Drivers with visual field loss in one Australian licensing jurisdiction

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Abstract

In Australia, the presence of a visual field deficit condition requires assessment by an optometrist or ophthalmologist before an individual can be considered fit-to-drive. However, there are currently limitations in the validity of tests and criteria used for assessing vision for safe driving. This paper examines the scope of the problem in one Australian jurisdiction by identifying the prevalence of visual field loss (VFL) amongst drivers referred for medical review and describing the current practices for managing their licence review. A random sample of medical review cases was extracted from the VicRoads Medical Review database to identify cases involving VFL conditions: glaucoma, age-related macular degeneration, diabetic retinopathy, hemianopia/ quadrantanopia and retinitis pigmentosa. Data on demographic information, visual field loss conditions and the referral process were collected for all identified cases.

A total of 170 cases (2.0% of 8295 total medical review cases) with visual field deficits were identified. Of these, 23 (14.7%) were involved in crashes and referred to VicRoads on this basis. Of these cases, 124 (72.9%) were assessed by either an optometrist or ophthalmologist. The most commonly used ophthalmological tools for assessing field loss included the Humphrey Field Analyzer (n=42, 26%); Esterman (n=16, 10%) and Goldman (n=7, 4%) visual field tests. In 89 (55%) cases, licences were continued unconditionally, 42 (26%) were discontinued, 14 (9%) were made conditional, and in 18 (11%) the decision was pending further review.

Drivers with visual field loss tended to be older and the majority had co-morbid conditions. There was considerable variation in the methods for assessing visual deficits. Despite the Austroads Fitness to Drive recommendations, 27.1% of cases were not referred for further assessment by an optometrist or ophthalmologist. Though some of these drivers may have surrendered their licences or had them discontinued on the basis of other reasons, 22 (13.9%) of these drivers had their private car licences continued and one driver had a commercial licence continued on a conditional basis without specialist vision assessment. Five cases had their private licences discontinued based on static perimetry alone. In two of these five cases, the drivers were contesting the decision made by VicRoads. These findings are discussed in the context of the current medical review guidelines in Australia.

Background

Adequate vision is considered essential for driving safely (Hills, 1980; Kline et al., 1992; Reuben et al., 1988; Shinar & Schieber, 1991), and vision impairments have been shown to be associated with an increased crash risk (Johnson & Keltner, 1983). There are a range of medical conditions that can lead to visual impairments either through deficiencies in the eye or the visual pathways of the brain. As many vision conditions are associated with ageing, the prevalence of visual impairments is expected to increase over the coming decades as the baby boomers approach old age. Researchers have predicted that the number of people with vision loss and blindness in Australia may double by the year 2024 (Taylor et al., 2005). As baby boomers are also expected to be less inclined to use alternative modes of transport than previous cohorts of seniors (Rosenbloom, 2005), the number of drivers with visual impairments is likely to increase over the next decade.

To assess the visual function required to operate a motor vehicle safely, different measures of vision have been used, including tests of acuity, contrast sensitivity, colour, night vision and visual fields (DeLaey & Colenbrander, 2006). Static visual acuity (or the clearness of vision when an individual focuses on a fixed object) is the most commonly measured aspect of vision during licensing assessments. The primary method for measuring static visual acuity is the Snellen eye chart, but this has been shown to be a poor predictor of driving ability (Currie et al., 2000).

Adequate visual fields are also considered important for driving performance (Bowers et al., 2005). While most visual information necessary for driving is received through the central (macular) region, peripheral vision is also vital in the perception of approaching hazards such as oncoming or turning traffic and pedestrians. Visual field loss may occur around the periphery of the field of view or in arbitrary patterns in the central (macular) field and can result from disease or trauma to the eye, optic nerve or brain.

In Australia, the prevalence of vision impairment (including all people with low vision or blindness) in middle-aged people (40 to 49 years) has been estimated as less than 1%, but this increases to 28.8% in adults aged over 80 years (AIHW, 2005; Taylor et al., 2005). The prevalence of visual field loss is also known to increase with age (Haegerstrom-Portnoy et al., 1999; Taylor et al., 1997). Glaucoma, age-related macular degeneration, diabetic retinopathy, hemianopia/quadrantopia and retinitis pigmentosa (RP) are conditions accounting for the majority of non-correctable visual field loss in Australia (Quillen, 1999; Wang et al., 2000). Each of these conditions are described further herein.

Glaucoma

Glaucoma is caused by damage to the optic nerve, resulting from raised pressure in the eye or a lack of blood flow. The vision loss usually begins around the periphery of the eye, but can compromise contrast sensitivity and depth perception. Because many people with the condition are often unaware of their waning vision, glaucoma is known as the “silent blinder” (Coleman, 1999).

Age-Related Macular Degeneration

Age-related macular degeneration (AMD) is a condition where the photoreceptors in the central region of the eye (macula) degenerate. As the macula is where the sharpest vision occurs, this condition compromises the acuity of vision and can dim contrast sensitivity and colour perception (National Eye Institute, 2006).

Diabetic Retinopathy

Diabetic retinopathy is an eye disease caused by vascular complications from diabetes mellitus where the blood vessels that supply the retina are damaged and the risk for developing retinopathy increases with the duration of the patient's diabetes (Fong et al., 2004). In the early stages of this condition, vision can become blurred and specks of blood in the eye may cause black, floating spots.

Hemianopia/ Quadrantopia

Hemianopia results in the loss of half of the visual field in each eye, and quadrantopia is loss of vision in a quarter of the visual fields in each eye (O'Harrington, 1981). The large segments of field loss in hemianopia and quadrantanopia are usually the result of brain damage from stroke or surgery. The brain damage and associated field loss in these conditions may have a different impact on driving abilities when compared to the patchy field loss produced by conditions such as glaucoma and diabetic retinopathy, which are both progressive conditions and may, therefore, allow better adaptation.

Retinitis Pigmentosa

Retinitis pigmentosa is a genetic condition which usually has its onset in adolescence or early adulthood. This condition is marked by a degeneration of the cones and rods in the eye leading to night-blindness and tunnel-like vision.

The collective prevalence of these conditions in the general Australian population is estimated as between 2 to 3% (AIHW, 2005; Rochtchina & Mitchell, 2000; VanNewkirk, Weih, McCarty & Taylor, 2001; McKay, McCarty and Taylor, 2000; Taylor, Livingston, Stanislavsky, & McCarty, 1997). But the significance of field loss to driving varies considerably with the type of loss (peripheral vs central), level of macular sparing, and the presence of associated cognitive deficits due to brain damage, which may be associated with stroke-related field loss or co-morbidities (Coeckelbergh *et al,* 2002). Many of the conditions are progressive, thus, the extent of field loss will also vary depending on the stage of the condition.

Driving with Vision impairments

In Victoria, people with medical conditions that may affect driving can be referred to the VicRoads Medical Review office through self-referral, by the police, medical practitioners or members of the public. These drivers are then requested by VicRoads to consult their medical practitioner and provide documentation of their fitness to drive. Depending on the medical condition and overall health status of the driver, further follow-up from medical specialists, occupational therapists or an on-road driving test may be required.

The Austroads *Assessing Fitness to Drive* Guidelines (Austroads, 2003) provide the national standard in Australia for assessing the fitness of drivers with medical conditions to hold private and commercial licences. The guidelines recommend that after an initial screening by a medical practitioner, drivers suspected of having a visual field deficit should be referred for specialist assessment by an optometrist or ophthalmologist. Drivers in Australia with binocular visual fields of less than 120 degrees along the horizontal plane including 10 degrees above and below, or those who have hemianopia or quadrantopia are precluded from holding an unconditional private motor vehicle licence; however, they may be granted a licence subject to periodic review at the discretion of the specialist and licensing authority. These requirements are similar to those in other countries, although there is variation in the range of visual fields in different countries required for licensing (see Table 1 for summary of selected international requirements). Drivers in Australia with binocular fields of less than 140 degrees within 10 degrees above and below the horizontal midline are precluded from holding a commercial vehicle licence. Those drivers with a less significant field loss (e.g. < 140 degrees) may hold a conditional commercial licence, which is subject to periodic review.

Insert Table 1

The Austroads guidelines recommend that drivers suspected of having visual field loss should initially be assessed using an automated static perimeter (Humphrey Field Analyser, Medmont M700, Octopus, etc.). In this test, the subject is asked to fix their gaze on a central target and is then presented with visual stimuli in the form of static (ie. non-moving, “white-on-white”) flashes of light, usually at low contrast or greater intensity. Positive responses are registered electronically and a computer generated field chart is produced, complete with a score or measurement of false positives and negatives. In clinical practice, other types of perimetry software are becoming more widely used, particularly for glaucoma assessment. These tools may be used to produce field charts for driving reports, with uncertain relevance. An example of this is the first-generation Frequency Doubling Technology plot used for glaucoma assessment which lacks the resolution to allow assessment of field loss relevant to driving (Anderson & Johnson, 2003). While such a technique plots the useable field in terms of absolute response to light, they are not a realistic simulation of the driving task where the driver may be presented with moving objects of various sizes and intensities in different conditions of lightness and darkness (Crabb et al, 2004).

If the criteria for an unconditional licence are not met using static perimetry, the guidelines state that kinetic perimetry assessment, such as Goldmann or Esterman perimetry, should be performed (Austroads, 2003). The Goldmann or Esterman methods use moving targets, but these also lack validation with respect to the driving task (McLean et al, 2002).

Because the basis of driving errors in visual field loss conditions remains poorly understood, there are limitations in the validity of tests and criteria currently used for assessing vision for safe driving (Wood, 2002). Currently there is no test for assessing field deficits which is considered to be the 'gold standard', so it is expected that there may be a high degree of variability in the methods used for assessing visual field loss for driving. There is a need to accurately assess and identify drivers who have vision impairments that place them at a significant risk for crashes, so safe drivers can continue to drive and do not have their licences revoked unnecessarily.

Aims

This paper reviews the current processes used by clinicians for assessing drivers with visual field loss in one Australian jurisdiction (Victoria). The specific aims of this review are: 1) to identify the proportion of all VicRoads Medical Review referrals with a condition causing visual field loss; 2) to examine the decision-making processes used by medical practitioners in assessing vision for fitness to drive, including what instruments are most commonly used to assess visual fitness to drive, who conducts the assessments and how co-morbid conditions are taken into account; 3) to describe the licence outcomes (i.e. the proportion of licence renewals/withdrawals and conditional licences) for those drivers referred with visual field loss.

Methods

Approximately 32,000 cases are currently on file with the VicRoads Medical Review office. The VicRoads case files contain records on all Victorian drivers undergoing medical review for licensing purposes. Medical Review case files contain VicRoads correspondence, driving assessment records, medical evaluations of drivers including associated test results and other licence review request documentation, which may be submitted by police officers, medical practitioners or members of the public.

A random sample of approximately 10,000 (31.25%) Medical Review cases occurring from 1 January 2002 to May 2007 was extracted from the VicRoads Medical Review database and reviewed by VicRoads staff. As the prevalence of the conditions under review is low in the general Australian population, this sample size was selected to ensure an adequate number of cases were identified. The reviewers were asked to identify any Medical Review records where one or more of the six visual field loss conditions of interest was reported (glaucoma, age-related macular degeneration (AMD), diabetic retinopathy, hemianopia, quadrantopia and retinitis pigmentosa (RP)). These were classified as cases and the remaining records were classed as controls.

The licence number, age at initial referral and gender were recorded for all cases. For cases with a visual field loss condition, additional information was collected on the date of first referral to VicRoads, category of the health professional conducting the assessment, method of field loss measurement, driver's licence number, age, gender and health status (co-morbidities, medications etc), crash history and final licensing outcomes.

All data were entered into an MS Access database by VicRoads. Case details were checked for accuracy by a Monash researcher, and a sample of 200 case files were reviewed by this researcher to ensure that case details were classified accurately. The majority of the statistical evaluation is univariate and descriptive.

Results

As at July 2007, 8,295 medical records were extracted from the VicRoads case files and reviewed. In 170 (2.0%) cases, a visual field loss condition was identified. The breakdown of cases by condition, age, gender and crash involvement rate is reported in Table 2. A total of 158 (92.9%) cases were reviewed for private car or motorcycle licences, while 21 (12.4%) reviews involved heavy vehicle licences (some applications considered both the driver's private and heavy vehicle licence).

Insert Table 2

The majority of cases had glaucoma (84, 50%), while the remaining cases had hemianopia/quadrantopia (41, 25%), diabetic retinopathy (24, 13%), AMD (18, 10%) and RP (3, 2%). All conditions, except for retinitis pigmentosa had a mean age greater than 55 years (57.6 to 81.6 years), making the cases slightly older than controls (mean age of 55.8 years). The majority of both cases and controls were male. Co-morbid medical conditions were reported in 63.4% of cases (n=98) including heart condition/ hypertension (n=18, 10.6%), diabetes (14, 8.2%), previous stroke (10, 5.9%), dementia (1, 0.6%) or other (55, 32.3%).

A total of 23 (14.6%) cases were involved in recent crashes and referred to VicRoads on this basis. The majority of referrals for review were made by anonymous sources (24.1%) or the police (22.2%). Either an optometrist or ophthalmologist assessed 124 (72.9%) of the cases. Of cases where the type of field assessment was reported (74, 43.5%), static perimetry assessments were the most commonly used methods for assessing field loss, the majority of which were assessed using the Humphrey Field Analyzer (44, 25.9%), with 2 using the Medmont (1.2%) and 1 using the Octopus (0.6%). Kinetic perimetry was used in 25 (14.7%) cases, including the Esterman (18, 10.6%) and the Goldmann (7, 4.1%) perimetry.

Insert Table 3

The licence review outcomes for private car licences and other summary data are reported in Table 3. A proportion of cases (12.9%, 21 private car licences and 1 heavy vehicle licence) were still under review and were excluded from further analysis. The majority of private car license cases for whom reviews were complete had their licences continued unconditionally (86, 62.8%), 30 (21.9%) were discontinued, 14 (10.2%) were made conditional, and 7 (5.1%) people surrendered their licences voluntarily once the review process was initiated. The majority of heavy vehicle licences were also continued (10, 50%), with 6 discontinued (30%), 3 continued conditionally (15%) and 1 (5%) was voluntarily surrendered. The outcomes of the heavy vehicle licences are reported in Table 4. Ten drivers (50% of those with a finalised review) had their licences continued unconditionally.

Insert Table 4

Discussion

Based on a random sample of approximately 10,000 drivers reviewed by VicRoads Medical Review, approximately 2% of had a visual field deficit condition identified. This figure is generally consistent with the prevalence rates of field loss conditions found in previous studies among the general Australian population (AIHW, 2005; Rochtchina & Mitchell, 2000; VanNewkirk, Weih, McCarty & Taylor, 2001; McKay, McCarty and Taylor, 2000; Taylor, Livingston, Stanislavsky, & McCarty, 1997). This could suggest that individuals with field loss conditions are not over-represented in the cohort referred for medical review despite the older mean age of this group. This could suggest that drivers with field loss conditions do not present a greater danger on the roads and are, therefore, not referred in a higher proportion to other drivers. However, it may also be that at-risk drivers with field loss conditions are handled in other ways (e.g. traffic violation citations, fatal crashes).

The majority of cases identified in the study were slightly older than controls, whose mean age was 55.8 years. This is not surprising given that the rate of visual field loss conditions is known to increase with age (The Eye Diseases Prevalence Research Group, 2004; Johnson & Keltner, 1983).

There were a higher proportion of males in this cohort among both cases and controls, which may be associated with the cohorts' older age. Many women in the older cohorts have never driven or may be more likely to rely on their male partners to do the majority of driving (Rosenbloom, 1995). Additionally, older women are more likely to retire from driving due to loss of confidence in their functional abilities for safe driving (Brabyn et al., 2005; Oxley et al., 2005). Therefore, older women with field loss conditions may be more vulnerable to the negative consequences associated with losing their mobility, and this issue deserves further investigation.

Decision-making process

There was considerable variation identified in the methods for assessing visual deficits. Despite the Austroads Fitness to Drive recommendations (Austroads, 2003), 27.1% of cases were not referred for further assessment by an optometrist or ophthalmologist. Though some of these drivers may have surrendered their licences or had them discontinued on the basis of other medical reasons, 22 drivers (16.1% of those where a final decision had been made on their licensing outcome) had not undergone specialist assessment and had their private car licences continued or approved on a conditional basis. One driver had a commercial vehicle licence approved without specialist vision assessment. Five cases had their private licences discontinued based on static perimetry alone, despite Austroads' recommendations to check static perimetry results with kinetic perimetry. In two of these five cases, the drivers were contesting the decision made by VicRoads.

Twenty-three drivers were referred to VicRoads Medical Review due to a crash, making the crash involvement rate of cases 13.5% overall. Drivers with glaucoma had the highest rate of crash involvement (20.2%) of any of the field loss groups, and this may be related to the fact that people with the condition are often unaware of their decreased visual capabilities. The crash rate in this study is more than double the state-reported crash rate (6.7%) and self-reported crash rates (5.8%) identified in other studies involving older drivers with visual impairments (Rubin et al., 2007; Ivers et al, 1999). Though the small sample size makes it difficult to draw reliable conclusions, the higher crash rate in this population may be the result of a 'selection bias.' As the cohort in this review was referred into the VicRoads system specifically for the purposes of a driving review, they are more likely to be a high risk group than a sample of visually-impaired drivers sampled randomly from the general population. The populations in the previous studies also included people with a broader range of visual impairments (e.g. refractive errors), which may partially account for some of the difference in crash rate. This issue needs to be more closely monitored as the population ages.

The majority of cases were referred by a medical practitioner, including general practitioners, optometrist/ophthalmologist or other health professionals (25.3%), anonymous sources (24.1%) or the police (22.2%). As Victoria does not have a mandatory licensing re-assessment procedure for older drivers, there is likely to be greater reliance on external community sources to report drivers who are suspected of being unsafe. Interestingly, the highest proportion of licences that were discontinued were referred by community reports (50% of licences referred from community members were discontinued) and anonymous sources (28.9% discontinued), suggesting that family, carer and community reports may be a relevant indicator of unsafe driving in older or functionally impaired drivers (Naidu & McKeith, 2006).

The majority of cases (54.4%) had both their private car and heavy vehicle (47.6%) licences continued. Those whose licences were discontinued tended to be older (72.3 years vs. 64.4 years for continued licences), and were more likely to have hemianopia (56.5% of hemianopes had their licences discontinued). Because hemianopia is caused by damage to the brain from injury or stroke, this group may be more likely to suffer from cognitive impairments than people with other field loss conditions. Approximately one-third (29.4%) of people with AMD had their licences discontinued, and this may be related to the older mean age of this group. Furthermore, 10 heavy vehicle licences (47.6% of those reviewed) were continued unconditionally, despite the presence of a vision condition being prohibitive of an unconditional commercial licence.

Seven drivers voluntarily surrendered their licences once the review process was initiated. The average age of these drivers was the oldest (age range = 67– 90 years) and all 7 had co-morbid conditions reported. Previous research has shown that licensing assessment may encourage some older drivers to prematurely retire from driving (Langford & Koppel, 2006). This issue deserves further investigation in relation to the Medical Review process, as the loss of mobility has been shown to be associated with negative outcomes for older people and is undesirable if done prematurely.

Research conducted in the United States has demonstrated that mandatory vision testing procedures for all older drivers (mainly for visual acuity) do little to improve road safety outcomes (Grabowski et al, 2004). This is likely to be because the vision assessments being used (e.g. Snellen acuity chart) are not good predictors of driving performance. Hence, it is critical that the Medical Review process in Australia use the best available methods for assessing vision and determining licensing outcomes to ensure that visually impaired drivers who are at risk are identified, while not limiting the mobility of others.

Limitations

The findings are limited by the accuracy and details of recorded data in the VicRoads Medical Review records. Current privacy legislation prevented the linkage of these records to official police crash or citation records and other medical records. The crash rate reported in this review is based solely on cases referred because of crash involvement and is therefore likely to be an under-estimate of crash involvement in the overall group. In some cases, documentation was incomplete and this may have led to an under-estimation of the number of drivers with visual field loss conditions or the adequacy of the assessment procedures. Additionally, results of the visual field assessments were not included in the majority of case records (57%) making it difficult to evaluate the drivers' level of visual field loss or the appropriateness of the assessment procedures and licensing decisions. Future work on this study will involve two vision science experts reviewing records where visual field charts have been included to grade the level of vision loss in a systematic way.

Conclusion

The results of this study raise questions about the appropriateness of the current processes in place for reviewing drivers with visual field loss and the need for more prescriptive guidelines. Research evidence relating to visual field loss conditions and driving safety is unclear, and the methods for assessing driving safety in those who have field loss conditions are not well validated. (Wood, 2002; Higgins & Wood, 2005). There was wide variation in the assessment methods used by clinicians and licensing decisions among this cohort of drivers. This is not surprising given the heterogeneity of the group in terms of co-morbidities and individual coping abilities. Further research in this area is needed to establish a stronger evidence-base for vision assessments with a high predictive value for crash risk and to identify risk factors for unsafe driving in individuals diagnosed with field loss conditions.

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TABLES

TABLE 1. International visual field requirements for private motor vehicle licenses

Country	Visual Field requirements
Australia (AustRoads, 2003)	The binocular visual field must have a horizontal extent of at least 120 degrees within 10 degrees above and below the horizontal midline;
Canada (Canadian Medical Association, 2006)	Fields greater than or equal to120° along the horizontal meridian and 15° continuous above and below fixation, with both eyes open and examined together.
European Union (Council Directive 1991; Eyesight Working Group Report, 2005)	Vision must be at least equal to 120° along the horizontal meridian, (apart from exceptional cases)
New Zealand (Land Transport Safety Authority, 2002)	In all circumstances a binocular visual field of 140° is required. There should be no pathological defect encroaching within 20° of fixation.
United Kingdom (Drivers Medical Group, 2007)	A field of at least 120° on the horizontal and no significant defect in the binocular field which encroaches within 20° of fixation above or below the horizontal meridian
United States (American Medical Association, 2003)	Many States require a visual field of 100 degrees or more along the horizontal plane, while other States having a lesser requirement or none at all.

TABLE 2. Visual field loss conditions by mean age, gender and crash involvement

Visual Deficit Condition	Total (% of n=170)	Mean age (years)	% Male	Crash Involvement
AMD	18 (10%)	81.6	66.7%	1 (5.6%)
Diabetic Retinopathy	24 (13%)	58.5	79.2%	3 (12.5%)
Glaucoma	84 (50%)	71.9	70.7%	17 (20.2%)
Hemianopia	24 (15%)	62.1	83.3%	1 (4.2%)
Quadrantopia	17 (10%)	57.6	82.4%	1 (5.9%)
RP	3 (2%)	30.7	66.7%	0
Controls	8125	55.8	88.1%	-

TABLE 3 Selected Variables by Outcome for Private Licence Reviews

SELECTED VARIABLES	OUTCOME OF LICENCE REVIEW									
	Continue (n=86)		Conditional Licence (n=14)		Voluntary Surrender (n=7)		Discontinue (n=30)		Total (n=137*)	
Mean Age (years)	64.4		61.7		79.6		72.3		67.8	
	Freq.	*% row*	*Freq.*	*% row*	*Freq.*	*% row*	*Freq.*	*% row*	*Row Total*	*% (n=137)*
VFL Condition										
Age Related Macular Degeneration	1	5.90%	4	23.50%	1	5.90%	5	29.40%	17	12.4%
Diabetic Retinopathy	10	50.00%	5	25.00%	1	5.00%	2	10.00%	20	14.6%
Glaucoma	54	68.40%	3	3.80%	4	5.10%	9	11.40%	79	57.7%
Hemianopia	6	26.10%	1	4.30%	0	0.00%	13	56.50%	23	16.8%
Quadrantopia	13	81.30%	0	0.00%	1	6.30%	1	6.30%	16	11.7%
Retinitis Pigmentosa	2	66.70%	1	33.30%	0	0.00%	0	0.00%	3	2.2%
Who Assessed the Deficit										
Optometrist/Ophthalmologist	66	55.00%	12	10.00%	3	2.50%	24	20.00%	120	87.6%
Other (GP, Endocrinologist, OT)	20	52.60%	2	5.30%	4	10.50%	6	15.80%	38	27.7%
Measurement of Deficit										
Dynamic perimetry	12	52.20%	4	17.40%	0	0.00%	5	21.70%	23	16.8%
Static perimetry	33	73.30%	2	4.40%	1	2.20%	5	11.10%	45	32.8%
Method not stated	41	45.60%	8	8.90%	6	6.70%	20	22.20%	90	65.7%

** The licensing outcome of 21 cases were pending further specialist review*

TABLE 4. Outcome of Commercial Licensing Reviews

	OUTCOME of LICENSE REVIEW					
	Continue/Conditional (n=13)		**Discontinue (n=6)**		**Total (n=19*)**	
VFL Condition	**Freq**	***% row***	**Freq**	***% row***	**Row Total**	**% (n=19)**
AMD	1	100.0%	0	-	1	5.3%
Diabetic Retinopathy	3	40.0%	1	20.0%	4	21.1%
Glaucoma	7	55.6%	1	11.1%	8	42.1%
Hemianopia	1	25.0%	3	75.0%	4	21.1%
Quadrantopia	1	50.0%	1	50.0%	2	10.5%
Who Measured Deficit						
Optometrist/Ophthalmologist	5	55.6%	4	44.4%	9	47.4%
Other (GP & Occupational Therapist)	1	50.0%	1	50.0%	2	10.5%
Not reported	7	87.5%	1	12.5%	8	42.1%
Measurement of Deficit						
Dynamic perimetry	1	100%	0	-	1	5.3%
Static perimetry	4	80.0%	1	20.0%	5	26.3%
Method not stated	8	61.5%	5	38.5%	13	68.4%

**1 case voluntarily surrendered their license and the licensing outcome of 1 case in this category was still pending further specialist review.*

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