Health Innovation
North East and North Cumbria

An Evaluation of an Eko Digital Stethoscope

November - December 2023

CONTENTS

SUMMARY

The Health Innovation North East North Cumbria (HI NENC), formerly known as the Academic Health Science Network for the North East and North Cumbria (AHSN-NENC), conducted an evaluation of an Eko Core Digital Stethoscope as part of the North East and North Cumbria Digital Pioneers programme. This electronic stethoscope facilitates the amplification, filtering, and transmission of auscultation sound data.

Redmoor Health, a trusted NHS partner, generously gifted 20 Eko Core Digital Stethoscopes to HI NENC for the purpose of conducting an evaluation targeting healthcare professionals in the North East and North Cumbria region.

The evaluation was conducted internally. Its aim was to explore the device's potential, with the possibility of expanding it into a larger project that incorporates an AI component. Another primary objective was to support healthcare practices in gauging the additional benefits and alternative applications of the technology to improve patient outcomes and address capacity-related challenges.

Expressions of interest were actively sought to identify participants interested in evaluating and testing the device. Once participants were identified, the devices were dispatched to them for a 10 12 week testing phase. Following the testing phase, a set of questions was utilised to delve into their motivations for testing the device, patterns of usage, anticipated benefits, perceived value, and frequency of use, among other aspects.

Some advantages noted in utilising the device were:

- The ability to aid in the education and training of clinical staff.
- A preference for digital stethoscopes over an analogue one, mainly due to better sound quality and the capability to record sounds.
- The potential for utilising the device in virtual wards and step-up/step-down services.

However, some obstacles to its use were also identified:

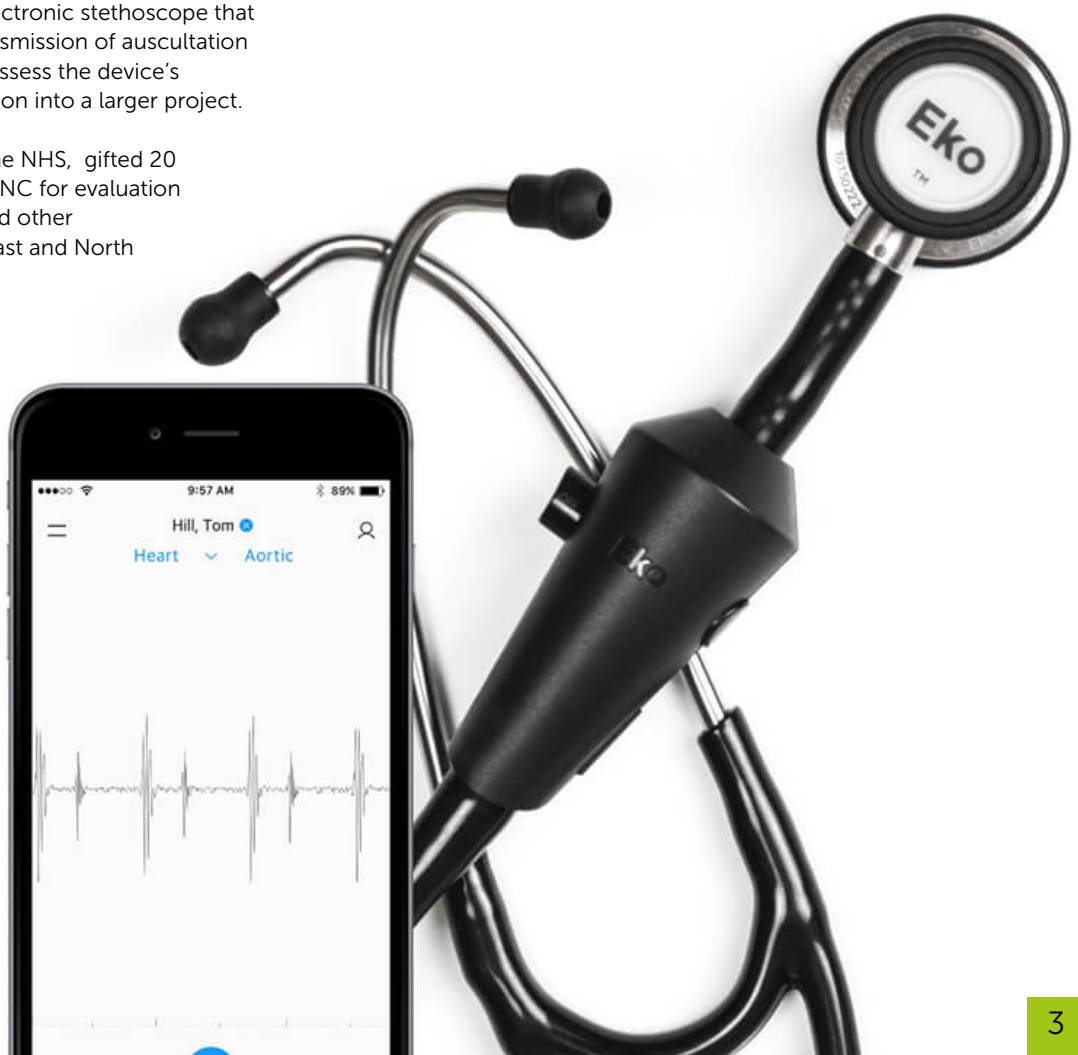
- The requirement for stable and sufficient network connectivity, particularly during home visits to rural areas.
- A need for a clearer indication of when the device is turned on or off.
- Remembering to charge the battery is crucial for ensuring that the device remains powered when required for use.

INTRODUCTION/BACKGROUND

On behalf of the North East and North Cumbria Digital Pioneers programme of work, HI NENC undertook an evaluation to review an Eko Core Digital Stethoscope, an electronic stethoscope that enables amplification, filtering, and transmission of auscultation sound data. The evaluation aimed to assess the device's potential, possibly leading to its expansion into a larger project.

Redmoor Health, a trusted partner of the NHS, gifted 20 Eko Core Digital Stethoscopes to HI NENC for evaluation by general practitioners, trainee GPs and other healthcare professionals in the North East and North Cumbria region.

The Eko Core Digital Stethoscope has the capability to transform acoustic sounds into electronic signals, enhancing the listening experience through amplification. These electronic signals can be processed and converted into digital format for transmission to a personal computer or laptop. The device is designed for healthcare professionals requiring precise listening to body sounds in environments with background noise, or those routinely examining patients for irregularities.



AIMS/OBJECTIVES

The Digital First Primary Care programme is a key driver for change and transformation and the project is designed to experiment with the Eko Core Digital Stethoscope device and explore innovative and novel ways of using it

The project aimed to:

- Explore the functionalities of the Eko Core Digital Stethoscope device.
- Identify innovative methods for its use.

The evaluation focused on identifying optimal ways in which:

- The device could be employed to address prevailing challenges in primary care.
- To see if the device would assist practices in assessing the supplementary benefits and alternative applications of the technology to enhance patient outcomes and address capacity-related challenges.
- To find out from health care professionals:
  - their motivations for testing the device;
  - utilisation patterns;
  - desired benefits;
  - perceived value;
  - frequency of device usage.

By undertaking this process, it will aid in assessing the project's potential and potentially pave the way for its expansion into a larger project.

METHODS

Initially, 20 Eko Core Digital Stethoscopes were gifted by Redmoor Health, but on inspection, only 17 devices were discovered. Expressions of interest were sought to identify interested participants, comprising of general practitioners, trainee GPs, and other health professionals who would evaluate and test the device. Subsequently, devices were sent to the interested participants for a 10-12 week testing phase.

When the devices were distributed, relevant information was provided, including a Quick Start Guide with instructions on downloading the App from either the Apple or Google Play Store. Additionally, a video link was shared, demonstrating the effective use of the device and offering further guidance on utilising the Digital Stethoscope (Appendix 1).

Following the 10-12 week testing phase, participants were invited to take part in a semi structured interview, and were asked to complete a consent form, granting permission for the interviews to be recorded and for anonymised feedback to be incorporated into the evaluation report (refer to Appendix 2). For those who completed and returned the consent forms, interviews were undertaken between November 2023 to December 2023, and were hosted on Microsoft Teams, lasting approximately 15 – 25 minutes.

A list of interview questions was employed in interviews to ensure a uniform and consistent approach across all interviews. These were posed to each professional in a consistent order. (Appendix 4).

Interviews were transcribed and thematic analysis techniques were used to identify common themes across participants. Where appropriate, specific themes were identified and quantified to support with reporting.

MAIN FINDINGS

Distribution of the Eko Digital Stethoscopes

In total, 17 Eko Core Digital Stethoscope devices were distributed to those who expressed an interest in testing the device. Those who received the device were from across the North East and North Cumbria region (Figure 1), and mainly consisted of GPs (Figure 2).

Figure 1: Allocation by area

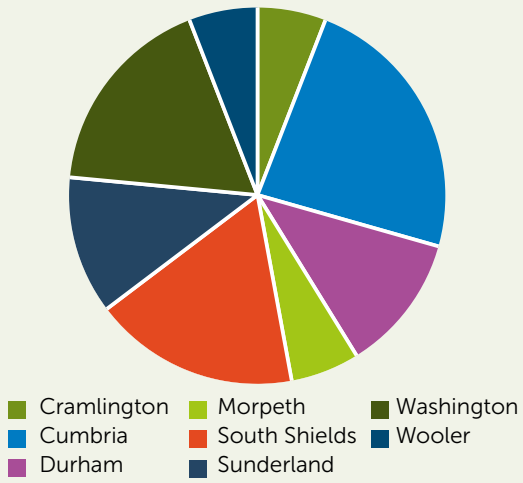
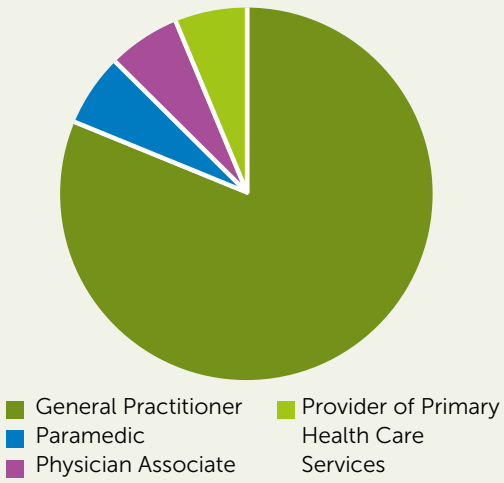


Figure 2: Allocation by profession



REASONS FOR TESTING OUT THE EKO DIGITAL STETHOSCOPE

Table 1: Why healthcare professional wanted to test the Eko Digital Device

		Response
Interested in new technology and innovations and to see if it made a difference.	9	(64.3%)
Was asked to test the device.	3	(21.5%)
To see if it could be used as a teaching / evaluation tool.	1	(7.1%)
To see if it was better than an analogue stethoscope.	1	(7.1%)
Answered	14	(100%)

From interviews conducted, the most common reason for wanting to test out the device was centred around being interested in trying new technology and to explore whether new innovations can make a difference in practice (Table 1). This highlights the eagerness for some primary care clinicians to engage with new technologies to improve upon already embedded devices.

One GP stated:

"I have only ever used Littman stethoscopes before, and my current one is probably approaching the end of its lifespan. I was quite keen to try something different and also to see if it did make any sort of discernible difference to the day-to-day practice."

Similarly, another GP expressed interest about observing how it would fare in comparison to his conventional stethoscope:

"I was quite interested to see how it would compare with our normal stethoscopes and see whether it would make a difference or it was something similar."

CLINICAL SCENARIOS THE EKO DIGITAL STETHOSCOPE WAS UTILISED

The device found its primary usage in general practice settings for consultations, as indicated in Table 2. This outcome is unsurprising, considering that 64.4% of the allocations were designated for general practitioners. One GP found it particularly useful whilst examining children:

"I have some people particularly paediatric cases where actually, it was quite nice to engage with a child to be able to have them listen to their heart and things like that and I found that quite nice in a sort of rapport building sense. So, it was just do it through my phone and turn the volume up and let them listen to their heart and that was just quite more of a rapport building. "

Another GP incorporates the device into his daily practice, utilising it 4-5 times a day, and has discontinued the use of his previous stethoscope.

"I thought that using it once in a while would not give a real feel for what it does. So, I packed up the old one and I have been using it every day for 4 weeks or thereabouts."

A provider of primary healthcare services shared his experience with utilising the device for virtual wards. However, the endeavour proved to be challenging as the team was dispersed over a considerable geographic area and they were only allocated one device:

"It was provided to the clinical team/respiratory team for virtual wards. Initially the first part of the test was getting the staff familiar with this. That took a little bit longer than originally planned. Mainly because they are a team that are spread out across a large geographical area."

Table 2: Usage by healthcare professionals

		Response
In a GP setting i.e., consultation	9	(64.4%)
In a teaching or training scenario	2	(14.3%)
Used in virtual wards	1	(7.1%)
Used adhoc	1	(7.1%)
Not used in surgery at all	1	(7.1%)
Answered	14	(100%)

A GP mentioned that she had never utilised the device herself; nevertheless, she acknowledged the potential benefits of GP trainees incorporating it into their visits:

"I haven't used the device in the surgery at all because there wasn't the opportunity and the wider network there, but I can see the benefit of it for GP trainees going out on visits or for when we are setting up services that are not necessarily GP led but are GP supported. It allows a bit more flexibility."

In contrast 2 GPs did not feel there was any advantage to using the digital stethoscope over an analogue stethoscope:

PHYSICAL FEATURES AND BENEFITS OF THE EKO DIGITAL STETHOSCOPE

Recording Capability

Based on feedback received, it was discovered that the device recording feature was the most utilised aspect. Once more a GP suggested that it would be beneficial for examining children:

"I have actually removed the digital component rather than using the ears and you are able to auscultate hearing it so you can record it and listen to it rather than having to put it into your ears, which is really quite useful with children, specifically because they know when you put something in your ears you are coming for something, but if you can give them something else the hand held bit. That is handy for small children.~

In contrast, another GP mentioned they would use the recording feature, but would not play recordings back to patients:

"I personally wouldn't play it back to patients as I think that's too intrusive and I could see a role for that as well if people were convinced there was something wrong with their chest and to play it back and say look It's clear, but then they don't have a trained ear."

One GP experimented with the recording feature but expressed that replaying the audio recording served no purpose for him:

"As far as I can tell all it does is record an audio of what I'd be listening to and so there's no analytical element to that, you can go onto the app and replay the audio, but I would have no purpose for that really. "

Sound Quality

The primary benefits of opting for a digital stethoscope over an analogue one appeared to centre around sound quality.

Comments from GPs included:

"I can hear better. Actually, yesterday I picked up my old stethoscope and 'ooh, I can't really hear anything."

"One thing I really found useful is the fact that it isn't just listening to the sounds but actually the fact you could record the heart sounds and explain to patients."

Another point made by a GP on the benefits of using the digital stethoscopes was:

"In this day and age of medical legal medicine, to not listen to someone's chest and blindly prescribing antibiotics, especially particularly for the frail elderly, is not perhaps medically legally defensible in some occasions. I think this device will be great to use."

When questioned about recommending it to others, a GP felt the Eko Digital Stethoscope had superior sound quality compared to a traditional stethoscope, emphasising its potential benefits in noisy hospital environments. Whilst another GP would recommend it to colleagues with hearing impairments as described below:

"I would yes. The sound quality, acoustic quality was far better than any stethoscope I've used before. So, I think that alone would make me want to use the device longer term. Especially in noisy environments such as places like A&E, acute medical wards. Having that noise cancelling and an amplified sound would make a big difference I think."

"As it stands only if they are hearing impaired and it would offer the potential to enable them to hear stuff that they couldn't otherwise hear."

TRAINING AND EDUCATION

A commonly reported benefit of the device was based around the ability to support with education and training of clinical staff, which also overlapped with the ability to record sounds on the device.

"I think that's a massive advantage in terms of from a teaching perspective as well as developing your own skills and in reinforcing your own knowledge and understanding."

A Physician Associate, for instance, stated they would suggest it to newly qualified Physician Associates, as described below:

"I would recommend it to other people and would especially recommend it to physician associates as they are coming first off as qualifying as they may not have as much experience from that point of view. It's having that capability of being able to record and sort of showing that during debriefs and using it as a teaching opportunity will help you build on your experience."

"I think that's a massive advantage in terms of from a teaching perspective as well as developing your own skills and in reinforcing your own knowledge and understanding."

Additionally, one participant highlighted that whilst they believed the benefit was limited in a GP setting, the device could have benefit for paramedics and again, valued the potential use for training.

"I would probably donate the two we have in the surgery to the paramedics and get them to evaluate it from their perspective because I think they'll get more use out of it than at the moment we would in the surgery, but as a future development if you were a training practice you could have a couple that you might send your GP trainees out on a visit with."

LIMITED BENEFITS

A primary healthcare service provider showed particular interest in the AI component of the device and reached out to EKO for assistance. It was found although the Eko app is available internationally, every country has its own set of guidelines on what is and is not available. It was reported that the AI heart murmur/AFib detection and live streaming service is not included, as these algorithms have not been cleared for international use at this time. (See Appendix 3).

"We ended up reaching out to Eko because we couldn't get the AI part to work and what Eko advised was it wasn't available in the UK. It wasn't licensed which was the reason."

A GP refrained from delving into the extra features due to the absence of instructions. Nevertheless, when devices were distributed, relevant information was provided, including a Quick Start Guide with instructions on downloading the App from either the Apple or Google Play Store. Additionally, a video link was shared, demonstrating the effective use of the device and offering further guidance on utilising the Digital Stethoscope. (See Appendix 1).

"One of the challenges with it with regards to using additional features is it came with no instructions. "

"I don't think it offers much more than a little bit of specialist use case and a bit of fun in the reality."

In contrast, a GP didn't see any advantages over an analogue stethoscope and would not endorse it to fellow professionals:

"I would not because I don't think it offers additional utility over and above a normal stethoscope for the money unless you had a special interest in cardiology, and you are going to be listening to hearts for murmurs and checking that sort of thing on a regular basis. But even then, you are probably going to be seeing patients who have had echoes so I think there's some very edged cases and very specific clinicians who will benefit from this. My feeling as a GP I don't feel that this iteration of the product offers much benefit over and above an analogue stethoscope."

USEABILITY AND IMPROVEMENT TO DESIGN FEATURES

50% of respondents reported having no practical issues with the device. Comments included:

"It was dead easy to use. I have USB ports literally about 3 inches in front of my face right now so charging it was never an issue. It was dead easy to do on that front. "

"Literally none. It's very easy to use and you don't need to think about how you're going to charge it."

Recommendations were put forward concerning improvements to the design of the device, specifically regarding the on/off switch:

"Clearer marking is needed for when it's on and when it's off. There's just a light that comes on and when the light goes off, so you are never quite sure if it's on or off."

"For it to be clear when it's turned on and turned off. It's clear in terms of when the battery is low. Otherwise, it's a decent looking bit of kit. Once it was on it worked well."

"I found it turned on. it's sods law that there is one patient I desperately wanted to communicate about, and I couldn't record it. I want to know that it is going to work and there is some way of telling you."

Two general practitioners believed that additional assistance would have been advantageous regarding the device's usage:

"When you start to use it, the app set up was a bit tricky. It would have been nice for someone to say you need to do it this way and then you're all set up."

In terms of contacting Eko Support, a Provider of Primary Health Care Services had mentioned:

"In terms of Eko, the only way you can get in touch with them, that I could see, is through the website. It's not a major thing but I believe probably time difference was potentially an issue, but they did come back within 24 hours so obviously that was something if you didn't have that local support – re. that first line support. "

BARRIERS TO USING THE EKO DIGITAL STETHOSCOPE

Over half of participants encountered no obstacles in utilising the device. Nevertheless, two reported facing issues when the device ran out of charge. While this observation from a GP may not necessarily be viewed as a negative aspect, it serves as a reminder to keep the device charged consistently:

"You would never guess how important it is to have the charger for your stethoscope, because at one point I did run out of battery life on the stethoscope, and it was right in the middle of a consultation. It's about if your phone was about to die you would keep an eye on things and plug it in. It's a balance of always have a charger handy for the stethoscope. "

A paramedic frequently operating in rural regions mentioned that stable and sufficient network connectivity is essential, particularly during home visits conducted by paramedic practitioners in general practice.

"The fact that the app disconnects itself. Especially when you are with a patient, and you say I'm going to listen to your chest, and I've got a new stethoscope and I'm going to use it and link it to my phone so that I can explain it to the doctor. Then by the time you've done all that and get it out and realise the app suddenly wants you to sign back in again is really frustrating."

Despite most respondents feeling there were no barriers to use, a GP noted that unsolicited emails might be discouraging for certain users and could be perceived as a barrier:

"Having to register for the website and downloading the app - getting more unsolicited emails as a result."

Another general practitioner expressed the opinion that for consistent usage of the device, it ought to be seamlessly integrated into routine practice; otherwise, this could pose a barrier to use.

"If it was something that was going to be rolled out, it would need to be something that is rolled out and embedded in normal practice, normal use rather than on an ad hoc basis. Because if it is ad hoc people will forget about it until they need to use it. So, it's setting it up so it's something that is used all the time or it's easier to use ad hoc I think is a key barrier."

UTILISATION OF THE EKO DIGITAL STETHOSCOPE TO LINK WITH SECONDARY CARE

Over two thirds of participants identified potential connections with secondary care in relation to clinical pathways, primarily through the sharing of recordings with Cardiologists as described below:

"Potentially where there is a situation of where there's a murmur heard on heart oscillation, we might want to record it and ask for advice from a cardiologist."

"If it was used in secondary care, you could have junior staff on it and A&E recording it and show it to a consultant and they could relay back what they think and their thoughts."

One GP believed it would prove beneficial for remote monitoring and virtual wards.

"I think remote cardiology clinics have massive potential. Just general remote working utilising different staff groups to be able to go see a patient and basic obs and chest or heart listen to. Even care home patients who have not opened their bowels for a while and they are a bit bloated - actually all you really need to do is have a listen to their bowel sounds. It opens the doors for pathway for care for remote care utilising different workforce people, but things like virtual wards and stepping up and stepping down I think has potential or that as well. "

In contrast, another GP did not think it offered any potential links to secondary care:

"I just can't. When we are referring things on, I'm sure I could have attached a recording of heart sounds through, but I don't think it offered anything useful for a cardiologist or respiratory physician. I think they would listen to it and would say why couldn't you send for an echo or why not just refer it in."

ADDITIONAL SCENARIOS OF UTILISATION

During interviews, participants were asked if there were any additional points they wished to share that had not been addressed in the discussion regarding device usage. Comments included:

Spare Parts to be considered:

"To consider spares, e.g., if the diaphragm has gone. With other stethoscopes you need to buy diaphragm or whatever. And they are easy to dismantle and is each bit replaceable. I think ongoing maintenance spares or whatever."

Next iteration to include an ECG Tracer:

"It has its place but in a niche window. That being said the model up If you were going to spend the money. I would have paid a little bit extra to get the one with the ECG tracer on it. I will keep the device as a second line for when it's needed and hopefully it will still have some value."

Hard of hearing healthcare professionals:

"Thinking about clinicians or physicians that were starting to get hard of hearing themselves if they knew that there were actual digital stethoscopes that they could use that had a volume on it."

For use in care homes:

"I see real value in care homes in reducing home visits. Especially if you are asked to do a late home visit – 65-75 year old at night. An 80 year old lady in a care home with chesty symptoms, you get a set of obs, chest sounds perfect. Still keen to test it out if you are still up for it. Because I've given the heads up to our local nursing home. Maybe it's something we can do for the future."

Data Protection

"if I wanted to send heart sounds to a consultant - we don't really know the process when we are looking at things like data and with data protection. For instance, if I've got this sound how do I then send it. Do I send it by email? Will there be potential data protection issues with that?"

CONTINUED USE OF THE DEVICE

Over three quarters of participants intend to continue to use the device and see its potential.

"I will be using it constantly and I'm going to buy a pouch for it myself because I love it and this may sound a bit weird but my administration staff are always curious about what do you mean by crackles, and what do you mean by this and how can you tell there's an infection. So, if I'm actually able to do that play it out at lunchbreak or help people use it. I think it's such a good technique to keep the morale up."

KEY FINDINGS

The key findings include:

- The primary motivation for testing the device was rooted in curiosity about new technology and exploring its potential impact on practice.
- Its predominant use occurred in general practice settings during consultations.
- The preference for a digital stethoscope over an analogue one centred on sound quality and the ability to record sounds.
- The recording feature was the most frequently utilised aspect of the device.
- While some participants believed no changes were needed in the device design, suggestions for improvement particularly related to the on/off switch.
- Main barriers to usage related to technological challenges and battery power, with some acknowledging the user's responsibility to charge the device as needed.
- Stable and sufficient network connectivity is needed especially on home visits from paramedic practitioners in general practice.
- Participants identified potential connections with secondary care through clinical pathways, particularly via sharing recordings with Cardiologists.
- Respondents expressed a readiness to recommend the device to others, citing its use in training, a recurring theme in interviews.
- Most respondents plan to continue using the device and recognise its potential. In an interview where a GP mentioned that they won't be using it after the testing period, they have proposed handing it over to a GP with hearing impairment.

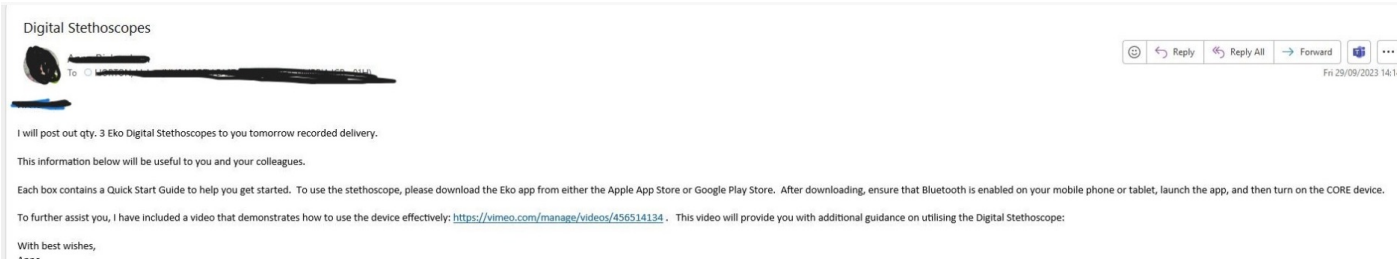
CONCLUSION AND NEXT STEPS

The overarching objective of this exercise was to evaluate the potential of the Eko Digital Stethoscope device, gather user experiences, and determine its value within the system. Despite not achieving the desired number of perspectives, 17 devices were distributed, and 14 interviews were conducted.

The evaluation suggests:

- The device is viable to roll out on a larger scale, however this is conditional on some modifications to the device design or having the next iteration of the product.
- There is the potential for the device playing an active role in teaching and training scenarios, which was a recurring theme in interviews that could be advantageous for trainee GPs and others.
- The recording facility being used on occasion in GP consultations.
- It might provide reassurance to patients when recordings are reviewed, potentially eliminating the need for unnecessary prescriptions, such as antibiotics.
- Possible use of the device in other settings, e.g., virtual wards and care homes.
- Possible additional research into the AI aspect of the device, specifically focusing on AI-based heart murmur and AFib detection as well as live streaming services. However, this will be dependent on international approval of these algorithms.
- This device being used in paediatric healthcare settings, especially when working with children to build rapport.

APPENDIX 1: DEVICE INSTRUCTION EMAIL



Digital Stethoscopes

[redacted]

To [redacted]

Reply | Reply All | Forward

Fri 29/09/2023 14:1

I will post out qty. 3 Eko Digital Stethoscopes to you tomorrow recorded delivery.

This information below will be useful to you and your colleagues.

Each box contains a Quick Start Guide to help you get started. To use the stethoscope, please download the Eko app from either the Apple App Store or Google Play Store. After downloading, ensure that Bluetooth is enabled on your mobile phone or tablet, launch the app, and then turn on the CORE device.

To further assist you, I have included a video that demonstrates how to use the device effectively: https://vimeo.com/manage/videos/456514134 . This video will provide you with additional guidance on utilising the Digital Stethoscope:

With best wishes,

[redacted]

APPENDIX 2: CONSENT FORM

Health Innovation
North East and North Cumbria

Consent Form

Evaluation title: Eko Digital Stethoscope

Conducted: Anne Richardson (HI NENC)

1- I understand that my participation is voluntary and I am free to withdraw at any time, without giving any reason

2- I understand that my opinions will be used to gain a greater understanding on how the device was used and whether it added value to my work.

3- I agree to take part in this service evaluation

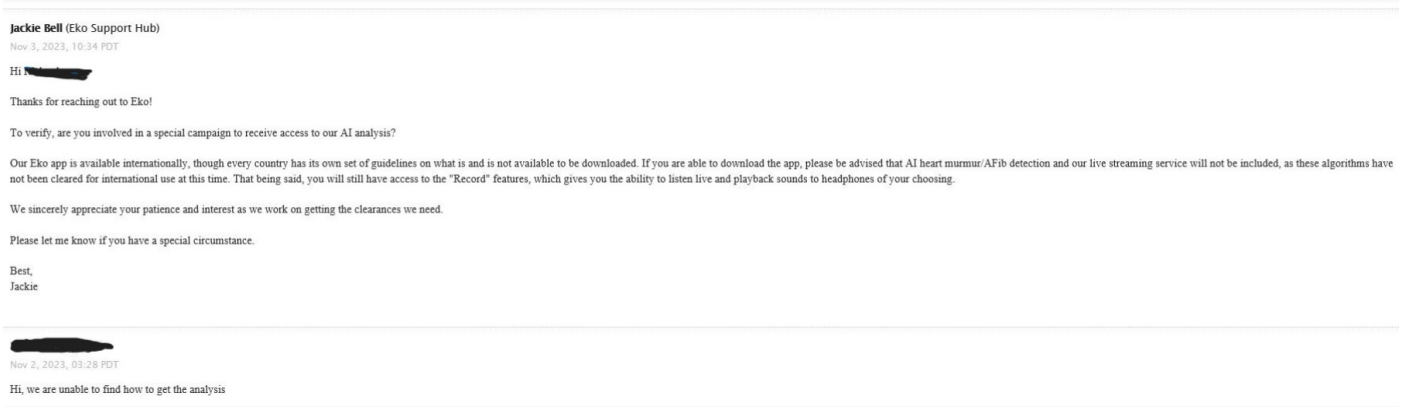
Name of participant……Date……

Signature of participant……

Name of evaluator……Date……

Signature of evaluator……

APPENDIX 3: EKO SUPPORT EMAIL



Jackie Bell (Eko Support Hub)
Nov 3, 2023, 10:34 PDT

Hi [redacted]

Thanks for reaching out to Eko!

To verify, are you involved in a special campaign to receive access to our AI analysis?

Our Eko app is available internationally, though every country has its own set of guidelines on what is and is not available to be downloaded. If you are able to download the app, please be advised that AI heart murmur/AFib detection and our live streaming service will not be included, as these algorithms have not been cleared for international use at this time. That being said, you will still have access to the "Record" features, which gives you the ability to listen live and playback sounds to headphones of your choosing.

We sincerely appreciate your patience and interest as we work on getting the clearances we need.

Please let me know if you have a special circumstance.

Best,
Jackie

[redacted]
Nov 2, 2023, 03:28 PDT

Hi, we are unable to find how to get the analysis

APPENDIX 4: EVALUATION QUESTIONS

Please explain why you wanted to test out the device.

Can you describe in what circumstances and how often you utilised the device?

What do you feel the benefits are (if any) of using a digital stethoscope compared to using an analogue stethoscope?

Prompt if not addressed - How long does it take to use the device compared to current analogue practice?

What (if any) additional features of the digital stethoscope have you utilised?

Prompt if not addressed - What are the benefits (if any) of using digital stethoscopes in training?

What improvements would you like to see to the device design?

Prompt if not addressed - How would this [improvement] affect the likelihood of implementation more widely?

Can you describe any practical issues you had with using the digital stethoscope?

Prompts: for example, with charging frequency or where technical support was needed?

Can you describe what barriers there were to using the device?

Thinking about the clinical pathways it has been used for – can you share your thoughts on any potential links with secondary care through, for example, shared recordings?

Would you recommend the device to others?

Can you explain why.

You're more than welcome to keep the device if you think it is of value to you. Will you continue to use the device after the testing period?

Can you explain why.

Do you have any further comments to make that are not included above?

Health Innovation
North East and North Cumbria

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www.healthinnovationnenc.org.uk