

Unofficial guide for **carers** - to help with remote use of the THINKLABS ONE digital stethoscope



Created by:

**Gabrielle Johnson, Kevin McGibbon, Dr Ruth
Chambers OBE, Rachel Hatfield**

INTRODUCTION

The aim of this guide is to help to support carers who have direct face to face contact with the patient for whom a remote clinician is using the Thinklabs One digital stethoscope via remote consultation. It is likely that the clinician will be initiating the capture of heart sounds or breath sounds as part of a remote clinical review with a patient- maybe in their own home or a Care/Nursing Home. The carer will place the digital stethoscope in relation to anatomical landmarks on the front of the patient's chest or their back; siting will be crucial for the effective interpretation of the outputs from the device by the clinician receiving the recordings that are then sent to them.

GETTING STARTED

To record and send sounds from the digital stethoscope you will need to download a suitable app to your smart phone/tablet. There are a number of applications that can be used with the Thinklabs One digital stethoscope to record and send the sounds such as the Thinklabs Wave app (available on the android play store/apple IOS store), voice recorder app, WhatsApp etc. There are a number of third-party apps too that are compatible but may have costs.

There are other apps available on the android play/IOS app store that provide many features suitable for phonocardiography, recording, teaching, sharing stethoscope sounds around the bedside or classroom; however whilst some elements are free, others must be paid for.

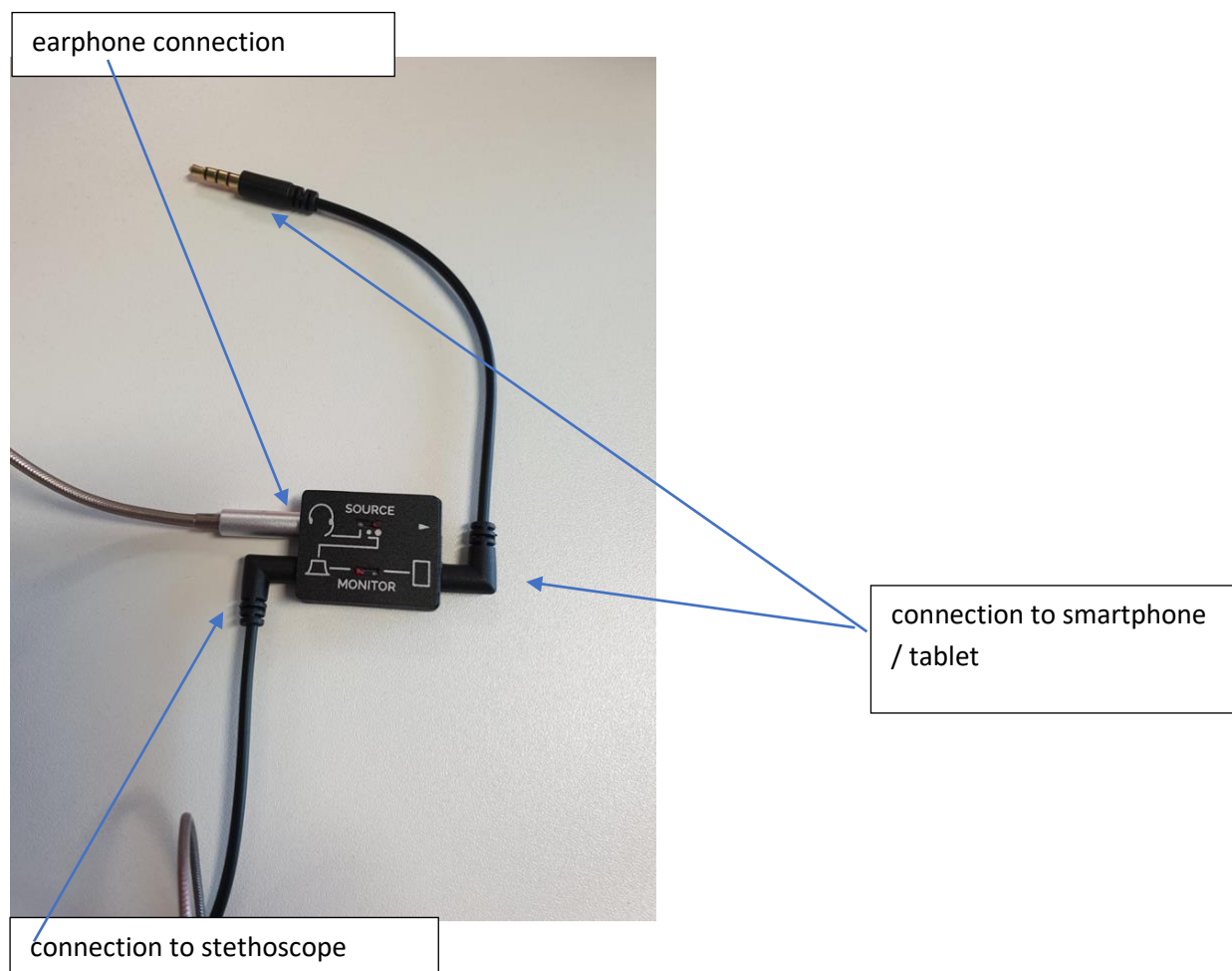
The WhatsApp Messenger can be used for the recording and transfer of heart/lung sounds and is free on both android and iOS platforms. It allows you to record heart or lung sounds and instantly send them directly to a clinician listed in your contacts, allowing you to get a second expert opinion in seconds.

To turn the digital stethoscope on, simply press and hold any button until the LEDs in the display illuminate. Connect the stethoscope to earphones via the earphone jack on the side of the device to use it. Adjust the frequency using the buttons on the stethoscope until optimum clarity is achieved (these are the bottom left / bottom right buttons).

To record – connect the device with either a smartphone or tablet with a jack plug. If your smartphone or tablet does not have the right jack plug use the converter in the pack provided. If you are using a newer model of smartphone you may need to purchase a separate adapter. Use the black monitor box (shown below) to connect the stethoscope to a smartphone / tablet as in Figure 1.

GETTING CONNECTED

Figure 1 – Getting connected



Connect the monitor box (Thinklink) to the stethoscope using the cable (one end in the monitor box and the other into the headphone jack on your smart phone / tablet). Move the monitor switch to the left – as in Figure 1.

Connect the earphones to the monitor box. Move the top switch (*source*) to the middle / far right position (when using the app, the far-right position works best / when using a voice recorder middle works – this will depend on the device though) as in Figure 1.

The centre position reduces the signal level to the mobile device. This is usually necessary, since the Thinklabs One digital stethoscope is usually too loud for most recording devices. You may also find that reducing the stethoscope's volume level to a 0 - 2 range is necessary during recording, to reduce clipping and distortion.

(Note that you can record from a headset microphone by switching the *source* switch to the left position. This will connect your headset microphone to the mobile device input, rather than connecting Thinklabs One as the audio source. This can be useful for dictating voice to annotate recordings. You must be using headphones that have a built-in microphone to perform this function.)

Connect the phone/tablet to the monitor (Thinklink) via the right-hand jack plug – see Figure 1. Open the app (e.g. Thinklabs Wave/WhatsApp/voice recorder) on your device. Once you have identified the heartbeat/lung sounds and can hear clearly through the earphones (adjust frequency as required using controls) click record in your chosen app – you will see on the phone / tablet display what is being captured. You can record for as long as required.

Playback: to play back recordings and listen to your recording device via the headphones, set the monitor switch to the right (mobile).

Save the recording – for patient data security purposes it is best that you save the recording with no identifiable patient information – e.g. use term 'patient 1' and once you have sent the recording via email / chosen method, delete the recording from the device.

Sharing the recording- once the recording is complete you can share this instantly – click the *share* icon on the app and then you have the option to email/share via email or your instant messenger apps if you have used a voice recorder on your device (e.g. WhatsApp Messenger which is an encrypted end to end/ messenger).

VOLUME CONTROLS

Volume control: the LED illuminated on the volume scale indicates the currently set volume. To increase the volume, press the button that corresponds with the + sign. To decrease the volume, press the button that corresponds with the - sign. It is recommended that people with normal hearing do not exceed a volume level of 4 - 5.

Using the digital stethoscope with hearing aids. The ability to use headphones means that the headphones can be worn over hearing aids. With the standard 3.5 mm jack, the digital stethoscope connects to any headphones and because it has over 100x amplification it is loud enough to compensate for hearing deficits. Further information regarding the use of the digital stethoscopes with hearing aids can be found at <https://www.thinklabs.com/hearing-aids>.

The Thinklabs One digital stethoscope can be directly connected to any headphone/earphones of your choice or you can connect them to a Bluetooth transmitter and have a wireless setup. The digital stethoscope does not have built in Bluetooth so if you want to do this you will need to attach a small Bluetooth transmitter to the headphone jack. Please note, if you wear a hearing aid that have Bluetooth capabilities, the sound quality may not be as good due to the limits of the sound amplification of the hearing aid.

MAINTENANCE OF THE THINKLABS ONE DIGITAL STETHOSCOPE

Wearing Thinklabs One digital stethoscope: Thinklabs One is easy to wear - much lighter and smaller than a conventional stethoscope.

Charging Thinklabs One is simple. Just plug the USB charger that's included with your digital stethoscope into the 3.5mm jack plug socket. One uses a rechargeable lithium ion battery that allows for around 4 hours of continuous listening (that should serve approximately 100 -125 patients) per charge. Battery level is indicated by a strobing LED light on the 1-10 scale when the unit is turned off manually. You can use the stethoscope again after just 30 minutes of recharging.

A thorough charge cycle can take as long as eight hours, however your Thinklabs One will have almost full capacity within four hours. The One operates on AC voltages worldwide and has a voltage range of 100 -240V, using a US-style flat-pin plug.

When charging, the Battery LED will flash. As the battery charges, the flash rate will slow. When the battery is fully charged, the LED will be on and stop flashing.

Battery life is estimated to be about 100 - 125 patients, depending on how long you keep your digital stethoscope on for and the loudness. Our tests, running the One at quite a loud volume, indicated battery life lasted for about five hours of continuous use.

Cleaning the digital stethoscope: it can be cleaned with most alcohol and bleach wipes that are commonly used, including: alcohol wipes, Cavi-Wipes, Sani-Cloth Plus.

Manual shut off: to turn the stethoscope off manually, simultaneously press and hold the *alt* and *minus* keys. You will see the LEDs scrolling from 0 to 10 on the volume scale and then the stethoscope will shut off.

CONNECTING THE THINKLABS ONE DIGITAL STETHOSCOPE TO EXTERNAL DEVICES

If you're connecting to an audio input jack or a microphone input, you can use one of the male-male 3.5mm cables provided with your Thinklabs digital stethoscope. Plug one end into the stethoscope and the other into the input jack of your device.

If you're connecting to a device with a *headset* jack (i.e., it provides both microphone input AND headphone output in one 3.5mm jack), use the monitor/Thinklink, which provides switching to facilitate changing the direction of signals - from the stethoscope to your device for recording and from your device to your headphones for playback.

Filter settings: the Thinklabs One digital stethoscope allows you to listen with multiple frequency filters simply by pressing the *filter* button (top left with audio jack facing right). You can even set two filters that you use most often as *favourites* making them super-fast and easy to select. You can do this by holding down the top left button (when the headphone jack faces right) until the LEDs are at the correct frequency and then release. This is similar to using the bell and diaphragm modes on a conventional stethoscope.

The filter choices on the Thinklabs One range from very low frequency sounds, like heart sounds (low-pitched sounds such as S3), to higher frequencies such as lung sounds. The lowest frequency is a strong version of the bell mode but the next setting above is also very good for heart sounds and is a less intense version if preferred. The higher frequencies are more useful for lung sounds and removes lower sound frequencies and is similar to the diaphragm mode on a normal stethoscope.

The Hz scale on the stethoscope display indicates the filter range selected. LEDs on the left side of the scale indicate lower frequencies will be reproduced; LEDs on the right indicate higher frequencies will be reproduced. The more LEDs that are on, the wider the range of frequencies, the narrower the indication, and the narrower the range of frequencies.

In addition to filter settings, you can change the frequency response by applying pressure on the diaphragm. As you push on the diaphragm, the *gap* in the sensor changes, which modifies the sensor's response to lower frequencies.

USING THE THINKLABS ONE DIGITAL STETHOSCOPE FOR A CLINICAL PURPOSE

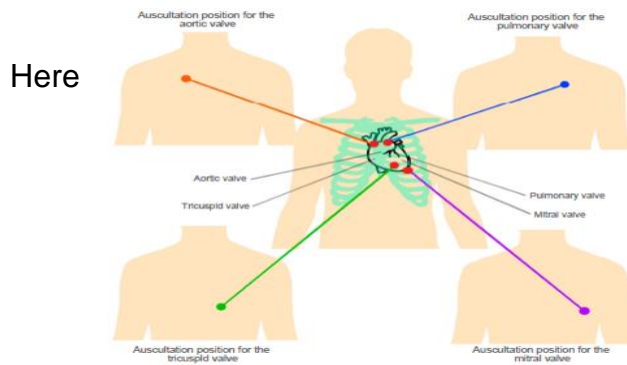
Heart sounds that you can hear by listening with a stethoscope reflect the turbulence that occurs in the blood flowing through the heart when the heart valves snap shut. The first heart sound heard (**S₁**) is the *lub* which represents the atrioventricular valves (bicuspid & tricuspid valves), closing. The second heart sound (**S₂**), the *dub*, is shorter but louder and represents the semi-lunar valves (aortic & pulmonary valves) closing.

The most common abnormal heart sound is a heart murmur. A murmur is a blowing, whooshing, or rasping sound that occurs during the heartbeat. An abnormal murmur in adults is usually caused by problems with the valves separating the chambers of the heart. If a valve doesn't close tightly and some blood leaks backward, this is called regurgitation. When a valve has become too narrow or becomes stiff, this is known as stenosis. Other abnormal sounds include:

- galloping rhythms
- clicks or short high-pitched sounds
- rubbing sounds.

A *murmur* or any other abnormal heart sounds may be an early indicator of a serious heart condition.

Place the digital stethoscope as you would a regular stethoscope – look at Figures 2 and 3 for the landmarks of the body upon which you should place your stethoscope when listening to a patient's heart and breath sounds.



HEART SOUND LANDMARKS

are the landmarks where you should place the device onto the patient's chest in order for it to pick up the sounds effectively and accurately. Bony landmarks are used to locate these sites.

Figure 2 Landmarks upon which to position your stethoscope for examining the heart

FLOWCHART FOR A HEART EXAMINATION (by person in face to face contact with patient)

Explain to the patient how the examination of their heart will be conducted by you; and how you will link with the remote clinician and transmit their heart sounds securely and their identity will be pseudoanonymised. Their continuation of the examination with the digital stethoscope will be taken as implied consent.

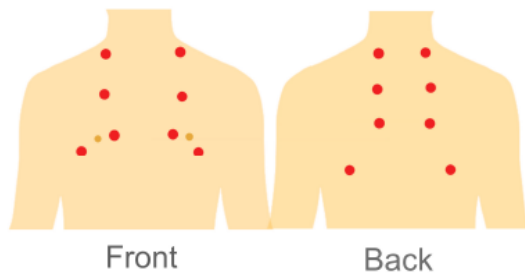
General Inspection: Look for peripheral oedema and cyanosis, any clubbing of the fingers and any brown lines along the nails. Record the patient's radial pulse and see if it is regular. If any of these are present report this to the clinician overseeing the virtual examination of the patient.

Palpate the apex beat and check that it is regular and check for any thrills or heaves. Then check for any thrills (vibrations) in all four valve areas (see Figure 2).

On the positions of the chest highlighted in Figure 2, place the diaphragm of the stethoscope on the patient's chest (or the bell for the mitral valve) and press record on your app. If you hear any murmurs or other odd sounds highlight this to the overseeing clinician when sending over the recordings.

Send the recordings to the responsible clinician and any notes that you have made of bodily signs and symptoms. Check with the clinician later that the recordings have been received and are clear enough for the clinician to be able to make an intelligent clinical assessment.

LUNG LANDSCAPE



LUNG SOUND LANDMARKS

Figure 3 Landmarks upon which to position the digital stethoscope for examining the patient's lungs

FLOWCHART FOR A RESPIRATORY EXAMINATION

Explain to the patient how your examination of their lungs will be conducted by you; and how you will link with the remote clinician and transmit their respiratory sounds securely and their identity will be pseudoanonymised. Their continuation of the examination with the digital stethoscope will be taken as implied consent.

General Inspection: Look for cyanosis (blue lips/fingers), wheeze, flail chest, any scars and looking for clubbing of the fingers which can be useful in indicating certain respiratory problems + oxygen saturation level if possible.

Palpate the patient's trachea- warn the patient beforehand that it may be uncomfortable. Use your middle finger to gently go down the trachea to make sure that it is central – report any abnormal push or pull to the overseeing clinician.

Assess the patient's chest expansion from the front and the back. Watch to see that the chest expands equally on both sides. If this is not the case report this back to the overseeing clinician.

On the positions of the chest highlighted in the diagram place your hand on the patient's chest and tap your middle finger and listen to the sound. If the sound is not hollow report this to the overseeing clinician.

Send the recordings to the responsible clinician and any notes that you have made of bodily signs and symptoms. Check with the clinician later that the recordings have been received and are clear enough for the clinician to be able to make an intelligent clinical assessment.

ABOUT THE AUTHORS

Gabrielle Johnson

Gabby is a medical student at Nottingham University

Kevin McGibbon

Kevin is an arrhythmia clinical nurse specialist with a focus on atrial fibrillation (AF)

Dr Ruth Chambers OBE

Ruth is a retired GP who leads on technology enabled care projects for Staffordshire STP's digital workstream

Rachel Hatfield

Rachel is national programme manager for digital upskilling of general practice nurses

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ruth.chambers@stoke.nhs.uk