**Activity analysis algorithm v6.14**

Last amended 2017-12-19 JS

In a more detailed fashion the algorithm should follow these steps once you have been allocated to a group you are then excluded from subsequent testing of inclusion criteria (with the exception of primary ECMO which is run on a subset of the data and the primary data set is then updated) – each report group is mutually exclusive.

Note:

1. General data processing – data is pre-processed using the process originally created by David Cunningham. This now needs to be updated to ensure no valid codes are excluded/removed.
2. Data is restructured for ease of manipulation.
3. Code groups are defined (see R code for detail).

If we use the following labels for assignment:

bypass

diagnostic:non-surgical

ep:non-surgical

hybrid

icd:non-surgical

intervention:non-surgical

no\_valid\_codes

non-bypass

pacemaker:non-surgical

primary\_ecmo

unallocated

unallocated-ecmo

vad

Note:

1. We now have a category called unallocated-ecmo (these are the non-primary ECMO) and should not be included in activity totals.
2. The complete list of codes is in a spreadsheet called ‘nchda\_and\_fetal\_codes\_v6.0.xlsx’, this has the complete list of IPCC short codes and whether they should be submitted or not and also the minor\_and\_excluded (for the AA and SP algorithm)
3. There is no longer a separate category for lung transplant – these are now included in the process for categorising bypass & non-bypass .
4. The activity allocation algorithm (AA) will no longer have additional fixes made to poor coding this means that:
	1. Procedure types must be correct (‘8. Other’ is ignored completely) any cases misallocated may be incorrectly categorised or unallocated.
	2. Procedures coded incorrectly for procedure (a diagnosis code used instead of a procedure) will not be correctly categorised.

**Step 0: excluded**

Selection criteria:

1. No valid code in any position (1..8)

Set report\_group = ‘no\_valid\_codes’ : these should now be being fixed as part of the data cleaning exercise, if they remain these are NOT being manually fixed.

**Step 1: bypass**

Selection criteria:

1. exclude primary\_ecmo\_exclude & vad (these used to be in minor\_and\_excluded)
2. procedure\_type = 1
3. report\_group = ‘’
4. check there is at least one valid code

Set report\_group = ‘bypass’

**Step 2: non-bypass**

Selection criteria:

1. exclude primary\_ecmo\_exclude & vad (these used to be in minor\_and\_excluded)
2. procedure\_type in (2,4,6,11)
3. report\_group = ‘’
4. check there is at least one valid code

Set report\_group = ‘non-bypass’

**Step 3: hybrid**

Selection criteria:

1. exclude primary\_ecmo\_exclude & vad (these used to be in minor\_and\_excluded)
2. procedure\_type in (7)
3. report\_group = ‘’
4. check there is at least one valid code

Set report\_group = ‘hybrid’

**Step 4: vad**

Selection criteria:

1. procedure\_type IN (1,2,4,6)
2. report\_group = ‘’
3. Must have one or more of these codes in procedure 1 to 8:

123704. Prosthetic heart implantation

128721. Ventricular assist device implantation

128722. RV assist device implantation,

128723. LV assist device implantation,

128724. Biventricular assist device implantation

128741. Ventricular assist device removal

Set report\_group = ‘vad’

**Step 5: set all possible ecmo cases**

Selection criteria:

1. procedure\_type IN (1,2,4,6,7)
2. report\_group = ‘’
3. Must have one or more of these codes in procedure 1 to 8:

128725. Cardiac support using Extracorporeal Membrane Oxygenation (ECMO) circuitry

128726. Mechanical life support procedure as bridge to transplant

128727. Mechanical life support procedure as bridge to recovery

Set report\_group = ‘ecmo’

These are then subsequently tested for inclusion as primary\_ecmo see step 12

**Step 6: icd:non-surgical**

Selection criteria:

1. Ignore any pacemaker, ep or diagnostic codes
2. procedure\_type IN (3,5,10)
3. report\_group = ‘’
4. Must have one or more of these codes in procedure 1 to 8:

124231. Implantable cardioverter & defibrillator (ICD) implantation

124233. Implantable cardioverter & defibrillator (ICD) implantation: endocardial

124234. Implantable cardioverter & defibrillator (ICD) system removal

124235. Implantable cardioverter & defibrillator (ICD) system transluminal removal

124239. Implantable cardioverter & defibrillator (ICD) procedure

124261. Implantable cardioverter & defibrillator (ICD) implantation: single chamber

124264. Implantable cardioverter & defibrillator (ICD) implantation: dual chamber

124265. Implantable cardioverter & defibrillator (ICD) implantation: biventricular

124279. Subcutaneous implantable cardioverter & defibrillator (ICD) implantation

Set report\_group = ‘icd:non-surgical’

**Example 1:**

Coding is:

124231. Implantable cardioverter & defibrillator (ICD) implantation

123485. Pulse generator box placement

123470. Pacemaker wire procedure

Categorise as icd > the 2nd and 3rd code are ignored because they are part of ‘i.’

**Example 2:**

Coding is:

124231. Implantable cardioverter & defibrillator (ICD) implantation

130506. Diagnostic cardiovascular catheterisation procedure: haemodynamic data obtained

Categorise as icd > the 2nd code is ignored because they are part of ‘i.’ the diagnostic list.

**Example 3:**

Coding is:

120036. Stent placement in superior caval vein (SVC)

124264. Implantable cardioverter & defibrillator (ICD) implantation: dual chamber

Is not categorised as icd because the 124264 is an intervention that isn’t ep, diagnostic or in the ep or pacemaker list.

**Step 7: pacemaker:non-surgical**

Selection criteria:

1. Ignore any ep or diagnostic codes
2. procedure\_type IN (3,5,10)
3. report\_group = ‘’
4. Must have one or more of these codes in procedure 1 to 8:

123450. Pacemaker system placement: single chamber

123451. Pacemaker system placement: dual chamber

123452. Pacemaker system placement: biventricular

123460. Pacemaker system placement: temporary

123463. Pacemaker system placement: permanent epicardial

123464. Pacemaker system placement: permanent endocardial

123467. Pacemaker system placement: permanent

123468. Pacemaker procedure

123470. Pacemaker wire procedure

123473. Cardiac resynchronisation therapy (biventricular pacing)

123484. Pacemaker wire revision procedure

123485. Pulse generator box placement

123513. Pulse generator box replacement

123514. Removal of complete implanted cardiac pacemaker system

124370. Pacemaker system placement: percutaneous leadless

124475. Removal of implanted pacemaker lead

Set report\_group = ‘pacemaker:non-surgical’

**Example 1:**

Coding is:

123450. Pacemaker system placement: single chamber

130517. Electrophysiological study (EPS) with three dimensional mapping

Categorise as pacemaker > the 2nd code is ignored because they are part of ‘i.’ the ep list.

**Example 2:**

Coding is:

123451. Pacemaker system placement: dual chamber

130015. Insertable electrocardiogram (ECG) loop recorder (eg Reveal) removal

Categorise as pacemaker > the 2nd code is ignored because they are excluded as part of the minor and excluded list

**Example 3:**

Coding is:

120043. Balloon dilation of systemic vein or pathway

123451. Pacemaker system placement: dual chamber

124475. Removal of implanted pacemaker lead

Is not categorised as pacemaker because the 120043 is an intervention that is not diagnostic, ep or in the minor and excluded list.

**Step 8: ep:non-surgical**

Selection criteria:

1. Ignore any diagnostic codes
2. procedure\_type IN (3,5,10)
3. report\_group = ‘’
4. Must have one or more of these codes in procedure 1 to 8:

123546. Transluminal cryoablation procedure for arrhythmia

123548. Transluminal radiofrequency procedure for arrhythmia

123557. Transluminal procedure for arrhythmia

123582. Transluminal procedure for atrial arrhythmia

123583. Transluminal procedure for ventricular arrhythmia

123584. Transluminal ablation procedure with pulmonary vein exclusion

123840. Transluminal ablation procedure for arrhythmia

123869. Percutaneous radiofrequency epicardial ablation procedure for arrhythmia

130512. Electrophysiological study (EPS)

130517. Electrophysiological study (EPS) with three dimensional mapping

Set report\_group = ‘ep:non-surgical’

**Example 1:**

Coding is:

130014. Insertable electrocardiogram (ECG) loop recorder (e.g. Reveal) implantation

130501. Diagnostic catheterisation procedure

130512. Electrophysiological study (EPS)

Categorise as ep > the 1st and 2ndcode are ignored because they are part of ‘i.’ or the diagnostic or minor and excluded list.

**Step 9: intervention:non-surgical**

1. Ignore any diagnostic codes
2. procedure\_type IN (3,5)
3. report\_group = ‘’
4. Must have one or more non-diagnostic codes in procedure 1 to 8:

Set report\_group = ‘intervention:non-surgical’

**Step 10: diagnostic:non-surgical**

Selection criteria:

1. procedure\_type IN (3,5)
2. report\_group = ‘’
3. must have **only** one or more of these codes in procedure 1 to 8:

120625. Transluminal right ventricular biopsy

124507. Transluminal diagnostic test occlusion

130501. Diagnostic catheterisation procedure

130505. Diagnostic cardiovascular catheterisation procedure: angiographic data obtained

130506. Diagnostic cardiovascular catheterisation procedure: haemodynamic data obtained

130507. Diagnostic cardiovascular catheterisation procedure with haemodynamic alteration (challenge)

130508. Diagnostic cardiovascular catheterisation procedure with electrophysiological alteration (challenge)

130513. Catheterisation study for pulmonary hypertension evaluation

Set report\_group = ‘diagnostic:non-surgical’

**Step 11: set any unallocated to unallocated**

1. report\_group = ‘’

Set report\_group = ‘unallocated’

**Step 12: primary ecmo**

**Notes:**

Include list:

128725. Cardiac support using Extracorporeal Membrane Oxygenation (ECMO) circuitry

128726. Mechanical life support procedure as bridge to transplant

128727. Mechanical life support procedure as bridge to recovery

**Process:**

The data set is copied

Selection criteria:

1. procedure\_type IN (1,2,4,6,7)
2. exclude ‘no\_valid\_codes’ and ‘unallocated’

Sort all data by:

* + 1. Patient identifier
		2. Procedure date (ascending)
		3. Type of procedure (ascending)

Sequentially iterate through the records and assess:

ecmo\_allocation <- function(nchda\_ecmo) {

 for(i in 1:nrow(nchda\_ecmo)) {

 ## first patient > cannot check preceding patient

 if (i == 1)

 {

 if (nchda\_ecmo[i,'report\_group'] == 'ecmo')

 {

 nchda\_ecmo[i,'report\_group'] <- "primary\_ecmo"

 }

 }

 else

 {

 ## all subesequent records

 ## if same patient

 if ((nchda\_ecmo[i,"patient\_identifier"]) == (nchda\_ecmo[(i - 1),"patient\_identifier"]))

 {

 ## check that record is ecmo

 ## & previous record is not ecmo

 ## & procedures are > 30 days apart

 if((nchda\_ecmo[i,'report\_group'] == 'ecmo')

 & (nchda\_ecmo[(i - 1),'report\_group'] != 'ecmo')

 & ((nchda\_ecmo[i,"procedure\_date"]) - (nchda\_ecmo[(i - 1) ,"procedure\_date"]) > 30)

 )

 {

 nchda\_ecmo[i,'report\_group'] <- "primary\_ecmo"

 }

 }

 else

 {

 ## different patient & first record for that patient - if ecmo then must be primary\_ecmo

 if (nchda\_ecmo[i,'report\_group'] == 'ecmo')

 {

 nchda\_ecmo[i,'report\_group'] <- "primary\_ecmo"

 }

 }

 }

 }

 ###############################################################################################

 return(nchda\_ecmo)

}

**Example 1: procedures for the same patient**

|  |  |  |
| --- | --- | --- |
| 13/08/2016 | 1. bypass | 120143.Atrial septectomy |
| 15/08/2016 | 2. non-bypass | 123103.Modified right Blalock interposition shunt |
| 16/08/2016 | 6. support | 128725.Cardiac support using Extracorporeal Membrane Oxygenation (ECMO) circuitry |

Not classified as ecmo – the procedure prior to ecmo is within 30 days so excluded

**Example 2: procedures for the same patient**

|  |  |  |
| --- | --- | --- |
| 09/11/2016 | 6. support | 128725. Cardiac support using Extracorporeal Membrane Oxygenation (ECMO) circuitry |
| 10/11/2016 | 1. bypass | 120000. Totally anomalous pulmonary venous connection repair 120000. Totally anomalous pulmonary venous connection repair |
| 10/11/2016 | 2. non-bypass | 128728. Procedure involving Extracorporeal Membrane Oxygenation (ECMO) circuitry |

Classified as ecmo – ecmo is the first procedure

**Example 3: procedures for the same patient**

|  |  |  |
| --- | --- | --- |
| 02/04/2016 | 2. non-bypass | 121402. Pulmonary trunk band (PA band) |
| 15/06/2016 | 6. support | 128725. Cardiac support using Extracorporeal Membrane Oxygenation (ECMO) circuitry |

Classified as ecmo – ecmo is instituted >30 days after the previous surgical procedure