Introduction

Congenital heart disease is a term that means a person was born with heart problems. These difficulties affect the heart’s function and structure. Congenital heart disease can range from mild, which may not need treatment, to severe, which often does. One congenital heart defect is known as right ventricular outflow tract (RVOT) dysfunction. Essentially, it’s a problem with how the blood flows as it leaves the heart and goes to the lungs. Repairing it requires reconstructing certain areas of the heart and placing a tube (conduit) to allow the blood to flow correctly. Over a long period of time the conduit can become narrowed or a specific valve can become leaky. A second valve replacement surgery may be needed in this situation. This second surgery is usually done as an open surgery. However, surgery using a long, thin tube (a heart catheter) instead of open heart surgery can be done in certain situations. This policy describes when an additional RVOT surgery using a catheter may be considered medically necessary.

Note: The Introduction section is for your general knowledge and is not to be taken as policy coverage criteria. The rest of the policy uses specific words and concepts familiar to medical professionals. It is intended for providers. A provider can be a person, such as a doctor, nurse, psychologist, or dentist. A provider also can be a place where medical care is given, like a hospital, clinic, or lab. This policy informs them about when a service may be covered.
<table>
<thead>
<tr>
<th>Service</th>
<th>Medical Necessity</th>
</tr>
</thead>
</table>
| Transcatheter pulmonary valve implantation (TPVI) | Transcatheter pulmonary valve implantation (TPVI) with a Food and Drug Administration-approved valve is considered medically necessary for individuals with congenital heart disease (CHD) and current right ventricular outflow tract obstruction (RVOT) or regurgitation including the following indications:  
  • Individuals with right ventricle-to-pulmonary artery conduit with or without bioprosthetic valve with at least moderate pulmonic regurgitation  
  OR  
  • Individuals with native or patched RVOT with at least moderate pulmonic regurgitation  
  OR  
  • Individuals with right ventricle-to-pulmonary artery conduit with or without bioprosthetic valve with pulmonic stenosis (mean RVOT gradient at least 35 mm Hg)  
  OR  
  • Individuals with native or patched RVOT with pulmonic stenosis (mean RVOT gradient at least 35 mm Hg).  
  
Transcatheter pulmonary valve implantation is considered investigational for all other indications. |

**Documentation Requirements**

The patient’s medical records submitted for review should document that medical necessity criteria are met. The record should include clinical documentation of:

- Diagnosis/condition
- History and physical examination documenting the severity of the condition
- Right ventricular outflow tract (RVOT) gradient
- Pulmonic regurgitation (if present)
### Code Description

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPT</td>
<td>Transcatheter pulmonary valve implantation, percutaneous approach, including pre-stenting of the valve delivery site, when performed</td>
</tr>
</tbody>
</table>

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### Related Information

N/A

### Evidence Review

### Description

TPVI is a less invasive alternative to open surgical pulmonary valve replacement or reconstruction for RVOT obstruction. Percutaneous pulmonary valve replacement may be indicated for congenital pulmonary stenosis. Pulmonary stenosis or regurgitation in a patient with CHD who has previously undergone RVOT surgery are additional indications. Patients with prior CHD repair are at risk of needing repeated reconstruction procedures.

### Background

#### Congenital Heart Disease

CHD, including tetralogy of Fallot, pulmonary atresia, and transposition of the great arteries, is generally treated by surgical repair at an early age. This involves reconstruction of the RVOT and pulmonary valve using a surgical homograft or a bovine-derived valved conduit. These repairs are prone to development of pulmonary stenosis or regurgitation over long periods of follow-up. Individuals living with congenital heart disease also face disparities in social determinants of health and the inability to obtain quality lifelong care for their condition which can contribute to inequities in morbidity and mortality."
Because individuals with surgically corrected CHD repair are living into adulthood, RVOT dysfunction following initial repair has become more common. Calcification of the RVOT conduit can lead to pulmonary stenosis, while aneurysmal dilatation can result in pulmonary regurgitation. RVOT dysfunction can lead to decreased exercise tolerance, potentially fatal arrhythmias, and/or irreversible right ventricular dysfunction.²

**Treatment**

Treatment options for pulmonary stenosis are open surgery with valve replacement, balloon dilatation, or percutaneous stenting.² The established interventions for pulmonary regurgitation are primarily surgical, either reconstruction of the RVOT conduit or replacement of the pulmonary valve. The optimal timing of these interventions is not well understood.³

**Summary of Evidence**

For individuals who have a history of CHD and current RVOT obstruction who receive TPVI with a U.S. Food and Drug Administration (FDA)-approved device and indication, the evidence includes a systematic review of retrospective comparative studies and prospective, interventional, noncomparative studies. Relevant outcomes are overall survival, symptoms, functional outcomes, quality of life, hospitalizations, and treatment-related morbidity and mortality. Results of the case series have indicated that there is a high rate of procedural success and low procedural mortality, although the rates of serious procedural adverse events reported ranges from 3.0% to 7.4%. Most valves have demonstrated competent functioning by Doppler echocardiography at 6- to 12-month follow-ups. Publications with longer follow-up have reported stent fractures in up to 26% of patients; however, most stent fractures did not required reintervention. Studies with follow-up extending to a maximum of 7 years postprocedure have suggested that the functional and hemodynamic improvements are durable, but a relatively high proportion of patients (20%-30%) have required reintervention on the pulmonary valve. Retrospective comparative studies have been reported, but are limited by differences in patient characteristics between those who are treated with percutaneous and open heart procedures. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who have a history of CHD and current RVOT obstruction who receive TPVI with a non-FDA-approved device or indication, the evidence includes case series. Relevant outcomes are overall survival, symptoms, functional outcomes, quality of life, hospitalizations, and treatment-related morbidity and mortality. There is limited evidence on the off-label use of TPVI,
including the use of a non-FDA-approved valve, or use of an approved valve for a non-FDA-approved indication. The published case series enrolled relatively few patients and are heterogeneous regarding devices used and indications for TPVI. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

**Ongoing and Unpublished Clinical Trials**

Some currently ongoing and unpublished trials that might influence this review are listed in Table 1.

### Table 1. Summary of Key Trials

<table>
<thead>
<tr>
<th>NCT No.</th>
<th>Trial Name</th>
<th>Planned Enrollment</th>
<th>Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ongoing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCT02744677(^a)</td>
<td>COngenital Multicenter Trial of Pulmonic vAlve Dysfunction Studying the SAPIEN 3 Interventional THV (COMPASSION S3)</td>
<td>108</td>
<td>Dec 2027</td>
</tr>
<tr>
<td>NCT02979587</td>
<td>The Medtronic Harmony™ Transcatheter Pulmonary Valve Clinical Study</td>
<td>50</td>
<td>Jan 2031</td>
</tr>
<tr>
<td>NCT02987387(^a)</td>
<td>New Enrollment SAPIEN XT Post-Approval Study (COMPASSION XT PAS)</td>
<td>57</td>
<td>Sep 2025</td>
</tr>
<tr>
<td>NCT04860765(^a)</td>
<td>Congenital Multicenter Trial of Pulmonic Valve Dysfunction Studying the SAPIEN 3 Interventional THV Post-Approval Study</td>
<td>150</td>
<td>Aug 2030</td>
</tr>
</tbody>
</table>

NCT: national clinical trial

\(^a\) Denotes industry-sponsored or cosponsored trial

**Clinical Input Received from Physician Specialty Societies and Academic Medical Centers**

While the various physician specialty societies and academic medical centers may collaborate with and make recommendations during this process, through the provision of appropriate reviewers, input received does not represent an endorsement or position statement by the physician specialty societies or academic medical centers, unless otherwise noted.
2018 Input

Clinical input was sought to help determine whether the use of TPVI for individuals with CHD and current RVOT obstruction or regurgitation would provide a clinically meaningful improvement in the net health outcome and whether its use is consistent with generally accepted medical practice. In response to requests, clinical input on the use of TPVI was received from two specialty society-level respondents while this policy was under review in 2018. The combined clinical input response incorporated input from a panel including physicians affiliated with academic medical centers.

Clinical input was provided by the following specialty societies:

- American College of Cardiology (ACC) and Society for Cardiovascular Angiography and Interventions (SCAI)\(^a\)

\(^a\) Indicates that conflicts of interest related to the topic where clinical input is being sought were identified by this respondent (see Appendix).

The clinical input supports that the following indications provide a clinically meaningful improvement in the net health outcome and are consistent with generally accepted medical practice:

- Use of TPVI for individuals with right ventricle-to-pulmonary artery conduit with or without bioprosthetic valve with at least moderate pulmonic regurgitation;
- Use of TPVI for individuals with native or patched RVOT with at least moderate pulmonic regurgitation;
- Use of TPVI for individuals with right ventricle-to-pulmonary artery conduit with or without bioprosthetic valve with pulmonic stenosis (mean RVOT gradient at least 35 mm Hg); or
- Use of TPVI for individuals with native or patched RVOT with pulmonic stenosis (mean RVOT gradient at least 35 mm Hg)

Practice Guidelines and Position Statements

Guidelines or position statements will be considered for inclusion if they were issued by, or jointly by, a U.S. professional society, an international society with U.S. representation, or National Institute for Health and Care Excellence (NICE). Priority will be given to guidelines that
are informed by a systematic review, include strength of evidence ratings, and include a description of management of conflict of interest.

Society for Cardiovascular Angiography and Interventions and the Adult Congenital Heart Association

In 2020, the Society for Cardiovascular Angiography and Interventions and the Adult Congenital Heart Association published a position statement on operator and institutional recommendations for TPVI. Included were recommendations for interventional training, practicing physician competency, ongoing education and training, and institutional and team requirements.

American College of Cardiology, American Heart Association, et al

In 2018, the American College of Cardiology and American Heart Association and 6 other societies published comprehensive guidelines on the management of patients with CHD. Included are recommendations for treatment of pulmonary stenosis, pulmonary regurgitation and tetralogy of Fallot (Table 2).

Table 2. ACC/AHA Guidelines on the Management of Patients with Tetralogy of Fallot

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>SOR</th>
<th>LOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Pulmonary valve replacement (surgical or percutaneous) for relief of symptoms is recommended for patients with repaired TOF and moderate or greater PR with cardiovascular symptoms not otherwise explained.&quot;</td>
<td>Strong</td>
<td>B-NR</td>
</tr>
<tr>
<td>&quot;Pulmonary valve replacement (surgical or percutaneous) is reasonable for preservation of ventricular size and function in asymptomatic patients with repaired TOF and ventricular enlargement or dysfunction and moderate or greater PR.&quot;</td>
<td>Moderate</td>
<td>B-NR</td>
</tr>
<tr>
<td>&quot;Surgical pulmonary valve replacement may be reasonable for adults with repaired TOF and moderate or greater PR with other lesions requiring surgical interventions.&quot;</td>
<td>Weak</td>
<td>C-EO</td>
</tr>
</tbody>
</table>
**Recommendation**

“Pulmonary valve replacement, in addition to arrhythmia management, may be considered for adults with repaired TOF and moderate or greater PR and ventricular tachyarrhythmia.”

**SOR** | **LOE**
---|---
Weak | C-EO

ACC/AHA: American College of Cardiology/American Heart Association; B-NR: Non-randomized (moderate quality evidence); C-EO: consensus of expert opinion; LOE: level of evidence, SOR: strength of recommendation; TOF: tetralogy of Fallot; PR: pulmonary regurgitation

**Regulatory Status**

Devices for TPVI were initially cleared from marketing by the U.S. Food and Drug Administration (FDA) through the humanitarian device exemption (HDE) process or used off-label until approved by FDA through the premarket approval (PMA) process between (see Table 3).

**Table 3. Regulatory Status of Transcatheter Pulmonary Valve Implantation Devices**

<table>
<thead>
<tr>
<th>Device</th>
<th>Manufacturer</th>
<th>Date Approved</th>
<th>PMA No.</th>
<th>Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melody® Transcatheter Pulmonary Valve (TPV)</td>
<td>Medtronic</td>
<td>Jan 2010</td>
<td>H080002 (HDE)</td>
<td>Pulmonary valve replacement for pediatric and adult patients with a dysfunctional, noncompliant RVOT conduit</td>
</tr>
<tr>
<td>Melody® TPV</td>
<td>Medtronic</td>
<td>Jan 2015</td>
<td>P140017</td>
<td>Pulmonary valve replacement for pediatric and adult patients with a dysfunctional, noncompliant RVOT conduit</td>
</tr>
<tr>
<td>Melody® TPV</td>
<td>Medtronic</td>
<td>Feb 2017</td>
<td>P140017/S005</td>
<td>Valve-in-valve for patients with a dysfunctional surgical bioprosthetic pulmonary valve</td>
</tr>
<tr>
<td>SAPIEN XT™ Transcatheter Heart Valve (pulmonic)</td>
<td>Edwards Lifesciences</td>
<td>Feb 2016</td>
<td>P130009/S037</td>
<td>Pulmonary valve replacement for pediatric and adult patients with a dysfunctional, noncompliant RVOT conduit</td>
</tr>
<tr>
<td>Harmony™ TPV</td>
<td>Medtronic</td>
<td>Mar 2021</td>
<td>P200046</td>
<td>Pulmonary valve for pediatric and adult patients with severe pulmonary regurgitation</td>
</tr>
</tbody>
</table>
In January 2010, the Melody® TPV and the Ensemble® Transcatheter Valve Delivery System (Medtronic) were approved by FDA under the HDE program for use as an adjunct to surgery in the management of pediatric and adult patients with the following clinical conditions:

- Existence of a full (circumferential) RVOT conduit that is 16 mm or greater in diameter when originally implanted, and
- Dysfunctional RVOT conduits with clinical indication for intervention, and either:
  - regurgitation: moderate-to-severe regurgitation, or
  - stenosis: mean RVOT gradient ≥35 mm Hg

On January 27, 2015, approval of the Melody® system was amended to a PMA because FDA determined that the device represented a breakthrough technology. The PMA was based, in part, on two prospective clinical studies, the Melody TPV Long-term Follow-up Post Approval Study and the Melody TPV New Enrollment Post Approval Study.

On February 24, 2017, approval of the Melody® system was expanded to include patients with a dysfunctional surgical bioprosthetic valve (valve-in-valve).

The Edwards SAPIEN XT™ Transcatheter Heart Valve (Pulmonic) (Edwards Lifesciences) was approved by FDA in 2016 “for use in pediatric and adult patients with a dysfunctional, noncompliant RVOT conduit with a clinical indication for intervention and:

- pulmonary regurgitation ≥ moderate and/or
- mean RVOT gradient ≥ 35 mmHg”

The approval for the pulmonic valve indication is a supplement to the 2014 PMA for use of the Edwards SAPIEN XT Transcatheter Heart Valve System for relief of aortic stenosis in patients with symptomatic heart disease due to severe native calcific aortic stenosis and who are judged by a heart team, including a cardiac surgeon, to be at high or greater risk for open surgical therapy (i.e., Society of Thoracic Surgeons operative risk score ≥8% or at a ≥15% risk of mortality at 30 days).

The Harmony™ Transcatheter Pulmonary Valve (Medtronic) received breakthrough technology status in 2019 and PMA in 2021. This device is indicated “for use in pediatric and adult patients with severe pulmonary regurgitation (determined by echocardiography and/or pulmonary
regurgitant fraction ≥ 30% by cardiac magnetic resonance imaging) who have a native or surgically-repaired RVOT and are clinically indicated for surgical pulmonary valve replacement."

FDA product code: NPV

References


### History

<table>
<thead>
<tr>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/10/12</td>
<td>New Policy – Policy created with literature search through June 15, 2011; considered medically necessary for patients who are high risk for open surgery and are poor</td>
</tr>
<tr>
<td>Date</td>
<td>Comments</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>09/27/12</td>
<td>surgical candidates due to multiple prior thoracotomies for open heart surgery. Considered investigational for all other indications. Clinical vetting information added.</td>
</tr>
<tr>
<td>01/29/13</td>
<td>Update Coding Section – ICD-10 codes are now effective 10/01/2014.</td>
</tr>
<tr>
<td>01/21/14</td>
<td>Replace policy. Policy updated with literature review, references 4, 5, 13-15, 17 added. Medically necessary statement amended to include &quot;when performed according to FDA-approved indications&quot;. Policy updated with literature review through September 30, 2013. References 13, 14, 16, 18, 21 added. Remove ICD-9 procedure and diagnosis codes; remove all ICD-10 codes except 02RH4JZ (which specifically applies) – these will not be used for adjudication.</td>
</tr>
<tr>
<td>09/23/14</td>
<td>Update Related Policies. Add 2.02.30.</td>
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<tr>
<td>01/19/16</td>
<td>Coding update. New CPT code 33477, effective 1/1/16, added to policy.</td>
</tr>
<tr>
<td>02/01/16</td>
<td>Coding update. Added 93799.</td>
</tr>
<tr>
<td>09/01/16</td>
<td>Annual Review, approved August 9, 2016. Policy updated with literature review through April 28, 2016; references 3, 5, 7-8, 16, 19, and 36-37 added. Policy statement unchanged. CPT coding updated.</td>
</tr>
<tr>
<td>08/01/18</td>
<td>Annual Review, approved July 10, 2018. Policy updated with literature review through May 2017; references 9, 22, and 43 added. Clinical input was obtained and policy statement changed to: Transcatheter pulmonary valve implantation is considered medically necessary for patients with congenital heart disease and current right ventricular outflow tract obstruction or regurgitation when specified indications are met.</td>
</tr>
<tr>
<td>04/01/19</td>
<td>Minor update, added Documentation Requirements section.</td>
</tr>
<tr>
<td>09/01/19</td>
<td>Annual Review, approved August 22, 2019. Policy updated with literature review through April 2019, no references added. Policy statements unchanged.</td>
</tr>
<tr>
<td>Date</td>
<td>Comments</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>09/01/22</td>
<td>Annual Review, approved August 8, 2022. Policy updated with literature review through May 10, 2022; references added. Minor editorial refinements to policy statements; intent unchanged.</td>
</tr>
<tr>
<td>06/15/23</td>
<td>Updated Related Policies. 7.01.585 is replaced with 7.01.132 Transcatheter Aortic-Valve Implantation for Aortic Stenosis.</td>
</tr>
</tbody>
</table>

**Disclaimer:** This medical policy is a guide in evaluating the medical necessity of a particular service or treatment. The Company adopts policies after careful review of published peer-reviewed scientific literature, national guidelines and local standards of practice. Since medical technology is constantly changing, the Company reserves the right to review and update policies as appropriate. Member contracts differ in their benefits. Always consult the member benefit booklet or contact a member service representative to determine coverage for a specific medical service or supply. CPT codes, descriptions and materials are copyrighted by the American Medical Association (AMA). ©2022 Premera All Rights Reserved.

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