



**THE UNIVERSITY  
OF BIRMINGHAM**

**Literature Search for  
Equivalence in the Detection of Binocular Field Defect  
Between Automated Perimeters / Goldmann Perimeter**

**Aggressive Research Intelligence Facility  
West Midlands Health Technology Assessment Collaboration**

October 2005

For the Drivers Medical Group  
DVLA  
Swansea

***ARIF***



## About ARIF and the West Midlands Health Technology Assessment Collaboration

The West Midlands Health Technology Assessment Collaboration (WMHTAC) is an organisation involving several universities and academic groups who collaboratively produce health technology assessments and systematic reviews. The majority of staff are based in the Department of Public Health and Epidemiology at the University of Birmingham. Other collaborators are drawn from a wide field of expertise including economists and mathematical modellers from the Health Economics Facility at the University of Birmingham, pharmacists and methodologists from the Department of Medicines Management at Keele University and clinicians from hospitals and general practices across the West Midlands and wider.

WMHTAC produces systematic reviews, technology assessment reports and economic evaluations for the UK National Health Service's Health Technology Assessment (HTA) programme, the National Institute for Health and Clinical Excellence (NICE). Regional customers include Strategic Health Authorities, Primary Care Trusts and regional specialist units. WMHTAC also undertakes methodological research on evidence synthesis and provides training in systematic reviewing and health technology assessment.

The two core teams within WMHTAC are the Aggressive Research Intelligence Facility (ARIF) and the Birmingham Technology Assessment Group (BTAG)

ARIF provides a rapid on-demand evidence identification and appraisal service primarily to commissioners of health care. Its mission is to advance the use of evidence on the effects of health care and so improve public health. The rapid response is achieved by primarily relying on existing systematic reviews of research, such as those produced by the Cochrane Collaboration, the National Institute for Health and Clinical Excellence (NICE), the NHS Centre for Reviews and Dissemination, and the NHS Health Technology Assessment (HTA) programme. In some instances, longer answers to questions are required in which case mini rapid reviews of existing systematic reviews and key primary studies are compiled, typically taking 1-2 months to complete.

Occasionally a full systematic review is required and then topics are referred to BTAG who coordinate the production of systematic reviews for several customers under a number of contracts. ARIF is intrinsically involved in the production of these systematic reviews.

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### **Warning**

**This is a confidential document.**

**Do not quote without first seeking permission of the DVLA and ARIF.**

The information in this report is primarily designed to give approved readers a starting point to consider research evidence in a particular area. Readers should not use the comments made in isolation and should have read the literature suggested. This report stems from a specific request for information, as such utilisation of the report outside of this context should not be undertaken. Readers should also be aware that more appropriate reviews or information might have become available since this report was compiled.

# **1 Aims**

The aims of this report were to address the following questions submitted by the Driver Medical Group:

## **1.1 Primary Questions**

Is there evidence comparing the outcomes of the measuring of size and location of a visual field defect in a binocular field using a target equivalent to Goldmann III4e target on the Humphrey, Henson, Dicon and Medmont automated perimeters?

## **1.2 Secondary questions**

Is there evidence comparing the outcomes of any of these perimeters and binocular field defect, identified using the III4e target on a Goldmann perimeter?

Further details are given in the request submitted by the Drivers Medical Group (Appendix 1 – Details of Request).

# **2 Background**

In recent years DVLA has preferred and required testing of binocular field on automated perimeters as the results using Goldmann perimeter vary with the skill of the tester. Four automated perimeters are approved for use, namely the Henson, Humphrey, Dicon and Medmont. Because of the lack of equivalence of the tested points between these perimeters, however, there is concern about the equivalence of the testing outcomes. Concerns have also been raised that the Humphrey gives an auditory cue, and that the colours of the targets are dissimilar in different perimeters. This report was set out to identify evidence in the literature that may address these issues.

Further background information is given in the documentation supplied by the Drivers Medical Group contained in Appendix 1 – Details of Request.

## 3 Methods

Outline methods for addressing the primary and secondary questions were:

- To undertake searches for existing systematic reviews and primary studies that compared the outcomes between automated perimeters (Humphrey, Henson, Dicon and Medmont), or between any of these automated perimeters and Goldmann perimeter, in the measuring of size and location of a visual field defect in a binocular field using a target equivalent to Goldmann III4e target.
- To broaden the search to include other potentially relevant studies (for example, using a target other than Goldmann III4e) if necessary.
- To identify from the searches the most relevant systematic reviews and/or primary studies for further scrutiny, based on match to the problem being addressed, currency and robustness of the research.
- If necessary, to contact the suppliers/manufacturers of the four automated perimeters in the UK and request relevant information.

### 3.1 Searches

#### 3.1.1 Existing Reviews

Searches to identify existing systematic reviews on this topic were performed utilising the well-established ARIF search protocol ( Appendix 2 – Search strategies)

#### 3.1.2 Primary Studies

Searches were undertaken for primary studies in Ovid MEDLINE from 1966 to 2005 and in Ovid EMBASE from 1980 to 2005. The search strategy employed MeSH headings related to vision disorders and binocular vision, and combined these with text terms for any of the five perimeters of interest. The strategy was kept broad and non-specific as initial results indicate there may be paucity of relevant studies. The details of terms used in the searches are also shown in Appendix 2 – Search strategies.

An information specialist undertook searches. The initial search results were scanned by a research reviewer for relevance based on information in the title and abstract. Articles that were potentially relevant to the broad criteria below were obtained in full for further assessment.

- **Inclusion:**

*Study design:* comparative studies that tested at least one subject using more than one of the perimeters of interest (see below).

*Population:* age 17 and above

*Intervention:* testing of *binocular* field of vision using any of the following perimeters: Goldmann, Henson, Humphrey, Dicon, and Medmont

*Outcome: agreement between different perimeters*

- **Exclusion:**

- Studies that used the perimeters of interest to test monocular fields

- Studies that simulated binocular fields using data from monocular field testing

Full text articles were assessed for their match to the questions being addressed (external validity).

Reference lists of retrieved full text articles were also checked in order to identify further relevant papers.

Conference proceedings from the biannual International Visual Field Symposia of the International Perimetric Society were searched online from 1974-present using the text term 'binocular'. Of the sixteen symposia that have taken place abstracts and/or full publication were available for fourteen. One of these (1<sup>st</sup> Symposium – 1974) was not searched as the abstracts were in French.

Manufacturers and suppliers of automated perimeters were contacted for relevant information.

## **4 Results**

### **4.1 Results of literature search**

No relevant systematic reviews were identified.

Searches of MEDLINE for primary studies for the years 1966-2005 identified 378 articles and EMBASE for the years 1980-2005 identified 58 articles. The titles and abstracts were assessed for general relevance and potential to meet the inclusion criteria. Fifteen full text articles were obtained but none of these actually met the inclusion criteria with most comparing outcomes of *monocular* field testing using different perimeters. One study (Manji and Plant 1999) compared field defect identified by monocular Goldmann perimeter test with results from binocular Esterman method performed on a Humphrey perimeter.

The search of conference abstracts from the International Perimetric Society revealed very few articles on binocular vision and none were directly relevant to this report. One article by Esterman et al (1985) described 422 perimetries performed repeatedly using both Goldmann perimeter and Dicon perimeter. Two case examples, one for monocular field and another for binocular field, were given to illustrate the agreement between Goldmann score (target III 4e) and Dicon score (at various intensity of 10000 asb, 5000 asb, and 2500 asb). Nevertheless, it is not possible to distinguish what proportion of the 422 perimetries was related to binocular field from the summary results in this paper. The conclusion of the study was that adjustment of light intensities of automated perimeters is needed to produce consistent results between automated perimeters and Goldmann perimeter. In this study, 2500 asb on Dicon perimeter was found to be equivalent to Goldmann III 4e. Given that the study was conducted twenty years ago it is not clear if it has any relevance to automated binocular field measurement today.

## **4.2 Contact of suppliers/manufacturers**

Zeiss UK (Humphrey), Grafton Optical (Dicon and Medmont), and WECO UK (Henson) were contacted with a request for relevant information. A few articles comparing different strategies for monocular field testing on Humphrey were identified, but none of the companies supplied information that was directly relevant to the questions being addressed here. Contact with Dr Henson, the inventor of the Henson perimeter, revealed that he was unaware of any literature comparing different perimeters for the assessment of binocular visual field.

## **4.3 Limitations of this report**

Further searches were not carried out to identify articles from other bibliographic databases due to time constraints. However given the paucity of evidence identified by the searches and the opinion of Dr Henson that evidence in this area is at best limited, then it is unlikely that any significant information already in the public domain was not identified.

Although key suppliers of the automated perimeters in the UK were contacted, there may be lack of incentive for them to provide relevant, and potentially confidential information, for this report. It has not been possible to ascertain whether this is the case.

## **5 Conclusion**

Although automated perimeters are widely available, they have been used predominantly for testing monocular field for the diagnosis of vision disorders in clinical practice and are only used infrequently for testing binocular field to determine the fitness to drive. Published literature appears to reflect this focus on clinical application as several studies were identified that compared different perimeters in the detection of monocular field defect. For the detection of binocular field defect, however, there is lack of evidence with regard to the equivalence of the results obtained from different perimeters. There is also lack of evidence that compared the results obtained from automated perimeters to those obtained from Goldmann perimeter, the conventional reference standard.

Given the lack of utility of binocular field testing in clinical diagnosis and hence the lack of interest in medical research, DVLA would appear to be a key force in advancing the evidence base for the use of automated perimeters in detecting binocular field defect, possibly through uncovering potentially unpublished information from the manufacturers or by requesting them to carry out relevant studies if these are indeed absent.

## 6 References

Esterman B, Blanche E, Wallach M, Bonelli A. Computerized scoring of the functional field preliminary report. Proceedings of the 6<sup>th</sup> Int Visual Field Symposium 1985; 333-339.  
Available at: <http://webeye.ophth.uiowa.edu/ips/Publications.htm>

Manji H, Plant GT. Epilepsy surgery, visual fields, and driving: a study of the visual field criteria for driving in patients after temporal lobe epilepsy surgery with a comparison of Goldmann and Esterman perimetry. J Neurol Neurosurg Psychiatry 2000; 68: 80-82.

## 7 Appendices

### 7.1 Appendix 1 – Details of Request

#### ARIF REQUEST FORM

Date of Request

18 / 08 / 05

Lead Medical Adviser  
Issuing request

Name – Dr Claire Jenkins  
Secretary to the Vision Panel

Contact details

Drivers Medical Group  
DVLA  
Sandringham Park  
Swansea Vale  
Llansamlet  
Swansea  
SA7 OAA

1. Without worrying about the structure of the question, state in full the nature and context of the problem.

- 1) Is there evidence comparing the outcomes of the measuring of size and location of a visual field defect in a binocular field using a target equivalent to Goldmann III4e target on the Humphrey, Henson, Dicon and Medmont automated perimeter?
- 2) Is the evidence comparing the outcomes of any of these perimeters and binocular field defect, identified using the III4e target on a Goldmann perimeter?

2. Please give a background to the question. Why has DMG raised this problem?

#### 1) Group 1

The minimum field of vision for safe driving is defined as “a field of at least 120° on the horizontal measured using a target equivalent to the white Goldmann III4e settings. In addition, there should be no **significant** defect in the binocular field which encroaches within 20° of fixation above or below the horizontal meridian.

This means that homonymous or bitemporal defects, which come close to fixation, whether hemianopic or quadrantanopic, are not normally accepted as safe for driving.

DVLA requires a binocular Esterman field to determine fitness to drive. Monocular full field charts may also be required in specific conditions. Exceptionally, Goldmann perimetry carried out to strict criteria



will be considered. The Secretary of State's Advisory Panel for Visual Disorders and Driving advises that, for an Esterman binocular chart to be considered reliable for licensing, the false positive score must be no more than 20%. When assessing monocular charts and Goldmann perimetry, fixation accuracy will also be considered.

## 2) Group 2

Applicants for a driving licence or for the renewal of such a licence must have visual acuity, with corrective lenses if necessary, of at least 0.8 in the better eye and at least 0.5 in the worse eye. If corrective lenses are used to attain the values of 0.8 and 0.5, the uncorrected acuity in each eye must reach 0.05, or else the minimum acuity (0.8 and 0.5) must be achieved either by correction by means of glasses with a power not exceeding plus or minus four dioptres or with the aid of contact lenses (uncorrected vision = 0.05).

The correction must be well tolerated. Driving licences shall not be issued to or renewed for applications or drivers without a normal binocular field of vision or suffering from diplopia.

Fields are tested using both eyes together. The fields are defined in terms of the Goldmann Perimeter, as this was the commonly available equipment in previous years. The tester controls the Goldmann apparatus. Because of this results can vary with the skill of the tester. For this reason DVLA has in more recent years preferred and required testing on automated perimeters.

Automated perimeters that are approved for use are the Henson, Humphrey, Dicon and Medmont. DVLA prefer the grid designed by Esterman although this has poor testing in the paracentral area as he imagined that the integrity of this would be reflected by acuity testing. The binocular Esterman grid was designed for the Humphrey perimeter. The grids of the Humphrey and Dicon are identical; Dicon created their DVLA grid specifically for our use. The co-ordinates for these grids are known. The grids of the Henson and the Medmont are not similar to the Esterman grid or to each other. They have been approved by Panel as giving equivalent target intensity and contrast, and testing in the appropriate areas.

Because of the lack of equivalence of the tested points, there is concern about the equivalence of the testing outcomes. Concern has been raised that the Humphrey gives an auditory cue or that the colours of the targets are dissimilar in different perimeters. Manufacturers have told us that this does not affect the outcome.

3. Giving references where appropriate, briefly detail the sources you have used to obtain background information on the *options* and *issues*, which might be important for the problems, you describe.

1	13 Sep 88	Equivalents for common perimeters
2	15 Apr 93	Definition of UK standard
3	12 Oct 93	Concern that Estermann "to lenient" in demonstrating normal binocular field Agreement that Estermann test was useful as did not have the complication of "relative" scotomata
4	14 Oct 97	False positive level agreed 20%
5	19 Mar 98	Henson Binocular Drivers Test UK type unacceptable
6	29 Sep 98	Expansion of defect after laser Likelihood of field defect cannot be "guestimated" by number of laser burns – there may be significant central defect even with small number of laser Rx Estermann can be done with or without glasses and better field accepted
7	23 Feb 99	Lack of evidence base. Concept of "likely" (Lord Woolfe)
8	23 Mar 99	Goldmann v Esterman discussion. Decision to request only Esterman because of info in central area obtained.
9	3 Oct 00	Decision confirmed to accept Esterman only. First mention of limiting to Humphrey, Henson and Dicon. Goldmann retained as back-up and as reference for standard.
10	3 Apr 01	Standard redrafted Dicon Esterman grid accepted subject to bowl and target luminance being

		equivalent to Humphrey perimeter. Medmont scale. Concern expressed about illumination and also about location of targets.
11	19 Jul 01	Central standard/exceptional case
12	29 Oct 01	Carl Zeiss co-ordinated for Esterman Medmont accepted with new programme
13	30 Apr 02	Panel noted that fields secondary to laser are likely to progress
14	14 Nov 02	Panel readvised as above
15	02 Dec 03	Presentation on above Panel confirmed that all approved perimeters had equity of testing
16	10 Jun 04	Henson/Humphrey comparison
17	21 Apr 05	Humphrey auditory cue
18		Medmont grid
19		Henson grid
20		Humphrey grid
21		Dicon grid
22		Letter from Carl Zeiss Ltd
23		Letter from H Tinsley & Co Ltd
24		Article on visual field defects in well defined retinal lesions using Humphrey and Dicon perimeters
25		Functional Scoring of the Binocular Field, Ben Esterman MD, FACS

4. Please give name and contact details of any expert or clinical contact e.g. relevant Panel Chairman/ expert Panel member.

Mr M H Miller (Chairman)  
MD FRCS FRCOphth  
Consultant Ophthalmic Surgeon  
Moorfields Eye Hospital  
City Road  
London EC1V 2PD

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5. What is the nature of the target population of the issue detailed above? E.g. age, profile, vocational drivers, young drivers, other co-morbid features.

**Group 1**  
Age group 17+ no upper age limit  
Visual field testing will be required for the following conditions:-

- a) Stroke with visual field defect declared
- b) Head injury with visual field defect declared
- c) Post brain surgery (whatever the cause) with visual field defect declared
- d) Congenital visual field defect (whatever the cause)
- e) Binocular glaucoma
- f) Binocular laser treatment for diabetic retinopathy
- g) Retinitis Pigmentosa

h) Any other condition with visual field defect declared

**Group 2**

Age group 21+ (18 if army) no upper age limit

All of the above and any condition affecting only one eye that could cause field defect.

Vocational drivers tested only the Humphrey unless on occasion the Goldmann is required.

Our current method of field testing assesses only field loss worse than 10 decibels. Results do not distinguish between defects which are "the tip of the iceberg" in a condition where there is generally depressed retinal sensitivity and defects which are secondary to a neurological pathway defect with a healthy retina.

6. What are the outcomes you consider particularly important in relation to the question posed? What decisions rest on these outcomes?

Are all our drivers/applicants having equitable testing regardless of which perimeter is being used?

What is the latest date that an ARIF response would be of value

24 / 10 / 05

Please either:

Fax this form to: 0121 414 7878 marking FAO ARIF

E-mail as a word document or pdf attachment to: [d.j.moore@bham.ac.uk](mailto:d.j.moore@bham.ac.uk)

Post to:-  
Dr David Moore  
Senior Research Reviewer and Analyst  
Aggressive Research Intelligence Facility  
West Midlands Health Technology Assessment Collaboration  
Department of Public Health  
University of Birmingham  
Edgbaston  
Birmingham  
B15 2TT

Please ring 0121 414 3166 or 6767 if you have any queries, or you want to check the progress with your request.

## **7.2 Appendix 2 – Search strategies**

### **7.2.1 ARIF Reviews Protocol**

#### **SEARCH PROTOCOL FOR ARIF ENQUIRIES**

(Feb 2005)

**In the first instance the focus of ARIF's response to requests is to identify systematic reviews of research. The following will generally be searched, with the addition of any specialist sources as appropriate to the request.**

##### **A. Cochrane Library**

- Cochrane Reviews
- Database of Abstracts of Reviews of Effectiveness (DARE)
- Cochrane Central Register of Controlled Trials (CENTRAL)
- Health Technology Assessment (HTA) database

##### **B. ARIF Database**

- An in-house database of reviews compiled by scanning current journals and appropriate WWW sites. Many reviews produced by the organisations listed below are included.

##### **C. NHSCRD (WW Web access)**

- DARE
- Health Technology Assessment Database
- Completed and ongoing CRD reviews

##### **D. Health Technology Assessments and evidence based guidelines(WW Web access)**

- NICE appraisals and work plans for TARs, Interventional Procedures and Guidelines programmes (NCCHTA work pages:[www.ncchta.org/nice/](http://www.ncchta.org/nice/))
- Office of Technology Assessment
- NHS Coordinating Centre for Health Technology Assessments
- Canadian Co-ordinating Office for Health Technology Assessment
- New Zealand Health Technology Assessment
- Wessex STEER Reports
- Agency for Healthcare Research and Quality (AHRQ)
- National Horizon Scanning Centre
- SIGN (Scottish Intercollegiate Guidelines Network)

## **E. Clinical Evidence**

## **F. Bandolier**

## **G. TRIP Database**

## **H. Bibliographic databases**

- Medline - systematic reviews
- Embase - systematic reviews
- Other specialist databases.

## **I. Contacts**

- Cochrane Collaboration (via Cochrane Library)
- Regional experts, especially Pharmacy Prescribing Unit, Keele University (&MTRAC) and West Midlands Drug Information Service (url: [www.ukmicentral.nhs.uk](http://www.ukmicentral.nhs.uk)) for any enquiry involving drug products

### **7.2.2 Primary studies protocol**

#### **Ovid MEDLINE 1966 to September week 3 2005**

- 1 (humphrey or henson or dicon or medmont or goldmann).mp.
- 2 vision binocular/
- 3 vision disorders/
- 4 binocular field\$.mp.
- 5 or/2-4
- 6 1 and 5

#### **EMBASE (Ovid) 1980 to 2005 Week 38**

- 1 (humphrey or henson or dicon or medmont or goldmann).mp.
- 2 binocular vision/
- 3 visual disorder/
- 4 binocular field\$.mp.
- 5 or/2-4
- 6 1 and 5