PEDIATRIC CARDIAC CRITICAL CARE CONSORTIUM

PC4 Improving outcomes and quality through collaboration

PC4 v3 Overview

January 2019

General changes

General changes

- **Updated all anomaly, diagnosis, procedure and preop risk factors to the latest STS**
- **Provided text fields to specify 'other' complications, medical diagnoses, etc.**
  - Text fields will not be used for any research/analytic projects
- **Many (but not all) date/time fields replaced with date fields**

Hospital admission

Hospital admission

- **Added fields to better capture patient status at hospital admission and events that could occur at any point during the hospital stay**
  - Trached at hospital admission
  - Home respiratory support at hospital admission
  - Ever had a chest tube during this hospital stay
  - Ever on cardiac acute care service during this hospital stay

Hospital admission (cont)

- **Moved existing fields from the CICU section to the hospitalization section**
  - PPM / AICD at hospital admission
    - If not, ever placed *during this hospital stay*
  - On transplant list at hospital admission
    - If not, ever listed *during this hospital stay*
  - New diagnosis of diaphragm dysfunction *during this hospital stay*
  - New diagnosis of vocal cord dysfunction *during this hospital stay*
  - All of the above are shared with PAC[3]

Hospital admission (cont)

- **Dropped fields**
  - Beta blockers at hospital admit/discharge

Cardiothoracic surgery

Cardiothoracic surgery

- **Fields added from STS**
  - OR entry time
  - Ultrafiltration after CPB
  - Endotracheal intubation
    - Intubated for the procedure or
    - On preop invasive vent and remained on support at time of surgery

CT surgery – PC4-specific fields

- **New fields unique to PC4 (i.e., cannot be imported from STS)**
  - Planned surgery
    - Record Yes if the surgery was the planned operative repair or part of a multi-stage palliative strategy *determined prior to the first intervention* (surgery or catheterization) during the hospitalization.
    - Delayed sternal closure, ECMO decannulation, VAD decannulation, and removal of Broviac catheter should always be coded as Planned = Yes.

CT surgery – PC4-specific fields (cont.)

- Planned surgery - examples

Patient underwent complete repair of AVSD. During the same hospital stay, developed mitral regurgitation requiring MV repair.

AVSD: Planned = Yes

Mitral valve repair: Planned = No

Patient had a hybrid stage 1 followed by a Norwood procedure during the same hospital stay.

Hybrid: Planned = Yes

Norwood: If it was planned prior to the hybrid, Planned = Yes. If, however, the intent had been to do a comprehensive stage 2, Planned=No

CT surgery – PC4-specific fields (cont.)

- Planned surgery - examples

Patient with critical aortic stenosis went to the cath lab for a balloon aortic valvuloplasty (knowing there was a good chance it would not be successful.) After the cath procedure, the patient did require a Ross procedure for aortic insufficiency.

Cath: Planned = Yes

Ross: Planned = No. Although the surgical repair may have been anticipated, it was not part of the planned palliative pathway. Had the cath been successful, there was no plan to do a Ross.

CT surgery – PC⁴-specific fields (cont.)

- Extubated in OR or upon arrival
  - Endotracheal tube removed in OR/PACU and arrived to the inpatient unit with a natural airway or
  - Endotracheal tube removed in the inpatient unit by the anesthesia team shortly after arrival *with no course of mechanical ventilation in the inpatient unit*.
    - Bag-mask ventilation does not qualify as mechanical ventilation.
    - This includes patients with a tracheostomy who are never mechanically ventilated but remain cannulated with their tracheostomy tube.

CT surgery – PC⁴-specific fields (cont.)

- Multiple bypass runs
  - Optional to collect

Cardiothoracic surgery

- **Fields dropped**
  - Glucose check on POD1 & POD2
  - VTE prophylaxis

Cardiac cath

Cardiac cath

- **Revamped the procedure types**

Can import from IMPACT

Diagnostic cath	EP cath (NEW)
ASD closure	PDA closure
Aortic coarct procedure	Proximal PA stent
Aortic valvuloplasty	Pulmonary valvuloplasty
EP ablation (NEW)	Transcath PV replacement

Unique to PC⁴/PAC³

Endomyocardial biopsy (NEW)	Transvenous PPM placement
PHTN eval	Other (text)

Cardiac cath (cont.)

- **Fields added from IMPACT**
  - Specific cath procedures
    - Full list (>300) procedures
    - Optional for collection
  - Procedure end date/time

Cardiac cath (cont.)

- **New fields unique to PC⁴**
  - Planned intervention
    - Same definition as surgical
  - Endotracheal intubation
  - Extubation in cath lab / on arrival
    - Same definitions as surgical

CICU encounter

CICU encounter - general changes

- **Dropped the time portion of the critical care end**
  - Still record date/time of CICU discharge
- **Added current surgical status**
  - In v2, field existed in non-surgical risk section only
  - Best designation of patient's current palliative stage/physiology
  - Added status post heart transplant to list of options

CICU encounter - general changes

- **Additional fields to document status at CICU admission**
  - Presence of permanent feeding tube
  - Advanced directive if age ≥ 18yr
- **Dropped**
  - DNR/DNI on file
  - Pacemaker/ICD at ICU admission (moved to hospitalization-level)

Reason for CICU encounter

- **New options**
  - Pre cardiac cath
  - Post non-cardiac procedure
  - Anticoagulation
- **Clarified definitions**
  - Non-CT postop, post cath, and post non-cardiac procedure are intended to capture *routine* post-procedural care. If there's an active medical condition and the patient would have otherwise gone to a non-ICU recovery area, code "Medical condition"

Encounter medical diagnoses

- **New cardiovascular options**
  - Heart failure, Chronic or acute on chronic
    - Chronic or acute on chronic heart failure which was managed prior the admission with heart failure medications and/or mechanical circulatory support and requiring the initiation of at least one of the following therapies: 1) new or increased dose of diuretic therapy (IV or enteral), 2) continuous infusion of a new vasoactive agent or increased dose of an existing vasoactive agent, 3) increased respiratory support (HFNC, non-invasive or invasive mechanical ventilation), 4) new mechanical circulatory support.

Encounter medical diagnoses (cont.)

- **New cardiovascular options (cont.)**
  - Inadequate pulmonary blood flow
  - Myocarditis, acute
  - Myocarditis, acute, infective
  - Pulmonary embolism
  - Syncope/near syncope
  - VAD malfunction

Encounter medical diagnoses (cont.)

- **New non-cardiovascular options**
  - GI – Hepatic injury
  - GI – NEC – Bell's II or III
  - GI – PLE
  - Neuro – Intracranial hemorrhage (non-stroke)
  - Resp – Hemothorax
  - Resp – Plastic bronchitis
  - Other – ICU therapy at home

Encounter medical diagnoses (cont.)

- **Added definitions to existing choices**

  CV – Arrhythmia, SVT
  CV – Arrest
  CV – Pericardial effusion
  Neuro – Stroke

- **Clarified definitions**

  CV – ADHF
  CV – PHTN
  GI – Bowel obstruction
  GI – GI tract hemorrhage
  Infectious – Sepsis
  Resp – Respiratory insufficiency
  Other – DNR/hospice care

CICU disposition

- **New options for patients transferred to another inpatient unit (current or outside hospital)**
  - Cardiac ward via procedure suite/OR
  - Rehab unit
  - Outside hospital CICU

Respiratory support

Invasive ventilation

- **Flag courses beginning during a procedure**
  - Course must begin during a surgery, cath, radiology procedure (i.e., not courses that begin pre-procedure and continue until start time)
- **Respiratory support following each course**
  - Type of support *immediately* following discontinuation of each course

Invasive ventilation (cont.)

- **Airways**
  - Removed the details about each airway
  - Only record the initial and the final airway (and trach date, if applicable)
- **Modes**
  - Grouped bi-vent with conventional
  - Renamed 'oscillator' to 'high-frequency'

Invasive ventilation (cont.)

- **Clarified definitions**
  - Wherever possible, replaced 'intubation' and 'extubation' with references to the beginning and ending of support
  - Vent end date known: Answer 'yes' if the patient is on support through the end of hospital stay and use hospital discharge date/time as the vent end date/time
  - End date/time for a trached patient is the end of mechanical vent support by any mode

HFNC / Positive airway pressure

- **Clarified definitions**
  - A 'course' is consecutive days on which the patient is on support for any part of that day
  - 'On support at CICU start' includes patients arriving from the OR/procedural suite and extubated on arrival by anesthesia to HFNC/CPAP/BiPAP

Vascular access

Vascular access

- **All dates/times replaced with date-only fields**
- **Added 'other' venue to option list for all line types**
- **Venous lines**
  - Added specific site options for patients with Glenn/Fontan physiology (IJ-Glenn/Fontan, Subclavian-Glenn/Fontan, Upper extremity-Glenn/Fontan)
- **Arterial lines**
  - Split umbilical lines into their own line site

Vascular access (cont.)

- **Clarifications**
  - Thrombi are only coded if they require initiation or increase in dose or duration of systemic anticoagulation
  - Thrombus treatment can begin at any time during or after the CICU encounter

Other therapy

Therapy - vasoactive infusions

- **Document start/end dates of every course**
  - Course begins when patient is on any agent
  - Course ends when patient is off all agents
    - If support restarts that day or the following calendar day, the course is not considered over
  - You do not need to record the individual agents for each course
- **Agents**
  - Added levosimendan and "other" (with text box)
  - Clarified that calcium exclusively for hypocalcemia and esmolol exclusively as an anti-arrhythmic should not be captured here

Other therapy

- **Sedation/analgesia/neuromuscular block infusion**
  - Added epidural anesthesia to list of agents
- **Peritoneal drain**
  - Added fields to record all peritoneal drainage
    - Not limited to peritoneal dialysis
    - Includes all indwelling devices (e.g., dialysis caths, pigtail caths)
    - If patient is getting peritoneal dialysis, code this field and peritoneal dialysis

Other therapy (cont.)

- **Renal replacement therapy**
  - Changed CRRT to RRT
  - Added earliest start and latest end dates for each dialysis type
  - Dropped CVAH from dialysis types
- **Monitoring**
  - Dropped CVP, continuous EEG, BIS, LA pressure, and PA cath
  - NIRS: Replaced 'limb' option with 'other'

Other therapy (cont.)

- **Dropped**
  - Apharesis/plasmapheresis
  - Enteral feeding

Complications

PC4/PAC3 sites

- **If the patient meets criteria during both their acute care and their critical care stay, code that complication in both registries.**
  - This ensures that joint sites are collecting data in exactly the same way as a PC4-only or PAC3-only site.
  - The data management team and ArborMetrix will distinguish distinct events from single events that span the acute/critical care units

Specific complications

Cardiovascular - Cardiac arrest

- **Record all arrests that occur during the encounter – including those that happen outside of the CICU**
  - Includes arrests in imaging suites, procedure rooms, etc. as long as they occur during the CICU encounter
  - Does not include arrests during cardiothoracic surgery procedures in any location

Cardiovascular - Cardiac arrest (cont.)

- **New cardiac arrest fields**
  - Rhythm at onset of CPR
    - Only code JET, SVT, or complete heart block if the CPR began while the patient had a pulse
  - Onset location
    - Venue in which CPR began

Cardiovascular – Arrhythmia

- **Added flag for arrhythmias receiving ICU-level treatment at CICU start**
- **Dropped the time portion of the arrhythmia end date/time**

Cardiovascular – Arrhythmia (cont.)

- **Clarifications**
  - Includes arrhythmias clearly documented in the OR for which therapy was initiated in the OR and ongoing at the time of CICU admission
  - Includes therapies while on ECLS/VAD
  - Drug treatment includes any continuous IV med (excluding electrolyte repletion with the exception of magnesium for torsades) or bolus dosing (excluding bolus digoxin)
  - Explicitly added SVT to the atrial tachycardia option and rapid atrial pacing to cardioversion/defibrillation
  - Start/end dates refer to ICU-level treatment. Clarified end dates for patients receiving cardioversion, or PPM/AICD placement

Cardiovasc – Mechanical Circulatory Support

- **Reason for ECMO**
  - Combined LCOS, cardiac failure, and ventricular dysfunction into a single option
- **ECMO cannula sites**
  - Added initial and final cannula sites
  - Options: peripheral, transthoracic, both
- **Clarification**
  - 'On support at CICU end' includes patients who died on support and those who died immediately after support withdrawn

Cardiovascular - LCOS

- **v3 criteria**
  1. VIS >15
  2. VIS tripled to ≥10 in 48hrs
  3. AVO2 diff >40% by invasive measurement or NIRS
  4. Physician note

  - Dropped criteria
    - Addition of new agent
    - Reinitiation of support after 24hr
- **Code the criteria met**
  - At initial LCOS date/time

Cardiovascular – LCOS (cont.)

- **Code the criteria met**
  - At initial LCOS date/time
  - If applicable, at initial postop LCOS date/time

Cardiovascular - PHTN

- **Qualifying therapies**
  - Iloprost removed from specific therapies
  - Added 'other' continuous IV, continuous inhaled, and continuous subcutaneous therapy
- **Clarifications**
  - Start/end refers to ICU-level therapy

Cardiovascular complications

- **Dropped**
  - Pulmonary vein obstruction
  - Systemic vein obstruction
  - Listed for heart transplant
    - Moved to hospitalization-level

Operative/procedural complications

- **Sternum left open**
  - List every time the patient had an open sternum in the CICU
    - Date opened & where opened (OR, CICU, etc.)
    - Date closed
- **Dropped unplanned reoperation (exclusive of bleeding)**
  - Now coding every surgery/cath as planned/unplanned

Respiratory complications

- **All date/time fields replaced with date only**
- **Chylothorax**
  - Added fields to capture specific therapies utilized (e.g., NPO, octreotide, etc.)
  - If treated with chest tube, asks if multiple chest tubes required
  - Clarified that either clinical status and/or lab data can be used to document chylothorax

Respiratory complications (cont.)

- **Pleural effusion/hemothorax & pneumothorax**
  - Only capturing events requiring chest tube placement
  - Added question asking if multiple chest tubes were placed
  - Pleural effusion and hemothorax combined into a single complication

Respiratory complications (cont.)

- **Dropped**
  - ARDS
- **Clarification**
  - Pulmonary embolism includes a thrombus in the cavopulmonary anastomosis pathway

Infectious complications

- **Sepsis – new definition**
  - Requires >6d antibiotic treatment (in addition to initiation/escalation of either inotropic support or mechanical vent)
  - Removed volume resuscitation from the qualifying treatments
  - Added field to capture whether patient had a positive culture

Infectious complications (cont.)

- **UTI**
  - Flag whether each UTI is a CA-UTI
- **Pneumonia**
  - Separated VAP from non-VAP pneumonia
- **Endocarditis**
  - Relocated from cardiovascular to infectious complication section
  - Added diagnosis date

Infectious complications (cont.)

- **Dropped meningitis**
- **Clarified definition for device-related infections**
  - These procedure-related infections must be adjudicated by local infection control for newly acquired infections in the CICU (i.e., not present on admission). Code clear examples of these infections present on admission that could not be adjudicated to the CICU by local infection control.

Neurologic complications

- **Stroke**
  - Document every stroke during the encounter
    - Stroke must be in new territory to be considered a distinct event
  - Means of diagnosis
    - Clinical findings, imaging, or both
  - Hemorrhagic strokes
    - Document if primarily hemorrhagic
    - If not primarily hemorrhagic, was there hemorrhagic conversion.
    - Conversion date/time, if applicable

Neurologic complications (cont.)

- **IVH ≥ grade II**
  - Record maximum grade and date that grade first noted
- **Intracranial hemorrhage - new definition**
  - Neurologic imaging study indicating a new or previously unsuspected focus of discrete CNS injury consistent with hemorrhage
  - Include
    - Subdural, subarachnoid, and IVH < grade II
  - Exclude
    - Hemorrhagic strokes and IVH ≥ grade II
    - Bleeding found on routine or research imaging

Neurologic complications (cont.)

- **Dropped**
  - Paralyzed diaphragm (moved to hospitalization-level)
  - Vocal cord dysfunction (moved to hospitalization-level)

Gastrointestinal complications

- **Hepatic injury – new definition**
  - ALT > 500
- **NEC – new definition**
  - Bell's criteria II or III
  - For each occurrence, code whether surgery was performed (and surgery date, if applicable)

Other complications

- **Pressure ulcer – new definition**
  - Now collection only stage III or higher
  - Record earliest date
  - Record maximum stage noted during encounter

Other complications (cont.)

- **Narcotic dependence – new definition**
  - Was the patient exposed to narcotic therapy that ultimately warranted transition to a narcotic weaning strategy?
  - Exposure could be in the ICU or those on a wean at admission to treat previous narcotic withdrawal.
  - Does not include treatment for neonatal abstinence syndrome.
  - Field is no longer optional to collect

Other complications (cont.)

- **Clarification**
  - Hypoglycemia (glucose <40) should be coded regardless of whether the patient received treatment
- **Text box added for 'other' complications**

Surgical risk

Surgical risk

- **New preop fields**
  - Treatment for PHTN at surgery
    - Includes ICU-level therapies or oral meds
  - Arrhythmia treatment at surgery
    - Includes ICU-level therapies or oral meds
  - Chronic lung disease of prematurity
  - PLE

Surgical risk (cont.)

- **New intraop / postop fields**
  - Intraop arrest with ≥ 10 minutes of CPR
  - Postop creatinine
    - First Cr in the CICU on POD0 or POD1, if available
    - Maximum Cr in the CICU from POD0-POD7, if available, and the earliest date it was recorded

Surgical risk (cont.)

- **Enteral feeds**
  - Only record data if
    - Patient was ≤30d at hospital admission and
    - This is the first surgical encounter during the hospitalization
  - Data collected
    - Any preop feeds in this hospital and, if so, venue(s) in which fed (NICU, CICU, other)
    - Any postop feeds in the CICU and, if so, earliest postop feeding date
    - Nutrition at CICU discharge (TPN, enteral, both)

Surgical risk (cont.)

- **Dropped**
  - ECMO initiated in the OR
  - Postop core temp
  - Postop blood pressure

Non-surgical risk

Non-surgical risk

- **Timeframe expanded from 4 to 18 hours for (most) labs**
  - Cr, BNP, and AST/ALT (for defining hepatic injury)
    - Maximum values from 12h pre-ICU admission to 6h post-ICU admission
  - Lactate is still 2h pre- through 2h post-ICU admission

Non-surgical risk (cont.)

- **Creatinine**
  - Record first and maximum Cr during the 18h window, if available
  - Record the maximum Cr in the CICU through ICU day 7, if available, and the earliest date it was recorded
- **Pupil reflex**
  - Record pupil reflex on admission (rather than at 2 hours)

Non-surgical risk (cont.)

- **Clarified high-risk diagnoses**
  - Arrhythmia requires ICU-level therapy
  - Added definitions for CPR and myocarditis
  - Removed DNR/hospice from options
    - This should be coded as the encounter medical diagnosis if the patient presents for comfort care only
- **Dropped current surgical status**
  - Moved to encounter-level and now answered for all patients

Vasoactive support

Surgical risk - VIS

Version 2

- **VIS at time of surgery**
- **Max VIS in first 2 postop hours**

Version 3

- **VIS at time of surgery**
- **Max VIS in first 2 postop hours**
- **VIS at predefined timepoints through POD7**

VIS – Non-surgical encounters

Version 2

- **Max VIS in first 2 CICU hours**

Version 3

- **VIS at time of CICU admission**
- **VIS at predefined timepoints through CICU day 7**

VIS – v3 timepoints

Surgical encounter	Non-surgical encounter
6 hr postop	6 hr post-CICU admit
12 hr postop	12 hr post-CICU admit
18 hr postop	18 hr post-CICU admit
24 hr postop	24 hr post-CICU admit
30 hr postop	30 hr post-CICU admit
36 hr postop	36 hr post-CICU admit
42 hr postop	42 hr post-CICU admit
48 hr postop	48 hr post-CICU admit
06:00 daily through POD7	06:00 daily through day 7

VIS – v3

- **Software vendors have been instructed to calculate these timepoints for you**
  - Based on the ICU/PACU arrival date/time for surgical encounters
  - Based on the CICU admit date/time for non-surgical encounters
- **You do not have to find the maximum VIS during the time intervals**
  - Recording the doses at that specific time

VIS – v3

- You do not have to look for any data after CICU discharge