, either derived from occupational pensions, commuting to well-paid professional jobs or running successful farms or their own businesses - Country Living contains the highest proportion of self-employed people of any group. Asset holdings in the form of stocks and shares are high.
Living in the least densely populated rural locations means car ownership is high. Most households have at least two cars for tasks from grocery shopping, to doing the school run and commuting to work.

"Public Sector
On the whole Country Living are a reasonably environmentally aware group and people here are better than average at making the effort to recycle, reduce and re-use.
Health among this group is good. When it comes to taking part in sport or proactively keeping in shape they are no better than the average. The State Pension aside, Country Living have amongst the least need for support from the state.
These rural folk live in areas with the lowest crime rate of all and there is little in the way of anti-social behaviour – Country Living are the most likely to feel that this is not a problem at all. However they do tend to be more concerned about speeding traffic. Not surprisingly, the fear of crime is very low indeed."

Group F: Senior Security (Elderly people with assets who are enjoying a comfortable retirement)

Average age: 76 – 80, Home owners, Low mileage drivers, Additional pensions above State Pension.

"Senior Security are elderly singles and couples who are still living independently in comfortable homes that they own. Property equity gives them a reassuring level of financial security. This group includes people who have remained in family homes after their children have left, and those who have chosen to downsize to live among others of similar ages and lifestyles.

"Core Features
Senior Security is the most elderly group of all, their average age is 75, and almost all are retired. Some are living with their long-time spouse, but a larger number are now living alone, and women outnumber men.
During their working lives Senior Security were employed in a range of managerial and intermediate occupations. They had sufficient income to buy their own homes with a mortgage which they have now paid off, leaving them with considerable equity in their homes.
These homes are comfortable semi-detached three bedroom houses and bungalows in pleasant suburbs. They are generally very settled, long-standing residents of their local communities and have the longest length of residency of any group, having lived in their homes for nearly 25 years, on average.
Though few now have high incomes, most live in reasonable comfort, their state pensions being supplemented by occupational pensions, and they are content with their standard of living.

"Public Sector
Considering their age, Senior Security are still able to enjoy good levels of health. In addition, although they no longer take a lot of exercise they do like to stay active and they are the least likely group to think they should do more to improve their health.
The crime rate is lower than average where they live, as is anti-social behaviour of all kinds, and this group has a relatively low fear of crime.
In contrast to their generally poor levels of understanding when it comes to issues such as climate change and carbon offsetting, Senior Security are amongst the most dedicated recyclers, re-users and reducers of energy use. However this tends to be

done less out of environmental concern and more through a desire to save money and avoid unnecessary waste.
These comfortably-off pensioners have little need for state support apart from drawing their pensions."

Procedure

The analysis for this study is based on CF data which is returned on an annual basis to the Department for Transport. The Department has supplied this data for use in this research.

The MAST Online data tool was used to examine seven years of data (2006 to 2013). MAST Online contains complete national STATS19 collision data, including data collected on the circumstances of collisions and the people (both casualties and drivers/riders) involved. STATS19 contains collisions resulting in fatal, serious and slight injuries. All injury severities were included in our analysis.

MAST Professional is an advanced version of MAST. It contains a pre-analysed set of data which includes contributory factors. To ensure analysis is as robust as possible, MAST Professional only includes collisions where a police officer has attended and where at least one contributory factor has been assigned to the collision.

Injury collisions can involve a number of participants and each collision could result in more than one casualty. It is necessary to be clear that collisions, casualties and involved drivers all represent different numbers. One collision can result in one casualty and involve one driver (known as a single vehicle collision, where the casualty could be the driver or could be a passenger or a pedestrian). Alternatively, collisions can involve multiple vehicles and multiple casualties (which may or may not be occupants of those vehicles, i.e. pedestrian casualties).

For the purposes of this analysis we focused on the number of different types of driver who received particular contributory factors. The rationale for this is that one collision could involve two drivers who both received eyesight-related CFs and we would therefore be underestimating the scale of the problem by only counting one collision and not two drivers.

The same rationale applies to counting the number of pedestrian casualties who received eyesight related CFs - it is conceivable that one collision involved two pedestrians with poor eyesight so counting the incident and not the participants would result in underestimating the issue.

Furthermore, focusing on the participants receiving the CFs (rather than the number of collisions) allows the researchers to understand more about the people involved (in terms of IMD, home location, age and vehicle type) in order to be able to direct resources. This information is unavailable at the collision level because each collision can refer to multiple participants.

It is also worth noting that drivers have been divided into two groups, based on eyesight requirements for licences. It is conceivable that a collision could involve one or more drivers from each of these groups. Counting the collisions involving drivers from the two different groups would limit insight into the circumstances and adding the two sets of drivers together would result in double (or more) counting for the reasons set out above.

To summarise, this analysis refers to police-attended injury collisions on the public road, where an attending police officer has chosen to record certain key contributory factors related to the incident. Both collisions which were not attended, and collisions for which the attending officer did not choose to record CFs, have been entirely excluded from the analysis. For the time period of this analysis (2006-2013), there were 1,295,540 police reported injury collisions in Great Britain and 1,008,929 of these collisions were police attended and at least one CF was recorded. This represents 78% of police recorded injury collisions.

For the purpose of this study, we only examined the contributory factors which may be linked to vision, health, impairment or disability. These are listed below:

Drivers/riders

CF405 Failed to look properly
CF406 Failed to judge other person's path or speed

CF504 Uncorrected, defective eyesight
CF505 Illness or disability, mental or physical

CF705 Dazzling headlights
CF706 Dazzling sun

Pedestrians

CF802 Failed to look properly
CF803 Failed to judge other person's path or speed

CF810 Illness or disability, mental or physical

Participant Groups

Four participant groups were identified, based on eyesight requirements for driver licences:

'Normal' or 'Group 1' Drivers – includes cars; taxis; minibuses; motorbikes; goods vehicles 3.5 tonnes maximum gross weight (mgw) and under; and tractors.

'Specialist' or 'Group 2' Drivers – includes buses and goods vehicles over 3.5 tonnes mgw.

'Other' – includes horses; pedal cyclists; and mobility scooters

‘Pedestrians’ – includes injured adult pedestrians

Driver analysis

MAST Professional (an advanced version of MAST) enables the data to be analysed by type of driver/rider or pedestrian who was involved in the collision and also the age of each person. It is generally accepted that the incidence of visual problems increases with age. This can be due to natural changes within the eye such as presbyopia, when the lens loses its ability to focus on close objects or eye diseases such as cataract, glaucoma, diabetic retinopathy and age-related macular degeneration (AMD).

There is no single definition of ‘older people’, but for the purpose of this study we have used age 60 as a cut-off point to define older drivers. We have chosen age 60 for two reasons. Firstly, individuals become eligible for NHS funded sight tests at age 60 on the grounds of age (NHS Choices, 2015) and secondly the College of Optometrists advises drivers age 60 and over to increase the frequency of sight tests from every 5 years (age 40) to every 2 years (College of Optometrists, 2011a). Age 60 was therefore used in the data analysis to investigate if older people are more or less likely to have collisions which involved a contributory factor related to vision or health.

It should be noted that MAST Online uses age bands in ten year increments (45-54, 55-64, etc). Dividing the population at age 60 created two five-year groups of 55-59 and 60-64, before reverting to the MAST Online conventional ten-year groups of 65-74, 75-84 and 85+.

Group 1 versus Group 2 licence holders analysis

Drivers are divided into Group 1 (normal driving licence holders) and Group 2 (professional driving licence holders). The DVLA visual standards for driving differ significantly between Group 1 and Group 2 drivers, with Group 2 drivers being required to meet stricter criteria. For Group 1 drivers with no reportable medical conditions, apart from correctly reading a number plate at the driving test, there is no requirement to have a formal eye examination or prove that eyesight meets current standards until the age of 70 when a licence is renewed.

In contrast, Group 2 licence holders have more stringent eyesight standards. This is formally assessed within a medical examination, which is required for an initial application and then at specific time intervals after that, determined by the age of the driver. It was therefore hypothesized that Group 2 drivers would have fewer collisions that involve contributory factors related to vision. The DVLA current visual standards are reproduced below and are available from Gov.UK (2015).

Driving eyesight rules

"You must wear glasses or contact lenses every time you drive if you need them to meet the 'standards of vision for driving'.
You must tell DVLA if you've got any problem with your eyesight that affects both of your eyes, or the remaining eye if you only have one eye

This doesn't include being short or long sighted or colour blind. You also don't need to say if you've had surgery to correct short sightedness and can meet the eyesight standards."

"You could be prosecuted if you drive without meeting the standards of vision for driving." (https://www.gov.uk/driving-eyesight-rules).

Standards of vision for driving

"You must be able to read (with glasses or contact lenses, if necessary) a car number plate made after 1 September 2001 from 20 metres.
You must also meet the minimum eyesight standard for driving by having a visual acuity of at least decimal 0.5 (6/12) measured on the Snellen scale (with glasses or contact lenses, if necessary) using both eyes together or, if you have sight in one eye only, in that eye.
You must also have an adequate field of vision - your optician can tell you about this and do a test.

Lorry and bus drivers

"You must have a visual acuity at least 0.8 (6/7.5) measured on the Snellen scale in your best eye and at least 0.1 (6/60) on the Snellen scale in the other eye.
You can reach this standard using glasses with a corrective power not more than (+) 8 dioptres, or with contact lenses. There's no specific limit for the corrective power of contact lenses.
You must have a horizontal visual field of at least 160 degrees, the extension should be at least 70 degrees left and right and 30 degrees up and down. No defects should be present within a radius of the central 30 degrees.
You must tell DVLA if you've got any problem with your eyesight that affects either eye.
You may still be able to renew your lorry or bus licence if you can't meet these standards but held your licence before 1 January 1997."

Geographical analysis

MAST contains full postcodes from STATS19 so driver home areas can be accurately assigned. The geographical information provided by MAST was interrogated to identify which types of road are most prone to crashes involving visual problems. The analysis also looked at which regions of the country drivers lived in. We then attempted to map these to the twelve regions identified by the

College of Optometrists for the purpose of governance (2014b), with the exclusion of Northern Ireland as STATS19 does not cover this region. There are nine English regions plus Scotland and Wales. The English regions match Regional Development Agency boundaries and are:

East Midlands	(Derbyshire, Leicestershire, Lincolnshire, Northamptonshire, Nottinghamshire, Rutland)
Eastern	(Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Norfolk, Suffolk)
London	(all areas)
North East	(County Durham, Northumberland, Tyne and Wear)
North West	(Cheshire, Cumbria, Greater Manchester, Lancashire, Merseyside, Isle of Man)
South East	(Berkshire, Buckinghamshire, Hampshire, East Sussex, West Sussex, Isle of Wight, Kent, Oxfordshire, Surrey)
South West	(Bristol, Cornwall, Devon, Dorset, Gloucestershire, Somerset, Wiltshire)
West Midlands	(Herefordshire, Shropshire, Staffordshire, Warwickshire, West Midlands, Worcestershire)
Yorkshire and Humber	(Humber, East Riding, North Yorkshire, South Yorkshire, West Yorkshire)

There are 81 Local Optical Committees (LOCs) in England located within specific geographical boundaries, and these are broadly aligned with the current arrangements of NHS England Area Teams in 2014/15. LOCs are formal optical groups with statutory obligations to represent the interests of local Optometrists, Dispensing Opticians and Optical practices. They are funded by a locally agreed statutory levy on NHS sight tests, and play a significant role in local negotiations.

In some geographical areas, Clinical Commissioning Groups (CCGs) have commissioned additional community eye care services from Optical practices, and this usually requires local negotiation between LOCs and CCGs. LOCs are supported by the Local Optical Committee Support Unit (LOCSU), who assist in the development of local eye care services. However, there is a wide variation in service provision across England, and this is represented via the LOCSU interactive map 'Atlas map of Optical Variation' (LOCSU, 2014).

Additional STATS19 analysis was carried out at the level of LOCSU Optical Areas identified from the LOCSU Atlas map of optical variation. This map shows the availability of a range of community eye care pathways in England according to the current arrangement of NHS England Area Teams and Clinical Commissioning Groups. Table 2 lists the areas used in subsequent analyses.

Table 2 LOCSU Optical areas used in the analysis

England
North East London
North West London
South London
Arden, Herefordshire & Worcestershire
Birmingham, Solihull & the Black Country
Derbyshire & Nottinghamshire
East Anglia
Essex
Leicestershire & Lincolnshire
Shropshire & Staffordshire
Hertfordshire & the South Midlands
Cheshire, Warrington & Wirral
Cumbria, Northumberland, Tyne & Wear
Durham, Darlington & Tees
Greater Manchester
Lancashire
Merseyside
North Yorkshire & Humber
South Yorkshire & Bassetlaw
West Yorkshire
Bath, Gloucestershire, Swindon & Wiltshire
Bristol, North Somerset, Somerset & South Gloucestershire
Devon, Cornwall & Isles of Scilly
Kent & Medway
Surrey & Sussex
Thames Valley
Wessex
Scotland
Wales

Calculation of Indices

Using indices is important as it allows findings to be put into context by comparing collision circumstances with collision involvement. If contributory factor analysis was undertaken in isolation, some types of driver could be identified as receiving certain contributory factors less often (or more often) than other types of driver. However, it could be that the type of driver in question is also involved in collisions less often than other types of driver. This would mean that they receive the contributory factor in proportion to their overall collision-involvement and are not under-represented at all.

Indices were calculated by determining the number of drivers involved in injury collisions in each age group for the condition or contributory factor in question as a percentage of all drivers involved in injury collisions in each age group. This is then multiplied by 100 to create an index. In some cases, the number of drivers who received the contributory factor was used as the base for looking at circumstances where the contributory factor was applied (lighting conditions, weather conditions etc).

For example, if 20% of collision-involved drivers are aged over 60 years old and 20% of drivers who received the contributory factor 'Uncorrected, defective eyesight' were also aged over 60 years old, then they would be no more likely to receive that contributory factor than any other aged driver and would have an index of 100. If, however, 40% of those who received the contributory factor 'Uncorrected, defective eyesight' were aged over 60 years old (but only 20% of collision-involved drivers were over 60 years old) then the index would be 200, which would indicate that twice as many older drivers were receiving that contributory factor than the norm. Index values of over 100 indicate an over-representation and indices under 100 indicate under-representations. The larger the number, the more over-represented that group is.

Experian's Mosaic Public Sector

Road Safety Analysis's Mosaic profiling uses Experian's Mosaic Public Sector cross-channel classification system, which is assigned uniquely for each casualty and vehicle user based on individual postcodes in STATS 19 records. Typically nearly 85% of casualty and driver STATS19 records can be matched to Mosaic Types, so residency analysis is based on about five out of six residents involved in reported injury collisions.

This report displays Mosaic analysis as column charts, to facilitate quick and easy insight into residents and relative risk. In these charts, the grey columns denote the absolute number of resident drivers in each Mosaic Group, corresponding to the value axis to the left of the chart. The red columns in the foreground provide an **index** for each Mosaic Group. These indices are 100 based, where a value of 100 indicates the number of drivers in that Group is exactly in proportion to the population size of that Group in Great Britain. Indices over 100 indicate **over representation** of that Group among drivers relative to the population: for example, a value of 200 would signify that people resident in communities of that Group were involved in collisions at twice the expected rate. Conversely, indices below 100 suggest **under representation**, so an index of 50 would imply half the expected rate. Inevitably, index values become less significant as numbers of involved residents decrease, because increased random fluctuations tend to decrease levels of confidence.

Additional data analyses and significance testing were performed using the Statistical Package for the Social Sciences (SPSS) Version 21. The independent samples t-test was used to compare CFs for drivers and pedestrians aged under 60 and 60 plus. For each CF, the number of people in each age band was calculated as a percentage of the total number of people in each age band involved in a police-attended collision and receiving at least one CF. Results are expressed as 95% confidence intervals (CIs) of the difference in mean percentage scores.

Results

In Great Britain, for the period 2006-2013, there were a total of 1,295,540 police reported injury collisions recorded on STATS19. Of these, 1,008,929 injury collisions were attended by a police officer where at least one contributory factor (CF) was assigned to any party in the collision. This represents 78% of police recorded injury collisions. Subsequent analyses are based on these data. Therefore this is a subset of the overall reported collisions and represents the minimum number of collisions where these circumstances could have occurred.

Table 3 shows the number of drivers and pedestrians aged under 60 or 60 or over who were *involved* in an injury collision which was attended by a police officer and where at least one CF was recorded. This table also provides figures for drivers and pedestrians who received a CF. As more than one person can be involved in a collision, the number of injury collisions is lower than the total number of participants. However, as not every participant in a collision has CFs attributed to them, the number of overall participants is higher than the number receiving CFs.

Table 3: Number of drivers/pedestrians involved in injury collisions where a CF was recorded and those receiving a CF

	Involved parties in injury collisions attended by police where at least one CF was recorded*	**Involved parties who received any CF****
Normal drivers (all)	**1,528,875**	**896,444**
Age <60 No. (%)	1,345,673 (88%)	787,445 (88%)
Age ≥60 No. (%)	183,202 (12%)	108,999 (12%)
Specialist drivers (all)	**86,876**	**47,196**
Age <60 No. (%)	78,061 (90%)	42,526 (90%)
Age ≥60 No. (%)	8,815 (10%)	4,670 (10%)
Pedestrians (all)	**109,172**	**76,546**
Age <60 No. (%)	83,804 (77%)	59,625 (78%)
Age ≥60 No. (%)	25,368 (23%)	16,921 (22%)

* all drivers/pedestrians of each type who were involved in injury collisions attended by the police where at least one CF was recorded regardless of whether the driver/pedestrian in question was the one to receive the CF.
** all the drivers/pedestrians in each type who actually received the CF.

Figures 1 to 3 show the distribution of injury collisions where a CF was recorded, by age group, for normal (Group 1) drivers, specialist (Group 2) drivers and pedestrians. There was a higher proportion of older people in the pedestrian group than in the drivers groups. Although there was a similar proportion of drivers aged 60 and over in the normal and specialist groups, there were few drivers aged 65 and over in the specialist group.

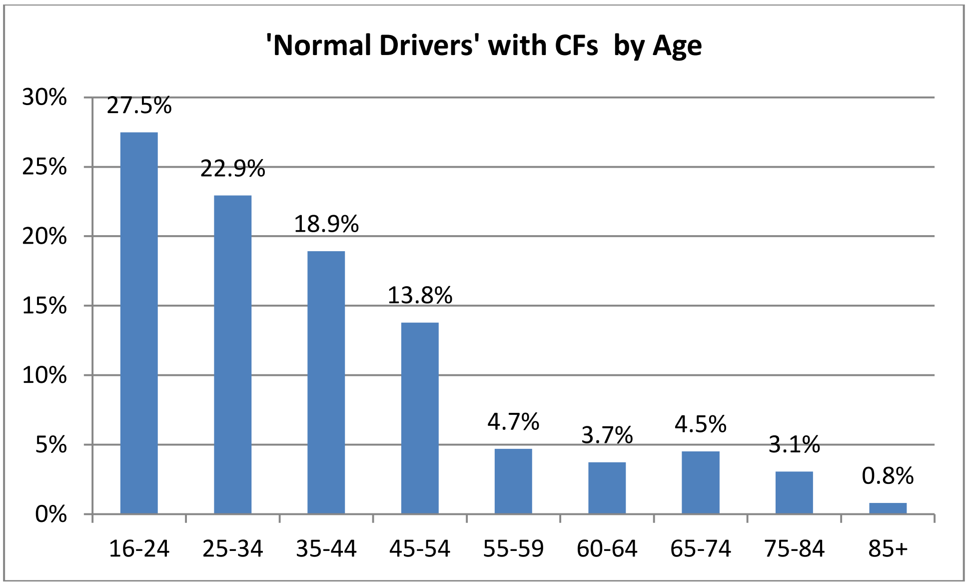

Figure 1: Normal (Group 1) drivers with contributory factors, by age group

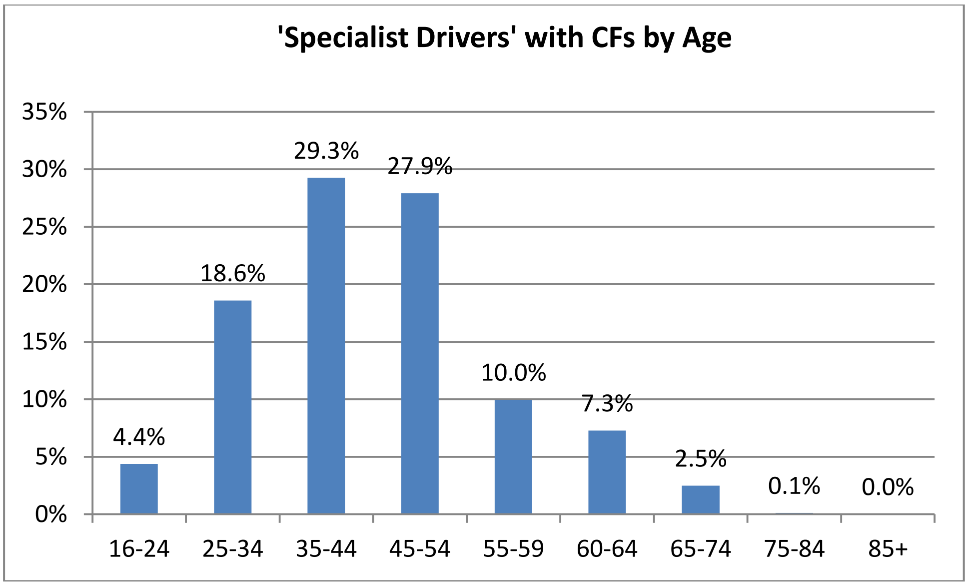

Figure 2: Specialist (Group 2) drivers with contributory factors, by age group

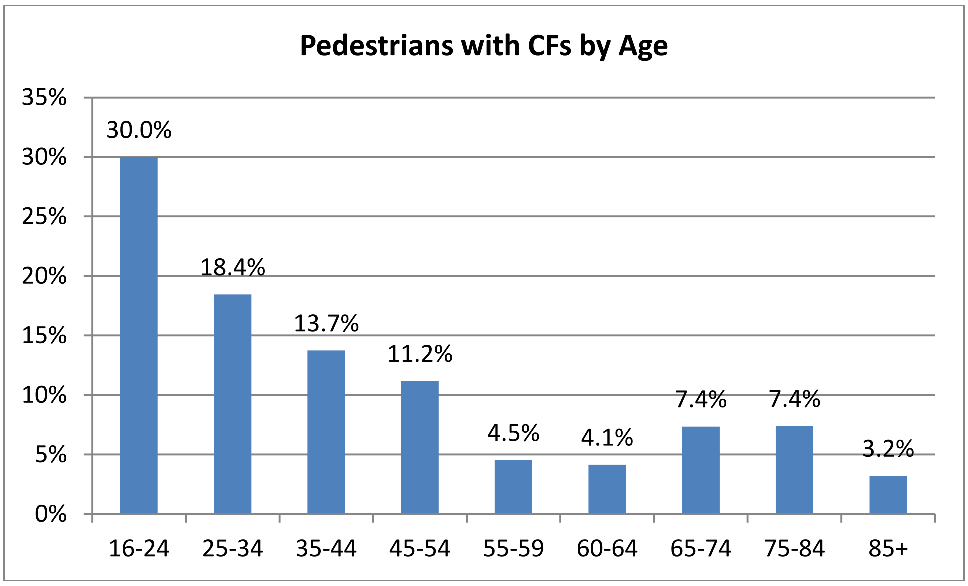

Figure 3: Pedestrians with contributory factors, by age group

Contributory Factors and Age

There is no difference between the rates at which contributory factors are assigned by age. Therefore, overall, normal drivers aged 60 and over are no more likely to receive a CF than those under 60.

Results pertaining to each of the contributory factors associated with vision and illness are detailed below. In the following charts depicting indices, the grey columns denote the absolute number of normal drivers, corresponding to the value axis to the left of the chart. The red columns in the foreground provide an index for each age group. These indices are 100 based, where a value of 100 indicates the number of drivers in that Group is exactly in proportion to the population size of that Group in Great Britain.

CF405 – Failed to look properly

Of the CFs related to vision, ‘Failed to look properly’ is the most commonly assigned contributory factor. It was assigned to normal drivers 328,077 times during the seven year study period. Nearly half of all normal drivers in the oldest age groups (75 years and over) received the CF405. Just over one third of specialist drivers received the CF405 (percentages are based on very small numbers for age groups 75-84 (23 out of 55 people) and 85+ (2 out of 6 people). Figure 4 shows CF405 as a percentage of all CFs assigned to each age group.

Figure 5 shows the number and indices for normal drivers aged 60 and over and those aged under 60. For CF405, drivers aged under 60 are close to the norm, but drivers aged 60 and over are over-represented. There was a significant difference between the age groups with drivers aged 60 and over more likely to receive CF405 than younger drivers ($t = 3.2$, $df=7$, $p = 0.015$, CI: 2.20 – 14.65).

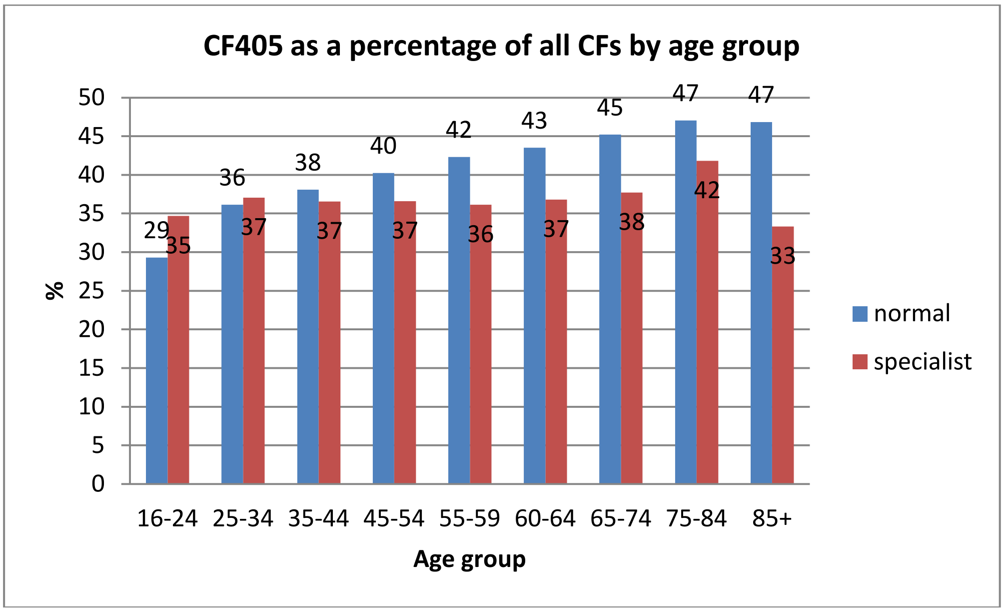

Figure 4: CF405 ‘Failed to look properly’ attributed to normal and specialist drivers, as a percentage of all CFs allocated to each age group.

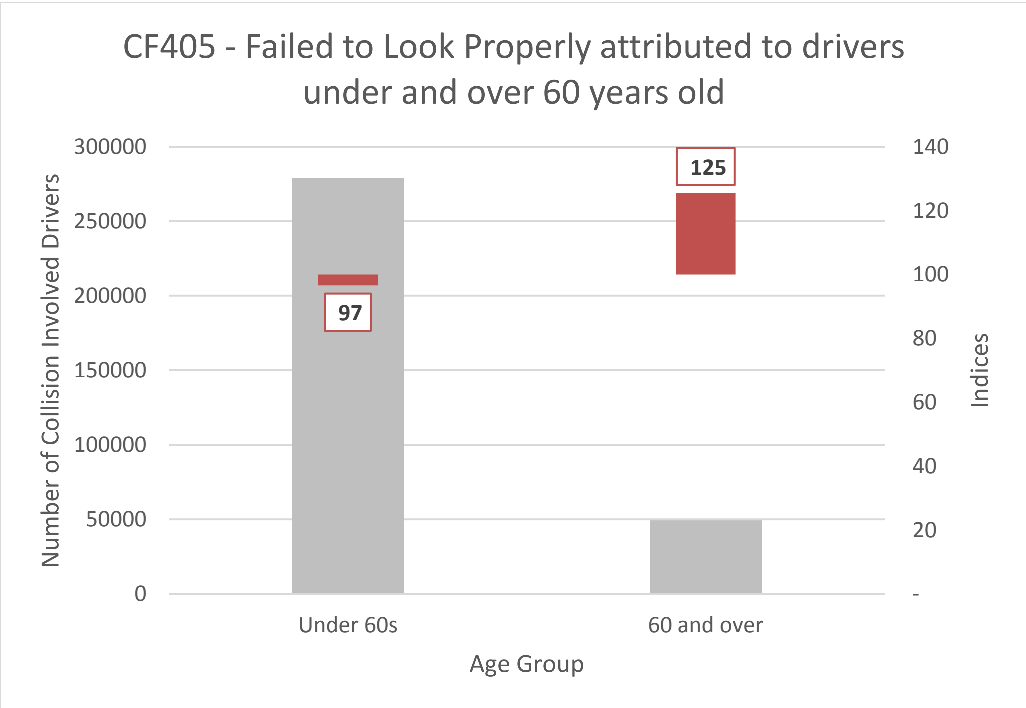

Figure 5: CF405 ‘Failed to look properly’ attributed to normal drivers aged under 60 and 60 and over (number of collisions and indices)

CF405 was further analysed to take account of time of year, weather conditions, time of day and lighting conditions. There is little variation from the norm in the assigning of CF405 throughout the year for either age group against the overall levels of CF405 assignment. There was little variation in the weather conditions when CF405 was assigned to under 60s. However, drivers aged 60 and over had an index of 117 for receiving CF405 in ‘Fine and windy’ weather.

Table 4 shows that normal drivers aged 60 and over were under-represented for night driving where there was street lighting. There was a significant difference in the percentage of older and younger drivers receiving CF405 in for both daylight (t = 3.42, df = 7, p = 0.01, CI: 2.32 – 12.71) and at night (t = -3.82, df = 7, p = 0.007, CI: -12.58 to -2.96).

Table 5 shows CF405 by time of day. Older drivers were under-represented during the late evening and night-time and early morning.

Table 4: Indices for normal drivers receiving CF405 by lighting conditions

Age Group	Dark	Daylight	Night – Lights lit
Under 60s	98	99	105
60+	109	108	69

Table 5: Indices for normal drivers receiving CF405 by time of day

Age Group	00:00-06:00	06:00-12:00	12:00-18:00	18:00-00:00
Under 60s	111	99	97	105
60+	35	106	116	69

There was no difference in the rates at which specialist drivers received CF405 for any of the above factors, including age.

There is no difference in assigning CF405 for men and women aged under 60. Women from the 60 and over age group are slightly more likely to receive CF405 (index of 105).

CF406 – Failed to judge other person’s path or speed

CF406 was assigned to normal drivers 182,435 times during the seven year study period. Figure 6 shows the number and indices for normal drivers aged 60 and over and those aged under 60. For CF406, drivers aged under 60 are close to the norm (index of 98), but drivers aged 60 and over are over-represented (index of 117). There was a significant difference between the age groups with drivers aged 60 and over more likely to receive CF406 than younger drivers (t = 3.96, df=7, p = 0.005, CI: 1.28 – 5.07).

Table 6 shows that normal drivers aged 60 and over were again under-represented for night driving where there was street lighting. Table 7 shows CF406 by time of day. Older drivers were significantly under-represented during the late evening and night-time and early morning.

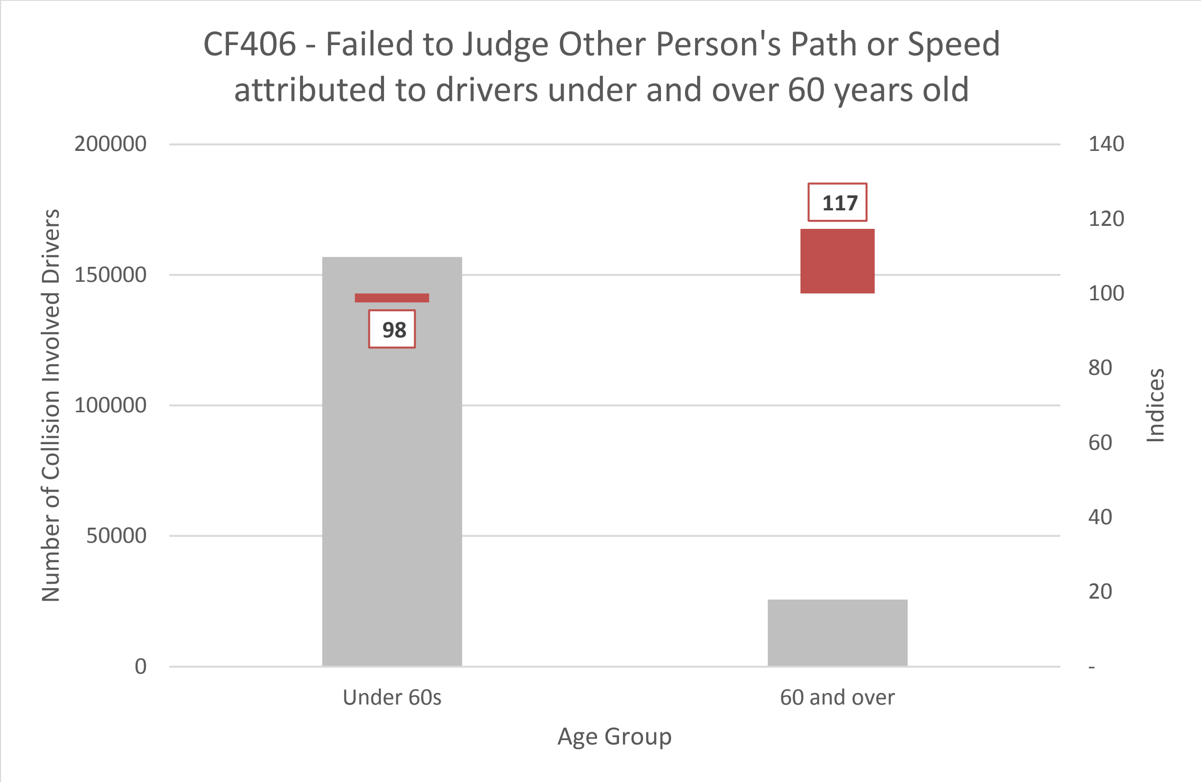

Figure 6: CF406 ‘Failed to judge another person’s path or speed’ attributed to normal drivers aged under 60 and 60 and over (number of collisions and indices)

Table 6: Indices for normal drivers receiving CF406 by lighting conditions

Age Group	Dark	Daylight	Night – Lights lit
Under 60s	99	99	106
60+	107	108	66

Table 7: Indices for normal drivers receiving CF406 by time of day

Age Group	00:00-06:00	06:00-12:00	12:00-18:00	18:00-00:00
Under 60s	112	100	99	106
60+	30	97	108	63

There is little variation for the norm in the assigning of CF406 throughout the year for either age group against the overall levels of CF406 assignment. There was little variation in the weather conditions when CF406 was assigned to under 60s. However, over 60s had an index of 110 for receiving CF406 in ‘Fine and windy’ weather.

There is no difference in assigning CF406 for men and women aged under 60. Women from the 60 and over age group are slightly more likely to receive CF406 (index of 105).

Figure 7 compares results for CF405 (failed to look) with results for CF406 (failed to judge) by lighting conditions and age group for normal drivers. Older drivers received fewer CFs 405 and 406 than younger drivers during hours of darkness. However, older drivers received slightly more CFs 405 and 406 than younger drivers during daylight hours.

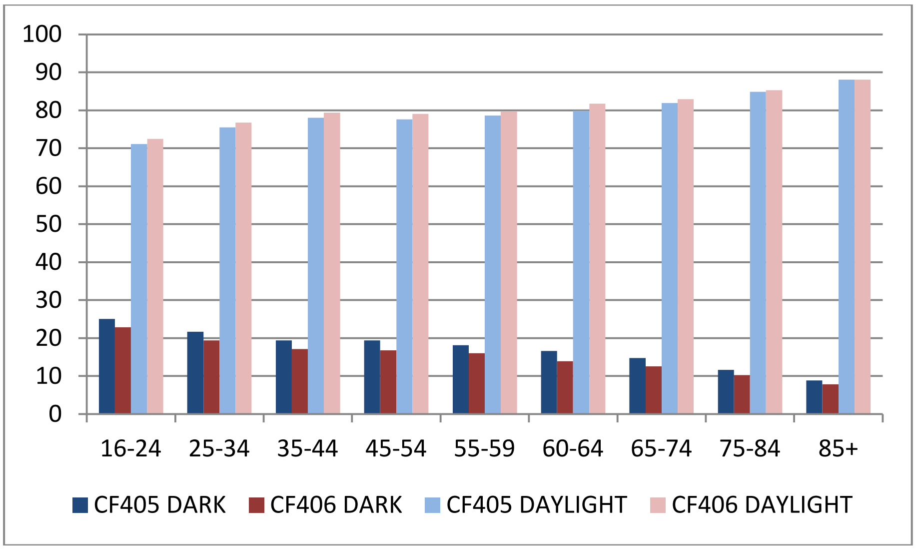

Figure 7: CF405 ‘Failed to look properly’ and CF406 ‘Failed to judge other person’s path or speed’ by lighting conditions and age group for normal drivers:

CF504 – Uncorrected, defective eyesight

There was a highly significant difference between normal drivers aged under 60 and those aged 60 and over for receiving CF504 ‘Uncorrected, defective eyesight’. Normal drivers aged 60 and over have an index of 640 for receiving CF504 compared to 26 for under 60s. However, over the seven year study period, CF504 was assigned to normal drivers only 1679 times.

Table 8 shows that normal drivers aged 60 and over were again under-represented for night driving both where there was street lighting and in the dark. There was a significant difference in the percentage of older and younger drivers receiving CF504 in the dark ($t = -3.36$, $df = 7$, $p = 0.01$, CI: -7.66 to -1.33); in daylight ($t = 3.37$, $df = 7$, $p = 0.01$, CI: 4.42 – 25.25) and at night with street lighting ($t = -2.67$, $df = 7$, $p = 0.03$, CI: -19.50 to -1.19). Figure 8 illustrates the differences by lighting conditions and age group.

Table 9 shows CF504 by time of day. Older drivers were significantly under-represented during the late evening and night-time and early morning. There was a significant difference in the percentage of older and younger drivers receiving CF504 between midnight and 6am ($t = -4.01$, $df = 7$, $p = 0.005$, CI: -10.48 - -2.71) and between noon and 6pm ($t = 2.46$, $df = 7$, $p = 0.04$, CI: 0.46 – 24.62).

Table 8: Indices for normal drivers receiving CF504 by lighting conditions

Age Group	Dark	Daylight	Night – Lights lit
Under 60s	163	82	160
60+	81	105	82

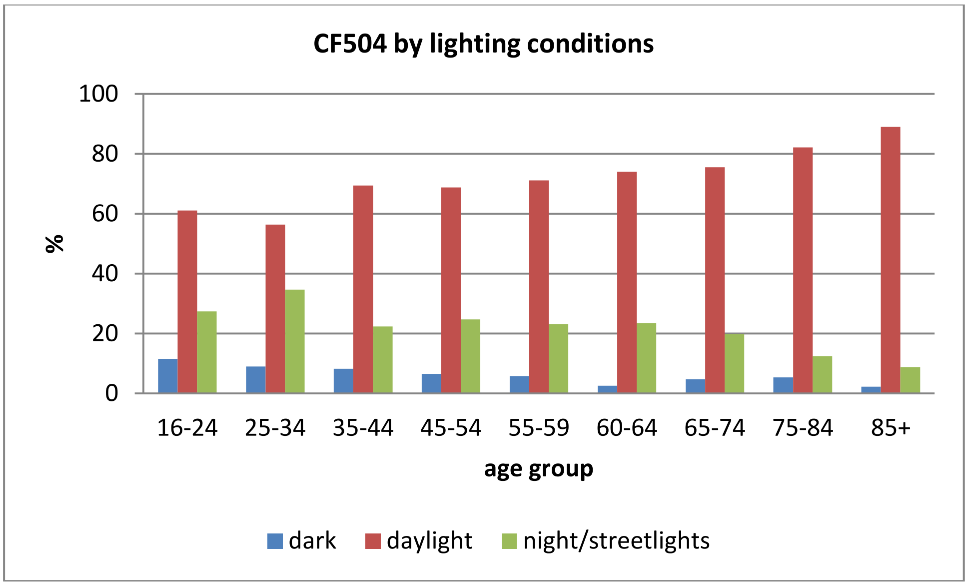

Figure 8: CF504 by lighting conditions and age attributed to normal drivers

Table 9: Indices for normal drivers receiving CF504 by time of day

Age Group	00:00-06:00	06:00-12:00	12:00-18:00	18:00-00:00
Under 60s	330	87	78	156
60+	30	104	107	83

Figure 9 shows the number and indices for normal drivers aged 60 and over and those aged under 60. For CF504, drivers aged under 60 are under-represented, but drivers aged 60 and over are extremely over-represented. However, due to low numbers there was no significant difference between the age groups ($t = 2.05$, $df = 7$, $p = 0.08$, CI: -0.30 - +4.13). Almost three-quarters (72%) of assignments of CF504 were to drivers aged 65 and over. When the age cut-off was raised to under 65 and 65 and over, there was a significant difference between the age groups ($t = 3.02$, $df = 7$, $p = 0.02$, CI: 0.54 – 4.43).

The likelihood of being assigned CF504 increases with age. The following indices are compared against total crash-involvement for these age groups:

- normal drivers aged 40+ have an index of 198 for receiving CF504 compared to an index of 23 for under 40s
- normal drivers aged 60 and over have an index of 640 for receiving CF504 compared to an index of 26 for under 60s

- normal drivers aged 70 and over have an index of 1332 for receiving CF504 compared to an index of 35 for under 70s

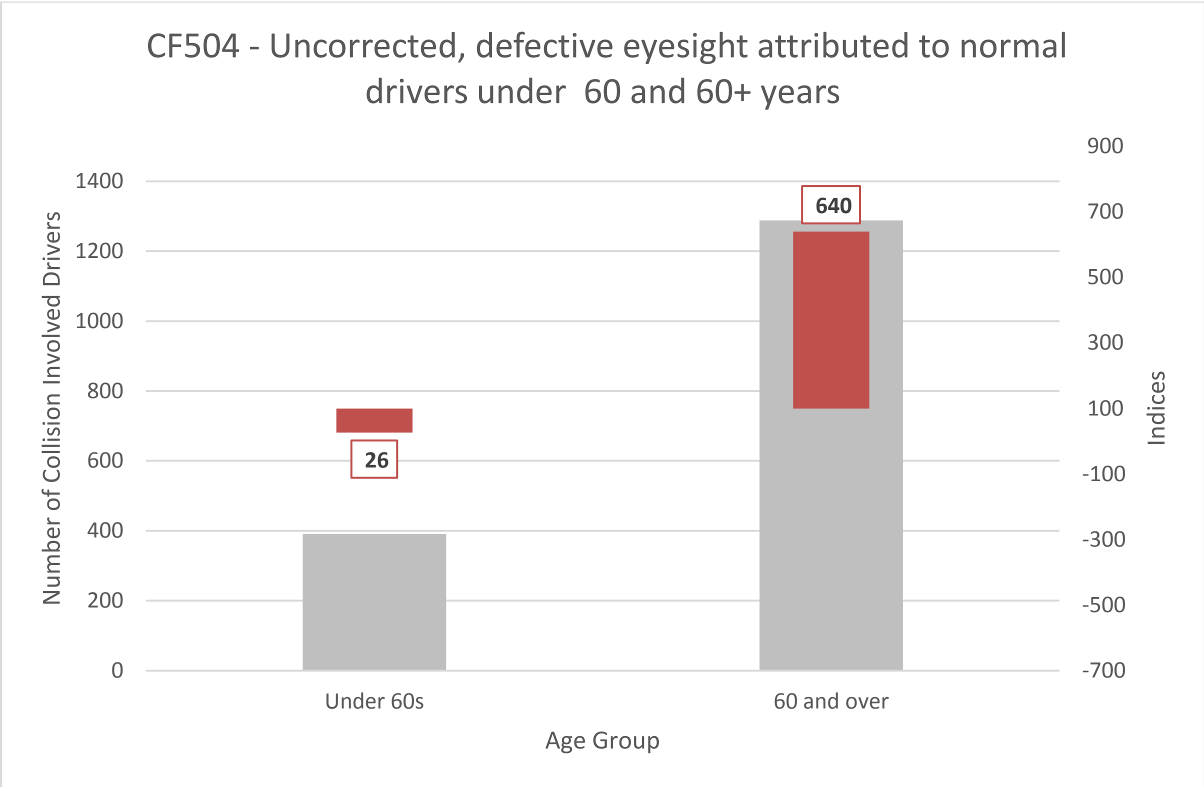

Figure 9: CF504 'Uncorrected, defective eyesight' attributed to normal drivers aged under 60 and 60 and over (number of collisions and indices)

There is little variation from the norm in the assigning of CF504 throughout the year for drivers aged 60 and over. For the under 60s group, there were higher indices in February (113), March (121), June (116) and November (113).

There was little variation in the weather conditions when CF504 was assigned to the 60 and over age group. Most incidences of CF504 took place in 'good' weather. However, drivers under 60s had an index of 129 for receiving CF504 in 'other conditions' and 137 for 'wet and still' weather.

Uncorrected, defective eyesight is **not** an issue amongst specialist drivers (those with more stringent eyesight requirements). Only 0.02% of all specialist drivers involved in police-attended collisions received CF504.

CF504 is most often assigned to motorists, only 0.04% of cyclists were assigned CF504.

There is no difference in assigning CF504 for men and women aged under 60. Men from the 60 and over age group are slightly more likely to receive CF504 (index of 106).

Association between CF405 'Failed to look properly' and CF504 'Uncorrected, defective eyesight'

The relationship between CF405 and CF504 was examined for normal drivers. Overall, only 0.06% of all drivers were assigned both CF405 and CF504. (920/1,528,875). Of those assigned CF405, 0.3% were also assigned CF504. (920/328,077). Of those assigned CF504, 54.8% were also assigned CF405. (920/1,679). Table 10 shows the results.

When the data were examined by age, normal drivers aged 60 and over were more likely to be assigned both CF405 and CF504. In the over 60 age group, 0.41% received both CF405 and CF504 (compared to 0.06% of all ages). For those assigned CF405, 1.5% also had CF504 (compared to 0.3% of all ages). Of those assigned CF504, 57.6% were also assigned CF405 (compared to 54.8% of all ages).

Table 10 Relationship between CF405 and CF504 for normal drivers (number of drivers in police-attended collisions where at least one CF was recorded)

	CF504 not assigned	**CF504 assigned**	**Total**
CF405 not assigned	1,200,039	759	1,200,798
CF405 assigned	327,157	920	328,077
Total	1,527,196	1,679	1,528,875

CF505 – Illness or disability, mental or physical

CF505 was assigned to normal drivers 14,337 times during the seven year study period. There was a highly significant difference between normal drivers aged under 60 and those aged 60 and over for receiving CF505 'Illness or disability, mental or physical'. Normal drivers aged 60 and over have an index of 410 for receiving CF505 compared to 58 for under 60s. Figure 10 illustrates these results. There was a significant difference between the age groups with normal drivers aged 60 and over more likely to receive CF505 than younger drivers (t = 3.67, df=7, p = 0.008, CI: 2.31 – 10.66).

Table 11 shows that normal drivers aged 60 and over were less likely than younger drivers to be assigned CF505 in hours of darkness or at night with streetlights lit. The over 60s were more likely to receive CF505 than younger drivers during daylight. There was a significant difference in the percentage of older and younger drivers receiving CF505 in the dark (t = -2.32, df = 7, p = 0.05, CI: -6.29 to +0.06); in daylight (t = 2.94, df = 7, p = 0.02, CI: 1.91 – 17.56) and at night with street lighting (t = -3.15, df = 7, p = 0.02, CI: -11.60 to -1.64).

Table 12 shows that older drivers were rarely assigned CF505 during the hours between midnight and 6am, and between 6pm and midnight. Older drivers were more likely to receive CF505 during the daytime, especially during the afternoon. There was a significant difference in the percentage of older and younger drivers receiving CF505 between midnight and 6am (t = -2.68, df = 7, p = 0.03, CI: -7.80 to -0.49), between 6am and noon (t = -2.31, df = 7, p = 0.05, CI: -3.92 to +0.05), between noon and 6pm (t = 4.64, df = 7, p = 0.002, CI: 7.46 – 22.94), and between 6pm and midnight (t = -4.05, df = 7, p = 0.005, CI: -14.45 to -3.79).

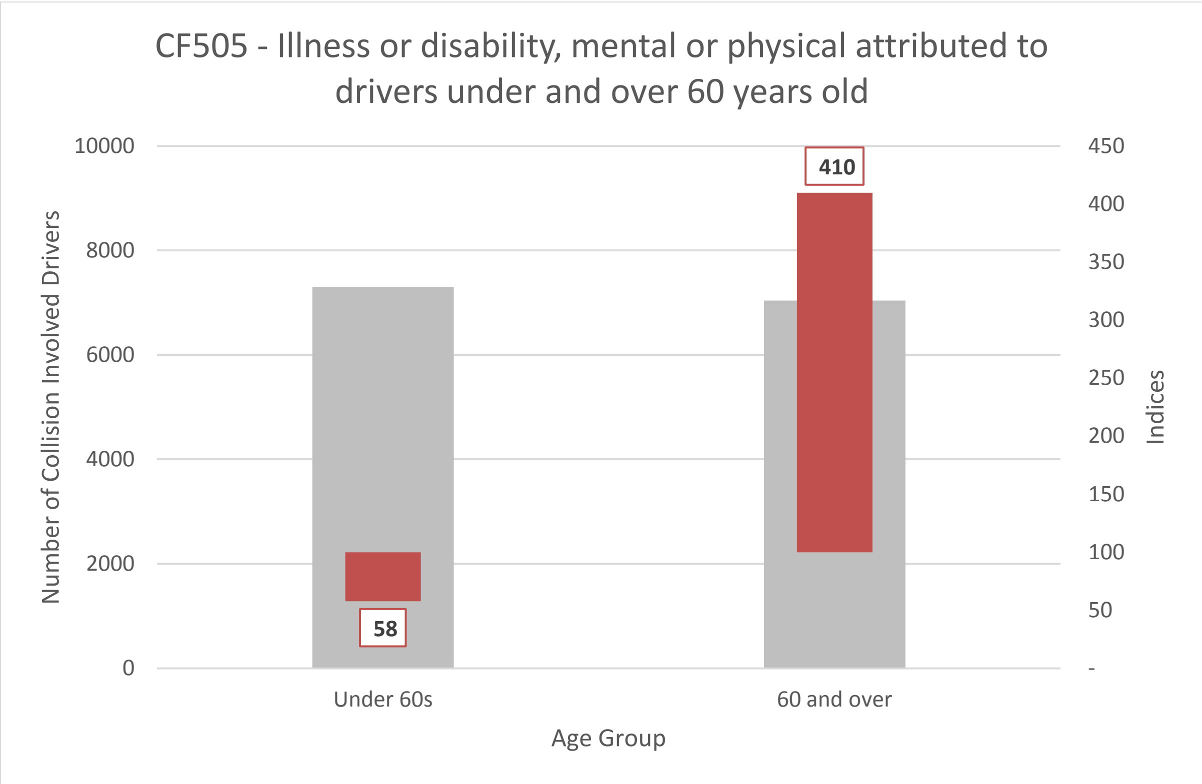

Figure 10: CF505 ‘illness or disability’ attributed to normal drivers aged under 60 and 60 and over (number of collisions and indices)

Table 11: Indices for normal drivers receiving CF505 by lighting conditions

Age Group	Dark	Daylight	Night – Lights lit
Under 60s	125	94	126
60+	74	106	73

Table 12: Indices for normal drivers receiving CF505 by time of day

Age Group	00:00-06:00	06:00-12:00	12:00-18:00	18:00-00:00
Under 60s	157	104	86	127
60+	41	96	115	72

There is little variation from the norm in the assigning of CF505 throughout the year for either age group against the overall levels of CF505 assignment. Regarding weather conditions, older drivers were more likely than younger drivers to be assigned CF505 during fine and windy or wet and windy conditions. Table 13 shows the results.

Table 13: Indices for normal drivers receiving CF505 by weather

Age Group	Fine & windy	Fog & mist	Other	Wet & still	Wet & windy	Fine & still
Under 60s	90	102	116	104	89	100
60+	111	97	84	96	111	100

There is no difference in assigning CF505 for men and women aged under 60. Men from the 60 and over age group are slightly more likely to receive CF505 (index of 106).

The relationship between CF504 (impaired vision) and CF505 (illness or disability) was explored. Figure 11 shows the percentage of drivers receiving these CFs and that older drivers are more likely to receive both of these CFs than younger drivers.

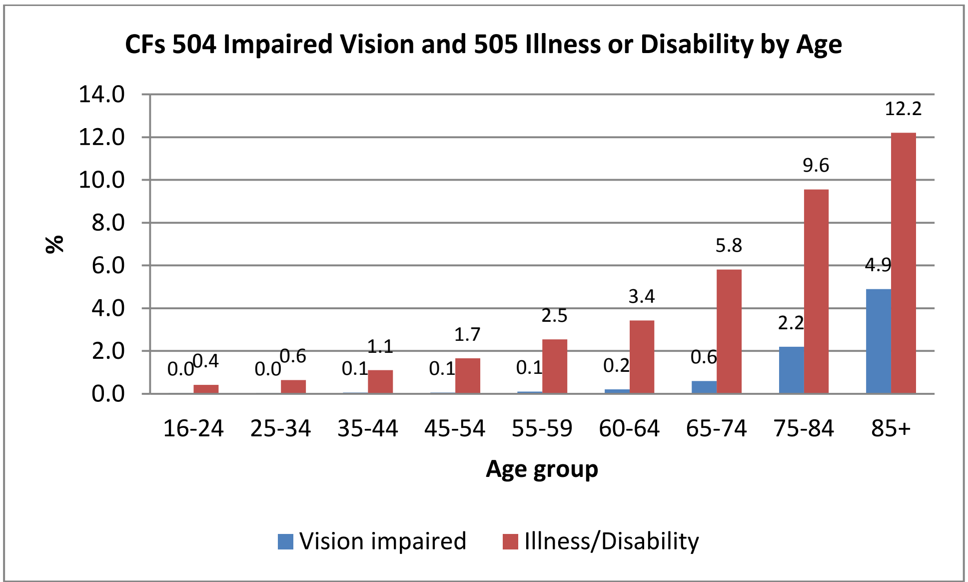

Figure 11: CF504 and CF505 by age group (normal drivers)
(For each age group, percentages are based the total number of injury collisions where the driver received at least one CF. Total n = 896,444)

CF705 – Dazzling headlights

CF705 was assigned to normal drivers 2855 times during the study period. Normal drivers aged 60 and over are significantly more likely to be assigned CF705 (dazzling headlights) than drivers aged under 60 (t = 4.14, df=7, p = 0.004, CI: 0.11 – 0.41). Older drivers have an index of 175 compared to 90 for under 60s. Figure 12 illustrates the results.

Table 14 shows the indices for older and younger normal drivers receiving CF705 by lighting conditions. Table 15 shows the indices by time of day. Dazzling headlights can be an issue during the day, as bad weather could be the reason for the lights or daylight running lights were used and either may cause dazzle.

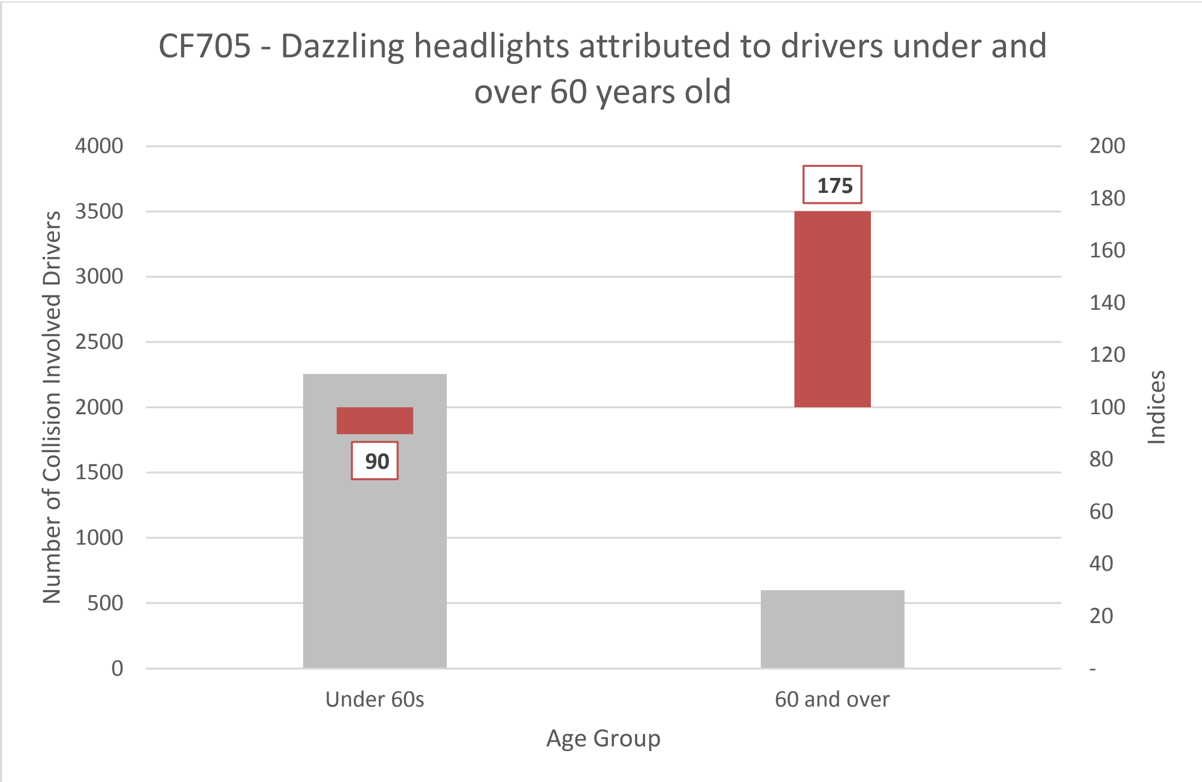

Figure 12: CF705 ‘dazzling headlights’ attributed to normal drivers aged under 60 and 60 and over (number of collisions and indices)

Table 14 Indices for normal drivers receiving CF705 by lighting conditions

Age Group	Dark	Daylight	Night – Lights lit
Under 60s	105	98	96
60+	82	106	117

Table 15 Indices for normal drivers receiving CF705 by time of day

Age Group	00:00-06:00	06:00-12:00	12:00-18:00	18:00-00:00
Under 60s	118	105	89	102
60+	31	80	140	92

The under 60s group have higher indices for CF705 between May and August (111, 119, 112 and 112). There are higher indices in the 60 and over age group in November and December (119 and 118).

There was little variation in the weather conditions when CF705 was assigned to under 60s, apart from for ‘other’ conditions (with an index of 112). Over 60s had an index of 119 for receiving CF705 in ‘Fine and windy’ weather.

There is no difference in assigning CF705 for men and women aged under 60. Women from the 60 and over age group are slightly more likely to receive CF705 (index of 108).

CF706 – Dazzling sun

CF706 was assigned to normal drivers 22,246 times during the seven year study period. Dazzling sun was a significant issue for older drivers. Normal drivers aged 60 and over have an index of 182 for receiving CF706 compared to 89 for under 60s. There was a significant difference between the age groups with normal drivers aged 60 and over more likely to receive CF706 than younger drivers ($t = 4.09$, $df=7$, $p = 0.005$, CI: 1.02 – 3.81). Figure 13 illustrates the results.

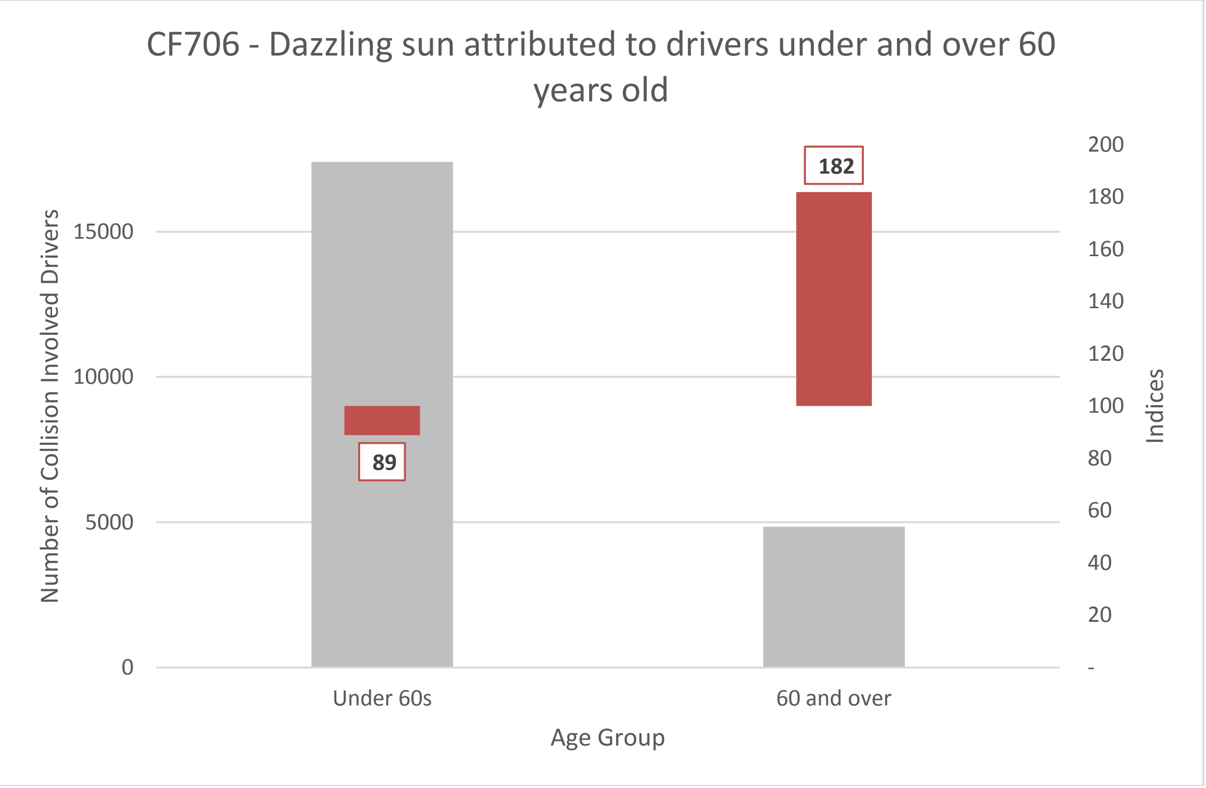

Figure 13: CF706 ‘dazzling sun’ attributed to normal drivers aged under 60 and 60 and over (number of collisions and indices)

Table 16 shows the indices for normal drivers receiving CF706 by time of day. There is little variation in the time of day when CF706 was assigned to under 60s. When analysed by month, there were higher indices for CF706 for drivers aged 60 and over in January (122), November (124) and December (129). There was little variation in the weather conditions when CF706 was assigned to under 60s. Over 60s had lower indices for receiving CF706 in ‘Wet and Still’ and ‘Wet and windy’ weather.

Table 16 Indices for normal drivers receiving CF706 by time of day

Age Group	**00:00-06:00**	**06:00-12:00**	**12:00-18:00**	**18:00-00:00**
Under 60s	111	103	94	107
60+	62	89	120	74

Specialist drivers aged 60 and over were slightly more likely to receive CF706 (107 compared to 99 for under 60s).

Women from both older and younger age groups are more likely than men to receive CF706 – 118 for under 60s and 112 for over 60s.

Figure 14 shows the percentage number of drivers in each age group (under 60s and 60 and over) who received CF705 (dazzling headlights) or CF706 (dazzling sun). For both CFs, the percentage of drivers receiving these CFs rises with age. However, dazzling sun is a greater problem than dazzling headlights.

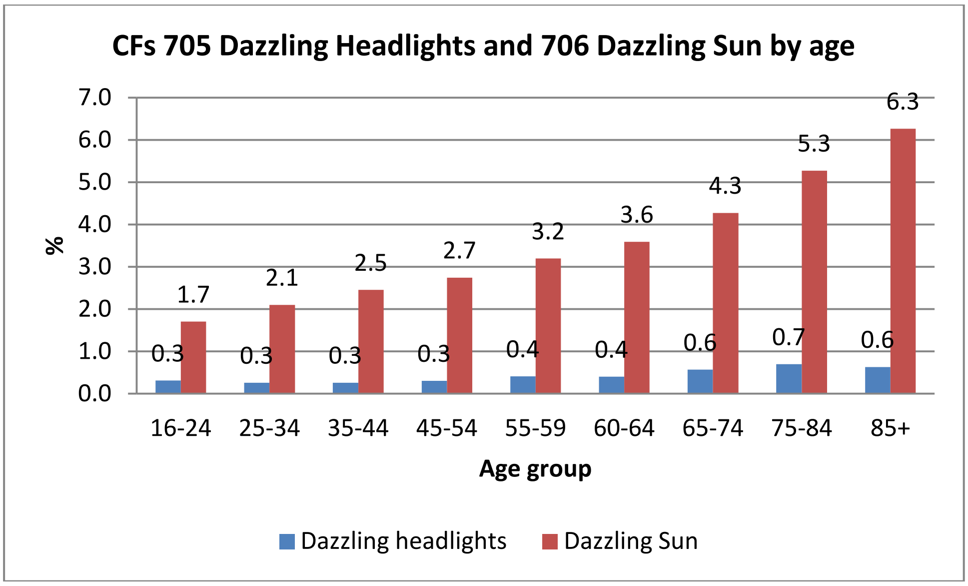

Figure 14: CF705 (dazzling headlights) and CF706 (dazzling sun) allocated to normal drivers, by age.
(For each age group, percentages are based the total number of injury collisions where the driver received at least one CF. Total n = 896,444)

Circumstances Analysis

The following tables (17 to 20) compare drivers with normal licences in the under 60s and 60 and over age groups with the vision-related CFs against road environment and driver characteristics.

Junctions

Normal drivers in the 60 and over age group were over-represented for receiving CF405 at roundabouts. Older drivers were over-represented for receiving CF406 at mini-roundabouts.

Table 17 Indices for normal drivers receiving CF405 'failed to look' by junction type (against junction type)

Age Group	**No junction**	**T junction**	**Crossroads**	**Multi-junctions**	**Other**	**Slip**	**Private**	**Mini-roundabout**	**Roundabout**
Under 60s	58	130	136	115	105	85	145	153	124
60+	55	127	127	109	109	90	135	159	140

Table 18 Indices for normal drivers receiving CF406 'failed to judge' by junction type (against junction type)

Age Group	**No junction**	**T junction**	**Crossroads**	**Multi-junctions**	**Other**	**Slip**	**Private**	**Mini-roundabout**	**Roundabout**
Under 60s	74	116	111	107	105	122	134	140	131
60+	64	118	111	98	112	125	134	155	144

Road Class

Dazzling headlights were most often a contributory factor in collisions on 'B' and 'C' class roads.

Table 19 Indices for normal drivers receiving CF705 'dazzling headlights' by road class (against road class)

Age Group	A	B	C	Unclassified	A(M)	M
Under 60s	90	153	141	99	24	11
60+	90	150	145	91	0	12

Road Type

Table 20 Indices for normal drivers receiving CF705 'dazzling headlights' by road type (against road type)

Age Group	Dual Carriageway	1 way/Slip	Roundabout	Single Carriageway
Under 60s	32	37	49	123
60+	39	49	62	117

Pedestrians

There was no difference between the assigning of CF802 (Failed to look properly) to adult pedestrians by age group. Under 60s have an index of 101 whilst drivers aged 60 and over have an index of 98. During the seven year study period there were 54,191 pedestrian casualties where CF802 was assigned. Table 21 shows the results by type of pedestrian crossing.

Older pedestrians are more likely to receive CF803 (Failed to judge vehicle's path or speed), with an index of 119, compared to 94 for under 60s. During the study period there were 18,808 pedestrian casualties where CF803 was assigned. Table 22 shows the results by type of pedestrian crossing.

Pedestrians in the 60 and over group are significantly more likely to receive CF810 (Disability or illness, mental or physical) with an index of 179, compared to the index of 76 for under 60s. During the study period there were 3559 pedestrian casualties where CF810 was assigned.

Table 21 Indices for pedestrians receiving CF802 ‘failed to look’ by pedestrian crossing (against pedestrian crossing)

Age Group	**Central refuge – no other controls**	**Footbridge or subway**	**No physical crossing facility**	**Pedestrian phase at traffic signal**	**Pelican puffin toucan or similar**	**Zebra crossing**
Under 60s	115	112	92	131	115	83
60+	117	124	95	128	109	83

Table 22 Indices for pedestrians receiving CF803 by pedestrian crossing (against pedestrian crossing)

Age Group	**Central refuge – no other controls**	**Footbridge or subway**	**No physical crossing facility**	**Pedestrian phase at traffic signal**	**PelicanPuffin Toucan or similar**	**Zebra crossing**
Under 60s	121	175	93	129	104	94
60+	128	102	102	108	88	85

Index of Multiple Deprivation

Indices of multiple deprivation were used to examine associations between deprivation level and collision-involved drivers who were assigned relevant contributory factors. Figures for the 10% - 20% most or least deprived are of particular interest. Tables 23 to 27 show the indices, and Figures 15 to 20 illustrate the results.

For CF405 (failed to look properly), a slightly higher proportion of older drivers than younger drivers fell within the ‘less deprived’ categories. The difference between older and younger drivers was greatest for CF504 (uncorrected or defective eyesight), with a significantly higher proportion of older drivers in the ‘less deprived’ 20% and a significantly lower proportion of older drivers in the ‘more deprived’ 20%. There was little difference between younger and older drivers for other CFs.

Table 23 Indices for normal drivers receiving CF405 (failed to look properly) by IMD (against IMD)

Age Group	Most deprived 10%	More deprived 20%	More deprived 30%	More deprived 40%	More deprived 50%	Less deprived 50%	Less deprived 40%	Less deprived 30%	Less deprived 20%	Least deprived 10%
Under 60s	106	110	109	102	98	96	94	94	94	94
60+	99	104	104	99	96	96	98	100	103	103

Table 24 Indices for normal drivers receiving CF406 (failed to judge) by IMD (against IMD)

Age Group	Most deprived 10%	More deprived 20%	More deprived 30%	More deprived 40%	More deprived 50%	Less deprived 50%	Less deprived 40%	Less deprived 30%	Less deprived 20%	Least deprived 10%
Under 60s	101	103	105	102	100	98	97	97	98	99
60+	97	97	101	97	99	96	99	102	106	102

Table 25 Indices for normal drivers receiving CF504 (uncorrected, defective eyesight) by IMD (against IMD)

Age Group	Most deprived 10%	More deprived 20%	More deprived 30%	More deprived 40%	More deprived 50%	Less deprived 50%	Less deprived 40%	Less deprived 30%	Less deprived 20%	Least deprived 10%
Under 60s	99	103	112	86	111	90	83	99	101	118
60+	94	71	96	95	90	94	108	101	121	110

Table 26 Indices for normal drivers receiving CF505 (illness or disability) by IMD (against IMD)

Age Group	Most deprived 10%	More deprived 20%	More deprived 30%	More deprived 40%	More deprived 50%	Less deprived 50%	Less deprived 40%	Less deprived 30%	Less deprived 20%	Least deprived 10%
Under 60s	80	86	90	100	105	106	106	111	107	111
60+	80	83	87	98	100	101	105	106	105	112

Table 27 Indices for normal drivers receiving CF705 (dazzling headlights) by IMD (against IMD)

Age Group	Most deprived 10%	More deprived 20%	More deprived 30%	More deprived 40%	More deprived 50%	Less deprived 50%	Less deprived 40%	Less deprived 30%	Less deprived 20%	Least deprived 10%
Under 60s	68	72	88	84	112	116	107	139	108	112
60+	66	75	89	114	100	97	100	115	102	111

Table 28 Indices for normal drivers receiving CF706 (dazzling sun) by IMD (against IMD)

Age Group	Most deprived 10%	More deprived 20%	More deprived 30%	More deprived 40%	More deprived 50%	Less deprived 50%	Less deprived 40%	Less deprived 30%	Less deprived 20%	Least deprived 10%
Under 60s	90	89	88	96	102	105	107	109	109	109
60+	86	83	88	88	101	111	106	100	106	110

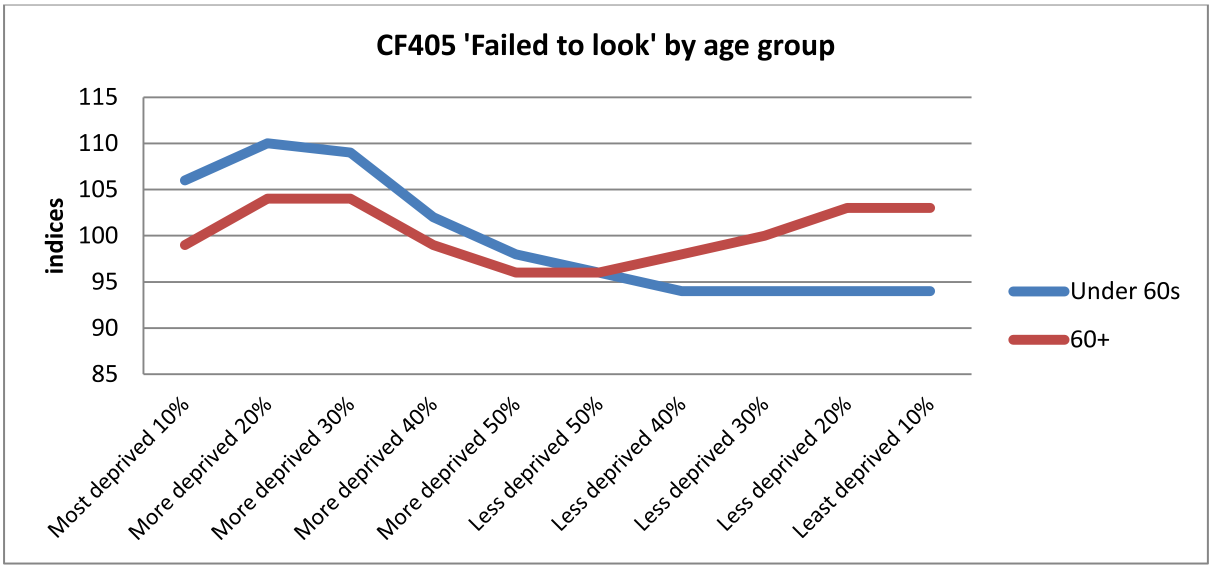

Figure 15: CF405 ‘Failed to look’ IMD deprivation levels by age group

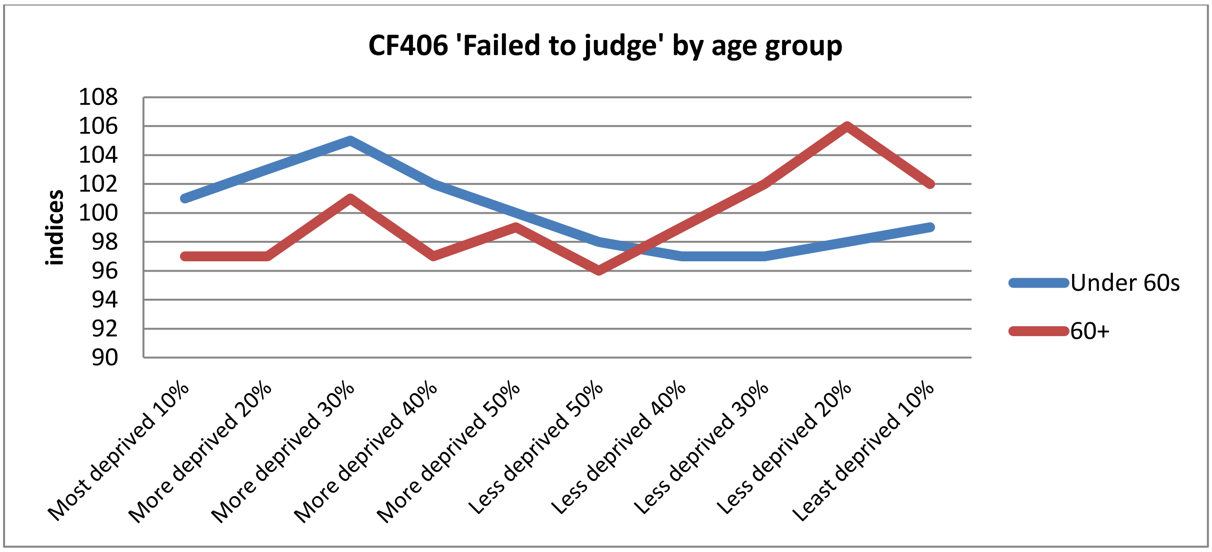

Figure 16: CF406 ‘Failed to judge’ IMD deprivation levels by age group

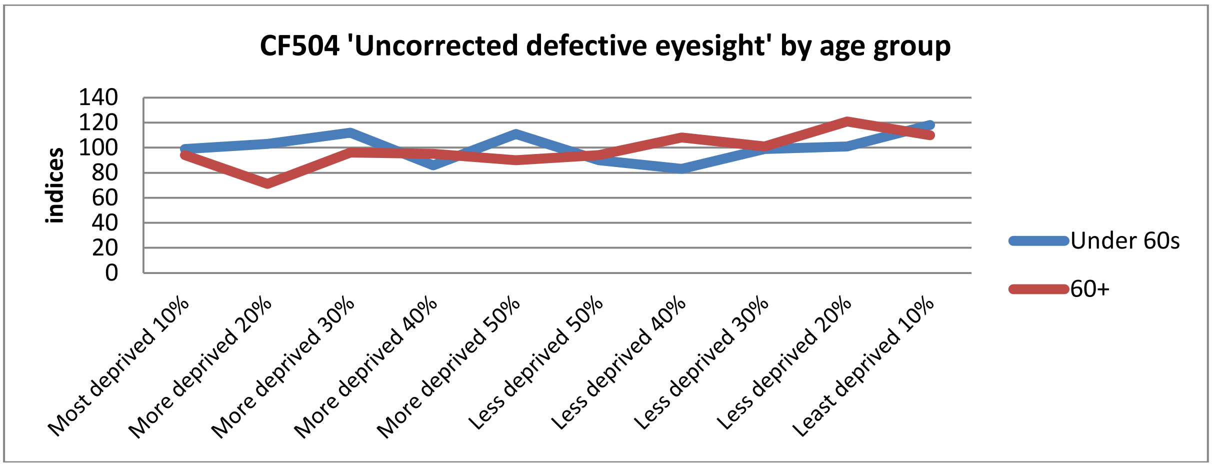

Figure 17: CF504 ‘Uncorrected, defective eyesight’ IMD deprivation levels by age group

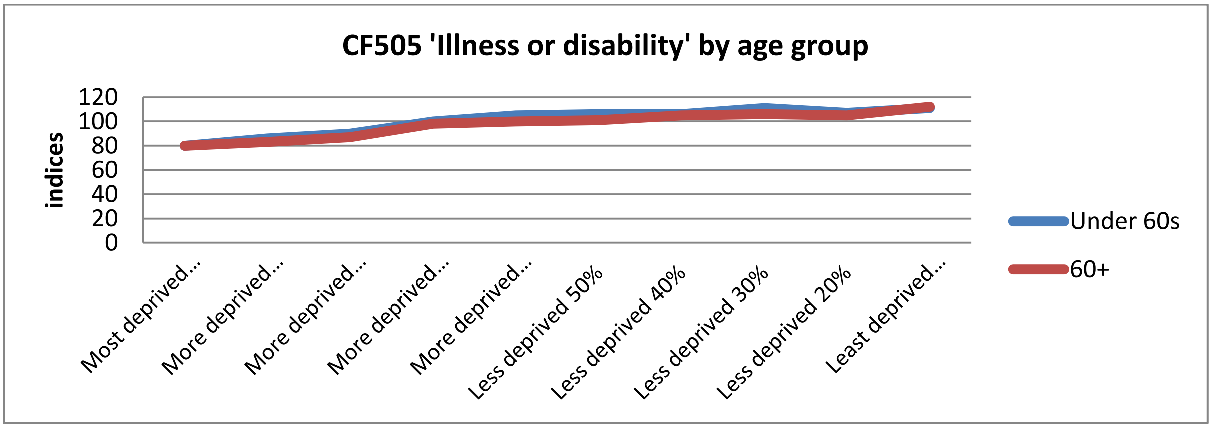

Figure 18: CF505 ‘Illness or disability’ IMD deprivation levels by age group

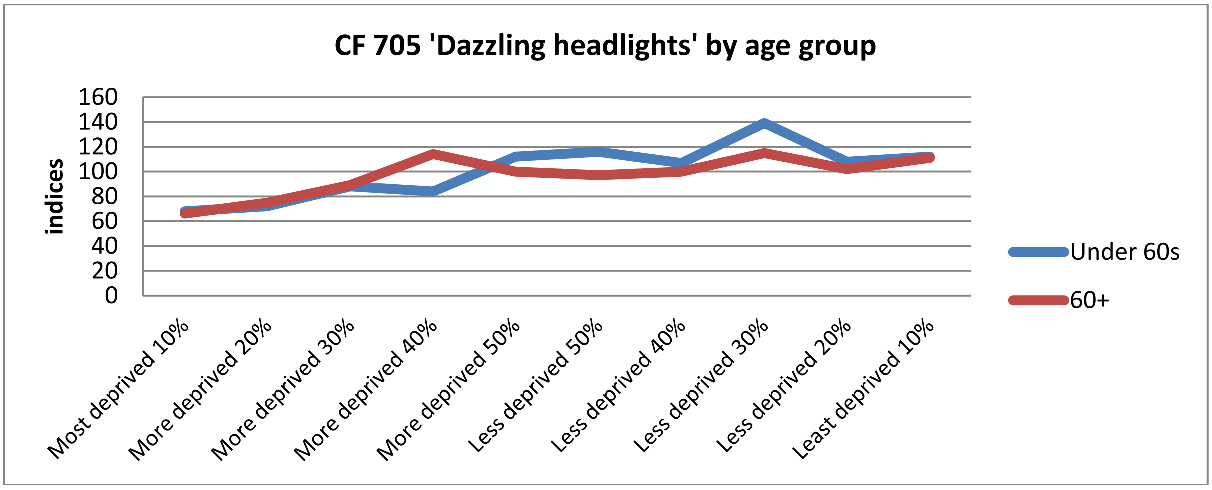

Figure 19: CF705 ‘Dazzling headlights’ IMD deprivation levels by age group

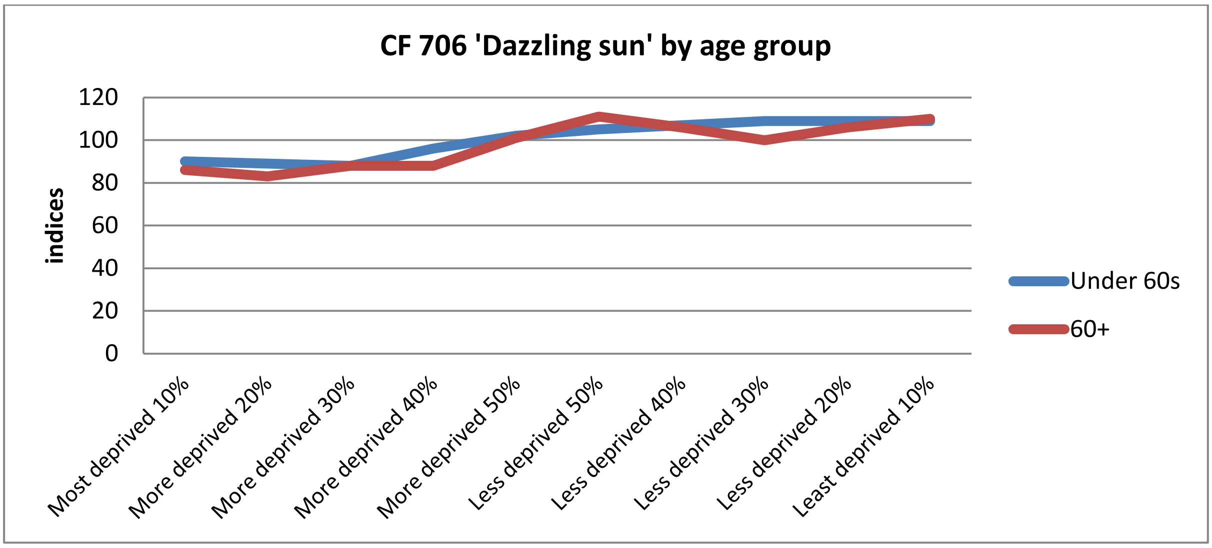

Figure 20: CF706 'Dazzling sun' IMD deprivation levels by age group

Mosaic Profiling

Mosaic 2014 classifies the community represented by each UK postcode into one of 15 Groups. Figure 15 shows the Mosaic distribution for all normal drivers in the study period (2006 to 2013) involved in a collision where a police officer attended and at least one CF was recorded (but the driver did not necessarily receive a CF themselves). The figures above each bar are index figures. These index the number of drivers in each Group against the national population. An index of 100 indicates the number of drivers in that Group is exactly in proportion to the population size of that Group in Great Britain.

Figure 21 shows that drivers in Groups C (city dwellers) and N (pensioners on low incomes) are having collisions at less than the expected rate, whereas drivers in Groups A (well-off country home-owners), G (people on low-incomes in rural and village locations) and I (urban and suburban residents) are having collisions at more than the expected rate.

Those in Group F (well-off retired people) are having collisions recorded on STATS19 at slightly less than the expected rate. Those in Group N (older people on a low income) are having collisions at less than the expected rate, possibly due to lower car ownership.

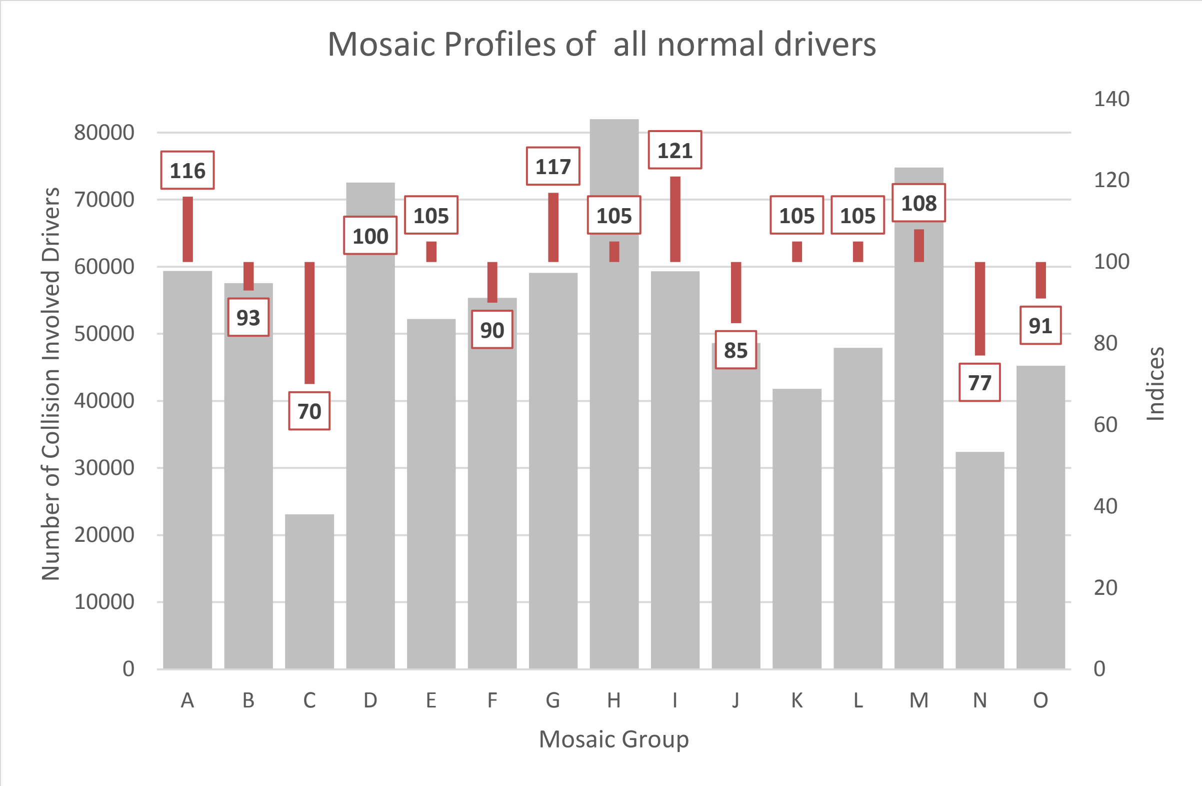

Figure 21: Mosaic profiles of all normal drivers with at least one CF (indexed to national population)

Mosaic profiles were linked to CF504 (uncorrected, defective eyesight). Figure 22 shows the results. Drivers in Group F ('Senior security' well-off retired people) were significantly over-represented for CF504, at almost two and a half times the expected rate for this Group. Similarly, drivers in Group A (well-off country dwellers) received CF504 at over twice the expected rate. Drivers in Group B ('prestige positions' containing well-off retired people and high achieving families), Group G (people on low-incomes in rural and village locations) and Group N (pensioners on low incomes) were also over-represented in receiving CF504.

Drivers in Groups C, J and O are not indexed as numbers were too small to be meaningful.

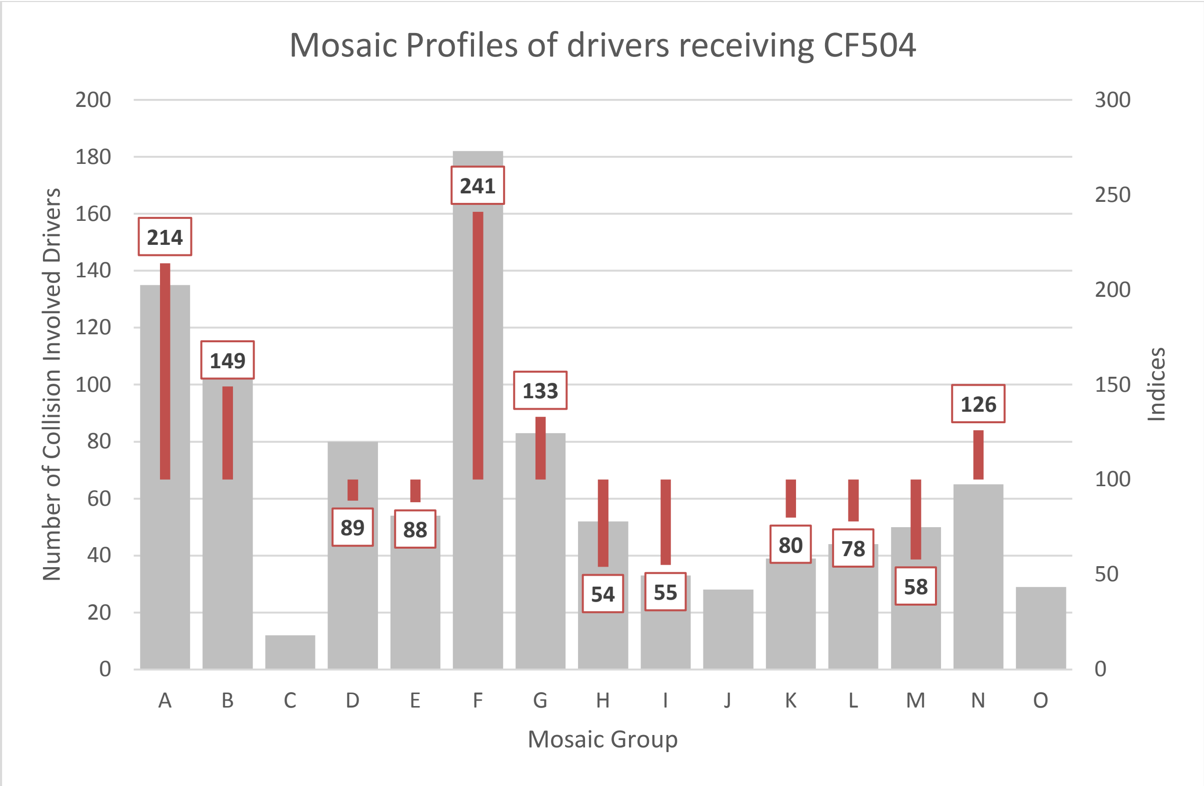

Figure 22: Mosaic profiles of normal drivers receiving CF504 (uncorrected, defective eyesight)

Regional Analysis

Driver residency was analysed by region, using Regional Development Agency Borders. Indices were created for normal drivers (aged under 60 and 60 and over) for each region, compared to the national average. Indices are based on annual collision-involved drivers per 10,000 population. Table 29 shows residency by region for normal drivers aged under 60 and table 30 shows residency by region for normal drivers aged 60 and over. Each table shows indices for overall crash involvement, and for CF405, CF406, CF504, CF505, CF705 and CF706. Indices significantly above expected levels (125 or above) are highlighted in bold. For younger drivers (table 29), CF504 was rarely recorded, indices are low and are presented for information.

For those aged under 60 years, more drivers from London received CF405 (failed to look) than expected. More drivers from the East and South East of England were assigned CF505 (illness or disability) than expected. More drivers from the East Midlands and North East England received CF706 (dazzling sun) than expected.

For drivers aged 60 and over, more from London received CF405 (failed to look) than expected. More drivers received CF504 (uncorrected, defective eyesight) and lived in the East and South East of England than expected. More drivers from the South East of England received CF505 (illness or disability) than expected. More drivers received CF705 (dazzling headlights) and lived in the East of England, the South East and South West of England.

Table 29 Normal drivers aged under 60 (indices based on annual collision involved drivers per 10,000 population)

	Crash Involvement compared to GB known	**CF405 compared to GB known**	**CF406 compared to GB known**	**CF504 compared to GB known**	**CF505 compared to GB known**	**CF705 compared to GB known**	**CF706 compared to GB known**
East	111	108	105	74	**138**	111	114
East Midlands	104	87	96	58	104	104	**126**
London	87	**139**	112	24	57	87	31
North East	91	84	79	44	82	91	**128**
North West	106	102	111	45	97	106	113
South East	115	106	117	76	**126**	115	112
South West	93	82	92	48	120	93	112
West Midlands	105	102	102	29	105	105	111
Yorks & Humber	106	99	94	46	101	106	116
Scotland	78	60	66	35	87	78	87
Wales	96	77	87	50	82	96	107

Table 30 Normal Drivers aged 60 and over (indices based on annual collision involved drivers per 10,000 population)

	Crash Involvement compared to GB known	CF405 compared to GB known	CF406 compared to GB known	CF504 compared to GB known	CF505 compared to GB known	CF705 compared to GB known	CF706 compared to GB known
East	107	109	99	**139**	117	**131**	99
East Midlands	100	91	95	77	108	95	113
London	97	**134**	109	43	67	28	36
North East	83	84	77	89	76	60	124
North West	104	103	114	99	95	107	100
South East	119	115	122	**160**	**131**	**148**	121
South West	95	90	96	113	119	**134**	112
West Midlands	94	98	102	96	92	77	98
Yorks & Humber	103	99	92	89	95	99	108
Scotland	91	70	71	49	79	63	89
Wales	90	79	87	86	81	97	101

Local Optical Committee Geographical Analysis

STATS19 analysis was carried out for the 27 LOCSU Optical areas identified from the Atlas map of optical variation, which shows community eye care pathways according to the 2014/15 arrangements of NHS England Area Teams and Clinical Commissioning Groups in England. The numbers of drivers (by age and CF) were analysed for these 27 areas within England, as well as Wales and Scotland. We present the raw figures here for information. This analysis has not been carried out by head of population as more detailed geographical mapping linking STATS19 by LOCSU area was beyond the scope of this study.

Table 31 shows the number of normal drivers involved in a police-attended collision where at least one CF was recorded.

The data were also examined by driver age group (over or under 60 years) and by CF. Here, the number of drivers in each age group could be indexed to the total number of drivers involved in a collision for each area. Results are presented for CF504 (uncorrected, defective eyesight) and CF505 (illness or disability). Table 32 shows the results. Indices of 125 and over are highlighted in bold to indicate over-representation above expected rates. Some areas show higher than expected incidences of CF504 and CF505 regardless of age, such as Devon, Cornwall and Isles of Scilly, East Anglia, and Thames Valley. These figures are not based on true population figures so are provided for information.

Table 31 LOCSU Optical Areas: Number of normal drivers involved in a police-attended collision where at least one CF was recorded*

LOCSU Optical Areas	**Area**	**Totals**
London	North East London	76,934
	North West London	77,612
	South London	82,654
	Total	*237,200*
Midlands and East of England	Arden, Herefordshire & Worcestershire	27,105
	Birmingham & the Black Country	33,630
	Derbyshire & Nottinghamshire	55,475
	East Anglia	65,653
	Essex	46,144
	Leicestershire & Lincolnshire	45,572
	Shropshire & Staffordshire	42,182
	Hertfordshire & the South Midlands	63,126
	Total	*378,887*
North of England	Cheshire, Warrington & Wirral	28,745
	Cumbria, Northumberland, Tyne & Wear	43,427
	Durham, Darlington & Tees	27,512
	Greater Manchester	72,422
	Lancashire	53,753
	Merseyside	32,149
	North Yorkshire & Humber	47,793
	South Yorkshire & Bassetlaw	37,531
	West Yorkshire	54,805
	Total	*398,137*
South of England	Bath, Gloucestershire, Swindon & Wiltshire	30,049
	Bristol, North Somerset, Somerset & South Gloucestershire	29,949
	Devon, Cornwall & Isles of Scilly	39,483
	Kent & Medway	50,375
	Surrey & Sussex	81,098
	Thames Valley	60,523
	Wessex	75,801
	Total	*367,278*
England	Total	**1,381,502**
Scotland	Total	**105,051**
Wales	Total	**69,917**
Total		*1,556,470*

* includes all drivers with a normal license, pedal cyclists, horse riders, specialist vehicles.

Table 32 CF504 (uncorrected, defective eyesight) and CF505 (illness or disability) for normal drivers aged over and under 60, by LOCSU optical area (indexed to total number of drivers involved in a collision shown in Table 30)

Optical Areas	**CF504 Over 60s**	**CF504 Under 60s**	**CF505 Over 60s**	**CF505 Under 60s**
Arden, Herefordshire & Worcestershire	89.8	49.3	101.9	109.1
Bath, Gloucestershire, Swindon & Wiltshire	120.9	29.6	**134.9**	**143.3**
Birmingham & the Black Country	87.4	65.1	80.9	86.5
Bristol, North Somerset, Somerset & South Gloucestershire	98.7	122.5	122.3	117.3
Cheshire, Warrington & Wirral	**166.3**	93.3	91.3	105.8
Cumbria, Northumberland, Tyne & Wear	**177.6**	124.3	100.1	96.6
Derbyshire & Nottinghamshire	62.7	102.8	113.0	96.6
Devon, Cornwall & Isles of Scilly	**141.2**	**161.3**	**137.1**	124.6
Durham, Darlington & Tees	70.2	111.0	96.4	94.2
East Anglia	**141.9**	**144.8**	109.7	**126.7**
Essex	115.8	**153.7**	109.5	113.7
Greater Manchester	77.3	96.2	90.8	92.7
Hertfordshire & the South Midlands	117.2	**136.0**	105.5	**127.8**
Kent & Medway	104.1	88.0	86.5	88.2
Lancashire	55.2	66.0	97.5	74.7
Leicestershire & Lincolnshire	102.6	**136.5**	112.2	106.6
London, North East	48.1	60.2	63.6	55.8
London, North West	76.8	45.9	83.4	71.3
London, South	64.4	91.1	83.1	83.5
Merseyside	91.1	96.1	91.0	117.7
North Yorkshire & Humber	**130.5**	105.9	113.3	**127.3**
Shropshire & Staffordshire	117.0	72.4	106.5	115.2
South Yorkshire & Bassetlaw	79.0	93.6	73.0	78.9
Surrey & Sussex	**164.0**	**155.9**	117.4	109.1
Thames Valley	**137.1**	**200.8**	**128.9**	**129.0**
Wessex	119.7	119.2	103.2	124.2
West Yorkshire	46.7	86.9	83.0	85.0
Scotland	61.5	55.2	97.8	113.3
Wales	97.2	68.2	90.5	87.1

Discussion

In Great Britain, between 2006 and 2013, there were over one million injury collisions on public roads which were attended by a police officer where at least one CF was assigned. This represents 78% of all police-recorded injury collisions so is a reliable representation of collisions taking place on British roads.

More than one person can be assigned a CF in each collision, so numbers of involved drivers exceeds the number of collisions. Over 1.5 million normal driver (Group 1 licence holders) were involved in an injury-collision attended by a police officer where a CF was recorded. The most commonly assigned CF was CF405 ‘failed to look properly’. Although this is not the same as impaired vision, it is significantly related to eyesight. Over half the drivers assigned CF504 ‘uncorrected or defective eyesight’ were also assigned CF405 ‘failed to look’.

There was no difference in the rates at which contributory factors were assigned by age. Overall, normal drivers aged over and under 60 were equally likely to be assigned a CF. However, drivers aged 60 and over were significantly more likely than younger drivers to receive any of the contributory factors related to vision and health: CF405 ‘failed to look’, CF406 ‘failed to judge’, CF504 ‘uncorrected or defective eyesight’, CF505 ‘illness or disability’, CF705 ‘dazzling headlights’, and CF706 ‘dazzling sun’. In particular, older drivers were more likely than younger drivers to be involved in collisions where, in the opinion of the attending police officer, CF504 ‘uncorrected or defective eyesight’ or CF505 ‘illness or disability’ were contributory factors to that collision. Nearly half of drivers in the 75+ age group received CF405 ‘failed to look’.

Specialist drivers (Group 2 licence holders) were less likely than normal drivers to receive a CF related to vision or health.

Mosaic profiling showed that drivers living in rural areas were over-represented for receiving at least one contributory factor related to vision or health. Areas with high populations of older drivers were also over-represented. Highest proportions of drivers receiving CF504 ‘uncorrected, defective eyesight’ lived in Mosaic areas A (well-off country dwellers), B (well-off retired people and wealthy families), F (well-off retired people), G (rural and village dwellers on low incomes) and N (pensioners on low incomes).

Regional analysis showed that for normal drivers aged 60 and over involved in road collisions, those living in the East and South East of England received CF504 ‘uncorrected, defective eyesight’ at rates significantly higher than the norm.

These findings are discussed in greater detail below.

Literature review – scope and purpose

There is a growing literature on vision and driving to date across a range of fields, such as ophthalmology, optometry, psychology, gerontology, accident prevention, civil engineering and others. For the purpose of this project, we have chosen to concentrate on relatively recent studies, and to narrow the scope, have restricted the main literature search to the past 15 years. The main aim of our literature review is to provide background and context for the research findings rather than a complete review of the literature as that falls outside the scope of the project. For a more extensive critical review of the literature on driving and vision, we suggest Owsley and McGwin (2010). We include information on visual function and how it changes with age and disease, but for more detailed information, further reading of an ophthalmology text is recommended. We discuss the results of each CF and use the literature to bring context to the findings. Finally we consider the wider implications of the findings and make practical recommendations.

The ageing eye

It is well known that the visual function of the eye decreases with age. This can be due to a number of factors, including the lens losing flexibility and focus, becoming more prone to light sensitivity and reduced acuity. 'Light scatter' may become problematic due to cataracts or other abnormalities affecting the anterior structures of the eye such as the cornea or vitreous, and these may cause problems with glare. The pupil also becomes smaller and allows in less light. Other disorders affecting posterior structures of the eye such as the retina and optic nerve can also have an impact on visual acuity and peripheral vision.

Glare

Glare is an important issue with respect to the ageing eye. It refers to light scatter within the eye, which reduces the contrast of the image on the retina. Headlights from an oncoming car, or bright sunlight, particularly when it is low in the sky could cause disability glare, which manifests as impaired vision. Discomfort glare refers to perceived discomfort from a light source, but without an impact on visual function. Much of the work on glare and its impact on vision and driving has a focus on driving in the dark, car headlights and driving in the sun (Aslam et al, 2007), and these driving conditions are specifically picked up within our CF analysis of CF705, Dazzling Headlights and CF706, Dazzling Sun.

CF405 – Failed to look properly

Of the CFs related to vision, 'Failed to look properly' was the most commonly assigned contributory factor. It was assigned to normal drivers 328,077 times during the seven year study period.

The data on CF405, failed to look properly is difficult to interpret as it may indicate situations when an individual did not look properly, or where an individual looked but did not perceive and interpret the information correctly. Age can have a negative impact on motor function, for example head movement, as well as higher level cognitive functioning, and both may have an impact on driving. It is notable that our results showed that almost half of the drivers aged 75 and over received CF405.

'Attentional visual field' or 'useful field of view' is the size of the visual field in which a peripheral target can be localised whilst looking at a central target. Reduced attentional visual fields are associated with reduced driving performance and increased crash risk. Isler et al (1997) studied the effect of reduced head movements in older drivers and its impact on useful field of view. They found that the oldest drivers in their study had lost up to one third of their movement ability, and this had a negative impact on useful field of view, and as a consequence driving performance was reduced. Rao et al (2013) suggest attentional visual field is more than a sensory visual process, but is associated with higher-level cognitive processing, enabling appropriate information to be extracted from a scene, and this declines with age.

In the context of older drivers, it is also important to note the impact of presbyopia. Presbyopia is a condition related to ageing, which causes deterioration in the ability to focus on near objects. Chu et al (2009) looked at a range of presbyopic lens types, and their impact on head and eye movement. They found that the pattern of head and eye movement was dependent on the type of lens being used to correct presbyopia and could affect reaction times and driving performance.

Although there are limitations on the way CF405 can be interpreted, these studies highlight challenges older drivers face when taking in and processing visual information and may explain why this CF is more likely to occur in the 60 and over age group, with an index of 125 compared to 97 in the under-60 group. The results show that CF 405 is more likely to be allocated to the 60 and over age group in daylight (108) or dark conditions (109) rather than in night conditions where street lights are lit (69). This finding suggests that older drivers may avoid travelling on urban roads at night.

When time of day is considered, older drivers were less likely to receive CF405 during the late evening, night-time and early morning. It is likely that these are times when older drivers avoid being on the road, particularly during the morning and evening 'rush' hours. This behaviour is consistent with the literature on patterns of driving avoidance and self-regulation observed in older drivers (Ball et al, 1998; Molnar and Eby, 2008; Molnar et al, 2013).

It is also interesting to note there was no difference in the rates by which professional drivers were attributed this CF. As these drivers have more stringent eyesight standards, it may indicate this CF is more likely to be linked to cognitive rather than sensory ability, or may highlight the limitations in visual acuity measures on 'real-world' vision for driving. Older drivers tend to drive fewer miles than younger drivers or professional drivers, so this may be an under-estimation of the true problem.

CF406 – Failed to judge other person's path or speed

CF406 was assigned to normal drivers 182,435 times during the seven year study period. Drivers aged under 60 are close to the population norm, but drivers aged 60 and over are over-represented.

In their study 'Capacity to Drive Safely', Anstey et al (2012) highlight the importance of various higher order cognitive abilities in driving that generally decline with age.

For example, spatial awareness and working memory seem to play an important role in performance, because driving requires judgement on location, distance and speed. In their study of differences in hazard perception time amongst healthy adults, Horswell et al (2009) found that drivers in the older age group were significantly slower to respond than drivers in younger groups, and this was linked to increased crash risk, particularly in the over-75 age group. Ao and colleagues (2014) explore the concept of dynamic visual acuity as a specific function of vision when viewing a moving target. They observed a disproportional improvement in dynamic visual acuity after cataract surgery when compared to the corresponding improvement in static visual acuity. This may offer additional insight into 'real-world' driving experience with moving traffic, and highlights the importance of ensuring that drivers with cataracts have timely access to cataract surgery.

It seems reasonable to assume that CF406, "failed to judge other person's path or speed" could be related to visual, cognitive or motor skills. As these skills deteriorate with age, it is not surprising results show this CF has a higher index for the 60 and over age group compared to the under 60 group, with relative indices of 117 and 98 respectively.

It is surprising to find little variation in this CF in different weather conditions. For example, Gray and Regan (2007) showed that there was a much smaller margin for error in time taken to execute a left turn in the presence of glare on a sunny day. Ni and colleagues (2012) compared old and young drivers' ability to detect a collision under simulated fog conditions, and although both groups had impaired performance in fog, the impact was greatest amongst older drivers. In previous sections, we have discussed the negative impact of driving in the dark for older drivers. The fact that there is no difference in different weather conditions may highlight self-regulating behaviour in older drivers to avoid driving in sub-optimal conditions. This could include driving slowly or avoiding driving all together.

CF504 – Uncorrected, defective eyesight

Our results show that uncorrected, defective eyesight as a CF is significantly associated with age, and is most commonly attributed to the over-70 age group. It is important to emphasise that CFs are a matter of judgement by police officers attending the scene, based on an interpretation of events and not on a formal assessment. This may be the reason why CF504 was infrequently assigned, and was allocated just 1679 times during the study period. This also indicates that police officers are using this CF when they are reasonably sure that eyesight is a factor in the collision.

Uncorrected, defective eyesight could be caused by uncorrected refractive error, visual impairment from underlying eye disease, or both. The most common causes of visual impairment in the UK include cataract, age related macular degeneration (AMD), glaucoma, diabetic retinopathy, and uncorrected refractive error.

Cataracts often cause reduced contrast sensitivity, and this can be problematic for driving at night or in the presence of glare during the day. Fraser et al (2013) found that contrast sensitivity was a significant factor in predicting driving difficulty when measuring the impact of first eye cataract surgery. In terms of risk, having cataract surgery halved the risk of being involved in a crash over the following 4-6 years when compared with not having surgery (Owsley et al 2002, Mennemeyer et al 2013).

Glaucoma primarily affects the field of vision. Haymes et al (2007) found that drivers with glaucoma were 5 times more likely to have been in a motor vehicle collision than the control group, and are more likely to experience difficulties driving at night (Blane 2014), however van Landingham (2013) and Blane (2014) suggested that many people with glaucoma adapt their driving habits to account for this. In Canada, Racette and Casson (2005) found a significant inter-subject variation on the impact of visual field loss, with driving performance affected more by location of the field loss rather than its extent. For example, diffuse field loss had the greatest impact on driving performance when present in the right hemisphere, but localised field loss was more significant when present in the left hemisphere. Amongst subjects with glaucoma and normal acuity with mild to moderate visual field loss, Szlyk et al (2002) found contrast sensitivity to be an important factor in assessing driving performance.

Age related macular degeneration affects central vision, and Sengupta et al (2014) found that drivers with central vision loss tend to adapt their driving behaviour. Although likely to continue to drive, they significantly reduce night driving and distance driven. McGwin et al (2013) studied drivers with different levels of AMD measured with the Age Related Eye Disease Study Group (2005) grading scale to see if there was a difference in the risk of motor vehicle collision according to severity of the condition. Surprising, despite having a degree of visual impairment they found a reduced risk of collision in the ‘intermediate level’ of AMD group. They question whether this result may be reflective of driver behaviour adaption and avoidance of higher risk driving situations.

Diabetic Retinopathy is a complication of diabetes which may require laser treatment. Szlyk et al (2004) found a correlation between driving performance and structural retinal changes caused by diabetic retinopathy and laser treatment. Increased retinal thickness was linked to higher numbers of simulated driving accidents and near misses. They suggest these retinal changes may not be detected using the standard tests of visual function such as visual acuity, visual fields and contrast sensitivity, and the effect on driving may be due to changes in visual processing speed. Vernon et al (2009) suggest that individuals with Type 1 diabetes who continue to meet visual acuity standards for driving can expect to retain their driving licence in the UK for 15 years following their final laser treatment for proliferative diabetic retinopathy.

Visual acuity is the most common measure used for driving assessment purposes. However, studies show that when used alone, it can be a poor predictor of driving performance and can risk missing the impact of other factors such as glare sensitivity and useful field of vision. These seem to be better at predicting the risk of collision (Rubin et al 2007). Daytime measures of visual acuity do not correlate well with driving ability at night (Gruber et al 2013) because of the effect of different lighting conditions on vision, particularly in older drivers. Wood et al (2010) and Wood et al (2012) compared the effects of reduced acuity caused either by simulated refractive blur or cataracts, and found small amounts of visual impairment had a significant impact on subject’s ability to see pedestrians at night. Importantly, they found that this was much worse in the presence of cataracts even when visual acuity is within acceptable standards.

There is a tendency for driving performance to deteriorate with age, even without visual impairment (Wood and Mallon, 2001), and this can be due to other factors such as impairment of cognitive and motor skills. As cognitive function declines in older age, older drivers tend to exhibit risk reducing driving behaviour compared to younger drivers (Bieri et al, 2015). For example, drivers with reduced useful field of vision and contrast sensitivity are less likely to drive at night (Kaleem et al 2012).

This raises a number of issues. We know that the risk of visual impairment increases with age and that this has an impact on driving performance. Therefore it is not surprising to find a significant correlation between CF504, uncorrected, defective eyesight and the 60 and over age group of drivers, and that this significantly increases for the 70 and over age group. What is more surprising, when considered in the context of literature on driver behaviour, is the consistent finding that older people with visual impairment tend to modify their driving habits to compensate for reduced driving skills (Molnar and Eby, 2008). Therefore, these figures may actually underestimate the true impact of visual impairment as a factor in motor vehicle collisions if the results were compared on a collision per mile driven basis across the two groups. Older drivers have higher casualty rates than middle-aged drivers when these are analysed by miles driven (Box, Gandolfi and Mitchell, 2010). However, mileage data by age of driver are not available at the level of detail necessary to calculate collisions per mile driven for different age groups using Stats19 data.

The literature on visual function shows that visual impairment significantly reduces driving performance at night. Surprisingly, the index ratio for CF504 among the over 60s is not higher in the evening, but during the day between 06.00 -18.00 hrs when driving conditions are expected to be better. However the literature on driver behaviour may help to explain this, as we know that drivers with visual impairment are more likely to self-regulate their driving activities to avoid higher risk situations, and this is known to include driving at night (Baldock et al, 2006; Molnar et al, 2013). As such, it may explain why the figure is lower than expected at night.

It is interesting to note that CF504 is rarely associated with professional drivers. Whilst over 85,000 specialist drivers were involved in injury collisions, only 17 received CF504, representing 0.02% of these drivers. This may be an indication of the effectiveness of the more stringent eyesight requirements for professional drivers and the regular formal re-assessment necessary for licence renewal. Furthermore, professional drivers may have a higher awareness of the importance of having regular sight tests and wearing corrective lenses given that driving is an important part of their livelihood. The findings also demonstrate that we can have confidence in the use of these CFs. It is unlikely that an attending police officer would avoid using CF504 for professional drivers due to awareness that these drivers should have better eyesight because of the higher visual standards required.

The relationship between CF405 and CF504

Contributory factors 405 ‘failed to look’ and 504 ‘uncorrected, defective eyesight’ were examined together to establish how many drivers received both CFs. We found that older drivers were more likely than younger drivers to receive both CF405 and CF504. Although numbers of drivers receiving both CF405 and CF504 are small (only 920 out of a total of 1,528,875 drivers), where defective eyesight is suspected, police officers are likely to believe that the driver also failed to look properly.

It is interesting to note the strong association between CF504, defective eyesight and CF405, failed to look. Analysis shows that 55% of those assigned CF504 were also assigned CF405. In contrast, only 0.3% those assigned CF405 were also assigned CF504. We have already discussed the difficulty of correctly interpreting what exactly constitutes ‘failed to look’ and how higher-level rather than sensory information processing is needed for ‘attentional visual fields’. Studies show that poor ‘attentional visual field performance’ poses a high crash risk and that this ability deteriorates with age (Rao, 2013). Drivers with poor attentional visual fields appear less able to perceive that this is an issue, and how this it might be impacting on driving performance (West et al, 2003) but drivers with visual impairment are more likely to be aware of their limitations and make modifications to their driving habits accordingly.

CF505 – Illness or disability, mental or physical

CF505 was assigned to normal drivers 14,337 times during the study period and older drivers were significantly more likely to receive this CF than younger drivers. Driving performance relies on visual, cognitive and motor skills and each of these can be affected by illness or disability. There is general agreement in the literature about the range of medical conditions that can slightly or moderately increase crash risk. These include visual impairment, cardio-vascular disease, cerebrovascular disease, traumatic brain injury, epilepsy, schizophrenia, dementia, depression, diabetes, musculoskeletal disorders, obstructive sleep apnea, alcohol dependence and the use of certain medications. However, presence or absence of the disease alone is not an adequate indicator and other factors need to be considered, such as severity of the disease and presence of co-existing conditions (Marshall, 2008).

Although functional ability, cognitive impairment and visual impairment have all been found to be associated with driving cessation, MacLeod et al (2014) observed that falls and cognitive impairment had the highest attributable risk. This links with Aksan et al’s (2013) finding that deterioration in driving performance with age was driven more by cognitive than visual impairment. Anstey et al (2006) also found that factors such as poor self-related health and cognitive performance were strongly associated with driving cessation. Ross et al (2009) looked at demographic factors and found that men in higher-level occupations were less likely to stop driving despite visual and cognitive impairment.

The literature highlights the complex nature of medical conditions, how they impact on driving performance, and the difficulty professionals face in making judgements over safety and when to advise an individual to stop driving. It is known that health professionals are often reluctant to advise a patient to cease driving even when that patient has a medical condition which can adversely affect fitness to drive (Hawley, 2010).

Interestingly, this CF is more likely to be attributed to the 60 and over age group during daylight hours rather than in the dark, and is more common between 12.00-18.00. This may be due to self-regulating driving behaviour and reflect the times that the older people are more likely to drive. In terms of weather conditions, the results seemed to be variable between the older and younger age groups.

CF705 Dazzling Headlights

In section 'CF504, uncorrected, defective eyesight', we discussed how a range of visual factors disproportionally affects the performance of older drivers. Glare has been identified as one of the contributing factors to poor driving performance, and will be explored in more detail here in the context of dazzling headlights. It is useful to note that although night driving and glare present visual problems, as outlined in the previous sections, disability glare, from headlights, could occur at other times of day.

Gruber et al (2013), in their literature review on night driving, highlight a lack of scientific evidence linking night driving performance with visual tests, and argue night driving performance does not correlate well with visual acuity measured in bright (photopic) conditions. Shandiz et al (2011) also found a strong association between cataracts, reduced visual acuity and contrast sensitivity, arguing that visual acuity measures alone were insufficient to predict the negative impact of cataracts on daily tasks. This highlights inconsistency between visual acuity measured under optimal conditions in the daytime and actual driving ability in the daytime or at night, particularly in the presence of glare. Wood and Owens (2005) advise "adding either photopic contrast sensitivity or mesopic visual acuity to the standard acuity test can provide a much more useful alternative to current drivers' licensing vision standards", but acknowledge there is a widespread debate on this issue and a lack of evidence. Theeuwes J, Alferdinck JW, Perel M (2002) found that even tests directly measuring disability glare using a de Boer rating scale did not accurately predict driver performance.

In their study of older drivers, McGregor and Chaparro (2005) found that glare, peripheral vision and night driving were key difficulties, regardless of the presence or absence of visual impairment. This corresponds with other research findings, that older drivers experience visual problems due to headlight beam and glare at night (Wood et al 2014; Wood et al 2005) and emphasise the importance of wearing appropriate visual correction to minimise refractive blur. Rubin et al (2007) cite glare sensitivity as one of the key predictors of crash involvement. This may become an increasing problem as new types of brighter headlights become more widely available (Mainster and Timberlake, 2003). Kaleem et al (2012) make the point that some drivers may be unaware that they have peripheral visual field loss, and only become aware of any functional vision loss when it manifests as difficulty with night driving. As a consequence, older drivers may regulate their night driving without realising why. Although there is evidence that older drivers regulate their driving to reduce exposure to difficult driving conditions, Stafford Sewall et al (2014) raise concerns that they seem to find it more difficult to perceive how much car headlight glare is affecting them when compared to younger drivers.

As expected, our results show that CF705, 'dazzling headlights' is more likely to be attributed to drivers over the age of 60, than under-60, with indices of 175 and 90 respectively. For the under 60 group, the index for CF705 is higher in the summer months between May and August. In contrast, for the 60 and over group, the index is highest in November and December. This can perhaps be explained by considering the amount of daylight hours during those months. For example, drivers, who generally prefer to avoid night driving, may find themselves driving in the dark through necessity to go about their normal routines in the winter months of November and December. This may also be reflected in the time of day when CF705 is most likely to be issued, between 12.00 – 18.00, rather than 18.00 – 12.00, with the latter being a time that some older drivers may avoid.

It is interesting to note that drivers over 60s are significantly over-represented in receiving CF705 according to lighting levels, during conditions of 'night–lights lit' with an index of 117 compared to 'dark' 82 or 'daylight' 106. This finding supports the suggestion that mesopic (dim) rather than scotopic (dark) lighting conditions may be more challenging for older drivers (Gruber et al 2013). It is possible that there may be some overlap with other CF results, on the basis that up to six CF can be attributed to a single incident. For example, an individual may receive CF504, uncorrected, defective eyesight and CF705 dazzling headlights for the same incident. Further work would be necessary to explore all such permutations.

CF706 – Dazzling Sun

Disability glare can be caused by the angle of the sun in the sky, particularly in winter months when the sun is low. Dazzling sun can be an important CF in collisions, and for normal licence holders, was assigned by an attending police-officer 22,246 times during the seven year study period. Gray and Regan (2007) differentiate between the disabling effects of glare from dazzling headlights compared with the angle of the sun in the sky, with low sun more likely to be a factor in collisions with pedestrians, cyclists and other vehicles. In contrast, disability glare caused by dazzling headlights is more likely to result in collisions with poorly illuminated objects such as pedestrians and cyclists. In their study of the effects of low sun in the sky, they reported significant inter-subject variability, suggesting this is not isolated to older-drivers, but can be encountered by younger drivers, for example on their way to or from work.

It is interesting to note the higher proportion of women being attributed CF706, 'dazzling sun' compared with men. Women from both age groups are over-represented for receiving CF706 compared to normative levels: 118 for under 60s and 112 for over 60s. This may in part be due to the higher incidence of cataracts in women (Klein, 2008), increasing the effect of glare in bright, dazzling sunlight.

Previous literature is consistent with our results for normal drivers, which show that for younger drivers under 60, CF706 is more likely to be a contributory factor before 6am and after 6pm (Gray and Regan, 2007). In contrast, for older drivers CF706 was most often a contributory factor in the afternoon between noon and 6pm. For drivers aged 60 and over there were higher indices in November (124), December (129) and January (122), as expected, with this corresponding to the time of year when the sun is lower in the sky.

Jägle and Besch (2005) present a case study to illustrate the difficulty of predicting the effects of disability glare on the basis of standard driving visual assessments, even in the case of more stringent standards for professional drivers. They describe the case of a professional bus driver with 15 years experience. He was accident-free until the age of 35, when he began to notice sensitivity to glare, and subsequently had three more driving accidents. Visual acuity was repeatedly tested, along with other visual tests, which revealed no problems. He was finally sent for a full ophthalmological investigation and diagnosed with a rare form of rod-cone dystrophy, an inherited retinal condition, which accounted for his problems with glare. This adds to the debate over whether additional tests for glare sensitivity should be added (Babizhayer, 2003) to licensing requirements, but there has been significant debate over exactly which tests to use, and how their effects on driving performance and safety can be validated.

It is interesting to note from our results that for specialist drivers, those aged 60 and over are more likely to receive this CF than the under 60 group, with a respective index of 107 compared with 99. This is in contrast to the CF 504, 'uncorrected, defective eyesight', which showed no significant difference between the two age groups. This highlights the limitation of visual acuity and visual field testing for licensing purposes, as it does not account for the effect of glare, despite stricter standards being applied to professional drivers.

Tinted spectacle lenses may help in glare or dazzling situations. The Association of British Dispensing Opticians provides advice on the use of tints and coatings (ABDO, 2012). To minimise the impact of glare for drivers at night or in non-sunny environments, anti-reflection coatings rather than tints are recommended. For sun glare, there are five categories of tints with specific recommendations on suitability for daytime and night time driving depending on the level of light transmission through the lens.

Socio-economic status

Indices of multiple deprivation (IMD) were used to examine associations between deprivation level and collision-involved drivers who were assigned relevant contributory factors. For CF405 (failed to look properly), a slightly higher proportion of older drivers than younger drivers fell within the 'less deprived' categories. The difference between older and younger drivers was greatest for CF504 (uncorrected or defective eyesight), with a significantly higher proportion of older drivers in the 'less deprived' categories. For the other CFs, there was little difference in socio-economic status between younger and older drivers.

Studies show that individuals from lower socio-economic groups are less likely to access sight tests than the general population. Sight tests are often symptom-led with cost frequently being cited as a perceived barrier (McLaughlan and Edwards, 2010; Hayden, 2012). In reality, this is only a perceived barrier, as individuals on low income are likely to be eligible for NHS funded sight tests and optical vouchers towards the cost of spectacles. Lack of access to sight tests may explain why indices for CF405, and CF406, are higher amongst the most deprived groups of drivers. It is possible that some of these individuals do not have appropriate corrective eyewear for driving. For CF504 however, amongst drivers aged over 60, the results seem to be counter-intuitive, with a second peak in the graph, showing even higher indices amongst the most affluent section of the population. One explanation could be that individuals in this group are accessing sight tests, but not actually wearing corrective eyewear to drive. Further work would be needed to explore the reasons for this in more detail, but the current findings may be useful to target specific groups of the population with a driving and vision campaign.

Older drivers living in more affluent areas are more likely to be driving than older drivers in less affluent areas. Those in least deprived areas may also be more dependent upon their cars and thus continue driving longer than their peers who may have better access to public transport. The literature suggests that older drivers may continue to drive longer where public transport is poor (Lang et al, 2013).

Mosaic Profiling

The results of Mosaic profiling suggest that drivers involved in an injury-collision, where uncorrected visual impairment was a factor contributing to the collision, are typically retired people living in rural or village locations. This is, of course, a generalization. However, we found significant over-representation of CF504 ‘uncorrected defective eyesight’ among drivers living in areas with a high proportion of older drivers, especially wealthy or comfortably off pensioners. This finding is consistent with analysis of the IMD data which shows that older drivers in less deprived areas are over-represented for receiving CF504.

These findings suggest that campaigns to raise awareness of the importance of vision and road safety should be targeted at older people living in rural and village locations. In particular, campaigns for regular sight tests and wearing glasses or contact lenses of the correct prescription.

Geography

The East and South East of England were found to be areas where older drivers were over-represented for receiving CF504 ‘uncorrected defective eyesight’ as a contributory factor. For younger drivers there was no geographical bias to receiving CF504.

For older drivers, the South East of England was also associated with collisions involving CF505 ‘illness or disability’. For younger drivers assigned CF505, there was over-representation in the East and South East of England.

For CFs involving dazzle, there were more collisions involving CF705 ‘dazzling headlights’ in the East of England, the South East and South West of England for older drivers. Somewhat surprisingly, for younger drivers, more collisions involving CF706 ‘dazzling sun’ took place in the East Midlands and North East England than expected.

Visual driving standards

The results of this study raise questions about the adequacy of visual driving standards in the UK. A comparison of visual driving standards in Europe shows significant differences between countries, with this variation including type of vision tests used, re-assessment requirements and type of personnel required to carry them out. The UK is amongst the countries with lowest standards (Optical Confederation, 2011a; RSA, 2013). In 2012, visual acuity was added as an extra visual standard in the UK, in order to implement EC directives, harmonising certain standards across EU member states (DVLA, 2014). Latham et al (2014) subsequently investigated the correlation between number plate test and visual acuity and found that some drivers were only able to meet one of the standards but not both. Although there have been calls for more stringent visual driving standards, a recent Cochrane Review identified a gap in the literature on vision screening and its impact on motor vehicle crashes for older drivers, highlighting the “need to develop valid and reliable tools of vision screening that can predict driving performance” (Optical Confederation, 2011b; RSA, 2013; Cochrane Review, 2014).

In the absence of more stringent visual driving standards, drivers are left to monitor their own abilities. However, studies show a general lack of awareness amongst the UK public around driving standards, and drivers in a roadside setting were often unable to accurately judge the distance required for number plate recognition (Anuradha, 2007; Pointer, 2007). Optometrists are well placed to offer holistic advice on eye health, vision and driving, yet research has shown a lack of understanding of this amongst the general population.

For example, a survey commissioned by the College of Optometrists (2011) showed a lack of awareness among the general public regarding the link between ethnicity and eye health, and impact of lifestyle factors on eye health. They also identified a perception among the public that the only role of the Optometrist is to prescribe and dispense spectacles and contact lenses. Hayden (2012) also identified a range of barriers for minority and disadvantaged groups to accessing to primary eye care services. This presents a problem, firstly because drivers may not be aware either of the importance of their responsibility in looking after eye health and vision during their lifetime of driving, or how they might access help and advice.

Healthy Eyes Safer Roads (2013) recommends a public awareness campaign. The report highlights the public health and road safety benefits of good vision and recommends a UK campaign to encourage regular sight tests. This links with the first outcome of the UK Vision Strategy to raise awareness of eye health amongst the population and encourage individuals to take responsibility for their eye health and vision. Although the DVLA and GOVUK websites remind drivers of their responsibility to meet the visual standards for driving and that they may be prosecuted for failing to do so, drivers are likely to remain unaware unless they have reason to visit these websites. The fact that these rules and standards are poorly signposted, and not tied to an explicit sight test, supports calls for a targeted public campaign for all drivers.

The Optical Confederation (2011c) supports compulsory visual fields and visual acuity testing for drivers when they renew their licence and say best practice would be to assess a driver at the age of 50 years and over, as is already the case in a number of other EU Member States. They also advocate ongoing assessment of all drivers' vision throughout their driving career.

Uncorrected refractive error still remains a significant cause of visual impairment, and this can easily be addressed with corrective eyewear or contact lenses. The findings of the current study do suggest that drivers should be made more aware of the importance of good vision and eye health, particularly as they get older. Public awareness campaigns on visual health should be targeted towards drivers, and particularly older drivers.

Limitations

The results of this study are reliant on contributory factors assigned by police officers for STATS19. Not all crashes will be captured by STATS19 as data is only collected for public roads. There are likely to be many crashes taking place on private land, in car parks and on private roads which are not captured. Older drivers, in particular, are perhaps more likely to have low-level shunts where the police are not called, even if the crash takes place on a public road. Consequently the results presented above are likely to be an under-estimate of the total number of crashes taking place.

Mileage data by age and head of population are not publicly available, so we were unable to index mileage against age. Similarly, there is no data available to show the ages of drivers out on the road each hour. Therefore, although we can present time of day by age group, it is not possible to put driver exposure into context. For example, we cannot be sure if the low numbers of older drivers involved in collisions at night are because they drive less at night due to self-regulation or that they are better at driving at night. Although the former is more likely to be true, the data cannot prove this.

The aim of this study was to examine contributory factors with regard to driver vision. The contributory factors collected by police for STATS19 were not designed for this purpose, so we used those CFs associated with vision. The one CF specific to visual impairment (CF504) was allocated infrequently, probably because it is difficult for the attending police officer to establish visual impairment. The only measure available to him or her is the number plate test.

We originally intended to examine CF502 'impaired by drugs (illicit or medicinal)'. The aim was to see if medicines may contribute to road collisions. There are several limitations with analysis of this CF, however. Firstly, it is not possible to determine whether the driver in question was impaired through an illegal or an illicit drug as the

CF can be used in both cases. Secondly, until the recent change in the drug driving legislation and the introduction of new roadside drug screening equipment, it was difficult for police officers to determine that a driver was impaired by drugs. This meant that the CF was not often used. Analysis showed that it was predominantly attributed to younger drivers who may have been more likely to be impaired by illicit drugs and thus the data were skewed. It was therefore not appropriate to use this CF in the final analysis. In the future, it is likely that CF502 will be recorded more systematically and will be more suitable for analysis.
Geographical analysis was carried out to provide information for providers of optometry services. These are raw numbers therefore any peaks in reporting of any CF could be due to the size of area or because of population density. More detailed geographical mapping linking STATS19 by LOCSU area was beyond the scope of this study but could be explored in future research.

Future Research

The results of this study suggest that socio-economic status measured by IMD or Mosaic profiling has a bearing on road collisions where vision is a contributory factor. In particular, older drivers are over-represented for receiving a vision-related contributory factor whether they are comfortably off or on low incomes. Further work is needed to explore the reasons for this and how road safety campaigns can best reach these groups of drivers.

If population data is made available for optometry areas, then geographical analysis of contributory factors would provide more powerful evidence for targeted campaigns on vision and road safety.

The contributory factor relating to illness and/or disability was assigned over 14,000 times. However, STATS19 data does not provide any details of the health issues associated with these collisions. Future research should examine the relationship between health and road collisions in more depth.

Research is needed to identify the best visual tests relevant to driver licensing. Part of this research should be to achieve consensus among key stakeholders on the most appropriate tests, and then to promote their use.

Research is also needed to establish the most effective combinations of visual tests and intervals between sight tests for drivers of every age.

Conclusions and Recommendations

The results of this study have shown an association between injury-collisions and visual impairment and health. Analysis of the MAST Online data supports the hypothesis that older drivers aged 60 and over are more likely to be involved in an injury-collision where visual impairment or illness and disability is a contributory factor.

When compared with population indices, the contributory factors of visual impairment and illness or disability were allocated to a higher than expected proportion of drivers in older age groups and especially to those living in rural or village locations. Despite the availability of free sight tests for people aged 60 and over, a higher than expected proportion of these drivers, in both comfortably-off and low-income groups, were allocated CF504 (uncorrected, defective eyesight).

The findings of this study support the recommendations of the College of Optometrists (2011a) that drivers should have regular sight tests, and that drivers aged over 60 should have even more frequent sight tests. There was no evidence that drivers aged 40 to 59 were at higher risk of accidents than younger drivers so we recommend that all drivers have regular sight tests. Furthermore, the study findings can inform road safety campaigns featuring the importance of good vision, which can then be targeted at specific groups of drivers. Such campaigns will likely lead to fewer injury-collisions involving visual impairment and thus contribute to road safety.

The profile of the typical driver needing advice on visual impairment and the importance of corrective lenses is a driver aged 60 or over; either male or female; retired; living in a rural or village location with poor public transport; either comfortably-off or on a low income; predominantly living in the East, South East and South West of England.

Recommendations

1. UK Campaign to encourage drivers to have regular sight tests and take responsibility for looking after their eyes.

2. All drivers should have a vision check every five years and every two years for drivers over 60.

3. Propose to Government that drivers aged 70 and over should have a mandatory sight test upon renewal of their driving licence.

4. Research to gain consensus on the best combination of visual tests for driver licensing in the UK, and the intervals between sight tests.

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Appendix I

Mosaic Groups (from Mosaic Public Sector Brochure (Experian, 2015))

A Country Living	A01	Rural Vogue	Country-loving families pursuing a rural idyll in comfortable village homes while commuting some distance to work
	A02	Scattered Homesteads	Older households appreciating rural calm in stand-alone houses within agricultural landscapes
	A03	Wealthy Landowners	Prosperous owners of country houses including the rural upper class, successful farmers and second-home owners
	A04	Village Retirement	Retirees enjoying pleasant village locations with amenities to service their social and practical needs
BB05 Prestige Positions		Empty-Nest Adventure	Mature couples in comfortable detached houses who have the means to enjoy their empty-nest status
	B06	Bank of Mum and Dad	Well-off families in upmarket suburban homes where grown-up children benefit from continued financial support
	B07	Alpha Families	High-achieving families living fast-track lives, advancing careers, finances and their school-age children's development
	B08	Premium Fortunes	Influential families with substantial income established in large, distinctive homes in wealthy enclaves
	B09	Diamond Days	Retired residents in sizeable homes whose finances are secured by significant assets and generous pensions

C City Prosperity	C10	World Class Wealth	Global high flyers and families of privilege living luxurious lifestyles in the most exclusive locations of the largest cities
	C11	Penthouse Chic	City workers renting premium-priced flats in prestige central locations, living life with intensity
	C12	Metro High-Flyers	Ambitious people in their 20s and 30s renting expensive apartments in highly commutable areas of major cities
	C13	Uptown Elite	High status households owning elegant homes in accessible inner suburbs where they enjoy city life in comfort

DD14 Domestic Success		Cafes and Catchments	Affluent families with growing children living in upmarket housing in city environs
	D15	Modern Parents	Busy couples in modern detached homes balancing the demands of school-age children and careers
	D16	Mid-career Convention	Professional families with children in traditional mid-range suburbs where neighbours are often older
	D17	Thriving Independence	Well-qualified older singles with incomes from successful professional careers living in good quality housing
E Suburban Stability	E18	Dependable Me	Single mature owners settled in traditional suburban semis working in intermediate occupations
	E19	Fledgling Free	Pre-retirement couples with respectable incomes enjoying greater space and spare cash since children left home
	E20	Boomerang Boarders	Long-term couples with mid-range incomes whose adult children have returned to the shelter of the family home
	E21	Family Ties	Active families with teenage and adult children whose prolonged support is eating up household resources
F Senior Security	F22	Legacy Elders	Elders now mostly living alone in comfortable suburban homes on final salary pensions
	F23	Solo Retirees	Senior singles whose reduced incomes are satisfactory in their affordable but pleasant owned homes
	F24	Bungalow Haven	Seniors appreciating the calm of bungalow estates designed for the elderly
	F25	Classic Grandparents	Lifelong couples in standard suburban homes enjoying retirement through grandchildren and gardening

G Rural Reality	G26	Far-Flung Outposts	Inter-dependent households living in the most remote communities with long travel times to larger towns
	G27	Outlying Seniors	Pensioners living in inexpensive housing in out of the way locations
	G28	Local Focus	Rural families in affordable village homes who are reliant on the local economy for jobs
	G29	Satellite Settlers	Mature households living in expanding developments around larger villages with good transport links
HH30 Aspiring Home makers		Affordable Fringe	Settled families with children owning modest, 3-bed semis in areas of more affordable housing
	H31	First Rung Futures	Pre-family newcomers who have brought value homes with space to grow in affordable but pleasant areas
	H32	Flying Solo	Young singles on starter salaries choosing to rent homes in family suburbs
	H33	New Foundations	Occupants of brand new homes who are often younger singles or couples with children
	H34	Contemporary Starts	Young singles and partners setting up home in developments attractive to their peers
	H35	Primary Ambitions	Forward-thinking younger families who sought affordable homes in good suburbs which they may now be out-growing
I Urban Cohesion	I36	Cultural Comfort	Thriving families with good incomes in multi-cultural urban communities
	I37	Community Elders	Established older households owning city homes in diverse neighbourhoods
	I38	Asian Heritage	Large extended families in neighbourhoods with a strong South Asian tradition
	I39	Ageing Access	Older residents owning small inner suburban properties with good access to amenities

J Rental Hubs	J40	Career Builders	Singles and couples in their 20s and 30s progressing in their field of work from commutable properties
	J41	Central Pulse	Youngsters renting city centre flats in vibrant locations close to jobs and night life
	J42	Learners & Earners	Inhabitants of the university fringe where students and older residents mix in cosmopolitan locations
	J43	Student Scene	Students living in high density accommodation close to universities and educational centres
	J44	Flexible Workforce	Young renters ready to move to follow worthwhile incomes from service sector jobs
	J45	Bus-Route Renters	Singles renting affordable private flats away from central amenities and often on main roads
KK46 Modest Traditions		Self Supporters	Hard-working mature singles who own budget terraces manageable within their modest wage
	K47	Offspring Overspill	Lower income owners whose adult children are still striving to gain independence meaning space is limited
	K48	Down-to-Earth Owners	Ageing couples who have owned their inexpensive home for many years while working in routine jobs
L Transient Renters	L49	Disconnected Youth	Young people endeavouring to gain employment footholds while renting cheap flats and terraces
	L50	Renting a Room	Transient renters of low cost accommodation often within subdivided older properties
	L51	Make Do & Move On	Yet to settle younger singles and couples making interim homes in low cost properties
	L52	Midlife Stopgap	Maturing singles in employment who are renting short-term affordable homes

MM53 Family Basics		Budget Generations	Families supporting both adult and younger children where expenditure can often exceed income
	M54	Childcare Squeeze	Younger families with children who own a budget home and are striving to cover all expenses
	M55	Families with Needs	Families with many children living in areas of high deprivation and who need support
	M56	Solid Economy	Stable families with children renting better quality homes from social landlords
N Vintage Value	N57	Seasoned Survivors	Deep-rooted single elderly owners of low value properties whose modest home equity provides some security
	N58	Aided Elderly	Supported elders in specialised accommodation including retirement homes and complexes of small homes
	N59	Pocket Pensions	Elderly singles of limited means renting in developments of compact social homes
	N60	Dependent Greys	Ageing social renters with high levels of need in centrally located developments of small units
	N61	Estate Veterans	Longstanding elderly renters of social homes who have seen neighbours change to a mix of owners and renters
OO62 Municipal Challenge		Low Income Workers	Older social renters settled in low value homes in communities where employment is harder to find
	O63	Streetwise Singles	Hard-pressed singles in low cost social flats searching for opportunities
	O64	High Rise Residents	Renters of social flats in high rise blocks where levels of need are significant
	O65	Crowded Kaleidoscope	Multi-cultural households with children renting social flats in over-crowded conditions
	O66	Inner City Stalwarts	Long-term renters of inner city social flats who have witnessed many changes