



Eko

Murmur
Analysis
Software

User Manual

Eko

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1.1

Introduction

This manual is intended to provide information to guide trained operators in the safe and effective operation of the Eko Murmur Analysis Software.

It is important that you read and understand all instructions in this manual before operating the device, and pay careful attention to the warnings and cautions throughout the manual.

CAUTION: United States Federal law restricts the sale and use of this device to either by or on the order of a clinician.

Eko Devices, Inc. assumes no responsibility for any injury to anyone, or for the improper use of the product that may result from failure to use this product in accordance with the instructions, cautions, warnings, or statement of intended use published in this manual.

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1.2

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1.3

Safety Related Labels & Symbols



Instructions for use



Model number



Manufacturer



EC Representative

1.4

Cautions

- **This is NOT a diagnosis.** The interpretations of heart sounds offered by the Eko Murmur Analysis Software are meant only to provide clinical decision support to the clinician, who may use the result in conjunction with their own evaluation and clinical judgment. The interpretations are not diagnoses.
- The Eko Murmur Analysis Software can provide automatic computer interpretations. A computer-generated interpretation cannot replace sound medical reasoning by a trained professional. Therefore, a physician should always review the interpretation and final analysis should always be obtained by a physician. **Proper administration and implementation of this device is the physician's responsibility.**
- The quality of the computer interpretations depends heavily upon the quality of the inputted data. **Only analyze high quality recordings of heart sounds.**

- The software only informs the clinician about the presence or absence of murmurs in the phonocardiogram, and if present, whether those murmurs are systolic or diastolic, and structural or innocent. The physician should conduct a more complete analysis of the detected murmur to determine from which valve(s) it emanates and the degree of disease severity it indicates. This may require additional testing, as indicated.
- The Eko Murmur Analysis Software is not intended as a sole means of diagnosis. The detection of abnormalities in heart sounds offered by the software are only significant when used in conjunction with physician interpretation.
- The software has been trained using sound recordings taken from the four standard cardiac auscultation positions (i.e., right upper sternal border, left upper sternal border, left lower sternal border, and cardiac apex). Device performance is unknown when analyzing sounds captured from elsewhere on the patient's body.

1.5

Indications for Use

The Eko Murmur Analysis Software is intended to provide decision support to clinicians in their evaluation of patients' heart sounds. The software analyzes heart sounds and phonocardiograms (and ECG signals, when available). The software will automatically detect murmurs that may be present, and the murmur timing and character, including S1, S2, innocent heart murmurs, structural heart murmurs, and the absence of a heart murmur.

The Eko Murmur Analysis Software is not intended as a sole means of diagnosis and is for use in environments where healthcare is provided by clinicians. The interpretations of heart sounds offered by the software are meant only to provide decision support to the clinician, who may use the result in conjunction with their own evaluation and clinical judgment. The interpretations are not diagnoses. The Eko Murmur Analysis Software is intended for use on pediatric and adult patients.

1.6

Notices

This manual provides instructions for the use of the Eko Murmur Analysis Software. It is assumed that the user is familiar with basic Eko software application use on mobile and desktop devices.

Standard procedures for auscultation should be followed including background noise reduction and optimal patient positioning when capturing data for the Eko Murmur Analysis Software.

Notifications made by this feature are potential findings, and are not a complete diagnosis of cardiac abnormalities. **The patient's medical history and physical examination results must be taken into consideration during the decision-making process.**

The Eko Murmur Analysis Software is unable to return a result if the Eko CORE or DUO stethoscope is unable to connect to the mobile device over Bluetooth or if the mobile device is unable to connect to the internet.

The Eko Murmur Analysis Software requires a minimum internet connection speed. The recommended upload speed for the mobile app is 4 Mbps. 4G cellular data service or similar is recommended.

The software should not be used on patients where the physician has difficulty auscultating with the Eko CORE or DUO stethoscopes. Software accuracy may suffer when the patient is obese or has loud pulmonary sounds.

Final judgment on the diagnosis still lies with the qualified medical personnel.

2.0

Analysis Results

MURMUR CHARACTERIZATION

The Eko Murmur Analysis Software (EMAS) identifies possible murmurs in a heart sound recording, and if present, whether those murmurs are systolic or diastolic, and innocent or structural. These are not diagnoses, only potential finding(s). If indicated, you should conduct further evaluation if a murmur is detected. A murmur finding is often a recommendation for echocardiography or specialist referral.

The EMAS will only function if the user has subscribed to the appropriate Eko software package, and the package has been activated on the user's account. Once activated, the EMAS will function automatically, immediately after the user takes a sound recording. (The recording must be at least 5 seconds long.)

Once the recording has completed, the Eko companion mobile application will invoke the EMAS and the results of analysis will be displayed on the Eko mobile application in less than 10 seconds. No user intervention is needed to initiate, complete, or display the analysis.

The Eko Murmur Analysis Software will display to the user these possible results, examples of which are shown in Figure 1:

- Poor quality heart sounds
- No murmur detected
- Systolic murmur detected
- Diastolic murmur detected
- Innocent murmur detected
- Structural murmur detected

The causes of systolic murmurs vary; where the murmur is heard the loudest can help in diagnosis. Aortic stenosis, atrial septal defect, and pulmonic stenosis are heard best at the left and right upper sternal borders, whereas mitral regurgitation is heard best at the cardiac apex. These structural (pathologic) murmurs warrant referral to a cardiologist for further evaluation.¹⁻³

Diastolic murmurs, such as those caused by mitral stenosis or aortic regurgitation, are heard best at the cardiac apex and are also structural (pathologic) and warrant further evaluation, including referral to a cardiologist.³

Innocent systolic murmurs, like Still's murmur, are common in children and often disappear by adulthood. Depending upon the clinical situation, some clinicians may follow these patients with repeat auscultation only.^{4,5}

The clinician should refer to recommended clinical management guidelines to determine appropriate actions for innocent and structural murmurs.

Note: Proper handling of the Eko digital stethoscope (the CORE or DUO) to minimize external background noise and hand rub/clicks should be practiced.

Note: The software will not detect cardiac conditions that do not cause heart murmurs.

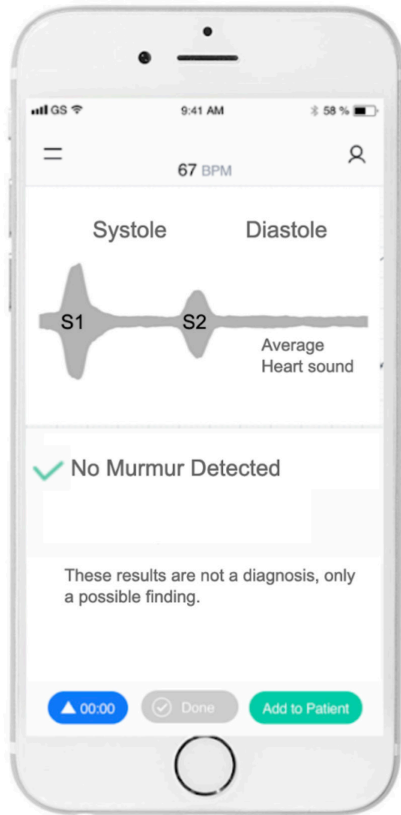
Note: All heart sound listening positions should be analyzed before making a referral decision.

Note: This software does not analyze lung sounds.

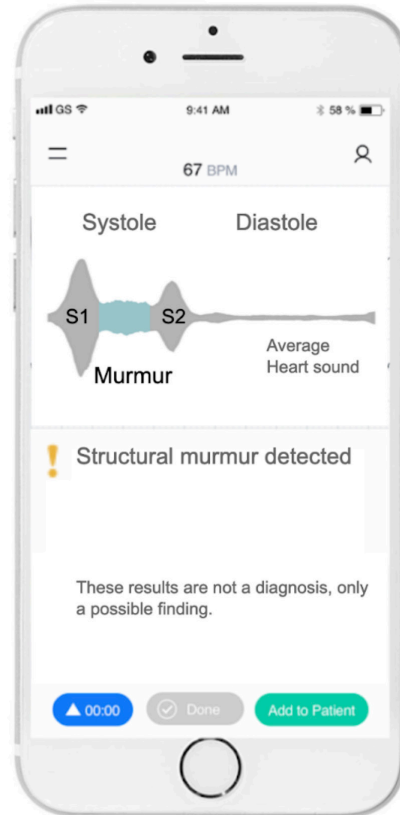
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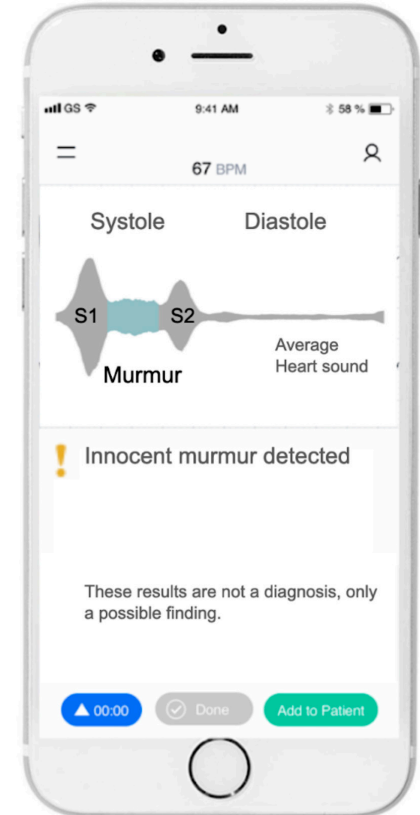
Figure 1:
Example EMAS outputs as seen on a smartphone screen



Averaged phonocardiogram with no murmur detected



Averaged phonocardiogram with structural murmur detected and highlighted during systole



Averaged phonocardiogram with innocent murmur detected and highlighted during systole



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