

USE OF NON-MYDRIATIC CAMERAS FOR DIABETIC RETINOPATHY SCREENING IN COMMUNITY-BASED SETTINGS

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1. INTRODUCTION

These recommendations are written in order to choose a suitable non-mydratic camera (NMC) for diabetic retinopathy (DR) screening in community-based settings. There is also a ranking made for seven cameras which include both a non-mydratic as well as a fluorescein angiography function. This function is a pre-requisite for laser treatment, but not necessary in DR screening.

Advances in technology will allow other cameras to use for DR screening in future, so these recommendations need to be reconsidered with time and there is a need for continuous evaluation of NMCs with time.

1.1 BASIC COMPONENTS CAMERA

Classical NMCs allow physiological pupil dilation when pupils dilate in the dark as all the alignment and focusing is performed with infra-red light which is not in the visible spectrum. Since image capturing is processed through an undilated pupil, dilation drops are not necessary. NMCs include illumination, positioning, focusing and fixation characteristics; infrared light for alignment and positioning, a pair of light spots as a positioning aid (working distance spots), a pair of lines as a focusing aid, and internal lightning at the target. A NMC is easier to use by people with limited eye care training compared to a mydratic camera. It is more convenient for patients and allows for brief image acquisition time.

1.2 DECISION CRITERIA

The cameras were ranked for their portability, field-readiness, ease of use, and performance (Table 1). The costs were also taken into account, but these might be lower when negotiating with the offering companies. The costs mentioned are estimated costs to purchase a camera given by the manufacturers. The portability depended on the weight to take it away and facilitate handling. It was divided into four categories to rank the NMCs for portability ('+' \geq 30kg; '++' 20-30 kg; '+++ 10-20 kg; '++++' <10 kg).

A backup battery power supply was an important component of field-readiness, because it allowed using the camera in outreach settings when electricity is unavailable. A USB interface enabled to temporally store the images on a USB stick without the need for a PC. A built-in database contributed to a more field-ready camera, because it allowed storing images on the camera itself. At last, use of telemedicine with Wi-Fi or transferring images through a local network (LAN) contributed to the field-readiness as it allowed sending images to remote graders to view and grade them.

Ease of use was determined by a simple operation or 'plug and play' with the camera. If the camera included automatic focus and a small pupil feature then it was found easier to capture images. With a built-in monitor it is possible to view the images and directly show them to patients. Another requirement of a NMC was found easy to use software provided and the ability to synchronise the software with base hospital software.

A NMC needed to perform quick imaging, screen a high patient number and be time-efficient and comfortable for patients. Performance was dependent on the image quality of captured images on the camera monitor or the PC monitor. Image quality consisted of (a) image clarity, because there is a need to give sufficient detail for retinopathy grading; and (b) adequate field definition, which shows the desired field of view for retinopathy grading (disc and macula). An indicator can be the visibility of macular vessels.

Other requirements to consider are transport and survival of long road trips, training, duration of the screening project, maintenance, software provided, database, equipment, and instructions or a manual. It should require minimal training to use the NMC. The software provided and database management may need an ophthalmic operator to support users. It is important that a NMC can work autonomously (no connection with a PC needed) to store and grade images and to directly show the images to the patients to improve the compliance and patient education.

Table 1. Explanation of essential characteristics and symbols used to rank cameras

Characteristics	Explanation
Portability	If the camera is portable, not too heavy and robust to facilitate handling and allow easy transport
Field-readiness	If the camera includes backup battery power supply, USB interface, built-in database, telemedicine (Wi-Fi) or transfer images through local network (LAN)
Ease of use	Simple operation, automatic focus, small pupil mode, built-in monitor, easy to use software provided, synchronise software with base hospital software
Performance	Quick imaging, screen a high patient number, time-efficient for patients, comfortable for patients Image quality on the camera monitor and PC monitor Image clarity: is there sufficient detail for automated retinopathy grading Adequate field: desired field of view for retinopathy grading
Essential characteristics	Symbol
Insufficiently covered	+
Partly covered	++
Mostly covered	+++
Fully covered	++++

Table 2 shows the ranking of NMCs for suitability to screen for DR in community-based settings. The performance of the 17 available NMCs was quite similar as all cameras could screen a high patient number and capture images with sufficient detail for DR grading in the desired field of view. The least suitable NMCs (ranking 9, 12-17) include additional functions which make them more expensive and less suitable for DR screening in community-based settings. However, those NMCs may be useful to implement in DR screening programs which need additional functions to optimise the screening they provide.

Table 2. Ranking of NMCs for suitability to screen for DR in community-based settings

Rank	NMC	Portability	Field-readiness	Ease of use	Performance	Cost (AUD \$)
1	Smartscope M5	++++	++++	++++	++	8,000
2	DRS	+++	+++	++++	+++	16,000
3	VI-NM1	+++	++++	++++	++	27,000
4	AFC-230	++	++	++++	++	32,950
5	TRC-NW300	++	++	++++	++	46,000
6	Nonmyd WX ^{3D}	++	++	+++	++	22,000
7	Nonmyd α -D III	++	++	+++	++	25,000
8	Nonmyd 7	++	++	+++	++	25,000
9	Canon CR-2	+++	++	++	++	26,500
10	Visucam 200	+	+++	+++	++	32,000
11	TRC-NW8	++	+	++++	++	28,000
12	Visucam 500	+	+++	+++	++	75,000
13	TRC-NW8F	++	+	++++	++	50,000
14	Canon CX-1	++	++	++	++	65,000
15	VX-10 α	+	+	+++	++	47,900
16	VX-10i	+	+	++	++	45,000
17	TRC-NW7SF Mark II	+	++	+	++	80,000

2. NON-MYDRIATIC CAMERA FOR DR SCREENING IN COMMUNITY-BASED SETTINGS

The following ten cameras are ranked from the most suitable NMC to a less suitable NMC for DR screening in community-based settings. The inclusion criteria are non-mydriatic, 45° field, portable to take to outreach areas and health care workers need to be able to use the camera. A small and portable non-mydriatic fundus camera can be used for outreach screening in which field-readiness and ease of use are the most important characteristics.

1. Smartscope M5 (Optomed)

Portability: +++++	0.4 kg, hand-held
Field-readiness: +++++	Optional battery operation, USB interface, built-in database, transfer images through local network
Ease of use: +++++	Automatic focus, small pupil mode, built-in monitor
Performance: ++	Field angle: 45°, images displayed on small size built-in monitor
Cost:	AUD \$5,000 - 8,000
Software:	The data management software is a part of the sales package



The Smartscope M5 is introduced in 2010 and provides hand-held ocular imaging. It is easily adopted into daily examination routines and connectivity to any patient database system enables image data sharing. The camera weighs 0.4 kg and because of its portable design it can be taken to remote areas. The camera includes 45° image field of view, automatic focus, a small pupil mode and a small built-in monitor. Those features enable easy use for people with limited eye care training. The camera does not need to be connected to a PC all the time. The average standby time will be 4 - 8 hours with full battery. The average usage time is approximately 1 h 30 min continuous use with full battery. The camera includes a built-in memory of 2 GB to store 400 images and a USB interface to download images. It is comparatively inexpensive, because the cost will be between AUD \$5,000 and AUD \$8,000. However, the camera has no Wi-Fi to directly transfer images through the network and need a separate PC to store and view the images on a large size monitor.

2. DRS (Ellex)

Portability: +++	19 kg, not hand-held
Field-readiness: +++	No battery operation, USB interface, built-in database, transfer images through Wi-Fi & local network
Ease of use: ++++	Automatic focus, small pupil mode, built-in monitor, touch-screen interface
Performance: +++	Field angle: 45° and 40°, images displayed on large size built-in monitor and directly on PC monitor using wireless Internet connection
Cost:	AUD \$16,000: dust cover included Optional table will cost AUD \$1,000
Software:	Centervue is currently working on a program called DICOM



The DRS is introduced in 2011 and is not hand-held, but it is portable (19 kg). The DRS camera is easy to use and field-ready as it includes a USB interface, a large built-in database, and it can transfer images through Wi-Fi or LAN. DRS covers a fully automated operation (auto alignment, autofocus, auto-exposure, and auto-capture) so DRS requires minimal operator training and minimal operator assistance. It supports single- as well as multi-field acquisition protocols, providing for seven standard 45° fields. It is entirely operated through its touch-screen interface. DRS can work autonomously as the DRS consists of a built-in database to store 100,000 images and a large built-in monitor (10.4 inch) to view the images. Images can be directly transferred through Wi-Fi Internet connection. However, the DRS is less portable compared to the Smartscope M5 and covers no backup battery power supply.

3. VI-NM1 (Vision Instruments)

Portability: +++	11 kg, not hand-held
Field-readiness: ++++	Optional battery operation, USB interface, built-in database, transfer images through local network
Ease of use: ++++	Automatic focus, small pupil mode, built-in monitor
Performance: ++	Field angle: 45°, images displayed on built-in monitor
Cost:	AUD \$27,000: transport case, dust cover and training material included
Software:	Developed own image management software



The VI-NM1 is introduced in 2011 and is not hand-held, but still portable (11 kg). It covers the highest field-readiness together with the Smartscope M5 as it includes a USB interface, an optional 12V battery operation, a built-in database and it can transfer images through the local network. The VI-NM1 covers a small pupil mode and includes an automatic focus capability to facilitate ease of use by inexperienced users. Several hundred images can be stored on board of the camera if it is used in autonomous mode (no PC connected). The own developed management software may result in some additional costs as it has to synchronise with base hospital software.

4. AFC-230 (Nidek)

Portability: ++	25 kg, not hand-held
Field-readiness: ++	No battery operation, USB interface, no built-in database, transfer images through local network
Ease of use: ++++	Automatic focus, small pupil mode, built-in monitor
Performance: ++	Field angle: 45°, images displayed on built-in monitor
Cost:	AUD \$32,950
Software:	NAVIS-Lite



The AFC-230 is introduced in 2007. The camera is heavier (25 kg) and partly covers field-readiness. It includes a USB-interface and can transfer images through a local network, but it does not include a battery operation or a built-in database. However, this camera is very easy to use as it includes automatic focus, a small pupil mode and a 5.7 inch built-in monitor. Autotracking allows easy and accurate alignment to the centre of the pupil. It includes an automatic blink detection system which eliminates the capture artifacts by blinking. The camera includes a 45° field of view and the images can be displayed on a built-in monitor. However, the camera needs a separate PC to install and use the NAVIS-Lite data software to allow easy patient data management and to store and view images.

5. TRC-NW300 (Topcon)

Portability: ++	22.7 kg, not hand-held
Field-readiness: ++	No battery operation, USB interface, no built-in database, transfer images through local network
Ease of use: ++++	Automatic focus, small pupil mode, built-in monitor
Performance: ++	Field angle: 45° or 30°, images displayed on separate PC monitor
Cost:	AUD \$46,000
Software:	IMAGEnet



The TRC-NW300 is introduced on the market in 2008. This camera is also heavier (22.7 kg) and not hand-held. It does not fully cover the essential characteristic field-readiness as it does not include a battery operation or built-in database. A USB interface enables to temporarily store images and images can be transferred through a local network. The camera is easy to use as it includes automatic focus, a small pupil mode and a built-in monitor to directly view the images. The TRC-NW300 has an integrated 8 megapixel camera, which enables the user to zoom in on details. Two spots on the monitor allow easy alignment. The 45° angle offers an overview of the fundus; fovea and macula in one image. Automatic focus, auto-shoot and auto-exposure result in clear images. The photographer can capture nasal, central and temporal fundus images, which can be combined to one overview.

6. Nonmyd WX^{3D} (Kowa)

Portability: ++	21 kg, not hand-held
Field-readiness: ++	No battery operation, USB interface, no built-in database, transfer images through local network
Ease of use: +++	No automatic focus, small pupil mode, built-in monitor
Performance: ++	Field angle: 45°, images displayed on built-in monitor
Cost:	AUD \$22,000 (AUD \$35,000 including a table, software and stereo viewer)
Software:	Digital Imaging System VK-2



The Nonmyd WX^{3D} is introduced in 2010. This camera includes normal, small pupil and stereo modes, and an external 12.0 megapixel digital single-lens reflex camera. It is easy to switch between the internal fixation targets (central, disk, macula), which makes it easy for non-experts with minimal training to capture images. The camera weighs 21 kg and is not hand-held. It partly covers field-readiness as it does not include battery operation or a built-in database. However, it includes a USB interface and can transfer images through a local network. The camera mostly covered the essential characteristic ease of use as it covers a small pupil mode and a built-in monitor, but no automatic focus. Images can be captured with a field angle of 45° and are displayed on a built-in monitor. The VK-2 software is available for retinal observation on 3D images and it is easy to stitch several images. However, a separate PC is needed to store and edit the images. The camera will cost AUD \$35,000 including a table, software and stereo viewer.

7. Nonmyd α-DIII (Kowa)

Portability: ++	22 kg, not hand-held
Field-readiness: ++	No battery operation, USB interface, no built-in database, transfer images through local network
Ease of use: +++	No automatic focus, small pupil mode, built-in monitor
Performance: ++	Field angle: 45° or 30°, images displayed on built-in monitor
Cost:	AUD \$25,000
Software:	Digital Imaging System VK-2



The nonmyd α-DIII is introduced in 2006. It is a compact NMC and weighs 22 kg, but is not hand-hand. It uses an internal 8 megapixel digital camera. It includes a USB interface and can transfer images through a local network. However, it does not include a backup battery power supply or built-in database. It is easy to use because all operations can be carried out with a simple touch of the button. It does not include automatic focus, but it includes a small pupil mode and a built-in monitor, which can display images in a field angle of 45° or 30°. The VK-2 software can be used on a separate computer to store, restore and compare data. The Nonmyd α-DIII is still developed by Kowa, however, the camera is no longer considered suitable for screening within the National Screening Program for DR according to the National Health Service in the UK.

8. Nonmyd 7 (Kowa)

Portability: ++	21 kg, not hand-held
Field-readiness: ++	No battery operation, USB interface, no built-in database, transfer images through local network
Ease of use: +++	No automatic focus, small pupil mode, built-in monitor
Performance: ++	Field angle: 45° or 20°, images displayed on built-in monitor
Cost:	AUD \$25,000
Software:	Digital Imaging System VK-2



The camera is introduced in 2004 and has similar features compared to the Nonmyd α -DIII at the same NMC unit costs of AUD \$25,000. However, it does not include a built-in camera. It includes a 5.5 inch monitor and it is an easy to use camera. However, the camera includes no automatic focus or built-in database. With the Digital Imaging System VK-2 it is easy to store, restore and compare data, but therefore a separate PC is needed.

9. Visucam 200 (Carl Zeiss)

Portability: +	30 kg, not hand-held, built-in camera
Field-readiness: +++	No battery operation, USB interface, built-in database, transfer images through local network
Ease of use: +++	Automatic focus, small pupil mode, no built-in monitor
Performance: ++	Field angle: 45° or 30°, images displayed on separate PC monitor
Cost:	AUD \$32,000
Software:	FORUM/VISUPAC archiving and image analysis System



The Visucam 200 is introduced in 2011. It is not a light-weight camera (30 kg), but mostly covers the essential characteristics field-readiness and ease of use. It features a built-in database (320 GB) in which 150,000 images can be stored. It is easy to capture images, because the camera includes automatic focus (7 field image capture) and auto flash for optimal image exposure. It allows fast and confident image capture. Imaging software (FORUM/VISUCPAC) is provided for archiving images and image analysis. Images can be fast transferred by USB or a LAN network. However, for use in remote areas, the camera is not portable compared to other NMCs and a separate PC monitor is needed to view the images.

10. TRC-NW8 (Topcon)

Portability: ++	24.5 kg, not hand-held
Field-readiness: +	No battery operation, no USB interface, no built-in database, transfer images through local network
Ease of use: ++++	Automatic focus, small pupil mode, built-in monitor
Performance: ++	Field angle: 45°, images displayed on built-in monitor
Cost:	AUD \$28,000
Software:	IMAGEnet R4



The TRC-NW8 is introduced in 2008. This camera is used with an external Nikon D-90, 12 megapixel digital camera. The 9 fixation targets enable to capture images which can be combined with the IMAGEnet software for a complete overview. The camera is not field-ready as it does not include a battery operation, USB interface and a built-in database. It is easy to use because of the alignment, automatic focus and auto shoot, and a small pupil mode. However, the camera does not include a built-in database or USB interface. A PC with IMAGEnet R4 patient database management system is needed to store the images and perform analysis.

2.1 RECOMMENDATIONS NON-MYDRIATIC CAMERA

The Smartscope M5, DRS and VI-NM1 were found to be the most suitable cameras to screen for DR in community-based settings. The Smartscope M5 is a portable camera (0.4 kg) which includes backup battery power supply and therefore it is a field-ready and portable camera. It includes automatic focus and is easy to use by health care workers with limited eye care training. The costs are only AUD \$8,000.

Another suitable NMC is the DRS. This camera is more expensive (AUD \$16,000) and heavier (19 kg) compared to the Smartscope M5, but less expensive than the VI-NM1 (AUD \$27,000). It does not include a battery operation, but it is able to send images directly by (Wi-Fi) Internet and it includes a large size monitor to view images and therefore it better covers the essential characteristic performance. The camera is very easy to use as it includes a fully automated operation. In addition, it includes a large memory to store 100,000 images.

The VI-NM1 is also a suitable NMC to use in community-based settings. This camera is more expensive and heavier (11 kg) compared to the Smartscope M5. However, it covers the highest field-readiness together with the Smartscope M5 as it also includes a backup battery power supply. The automatic focus capability with manual focus option makes it easy to use, also for people with limited eye care training.

3. ALL-IN-ONE CAMERA

The all-in-one retinal camera includes a non-mydratic function for screening and a fluorescein angiography (FA) function for patients referred to a DR clinic for examination prior to laser treatment. The FA function will allow investigating the pathogenesis of a variety of conditions that affect the retina, including DR. Patients can first be screened for DR outside the main hospital, in referral hospitals, during outreach screening sessions using a NMC.

Seven NMCs with FA function were compared and ranked for their portability, field-readiness, ease of use, and performance. Field-readiness and ease of use are the most important characteristics as the all-in-one camera needs to be used in hospitals and outreach areas.

1. Canon CR-2 (Optimed)

Portability: +++	15 kg, not hand-held
Field-readiness: ++	No battery operation, USB interface, no built-in database, transfer images through local network
Ease of use: ++	No automatic focus, small pupil mode, no built-in monitor, FA function
Performance: ++	Field angle: 45°, images displayed on separate PC monitor
Cost:	AUD \$26,500
Software:	Retinal Imaging Control Software



The CR-2 is introduced in 2010. It is a lightweight camera and consists of a compact and ergonomic design. It is comfortable to operate this camera. One sensor handles all functions: infrared, colour, digital red-free, and digital cobalt retinal photography. The software incorporated into the CR-2 allows it to be used as a stand-alone system or it can be integrated into an existing clinic network or DICOM network system. Retinal Image Control Software (RICS) supports the export of data in which collecting, processing, archiving and referencing has been made much easier. The camera is the cheapest NMC (AUD \$26,500) with a FA function. However, the camera does not include a built-in database and therefore it needs a USB-stick to store the images (temporary) or a PC. This NMC includes an external camera (3.0 inch) and no built-in monitor. Therefore, a separate monitor is needed to be able to view the captured images.

2. Visucam 500 (Carl Zeiss)

Portability: +	30 kg, not hand-held
Field-readiness: +++	No battery operation, USB interface, built-in database, transfer images through local network
Ease of use: +++	Automatic focus, small pupil mode, no built-in monitor, FA function
Performance: ++	Field angle: 45° or 30°, images displayed on separate PC monitor
Cost:	AUD \$75,000: table, stereo and FA function included
Software:	FORUM/VISUPAC archiving and image analysis system



The Visucam 500 is introduced on the market in 2010. It mostly covers field-readiness and ease of use. The Visucam 500 supports fast and easy capture of fundus images even by untrained users because it contains automatic focus, a small pupil mode, auto flash and easy manual or automatic positioning with working distance dots. Captured images are displayed on a separate monitor immediately for fast assessment. The camera includes a built-in database, in which over 150,000 images can be stored (320GB in total). The images can be transferred through a local network via USB or DVD. This camera is expensive (AUD \$75,000), however, it includes a table, stereo and fundus autofluorescence. This camera does not include a built-in monitor. Therefore a separate PC monitor is needed to view the captured images and use it for FA.

3. TRC-NW8F (Topcon)

Portability: ++	23.5 kg, not hand-held
Field-readiness: +	No battery operation, no USB interface, no built-in database, transfer images through local network
Ease of use: ++++	Automatic focus, small pupil mode, built-in monitor, FA function
Performance: ++	Field angle: 45°, images displayed on built-in monitor
Cost:	AUD \$50,000
Software:	IMAGEnet R4



The TRC-NW8F is introduced in 2010. The camera provides automatic focus, auto shoot and auto small pupil detection to make the image capture simple and user friendly. The camera is capable of non-mydratic colour, red free and fluorescein angiography. With one touch it is easy to switch between fluorescein and non-mydratic photography. There is an external 12.0 megapixel camera included: a digital single-lens reflex (SLR) camera, Nikon D-90. A built-in 6.4 inch monitor is available, so it is easy to view the captured image directly and show it to the patient. However, the camera does not include a built-in database or USB interface which make this camera not field-ready. As this camera cannot work autonomously, a PC with IMAGEnet R4 patient database management system is needed to store the images and perform analysis.

4. Canon CX-1 (Optimed)

Portability: ++	26 kg, not hand-held
Field-readiness: ++	No battery operation, USB interface, no built-in database, transfer images through local network
Ease of use: ++	No automatic focus, small pupil mode, no built-in monitor, FA function
Performance: ++	Field angle: 45°, images displayed on separate PC monitor
Cost:	AUD \$65,000
Software:	Retinal Imaging Control Software



The CX-1 is introduced in 2010 and partly covers the essential characteristics. It is a multimode camera including a non-mydratic as well as a mydratic mode, FA, cobalt, red free and colour photography modes. The modes can be changed and functions can be adjusted by a push-button operation. An external EOS camera can be linked with the CX-1. Using Retinal Imaging Control Software, images can be viewed, manipulated and send to a DICOM storage device or a printer. The camera has no built-in database and needs a separate monitor to view the images. The costs are high because it is a multi mode camera.

5. VX-10α (Kowa)

Portability: +	39 kg, not hand-held
Field-readiness: +	No battery operation, no USB interface, no built-in database, transfer images through local network
Ease of use: +++	No automatic focus, small pupil mode, built-in monitor, FA function
Performance: ++	Field angle: 45°, images displayed on built-in monitor
Cost:	AUD \$47,900
Software:	Digital Imaging System VK-2



The VX-10α is introduced on the market in 2009. This camera includes a 5.6 inch built-in monitor. It is easy to use the navigation panel and this allows selecting a mode (non-mydratic, mydratic, fluorescein) with one touch. The camera includes a small pupil mode. It is connected with a 2.1 digital megapixel CCD external camera which enables to take both standard colour photography and FA. Linked to the Digital Imaging System VK-2, all images can be saved and shared through a LAN. However, the camera does not include a USB interface and has no built-in database to directly store images. A separate PC with the Digital Imaging System VK-2 software is needed to store images.

6. VX-10i (Kowa)

Portability: +	37 kg, not hand-held
Field-readiness: +	No battery operation, no USB interface, no built-in database, transfer images through local network
Ease of use: ++	No automatic focus, no small pupil mode, external camera, built-in monitor, FA function
Performance: ++	Field angle: 45° or 27°, images displayed on built-in monitor
Cost:	AUD \$45,000
Software:	Digital Imaging System VK-2



The VX-10i is introduced in 2005. This camera is similar to the VX-10α, however, it does not include a small pupil mode which make it less easy to use as a NMC. FA can still be performed as dilation drops are administered before FA image capture. With an external 6.3 megapixel camera good quality images can be captured. Linked to the Digital Imaging System VK-2, all images can be saved and shared through a LAN. However, the camera is not field-ready as it does not include a USB interface and has no built-in database to directly store images.

7. TRC-NW7SF Mark II (Topcon)

Portability: +	35.9 kg, not hand-held
Field-readiness: ++	No battery operation, USB interface, no built-in database, transfer images through local network
Ease of use: +	No automatic focus, no small pupil mode, no built-in monitor, FA function
Performance: ++	Field angle: 50°, 45° or 30°, images displayed on separate PC monitor
Cost:	AUD \$80,000
Software:	IMAGEnet R4, EyeRoute



The TRC-NW7SF Mark II is introduced in 2009. This camera combines mydriatic and non-mydriatic retinal imaging capabilities into one single system at high costs (AUD \$80,000). It can capture images including colour, red-free, and FA. Simple touch screen controls provide switching through procedures. However, the camera is not easy to use as it does not include automatic focus or a small pupil mode. The camera has an external camera which allows for swing and tilt movement of the LCD monitor for precise image capturing. It is network ready and capable of operating in the EyeRoute web, also as an iPhone app. EyeRoute enables images to be viewed, compared, organised, and shared with other instruments. The camera is heavy and expensive, but is useful as a stationary camera at a hospital.

3.1 RECOMMENDATIONS ALL-IN-ONE CAMERA

It is recommended to use either the Canon CR-2 or the Visucam 500 as an all-in-one camera to combine FA with outreach screening for DR. The Canon CR-2 is the cheapest (AUD \$26,500) and a lightweight NMC with a FA function. However, if the budget is sufficient (AUD \$75,000) the Visucam 500 is easier to use and more field-ready to use in outreach areas as it includes automatic focus and a built-in database.