Supporting Community Nurses using Mobile Video Telemedicine

A pilot of BlueEye mobile video telemedicine in Västmanland home care for frail and elderly

Authors

Donal Morris (RedZinc Services Ltd)
Jeanne Caffrey (RedZinc Services Ltd)
Lalit Saini (RedZinc Services Ltd)
Annika Kärnsund (Region Västmanland)
Mattias Derneborg (Region Västmanland)
Marie Liljeberg (Region Västmanland)

"Video transfer could be very useful technology in small teams working in remote communities when it is easy to set up and use. Newer staff can contact more experienced colleagues and municipal nurses can contact the Mobile GP team using video. Video gives more detailed information and can enhance decision-making about patient health."

-Jan Gräsberg
GP, Mobile GP Team, Region Västmanland
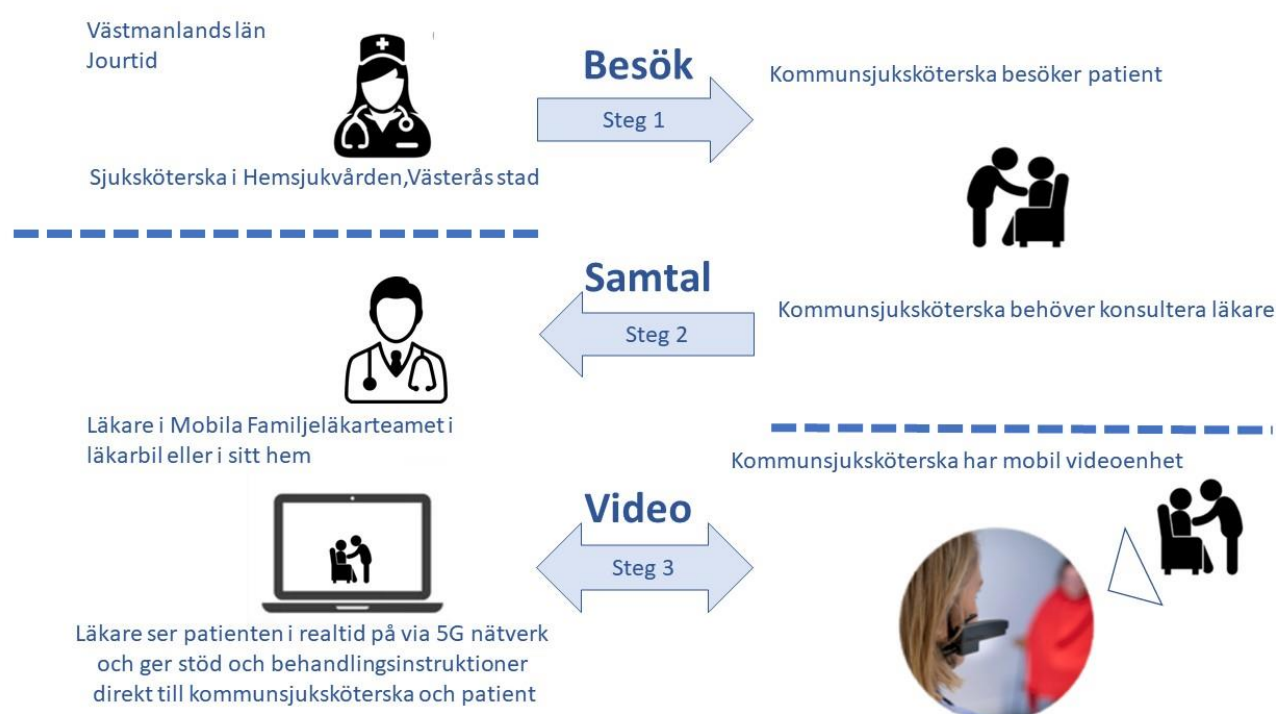
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SAMMANFATTNING

I områden där avstånden är stora skulle bärbar video kunna användas när det är tidskritiskt att adekvat personal får möjlighet att se en person för en medicinsk bedömning. **Videostreaming ger en överblick** i en medicinsk situation som inte kan återges lika effektivt genom enbart telefonsamtal. Videostreaming med hjälp av en bärbar kamera ger **vårdpersonalen ögon och öron på platsen**.

Mobila Familjeläkarenheten från *Region Västmanland* samarbetade under hösten 2021 med *RedZinc Services,* leverantör av mobil telemedicin, för att utvärdera om bärbar videokamera dvs videostreaming skulle kunna användas för att stödja sjuksköterskor i hemsjukvården, Västerås stad.

RedZinc tillhandahåller BlueEye, en bärbar videolösning. BlueEye består av en kamera integrerad med en molnbaserad videoplattform och 4G / 5G smartphones. BlueEye möjliggör realtidsvideo från kamerabäraren till en mottagare som tar emot videoströmmen via BlueEye hot desk. Mottagaren kan befinna sig var som helst där det finns uppkoppling mot internet.

Denna rapport beskriver syfte och mål med pilottesten, BlueEye videotekniklösning, utmaningar och resultat. Videotekniken testades under sex veckor. Användare var sjuksköterskor inom hemsjukvården i Västerås och Mobila Familjeläkarteamet, Region Västmanland. Med stöd av BlueEye kunde de mobila familjeläkarna samarbeta och vägleda sjuksköterskorna i utmanande medicinska situationer utan att behöva åka till platsen. När bedömning och behandling kan ske på plats besparas även patienten transport till sjukhus. Detta kan leda till ett bättre lagarbete, ökat förtroende, bättre patientvård och förbättrad effektivitet inom hälso- och sjukvården.

> Pilottesten indikerar att bärbar video skulle kunna förbättra patientresultaten genom att påskynda vården av patienten, underlätta för läkare att prioritera rätt patienter, minska behovet av resor och på det viset göra jourläkararbetet mer effektivt.

Västmanlands län
Jourtid

Sjuksköterska i Hemsjukvården, Västerås stad

Besök Steg 1 → Kommunsjuksköterska besöker patient

Samtal Steg 2 ← Kommunsjuksköterska behöver konsultera läkare

Läkare i Mobila Familjeläkarteamet i läkarbil eller i sitt hem

Kommunsjuksköterska har mobil videoenhet

Video Steg 3 →

Läkare ser patienten i realtid på via 5G nätverk och ger stöd och behandlingsinstruktioner direkt till kommunsjuksköterska och patient

1   EXECUTIVE SUMMARY

Wearable video promises to be useful in community nursing particularly in remote areas in places such as Sweden where frail/elderly patients are distributed across a wide region, and it is challenging for medical experts to travel to in a short time. **Video gives context** to a medical situation which cannot be replicated through verbal description. It gives the remote healthcare professional **eyes and ears at the scene**.

Mobile GP (General Practitioner) Team from *Region Västmanland* collaborated with Mobile Telemedicine provider, *RedZinc Services,* to evaluate if wearable video could be used to support community nurses in the City of Västerås.

RedZinc provides a wearable video solution called BlueEye. **BlueEye** is a **Wearable Video** solution consisting of a lightweight camera integrated with a cloud-based video platform and 4G/5G smartphones. BlueEye enables real-time point of view video from the camera wearer to remote location(s) which can be accessed via BlueEye hot desk.

This white paper describes the motivation and objectives of the pilot, BlueEye video technology innovation, pilot details, challenges, and outcomes. The pilot was conducted over a 6-week period during late summer 2021. User group were community nurses visiting frail elderly patients and a mobile GP team. The mobile GP team is an out of hours service from early evening to early morning and at weekends. With BlueEye, the mobile GPs were able to collaborate and guide the remote nurses faced with challenging medical situations. This may result in better teamwork, improved confidence, better patient care and improved healthcare service efficiency.

The pilot indicates that Wearable Video improves patient outcomes by expediting patient care, enables doctors to prioritise patients needing more immediate attention, saves doctors time by eliminating the need for travel and overall makes the doctors-on-call more efficient.

PROJECT COLLABORATORS CONTACT DETAILS

RedZinc Services Ltd   info@redzinc.net

Region Västmanland   innovation@regionvastmanland.se

Västerås Stad   kontaktcenter@vasteras.se

Tele2   info@tele2iot.com

Health5G   www.health5g.eu

Mälardalen University Sweden   cristina.seceleanu@mdu.se

2 INTRODUCTION

This white paper is produced as a result of the **Health5G project** healthcare at home pilot, in which *RedZinc Services* and *Region Västmanland* collaborated to evaluate the use of Wearable Video in community nursing of patients at home in the City of Västerås.

2.1 Background of the Pilot

Region Västmanland is an organisation responsible for health and medical care of the 278,608 inhabitants of Västmanland county. *Västerås Municipality* are responsible for homecare for people who need any kind of support from the community. **Region Västmanland has a Mobile General Practitioner (GP) team who are on duty out of hours. They support the nurses in Västerås Municipality that care for the frail and elderly at home and at nursing homes.**

RedZinc Services Ltd is a software company specialised in Mobile Video Telemedicine. BlueEye Handsfree is a wearable, mobile, point-of-view, cloud-based mobile video telemedicine service developed by RedZinc. *BlueEye facilitates remote consultation by transmitting point-of-view video from patient locations and immersing the remote medical expert into the critical patient scene where support is required.*

The pilot was a collaboration between Region Västmanland, the City of Västerås and RedZinc Services Ltd. Tele2 provided 5G SIM cards for the cellular network which is used by BlueEye wearable video for real-time video streaming. After a demonstration of BlueEye technology to Region Västmanland, a healthcare use case was identified, to send video from the municipal nurse to the Mobile GP team, to help assess remote patients.

2.2 Motivation for the Pilot

Community nurses working in Västerås Municipality are sometimes faced with patients who need extra medical support from doctors. These nurses are often alone in their decision-making, hence the support from remote GPs becomes important.

In the current setting, the Mobile General practitioners (GP) team receives phone calls from nurses all over Västmanland county. The nurse attends to the patient and reports any medical attention required from a general practitioner. If a phone consultation is not enough to decide whether the nurse can treat the patient or if a doctor is needed, **the Mobile GP Team must drive to the patient which is time consuming**. There may be further delays in vital patient care if, for example, the GP Team are occupied at another patient site, or they just have treated a patient at the opposite side of the County. If the Mobile GP Team are too far away it might be necessary to transport the patient to the hospital for consultation. This can be a strain for patient and relatives and can put a burden on the healthcare service. Furthermore, if the hospital visit is unnecessary, it is an additional cost for system in various forms.

3   BLUEEYE TECHNOLOGY

3.1   Wearable Video Technology

BlueEye Handsfree Video platform facilitates remote training, consultation or expert advice via point of view live video with the help of a wearable camera and a secure web portal.

BlueEye is an integrated solution (Figure 1) including:

1. BlueEye wearable handsfree camera
2. BlueEye app on smartphone for mobile connection and
3. Cloud-based BlueEye video platform based on dedicated secure servers to access live video remotely.

Figure 1. BlueEye camera headset with 5G smartphone and BlueEye hot desk

The nurse wears the Handsfree camera near the temple (Figure 2) and connects it with a 5G smartphone for **mobile communication.** The BlueEye app in the smartphone allows the nurse to relay live video to the remote doctor.
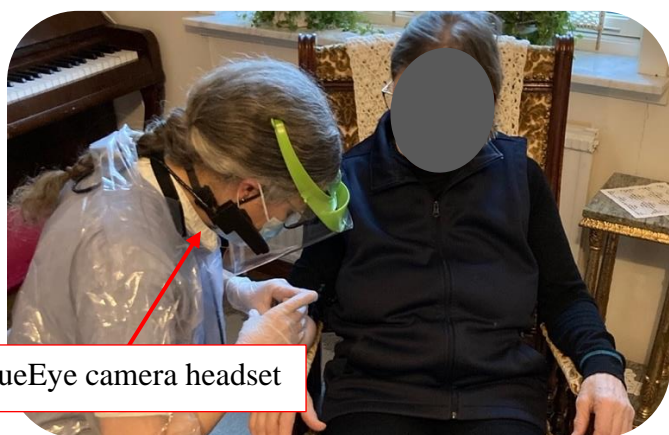
BlueEye camera headset

Figure 2. A Västerås nurse attends to a patient while wearing BlueEye camera headset

The remote doctor logs in to the secure BlueEye to access the real-time video from the nurse's point of view (Figure 3). The doctor can see the patient and help with pre-hospital diagnosis, treatment, and oversight. The doctor can also speak with the nurse and the patient.

Figure 3. A doctor watches real-time point-of-view video on BlueEye hot desk

The device works on both local Wi-Fi as well as 4G and 5G networks so it is not dependent on the availability of Wi-Fi. The headset does not impact the vision of the user when worn. The High-definition camera on the headset is rotatable allowing the user to change its direction for optimal quality video. The one-way video from the camera headset to the web portal enables the healthcare professional using the headset to focus on the action. The hardware is equipped with an IoT SIM card and cannot be used for ordinary voice calls.

BlueEye camera headset

BlueEye Handsfree solution has a camera which sits near the wearer's eyes to capture real-time video with the wearer's point-of-view. RedZinc continues to upgrade the camera features, of which currently are

a) 2 Mega Pixel camera
b) Wide-angel and narrow-angel options
c) Rotatable camera to adjust view
d) Multiple body docking options
e) Supports glasses, masks and vizors
f) Sturdy make suitable for rough and busy environments

BlueEye app features

BlueEye app currently offers the following features for the camera user to control video transmission

a. Start/ Stop video streaming
b. Screenshot option allows user take screenshots from either BlueEye camera or smartphone camera
c. Video features allows user set appropriate video quality as per the room settings
d. Video controls to mute microphone or pause video transmission
e. Call Attention button to notify the hot desk user about immediate attention needed

BlueEye hot desk features

BlueEye hot desk is used by the remote doctor to access live video has features

a. Access streaming from different BlueEye cameras
b. Take screenshot from BlueEye camera
c. Acquire GPS location details of the camera user
d. Mute audio transmission from hot desk
e. Mute audio transmission from BlueEye camera

BlueEye has been developed specifically for the busy environments keeping ease-of-use and security at the centre of the design.

4   PILOT DETAILS

4.1   Scope of the pilot

The pilot was carried out from over **six weeks in Autumn 2021** with the help of two user groups, community nurses visiting frail elderly patients and mobile GPs. Training sessions at a test site were offered to the participating personnel before and during the pilot. A total of *twelve training sessions* with scenario tests were carried out with about **35 participants**. There were thirty nurses involved of which five used the device in consultations at night time.

The new Standard Operating Procedure (SOP) is shown in the diagram below (Figure 4). Community Nurses workflow changes when using video.

The mobile community nurse visits the patient. Sometimes the nurse needs the doctor's advice and calls by phone (without video). In the new video SOP, the nurse wears the video camera, calls the remote doctor using BlueEye video and the doctor sees the remote patient and gives guidance to the nurse.
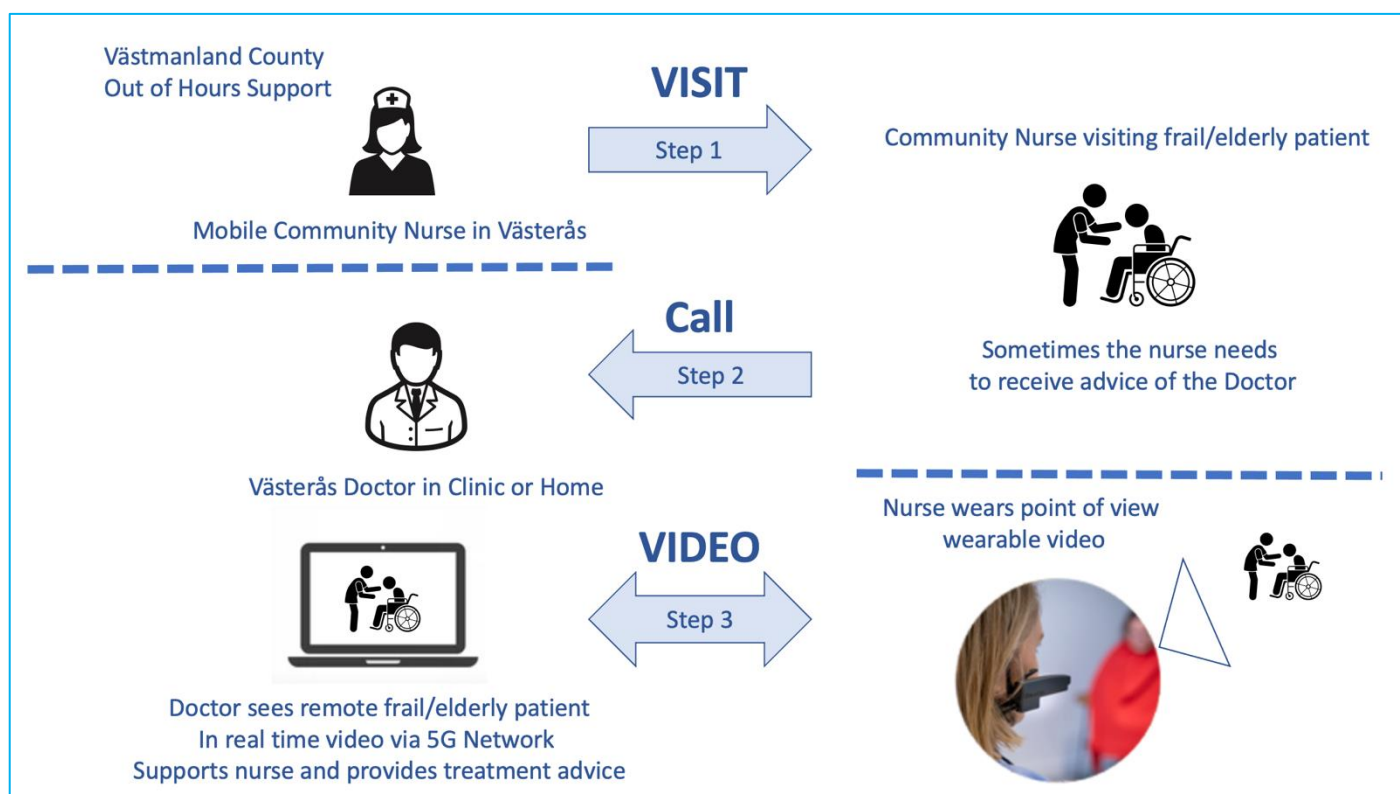

Figure 4. Standard Operating Procedure of Västerås nurses with BlueEye technology

4.2   Wearable Video Solution supports Community Nurses

The hypothesis is that wearable video solutions can support community nurses during out-of-hours work with patients as the nurses can transmit real-time video to mobile doctors to get support, collaborate and receive extra medical guidance. *The use of video is expected to reduce the number of visits by doctor making the service more efficient and enabling the doctor to go to highest priority patients first. BlueEye gives the nurse the opportunity to contact the doctor by video, no matter where they are, and the video allows the doctor to see and hear the patient from the nurse's point of view.*

Using Wearable Video

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1. Doctor gives advice based on **visual assessment** of patient and verbal information from nurse and/or patient
2. Doctor has **more information** to assess e.g. severity of case (wounds, skin rash, general condition)
3. More treatment options:
   - Nurse can treat with **remote clinical support and better information** (Doctor has higher level of patient contextual information)
   - Potential for remote doctor to guide nurse to **treat under supervision** e.g. drug prescription, treat minor wound
   - Patient is conveyed to hospital when needed

Potential benefits of using Wearable Video
- Reduces doctor visits
- Reduces doctor travel
- Keeps more patients at home
- Increases patient safety
- Supports remote junior doctors and nurses
- Can schedule non-urgent hospital appointments
- Preserve ambulance/emergency services for established acute cases

4.3 Pilot Execution and evaluation

The organisations participating in the pilot wanted to evaluate the usefulness and limitations of BlueEye Handsfree technology in clinical use in remote consultation. The users of BlueEye wearable video technology included

 a) *Community Nurses* who initiated the video calls

 b) *Mobile GP Team* who received the video calls

The nurses were instructed to use the BlueEye wearable video every time they could potentially use it to consult with the Mobile GP Team. The nurses called the Mobile GP team on an ordinary phone to asked them to login to BlueEye Hot Desk. Then they started transmitting video using BlueEye. The consultation followed the established routine in every other way. The nurses were instructed to go back to ordinary phone call if needed. After every use of BlueEye wearable video, users were asked to complete a web-based questionnaire.[1]

The pilot was evaluated with the digital questionnaire followed by interviews to collect more information. Nine interviews were conducted by telephone or by video call[2]. The interviewees worked as doctors, nurses, and assistant nurses within the Mobile GP Team in Region Västmanland and Västerås Municipality. Some managers who were involved in the project were also interviewed.

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[1] Note: Consultations regarding children, death management and care certificates were excluded from the pilot.

[2] All participants in the interview have given their permission for quotes from the interview to be used.

5 PILOT OUTCOMES

5.1 Pilot Challenges

Team Collaboration and ways of working

Community nurses in Sweden are used to caring for their own patients, it is responsible, solo work. Some personnel found it hard to get used to both the video technology and working in a different way with colleagues. One participant "thought *it was good, some colleagues said they felt a bit uncomfortable as we do not know each other. There is a challenge with this new technology to create new ways of working and different relationships.*"

As the nurses have many patients and they worked with both ordinary telephone and the BlueEye video, additional work was involved for the busy nurses for each video consultation.

It is important that both the community nurses and the Mobile GP team are empowered to use the video solution. In the pilot, the community nurses initiated video calls and staff of the Mobile GP Team received the video. One participant felt *"Would like both doctor and nurse to be able to start the system."*

The project was short due to financing and delayed due to the pandemic. Participants would have liked more time to test the equipment. The doctors and nurses work only a few nights per month. More structured communications may have helped here. Some of the inputs from the participants were *"During the project, we got new employees, it was difficult to reach the whole group"."*

"Only worked one weekend during the project. Did a connection test to a doctor and it worked. Would have liked to try it more."

One learning from the project is that all participants need to be trained in advance to use the BlueEye Handsfree wearable video solution.

It is good to have the training and instruction documents in the native language before the start of the pilot, where possible.

Post pilot, RedZinc has created more training materials (documents, videos) for training and quick reference of users. Training sessions can be organized on request.

A BlueEye Standard Operating Procedure can be defined with each hospital to assist the different teams coordinate effectively with each other.

Two Factor Authentication

Two factor authentication (2FA) or a two-step login was developed on request from Västmanland to give added security to the video transmission. As part of the setup of the pilot the involved managers consulted the data protection authorities and agreed that this feature was mandatory to fulfil the legal requirements in GDPR requirements when sensitive health data are streamed. Two-step login, calling and double confirming makes the login process more cumbersome and time consuming for the user. It seems like a small problem but it affected the project a lot. One of the participants said *"Used my own private phone for login and SMS otherwise the work phone was blocked."*

Post pilot, RedZinc has made 2FA optional, it can turned on or off as needed.

Hardware Challenges

The view was too wide, needs to be a narrower angle lens for patients. A zoom facility would be ideal for close ups. The camera headset was also loose on the head and the size could not always be adjusted enough. This is a new way of working and participants need to be conscious of the person watching, that they did not move around too much while transmitting video. Two participants felt *"Would like a camera reminiscent of "go pro" action camera that athletes use, for example, on a bicycle helmet, chest strap or headband.", "Fits well"*.

To address these issues, BlueEye camera is now available in both narrow and wide-angle options. The RedZinc team has also introduced a **headband camera** which fits better on the head and the team has also been working on introducing a cyclops camera (camera placement on forehead). A zoom-in feature is also in the product roadmap.

PPE causing audio issues

Personal protection equipment (PPE) such as plastic gowns, caused audio issues. The BlueEye hardware microphone covered by plastic led to poor sound quality in some consultations. This was only discovered after the start of the pilot.

Use of another phone for Wi-Fi and network connection

The nurses would have liked to have the BlueEye application on their own phones, rather than having to carry two phones with them. One nurse said, "*Would like to connect directly to the phone.*" In some cases, nurses forgot to bring the BlueEye smartphone, or the battery was discharged at the time of use.

In future, if remote users have phones with the BlueEye app specification (Android phone with a USB-C port and snapdragon chipset), they can use their personal smartphones.

5G Network Performance Observations

The community nurses used 5G SIMs and the network for the pilot location worked very well in general. Personnel did report some issues due to limited network coverage.

5.2 Clinical Pilot Outcomes

All interviewed participants thought that the training was good and that the devices were quite easy to handle. One participant said it was

> *"Fantastic to be part of the project".*

With this pilot, it was agreed that real-time video could be useful for a community nurse where extra support is needed from the Mobile GP team to help with guidance and decision-making.

The types of community nursing cases where medical guidance is needed are particularly for wounds/falls/skin rashes. The outcomes from this new way of working with video indicate that

- *Nurses were enabled to treat the patient in home with the doctor's advice, avoiding long travel by doctor, for example, examination of a wound by the doctor*
- *After a video consultation, doctors need only travel to patients if deemed necessary*
- *If treat at scene is not possible, the patient can be transferred to emergency service in hospital on the doctor's recommendation*

It was agreed that a broader implementation of such a pilot could result in

- The doctor having **enhanced information** and ability to prioritise patient visits
- **Reduced travel** means more time for the doctor to prioritise and visit patients in need
- Making the service more **efficient**

The feedback on BlueEye pilot can be summarised as follows:

Features	Issue	Suggestion for improvement	Solution/Outcome
Camera headset	Uncomfortable on the ears, loose on the head	Change design of mounting	Headband mounting (Already launched)
2FA	Makes login more complex. Legal requirement	Easier login	2FA is optional in BlueEye
Smartphone	Only supports RedZinc supplied camera	Allow to use personal phone	Supports any phone with snapdragon chipset and USB-C port
Audio under PPE	Noisy with PPE	Use audio (mic & speaker) connected to smartphone outside the PPE	Allows to use external audio. Audio switch feature in BlueEye app to switch between earphones and smartphone speakers
Team collaboration	Unfamiliar with new technology and working part-time	Thoroughly planned changes, Training	Training materials available. A re-run of the pilot with different application
Updates (software and camera)	Mandatory software updates during test period, too short timespan to be able to train all personnel in new features	Possible for the organisation to decide when to implement updates	Enable organisation to decide when to implement updates

5.3 RECOMMENDATIONS

Based on the pilot learnings and feedback from the participants, following suggestions are recommended for other healthcare providers when using wearable video

i. The Standard Operating Procedures should be defined and made clear to all the participants involved.

ii. It is very important that the system is safe for the patient, the data must be secure. There needs to be a balance between security and ease of use related for login. This needs to be resolved at a legal level with appropriate data protection assessment and agreements in place.

iii. The camera needs to be light and comfortable.

iv. The service should be introduced with direct involvement of the team to ensure compatibility between the technology and existing practice.

v. Plenty of time for discussion with staff and patients should be allowed about how it might affect the team and the healthcare service. If any changes are introduced in the technology, the new system should be evaluated.

vi. It is recommended to work in collaboration with the ICT department and technical support to establish roles and processes when using the technology.

vii. It should be used with an understanding of the patients' lives and how the technology relates to the management of their health condition.

viii. It is important to establish on what clinical basis the healthcare provider makes the decision to use camera or not.

ix. Finally, it is recommended to carry out a longer (6-12 months) and more metric driven pilot in a similar setting with evaluation-periods with partial reconciliations when changes are made.

x. Suggested metrics for a future pilot with/without video are
- Number of doctor call outs needed
- Number of patient transfers to hospital with/without video
- Time reduction for doctors in travelling to patients
- Time reduction for patient care

6   CONCLUSION

While a few challenges were encountered during the pilot which were related to training, communication and hardware issues, the **general feedback on the use of wearable video for community nurses was good.**

The main learnings from the pilot are that an SOP needs to be defined from the start. The technology needs to be tried out on a small team and any adjustments made before piloting with a larger team and before a training schedule is set in motion. The training should include team communications on the level of comfort around using a new technology.

Regarding the technology modifications resulting from the pilot, the loose-fitting headband has been addressed with an elasticated adjustable strap. The camera is available is narrow and wide lenses. The smartphone specification remains as it is for the purposes of the service.

The legal requirements of extra high security 2FA at the desktop or the smartphone dashboard, is a matter for individual hospitals and the login time can be adjusted to the needs of the team and training can be given on the final login procedure.

This platform would be particularly useful in cases where doctors are not readily available to visit the patient at their residence. The service can also enable doctors to make informed decisions on whether to visit the patients or not and thus save resources. Doctors are also able to prioritise the patient treatment based on level of acuity.

The participants felt that use of video in community nursing is the future as it has the potential to improve the accessibility of doctor's expertise. It was agreed that the same system could also be used to connect junior doctors with remote specialists for consultation and support.

Overall, the pilot participants felt that the use of video was good for patients and staff as the patient treatment was expedited and the staff received support. Several participants felt that **video could enable 'right care at the right time'** for the patients and **reduce a significant amount of travel for the doctors.**