Keystone First
Family of Health Plans

Acoustic Cardiography/Heart Sound Recording

Clinical Policy ID: CCP.1495

Recent review date: 9/2026

Next review date: 1/2028

Policy contains: Acoustic cardiography, acoustic heart sound recording, electronic heart auscultation.

Keystone First VIP Choice has developed clinical policies to assist with making coverage determinations. Keystone First VIP Choice's clinical policies are based on guidelines from established industry sources, such as the Centers for Medicare & Medicaid Services (CMS), state regulatory agencies, the American Medical Association (AMA), medical specialty professional societies, and peer-reviewed professional literature. These clinical policies along with other sources, such as plan benefits and state and federal laws and regulatory requirements, including any state- or plan-specific definition of "medically necessary," and the specific facts of the particular situation are considered by Keystone First VIP Choice, on a case by case basis, when making coverage determinations. In the event of conflict between this clinical policy and plan benefits and/or state or federal laws and/or regulatory requirements, the plan benefits and/or state and federal laws and/or regulatory requirements shall control. Keystone First VIP Choice's clinical policies are for informational purposes only and not intended as medical advice or to direct treatment. Physicians and other health care providers are solely responsible for the treatment decisions for their patients. Keystone First VIP Choice's clinical policies are reflective of evidence-based medicine at the time of review. As medical science evolves, Keystone First VIP Choice will update its clinical policies as necessary. Keystone First VIP Choice's clinical policies are not guarantees of payment.

Coverage policy

Acoustic cardiography, or heart sound recording, is investigational/not clinically proven and, therefore, not medically necessary for cardiovascular diagnosis.

Limitations

No limitations were identified during the writing of this policy.

Alternative covered services

- Physical examination.
- Laboratory testing.
- Routine imaging studies.

Background

Cardiac acoustic biomarkers are noninvasive measures of heart sounds and electrocardiographic complexes for assessing and monitoring heart function. Examples include the occurrence of third and fourth heart sounds and electromechanical activation time, which is calculated as the time from the QRS onset to the first heart sound as

the mitral valve closes. Cardiac acoustic biomarkers, either alone or in combination with other clinical indicators, may help identify heart failure decompensation and predict post-discharge outcomes (Munch, 2026).

Auscultation by stethoscope presents limitations in accurate cardiovascular diagnosis, specifically the inability to recognize murmurs of aortic regurgitation (both diastolic and systolic, but especially diastolic). Hand-held pocket-size echocardiography, digital stethoscopes, and acoustic cardiography are examples of recent remote monitoring technologies that attempt to improve sensitivity and clinical outcomes (Montinari, 2019).

Acoustic cardiography, also referred to as acoustic heart sound recording, is a diagnostic method that combines the heart sound waves from auscultation with an electrocardiogram to generate detailed information on systolic and diastolic left ventricular function, followed by computer interpretation. It is less operator dependent than a phonocardiogram and faster than a 12-lead electrocardiogram. Recent technical advances allow for ambulatory monitoring and capturing respiratory events. Acoustic cardiography is proposed for diagnosing early heart failure and ischemic heart disease, as well as sleep apnea, constrictive pericarditis, ventricular fibrillation, and left ventricular hypertrophy (Wen, 2014).

In 2004, the U.S. Food and Drug Administration granted pre-market approval to Zargis Medical Corporation to market the Zargis Acoustic Cardioscan, an electronic auscultatory device designed to measure specific heart sounds, including S1/S2 (first and second heart sounds), and suspected murmurs. The notification specified not to use the device or subsequent devices as a sole means of diagnosis (U.S. Food and Drug Administration, 2004, 2009).

In 2003, the U.S. Food and Drug Administration granted pre-market approval to Inovise Medical Inc. for the Audicor Sensor 4.0 with adapter to aid in diagnosis and determine effects of treatment on electrocardiography and hemodynamics in adults ages 18 and older. Since then, the Administration modified approval to include sleep disordered breathing and snoring detection only as a screening device for obstructive or mixed apnea to evaluate the need for polysomnography (U.S. Food and Drug Administration, 2003, 2011).

Findings

Guidelines

The American College of Cardiology and American Heart Association did not mention either correlated audioelectric cardiography or acoustic sound recording in their guidelines on managing ST-elevation myocardial infarction and heart failure (Anbe, 2018; Heidenreich, 2022).

A scientific statement by the Heart Failure Society of America lists Audicor among a number of device-based therapies under investigation that may address an unmet need in the future (Estep, 2024).

Evidence review

The evidence for this policy includes a systematic review of the literature published from 2013 to March of 2023 and one large individual study (n > 100) published subsequently. The studies evaluated the diagnostic accuracy of acoustic cardiography, the association between acoustic biomarkers and cardiac outcomes, and the use of acoustic cardiography to noninvasively monitor treatment response.

The relative ease of use and low cost of ambulatory acoustic cardiography, in particular, make it an attractive option for monitoring heart failure in hospital and home settings. However, small sample sizes, inadequate follow-up, and confounders of diagnostic accuracy (e.g., noise and movement) limit interpretation of the collective evidence base and make it difficult to establish a clinical role for acoustic cardiography in the management of patients with heart failure.

A systematic review assessed associations between cardiac acoustic biomarkers and heart failure outcomes across 27 studies. One randomized controlled trial (Sung, 2020) and five observational studies specifically examined acoustic cardiography; these six studies came from two main investigator groups. Third heart sound (S3) and electromechanical activation time were the biomarkers most frequently reported for heart failure monitoring. The evidence suggests that S3 presence, strength, and amplitude are positively associated with heart failure events. However, the diagnostic accuracy and predictive value of S3 across diverse heart failure populations and clinical settings require further study. Head-to-head comparisons are also needed to determine which acoustic characteristics are the strongest predictors of heart failure events. Electromechanical activation time and related measures may indicate heart failure severity and predict major adverse cardiac events, but substantial heterogeneity in study populations and designs limits confidence in the findings and indicates a need for validation (Butler, 2025).

The one randomized controlled trial reported on the potential impact of acoustic cardiography-guided treatment relative to symptom-guided treatment. Participants with acute heart failure pre-discharge were randomized into groups guided by symptoms (n = 111) or guided by acoustic cardiography (n = 114) to adjust medications (Sung, 2020). Participants had a mean left ventricular ejection fraction of 38.4 ± 14.4% before discharge and were followed for a mean of 238 days. Participants were well-matched at baseline except for a higher percentage of males in the symptom-guided group and higher triglyceride levels and percentages of statin prescriptions at discharge in the acoustic cardiography-guided group. The goal of each group was to reduce symptoms to New York Heart Association Functional Classification < II. In the acoustic cardiography group, additional treatment goals were targeting a %EMAT of < 15% and an S3 strength < 5 to prevent heart failure-related rehospitalizations.

Compared with symptom-guided therapy, acoustic cardiography-guided management significantly reduced the primary endpoints of all-cause death or rehospitalization due to heart failure within one year (37.7% vs. 55.0%; hazard ratio 0.61, 95% confidence interval 0.42 to 0.91, log-rank P = .0129). Acoustic cardiography-guided therapy demonstrated similar advantages over symptom-guided therapy when stratified by age (< 75 or ≥ 75 years), gender, and presence of atrial fibrillation, chronic kidney disease, or reduced left ventricular ejection fraction. The acoustic cardiography-guided group had more adjustments of diuretics and/or nitrates but not of renin-angiotensin-system blockers, β-blockers, or mineralocorticoid receptor antagonists. The %EMAT was not significantly shortened in either group, whereas S3 strength was significantly diminished in the acoustic cardiography-guided group but not in the symptom-guided group. The benefits of intensifying medical therapy with diuretics and/or nitrates in the presence of high %EMAT ≥ 15% or high S3 strength scores (≥ 5) should be confirmed in multicentered, randomized trials with larger sample sizes and longer follow-up periods (Sung, 2020).

Munch (2026) analyzed the utility of electromechanical activation time measured by acoustic cardiography (Audicor) as a screening test for risk of adverse cardiovascular outcomes in a community population of 3,401 participants from the second phase of the Dallas Heart Study. Median follow-up was 12.4 years. The clinical outcomes were major adverse cardiac events (cardiovascular death, nonfatal myocardial infarction, stroke, incident heart failure, and atrial fibrillation) and a composite of cardiovascular death/heart failure hospitalization. In multivariable analyses, electromechanical activation time was independently associated with a lower left ventricular ejection fraction (P < .001) and greater left ventricular end-diastolic volume (P = .04) but had poor discriminatory capacity for reduced left ventricular ejection fraction (C-statistic = 0.52), and was inferior to and not independent of N-terminal pro-B-type natriuretic peptide levels.

In 2022, we updated the references. These results confirm previous findings, and no policy changes are warranted.

In 2023, we updated the references with no policy changes warranted.

In 2024, we identified no newly relevant, published studies to add to the policy. No policy changes are warranted.

In 2025, we updated the references and added a new scientific statement by the Heart Failure Society of America (Estep, 2024). No policy changes are warranted.

In 2026, we updated the references with no policy changes warranted.

References

On July 24, 2026, we searched PubMed and the databases of the Cochrane Library, the U.K. National Health Services Centre for Reviews and Dissemination, the Agency for Healthcare Research and Quality, and the Centers for Medicare & Medicaid Services. Search terms were “acoustic cardiography,” “acoustic heart sound recording,” and “electronic heart auscultation.” We included the best available evidence according to established evidence hierarchies (typically systematic reviews, meta-analyses, and full economic analyses, where available) and professional guidelines based on such evidence and clinical expertise.

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Butler J, Brown M, Prokocimer P, et al. The role of cardiac acoustic biomarkers in monitoring patients with heart failure: A systematic literature review. *ESC Heart Fail*. 2025;12(2):980-997. Doi: 10.1002/ehf2.15075.

Estep JD, Salah HM, Kapadia SR, et al. HFSA scientific statement: Update on device based therapies in heart failure. *J Card Fail*. 2024;30(11):1472-1488. Doi: 10.1016/j.cardfail.2024.07.007.

Heidenreich PA, Bozkurt B, Aguilar D, et al. 2022 AHA/ACC/HFSA guideline for the management of heart failure: A report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. *Circulation.* 2022;145(18):e895-e1032. Doi: 10.1161/CIR.0000000000001063.

Montinari MR, Minelli S. The first 200 years of cardiac auscultation and future perspectives. *J Multidiscip Healthc*. 2019;12:183-189. Doi: 10.2147/JMDH.S193904.

Munch J, Ayers CR, Grodin JL, et al. Associations of electromechanical activation time with cardiac structure and function and clinical outcomes. *JACC Adv*. 2026;5(1):102371. Doi: 10.1016/j.jacadv.2025.102371.

Sung S-H, Huang C-J, Cheng H-M, Huang W-M, Yu W-C, Chen C-H. Effect of acoustic cardiography-guided management on 1-year outcomes in patients with acute heart failure. *J Card Fail*. 2020;26(2):142-150. Doi: 10.1016/j.cardfail.2019.09.012.

U.S. Food and Drug Administration. Letter to Inovise Medical Inc. 510(k) summary and premarket approval. https://www.accessdata.fda.gov/cdrh_docs/pdf10/K103516.pdf. Decision date February 4, 2011.

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Wen Y-N, Lee A P-W, Fang F, Jin C-N, Yu C-M. Beyond auscultation: Acoustic cardiography in clinical practice. *Int J Cardiol*. 2014;172(3):548-560. Doi: 10.1016/j.ijcard.2013.12.298.

Policy updates

9/2021: initial review date and clinical policy effective date: 10/2021.

9/2022: Policy references updated.

9/2023: Policy references updated.

9/2024: Policy references updated.

9/2025: Policy references updated.

9/2026: Policy references updated.

Related codes

Below are the most commonly submitted codes for the service(s)/item(s) subject to this policy CCP.1495. This is not an exhaustive list of codes. Providers are expected to consult the appropriate coding manuals and bill accordingly.

Code	Code description
93799	Unlisted cardiovascular service or procedure