**Inclusion/Exclusion criteria and pathway for VSD patients**

# Identify VSD group

## Step 1: Include patients who had evidence of VSD diagnosis

### Diagnostic code evidence of primary diagnosis ventricular septal defect

#### Patients who have a diagnosis code for ventricular septal defect (VSD)

##### Table A Diagnosis codes VSD as listed for Top rank

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| **Diagnosis codes for VSD as listed for Top rank** |
| 071000. VSD |
| 071001. Perimembranous VSD |
| 071012. VSD + malaligned outlet septum |
| 071101. Muscular VSD |
| 071200. Subarterial VSD |
| 071201. Doubly committed subarterial VSD |
| 071402. Communication between left ventricle + right atrium (Gerbode defect) |
| 071405. Inlet VSD |
| 071501. Tiny VSD (Maladie de Roger) |
| 071504. Multiple VSDs |
| 071505. Single VSD |
| 071002.Inlet perimembranous ventricular septal defect (VSD) without atrioventricular malalignment without a common atrioventricular junction. |
| 071004. Outlet perimembranous ventricular septal defect (VSD) with anteriorly malaligned of outlet septum. |
| 071017.Outlet ventricular septal defect (VSD) with anteriorly malaligned outlet septum. |
| 071018.Outlet ventricular septal defect (VSD) with posteriorly malaligned outlet septum. |
| 071019. Outlet perimembranous ventricular septal defect (VSD) with posteriorly malaligned outlet septum. |
| 071102.Inlet muscular ventricular septal defect (VSD). |
| 071103.Trabecular muscular ventricular septal defect (VSD) apical. |
| 071104.Trabecular muscular ventricular septal defect (VSD) midseptal. |
| 071105.Trabecular muscular ventricular septal defect (VSD)s multiple (Swiss cheese septum). |
| 071106. Outlet muscular ventricular septal defect (VSD) without malalignment. |
| 071107.Trabecular muscular ventricular septal defect (VSD) anterosuperior. |
| 071112.Trabecular muscular ventricular septal defect (VSD) postero-inferior. |
| 071115. Outlet muscular ventricular septal defect (VSD) with anteriorly malaligned outlet septum. |
| 071116. Outlet muscular ventricular septal defect (VSD) with posteriorly malaligned outlet septum. |
| 071202. Doubly committed juxta-arterial ventricular septal defect (VSD) without malalignment and with muscular postero-inferior rim. |
| 071203. Doubly committed juxta-arterial ventricular septal defect (VSD) without malalignment and with perimembranous extension. |
| 071205. Doubly committed juxta-arterial ventricular septal defect (VSD) with anteriorly malaligned fibrous outlet septum and perimembranous extension. |
| 071206. Doubly committed juxta-arterial ventricular septal defect (VSD) with posteriorly malaligned fibrous outlet septum and perimembranous extension. |
| 071207. Doubly committed juxta-arterial ventricular septal defect (VSD) with anteriorly malaligned fibrous outlet septum and muscular postero-inferior rim. |
| 071208. Doubly committed juxta-arterial ventricular septal defect (VSD) with posteriorly malaligned outlet septum and muscular postero-inferior rim. |
| 071209.Outlet ventricular septal defect (VSD) without malalignment. |
| 071212.Doubly committed juxta-arterial ventricular septal defect (VSD) with anteriorly malaligned fibrous outlet septum. |
| 071213.Doubly committed juxta-arterial ventricular septal defect (VSD) with posteriorly malaligned fibrous outlet septum. |
| 071406.Inlet perimembranous ventricular septal defect (VSD) with atrioventricular septal malalignment and without common atrioventricular junction. |

### Procedure evidence of primary diagnosis ventricular septal defect

#### Include patients who have a specific procedure 50: multiple\_VSD, 51:VSD or 70:vsd\_transluminal. using specific procedure algorithm in LAUNCHES

## Step 2: Exclude patients who had more complex CHD

Exclude patients if they had a code from Table B, and those identified as having HLHS, FUH, TGA, Pulmonary atresia, AVSD , Fallot, aortic stenosis or coarctation according to the CHANPION rules, which may not be adequately captured by Table B alone.

### Table B: VSD diagnosis Exclusion Codes (codes that are indicative of more complex CHD condition)

As this is a diagnosis-based analysis, we mainly use diagnostic exclusion codes with a small number of key procedure exclusion codes. This is because the procedures undertaken in these patients are variable and we aim to be inclusive to variations in management pathway.

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| **Diagnostic codes** |
| 010101. Tetralogy of Fallot |
| 010106. Pulmonary atresia + ventricular septal defect (VSD) (including Fallot type) |
| 010125. Pulmonary atresia + ventricular septal defect (VSD) + systemic-to-pulmonary collateral artery(ies) (MAPCA(s)) |
| 090525. Tetralogy of Fallot with absent pulmonary valve syndrome |
| 090726. Solitary arterial trunk (absent intrapericardial pulmonary arteries) |
| 010109. Hypoplastic left heart syndrome |
| 060101. Triscuspid atresia |
| 060201. Mitral atresia |
| 091503. Aortic atresia |
| 010114. Double inlet AV connection (double inlet ventricle) |
| 010122. Functionally univentricular heart |
| 010104. Double outlet right ventricle |
| 010124. Double outlet right ventricle: with intact ventricular septum |
| 010119. Double outlet right ventricle with non-committed ventricular septal defect |
| 010140. Double outlet right ventricle with subaortic or doubly committed ventricular septal defect without pulmonary stenosis, ventricular septal defect type |
| 010403. Double inlet RV |
| 010404. Double inlet LV |
| 020305. Solitary ventricle of indeterminate morphology |
| 070841. Ventricular imbalance: dominant left ventricle + hypoplastic right ventricle |
| 070842. Ventricular imbalance: dominant right ventricle + hypoplastic left ventricle |
| 090101. Common arterial trunk (truncus arteriosus) |
| 090200. Truncal valvar abnormality |
| 090203. Truncal valvar regurgitation |
| 092931. Interrupted aortic arch |
| 010103. Congenitally corrected transposition of great arteries (discordant AV & VA connections) |
| 010116. Partially anomalous pulmonary venous connections: Scimitar syndrome |
| 010133. Shone's syndrome: left heart obstruction at multiple sites, |
| 010503. Double outlet left ventricle |
| 050201. Cor triatriatum (divided left atrium) |
| 090401. Aortopulmonary window |
| 091600. Supravalvar aortic stenosis |
| 094101. Anomalous origin of coronary artery from pulmonary artery |
| 060134. Ebstein's malformation of tricuspid valve |
| 050601. Common atrium (virtual absence of atrial septum) |
| 060501. AVSD AV valvar abnormality |
| 060506. AVSD AV valvar regurgitation |
| 060600. Atrioventricular septal defect |
| 060601. AVSD: isolated atrial component (primum ASD)(partial) |
| 060608. AVSD: isolated ventricular component |
| 060609. AVSD: atrial & ventricular components with common AV orifice (complete) |
| 060610. AVSD: atrial & (restrictive) ventricular components + separate AV valves ('intermediate') |
| 010120. AV septal defect and Tetralogy of Fallot |
| 060726. AVSD with ventricular imbalance |
| 010117. Double outlet right ventricle: Fallot type (subaortic or doubly committed VSD & pulmonary stenosis) |
| 091501. Aortic valvar stenosis: congenital |
| 091513. Aortic valvar stenosis |
| 091592. Aortic stenosis |
| 050202. Supravalvar mitral ring |
| 060207. Mitral valvar stenosis: congenital |
| 060213. Mitral subvalvar stenosis |
| 060256. Parachute malformation of mitral valve |
| 060292. Mitral stenosis |
| 060293. Mitral valve stenosis |
| 040600. Totally anomalous pulmonary venous connection: supracardiac |
| 040805. Totally anomalous pulmonary venous connection |
| 040806. Obstructed pulmonary venous connection(s) |
| 040810. Totally anomalous pulmonary venous connection: intracardiac |
| 040820. Totally anomalous pulmonary venous connection: infracardiac |
| 040830. Totally anomalous pulmonary venous connection: mixed |
| 030104. Right isomerism ('asplenia') |
| 030105. Left isomerism ('polysplenia') |
| 010118. Double outlet right ventricle: transposition type (subpulmonary VSD) |
| 010501. Discordant VA connections (TGA) |
| 010102. Transposition of great arteries (concordant AV & discordant VA connections) & IVS |
| 092901. Aortic coarctation |
| 092911. Aortic arch hypoplasia (tubular) |
| 070530. Subpulmonary stenosis |
| 090501. Pulmonary valvar stenosis |
| 090504. Pulmonary valvar stenosis: congenital |
| 090592. Pulmonary stenosis |
| 070900. Subaortic stenosis |
| 070903. Subaortic stenosis due to fibromuscular shelf |
| 090511. Pulmonary atresia |
| 090512. Pulmonary atresia: imperforate valve |
| 010107. Pulmonary atresia with intact ventricular septum |
| 091701. Aortoventricular tunnel |
| 091702. Aorto - left ventricular tunnel |
| 010309 AV and or/VA connections abnormal |
| 070301. Double chambered right ventricle |
| 010405.Double inlet to solitary ventricle of indeterminate morphology. |
| 020303.Crisscross heart (twisted atrioventricular connections). |
| 060311.Congenital anomaly of right-sided atrioventricular valve in double inlet ventricle. |
| 060411.Congenital anomaly of left-sided atrioventricular valve in double inlet ventricle. |
| 090111. Common arterial trunk (truncus arteriosus) with aortic dominance and one pulmonary artery absent from trunk. isolated pulmonary artery. |
| 090112. Common arterial trunk (truncus arteriosus) with pulmonary dominance and aortic arch obstruction. |
| 090114. Common arterial trunk (truncus arteriosus) with aortic dominance and both pulmonary arteries arising from trunk. |
| 090115. Common arterial trunk (truncus arteriosus) with aortic dominance (no aortic arch obstruction). |
| 090118. Common arterial trunk (truncus arteriosus) with pulmonary dominance and interrupted aortic arch. |
| 090119. Common arterial trunk (truncus arteriosus) with pulmonary dominance and aortic coarctation. |
| 090201.Dysplasia of truncal valve. |
| 090218.Congenital truncal valvar stenosis. |
| 090219.Congenital truncal valvar regurgitation. |
| 010110.Transposition of the great arteries with concordant atrioventricular connections and ventricular septal defect. |
| 092932. Interrupted aortic arch distal to subclavian artery. type A. |
| 092933. Interrupted aortic arch between subclavian & common carotid arteries. type B. |
| 092934. Interrupted aortic arch between carotid arteries. type C. |
| 090908. Pulmonary artery from ascending aorta (hemitruncus) |
| 091010. Discontinuous (non-confluent) pulmonary arteries |
| 010126.Tetralogy of Fallot with pulmonary atresia. |
| 010157.Tetralogy of Fallot with pulmonary atresia and systemic-to-pulmonary collateral artery(ies) (MAPCA(s)). |
| 090516.Congenital pulmonary atresia. |
| 090705. Absent or atretic pulmonary trunk (main pulmonary artery). |
| 090902.Right pulmonary artery from arterial duct. |
| 090903.Right pulmonary artery from ascending aorta. |
| 090904.Left pulmonary artery from arterial duct. |
| 090905.Left pulmonary artery from ascending aorta. |
| 090911. Pulmonary artery from arterial duct. |
| 091030.Congenitally discontinuous. non-confluent right and left pulmonary arteries. |
| 091075.Absent or atretic right pulmonary artery. |
| 091077.Absent or atretic left pulmonary artery. |
| 150503. Pulmonary vein obstruction |
| 020101.Extrathoracic heart (ectopia cordis). |
| 040802.Congenital atresia of pulmonary vein(s). |
| 040804.Congenital anomaly of pulmonary vein(s). |
| 040831.Congenital pulmonary venous stenosis and-or hypoplasia. |
| 090407.Congenital aortopulmonary window. |
| 091506. Aortic valvar atresia. |
| 091618. Congenital supravalvar aortic stenosis. |
| 093134.Vascular ring of left aortic arch and right arterial duct or ligament. |
| 093135.Vascular ring of right aortic arch and left arterial duct or ligament. |
| 094103. Anomalous origin of left coronary artery from pulmonary artery (ALCAPA). |
| 094221.Anomalous aortic origin of coronary artery with ventriculo-arterial concordance. |
| 060598. Deficient mural-lateral leaflet of left ventricular component of common atrioventricular valve (left atrioventricular vale) |
| 050603.Common atrium with common atrioventricular junction. |
| 060514.Atypical common atrioventricular valve. |
| 060525. Double orifice of left ventricular component of common atrioventricular valve (left atrioventricular valve). |
| 060560.Common atrioventricular valvar regurgitation. |
| 060571.Atypical right ventricular component of common atrioventricular valve (right atrioventricular valve). |
| 060572.Atypical left ventricular component of common atrioventricular valve (left atrioventricular valve). |
| 060705. Atrioventricular septal defect (AVSD) with ventricular imbalance with dominant right ventricle and hypoplastic left ventricle. |
| 060706. Atrioventricular septal defect (AVSD) with ventricular imbalance with dominant left ventricle and hypoplastic right ventricle. |
| 060727. Atrioventricular septal defect (AVSD) with balanced ventricles. |
| 060728.Common atrioventricular junction with spontaneous fibrous closure of atrioventricular septal defect (AVSD). |
| 060736. Common atrioventricular valve with unbalanced commitment of valve to ventricles. |
| 060737.Common atrioventricular valve with unbalanced commitment of valve to right ventricle. |
| 060738.Common atrioventricular valve with unbalanced commitment of valve to left ventricle. |
| 060104. Tricuspid annular hypoplasia. |
| 060105. Overriding tricuspid valve. |
| 060107. Congenital tricuspid valvar stenosis. |
| 060111. Congenital anomaly of tricuspid valve. |
| 060126. Tricuspid atresia with absent valvar annulus (connection-junction). |
| 060202. Mitral atresia with imperforate mitral valve. |
| 060203.Dysplasia of mitral valve. |
| 060204. Mitral annular hypoplasia. |
| 060205. Overriding mitral valve. |
| 060211.Congenital anomaly of mitral valve. |
| 060221.Congenital anomaly of mitral subvalvar apparatus. |
| 060222. Congenital mitral subvalvar stenosis. |
| 060226. Mitral atresia with absent valvar annulus (connection-junction). |
| 060272. Congenital mitral valvar prolapse. |
| 040807. Anomalous pulmonary venous connection. |
| 091517. Aortic 'annular' hypoplasia. |
| 092944.Descending thoracic or abdominal aortic coarctation. |
| 090711. Pulmonary trunk hypoplasia |
| 090713. Supravalvar pulmonary trunk stenosis |
| 091001. Pulmonary arterial stenosis |
| 091006. Peripheral pulmonary arterial stenoses: at-beyond hilar bifurcation |
| 091007. Central pulmonary arterial stenosis: proximal to hilar bifurcation |
| 091025. Right pulmonary arterial stenosis |
| 091026. Left pulmonary arterial stenosis |
| 070520.Congenital right ventricular outflow tract obstruction. |
| 070532.Congenital subpulmonary stenosis. |
| 090505.Pulmonary 'annular' hypoplasia. |
| 090715.Congenital supravalvar pulmonary stenosis. |
| 090716.Congenital anomaly of pulmonary arterial tree. |
| 090719. Congenital pulmonary trunk (main pulmonary artery) anomaly. |
| 090720. Congenital pulmonary trunk hypoplasia. |
| 091027.Congenital pulmonary arterial branch stenosis. |
| 091028.Congenital right pulmonary arterial stenosis. |
| 091029. Congenital left pulmonary arterial stenosis. |
| 091037.Congenital central pulmonary arterial stenosis or hypoplasia proximal to hilar bifurcation. |
| 091038. Congenital peripheral pulmonary arterial stenoses or hypoplasia at or beyond hilar bifurcation. |
| 070908. Left ventricular outflow tract obstruction due to atrioventricular valve. |
| 070916.Subaortic stenosis due to fibromuscular tunnel. |
| 070928.Congenital left ventricular outflow tract obstruction. |
| 070934.Congenital anomaly of aorta and-or its branches. |
| 070950.Congenital subaortic stenosis. |
| **Procedure exclusion codes (that have a special link to this diagnosis and therefore can lead to patients being misallocated)** |
| 121801. Aortic coarctation-hypoplasia repair by resection & end to end anastomosis |
| 121803. Aortic coarctation-hypoplasia repair by subclavian flap aortoplasty |
| 121800. Coarctation-hypoplasia of aorta repair |
| 121802. Aortic coarctation-hypoplasia repair by patch aortoplasty |
| 123031. Takedown of Fontan type procedure |
| 120635. Double chambered right ventricle repair |
| 121302. Pulmonary valvotomy: open |
| 121810. Aortic coarctation-hypoplasia repair by resection & extended end to end anastomosis |
| 121830. Aortic arch repair |
| 120440. Atrioventricular septal defect (AVSD): left atrioventricular valvar procedure |
| 120081. Anomalous systemic venous connection repair |
| 120420. Atrioventricular septal defect (AVSD): right atrioventricular valvar procedure |
| 123602. Left ventricle to pulmonary artery conduit construction |
| 121430. Pulmonary artery origin from ascending aorta (hemitruncus) repair |
| 123601. Right ventricle to pulmonary arterial tree conduit construction |
| 120143. Atrial septectomy |
| 121431. Pulmonary artery ligation |
| 122920. Double outlet right ventricle repair |
| 120157. Atrial baffle procedure |
| 120400. Atrioventricular septal defect procedure |
| 121004. Application of bilateral pulmonary arterial bands & transcatheter placement of stent in arterial duct |
| 121505. Application of right pulmonary artery band |
| 120190. Interatrial communication creation-enlargement |
| 120806. Ventricular septal defect (VSD) enlargement |
| 124802. Atrioventricular septal defect (AVSD): suturing together superior + inferior bridging leaflets to left ventricular side of septum ('cleft'), |
| 121602. Aortic valvotomy: open, |
| **Specific Procedure exclusion list (exclude patients if had the following allocated specific procedure in records, using specific procedure algorithm in LAUNCHES)** |
| 01:norwood |
| 04:common\_arterial\_trunk\_aorta\_repair |
| 05:common\_arterial\_trunk\_repair |
| 06:cctga\_repair\_a |
| 07:cctga\_repair\_b |
| 08:atrial\_switch |
| 09:rastelli\_rev |
| 10:transposition\_complex |
| 11:transposition\_arch |
| 12:transposition\_vsd |
| 13:transposition |
| 14:tapvc\_shunt |
| 15:tapvc |
| 16:fontan |
| 17:glenn |
| 18:avsd\_fallot\_a |
| 19:avsd\_fallot\_b |
| 20:avsd\_complete |
| 21:avsd\_partial |
| 22:mitral\_valve\_replacement |
| 23:ross\_konno\_a |
| 24:ross\_konno\_b |
| 25:ross |
| 26:aortic\_root\_replacement |
| 27:aortic\_valve\_replacement |
| 28:tricuspid\_valve\_replacement |
| 29:pulmonary\_valve\_replacement |
| 33:pulmonary\_atresia\_vsd |
| 34:mapca\_unifocalisation |
| 35:absent\_pulmonary\_valve\_syndrome |
| 36:fallot |
| 37:rv\_pa\_conduit |
| 38:vsd\_rvoto |
| 39:supra\_valvar\_aortic\_stenosis |
| 40:sub\_valvar\_aortic\_stenosis |
| 41:ap\_window |
| 42:anomalous\_coronary |
| 43:cor\_triatriatum |
| 45:arterial\_shunt |
| 46:iaa |
| 47:coarctation\_hypoplasia |
| 48:pulmonary\_vein\_stenosis |
| 49:conduit\_replacement |
| 58:pda\_stent |
| 59:pulmonary\_valve\_replacement\_transluminal |
| 60:rvot\_stent |
| 61:pulmonary\_valve\_radiofrequency |
| 62:blade\_atrial\_septostomy |
| 63:balloon\_atrial\_septostomy |
| 64:pulmonary\_vein\_intervention |
| 65:coarctation\_stent |
| 66:coarctation\_balloon |
| 67:recoarctation\_balloon |
| 68:balloon\_aortic\_valve |
| 69:balloon\_pulmonary\_valve |
| 74:pa\_stent |
| 75:pa\_ballooning |
| 76:mapca\_transluminal |
| 77:conduit\_balloon\_stent |
| 78:stent\_dilatation |

# Step 3 Identify VSD diagnosis - Pathway

Consider patients selected in [step 1](#_Step_1:_Diagnostic) and [step 2](#_Step_2:_Procedure) and then assign pathway type to each procedure.

The individual types of pathway procedure are ‘Stage one palliative procedures’ and ‘reparative procedures for VSD diagnosis’ all of these are biventricular procedures.

If multiple types of pathway procedure happened in the same record, then we mark the individual procedure as the most complex one, i.e., the hierarchy/complexity order is reparative procedure for VSD diagnosis then palliative procedures.

The first occurrence of a pathway procedure Identifies the occurrence of this type of pathway procedure. For any of the defined pathway procedures, palliative and reparative, only the first occurrence will be the pathway procedure of that type. Other subsequent occurrence of these individual procedures will be identified as re-do and off pathway. Patients can have up to 2 pathway procedures in whole history.  Of note, additional reparative or stage one procedure(s) after final expected reparative procedure will be identified as additional or off pathway.

Patients who have a procedure before the first pathway procedure are considered to have had a ‘pre-pathway procedure’. These will be described.

Patients who have no pathway procedures will be described.

Then patients who have a pathway procedure and then have additional post pathway / off pathway procedures which will be described divided by the stage at which they occur.

## Pathway applicable to VSD diagnosis

Assign pathway type to each procedure:

### Palliative procedures applicable in VSD diagnosis

Look for staged palliative procedures, i.e., palliative first stage procedure which has two subtypes:

#### i. Banding:

* 121402: Pulmonary trunk band (PA band) (with or without PDA closure)

#### ii. PDA closure: see code in Table C

##### Table C: PDA closure codes

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| **Palliative procs in VSD – PDA closure type** |
| 122404. Arterial duct (PDA) closure with transluminal device, |
| 122410. Arterial duct (PDA) closure |
| 122420. Patent arterial duct (PDA) closure: surgical |
| 122421.  Arterial duct (PDA) closure with transluminal coil |
| 122422. Arterial duct (PDA) closure with transluminal Amplatzer plug |

### reparative procedure for VSD diagnosis

The pathway is determined by the first pathway procedure that occurs for the patient.

##### Table D: Reparative procedures for VSD diagnosis

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| 120801. Ventricular septal defect (VSD) closure, |
| 120802. Ventricular septal defect (VSD) closure by direct suture, |
| 120803. Ventricular septal defect (VSD) closure using patch, |
| 120807. Ventricular septal defect (VSD) closure with transluminal device, |
| 120816. Closure of multiple ventricular septal defect (VSD)s, |
| 120828. Intraoperative ventricular septal defect (VSD) closure with transluminal device (hybrid approach), |

# Step 4: Identify diagnostic subgroups

## Multiple VSDs

If either of these codes are present the patient is in multi group

* 071504. Multiple VSDs
* 120816. Closure of multiple ventricular septal defect (VSD)s

## Isolated VSD

All other patients are in isolated VSD group

# Step 6: Remove patients according to the violation rules.

Exclude patients if

* had only non-contributory procedure records via activity algorithm.

# Step 7: Flagging rules to centre

## Patients with suspected missing or miscoded data

These patients will be excluded from pathway analysis and reintervention monitoring.

None for this diagnosis

## Patients with minor data errors/unusual records

Patients can be included in analysis with these as long as they didn’t have major data missing.

### Generic flagging rule:

* Flag patients if there is a cardiopulmonary bypass surgery as a pre-pathway procedure - please check this patient’s diagnostic and procedure coding is correct

### VSD specific rule:

* patients had pre-pathway only (some patients who have undergone pats only may had a small VSD and as a result, do not require an additional reparative procedure).