CHI St. Vincent

POLICY NUMBER	**OC068PCS**
ORIGINAL DATE:	**September 2, 2017**
TITLE:	**THERAPEUTIC HYPOTHERMIA (CHI SVHS)**
KEYWORDS:	Cardiac Arrest; shivering; temperature controlled CVL

ACCOUNTABILITY:

SVP and Chief Nursing Officer
Chief Medical Officer

OBJECTIVES:

The Mission of Catholic Health Initiatives is to nurture the healing ministry of the Church, supported by education and research. Fidelity to the Gospel urges us to emphasize human dignity and social justice as we create healthier communities. To fulfill this mission, CHI St. Vincent will implement Therapeutic Hypothermia at St. Vincent Hot Springs to improve survival as well as neurological outcomes in comatose survivors of non-traumatic cardiac arrest.

DEFINITIONS:

Induced Hypothermia decreases the body temperature to 32-36 ° C/89.6-96.8 ° F in comatose cardiac arrest survivors. Induced Hypothermia reduces reperfusion injury to ischemic areas with the goal of improving global/neurological outcomes.

POLICY:

I. The scope of this policy applies to CHI St. Vincent Hot Springs only.

II. Assessment

A. Patients will be identified for inclusion in or exclusion from Therapeutic Hypothermia based on the criteria outlined below:

1. Inclusion Criteria: *(All must be met)*

a. Non-traumatic Cardiac Arrest with return of spontaneous circulation (ROSC) within 30 minutes of initiation of CPR
b. Cardiopulmonary Resuscitation (CPR) initiated within 10 minutes of cardiac arrest
c. **Initial rhythm:**
   - Ventricular Fibrillation (VF)
   - Pulseless Ventricular Tachycardia (VT)
   - Pulseless Electrical Activity (PEA)
   - Asystole
d. Age: 18 years or older
e. Women of childbearing age must have negative pregnancy test

f. No purposeful movement and Glasgow Coma Scale <6
g. Requires mechanical ventilation
h. Able to maintain mean arterial pressure (MAP) ≥ 60 for at least 30 minutes post ROSC with or without vasoactive medication
i. Initiation of induced Therapeutic Hypothermia must begin within 6 hours of collapse
j. Initial body temperature must be greater than 30C
k. Non-Contrast Head CT Scan without acute intracranial process

2. Patients for whom hypothermia may theoretically carry increased risk include those with the following conditions:
    a. Recent major surgery within 14 days - Possible risk for infection and bleeding
    b. Systemic infection/sepsis - Small increase in risk of infection
    c. Coma from other causes (drug intoxication, preexisting coma prior to arrest)
    d. Known bleeding diathesis or with active ongoing bleeding - Hypothermia may impair the clotting system (however, patients may receive chemical thrombolysis, antiplatelet agents, or anticoagulants if deemed necessary in the treatment of the primary cardiac condition)
    e. ***The final determination for the initiation of hypothermia rests with the intensivist at the bedside****.*
3. Exclusion Criteria: (none must be met)
    a. Prolonged arrest time longer than 60 minutes
    b. Age less than 18 years
    c. Pregnancy
    d. Uncontrolled bleeding, thrombocytopenia or other coagulopathy (Platelets < 50, INR>2.0)
    e. DNR or DNI status
    f. Severely impaired pre-arrest cognitive status
    g. Co-morbidities with minimal chance of meaningful survival independent of neurological status
    h. Known terminal illness
    i. Response to verbal commands after return of spontaneous circulation
4. Once identified as appropriate for cooling, the physician must initiate the therapeutic hypothermia orders (see Targeted Temperature Management Protocol for CHI St. Vincent Hot Springs).

B. Reassessment will occur as outlined on the Therapeutic Hypothermia orders. Shivering will be assessed with vital signs. Scale for management of shivering: Bedside Shivering Assessment Scale (BSAS):

Bedside Shivering Assessment Scale (BSAS):

0- None	**None; No shivering or goose bumps. Must not be shivering on ECG or palpation.**
1-Mild	**Mild; Shivering localized to neck/thorax. May only be noticed on ECG or palpation.**
2-Moderate	**Moderate; Shivering involves gross motor movements of upper extremities in addition to neck/thorax.**
3-Severe	**Severe; Shivering involves gross motor movements of trunk and upper and lower extremities.**

III. Interventions

A. **Education:** Training will be provided to staff participating in the care of the selected patients, and this training should be verified by the nurse manager and charge nurse according to predetermined nursing protocols.

B. **Family/Patient Teaching:**

1. Where possible the purpose of therapeutic hypothermia should be explained to the family.
2. The use of other supportive devices (ventilator, IV pumps, monitors, Sport bed, pulse oximetry, cooling blankets) will be explained.
3. Pastoral Support should be offered.

C. **Gather Equipment for Cooling:**

1. Zoll Intravascular temperature management (IVTM) Machine
2. Quattro Cooling catheter
3. Arterial line and central line set up
4. Consent for catheter placement, and invasive monitoring.

D. **Set Up Zoll Machine According to Manufacturer Guidelines in the manual provided.**

1. Once the femoral cooling catheter and other invasive monitoring have been placed by the intensivist, the machine should be attached to the catheter as per guidelines.

E. **Temperature Induction with Intravenous Hypothermia Catheter:**

1. Set target temperature based on the Target Temperature Decision Tree (included in the Targeted Temperature Management Protocol for CHI St. Vincent Hot Springs 33 ° C or 36 ° C)
2. Final temperature goal should be ordered by the intensivist.
3. If initial temperature 30-33° C then warm to 33° C.
4. Ensure rectal temperature probe is attached to the cooling machine. Secondary temperature probe (Foley) will be used to correlate to cooling temperature probe.
5. If unable to obtain target core temperature within 3 hours, contact the provider.

6. Be alert for early signs of shivering and initiate shivering protocol (patients most at risk between 35-36° C.)
7. Once target temperature is reached, document this time and maintain for 24hrs.

Note: Please see Hypothermia orders and Targeted Temperature Management Protocol for CHI St. Vincent Hot Springs in regards to initiation of sedation for management of shivering as well as ongoing assessment/management of patient during the cooling, maintenance, and re-warming phases.

IV. Documentation

A. The unit nurse will document the name of the physician calling the tip verification and confirming use of catheter.
B. The unit nurse will document the following assessment:
   1. All dressing/cap changes in the patient medical record
   2. The nurse will document all flushes and fluid changes on eMAR.
   3. IV tubing changes and dressing changes in the patient's electronic health record.
   4. Assessments before and after insertion or removal of temperature controlled CVL and all interventions.
   5. Patient and family education
   6. Any signs/symptoms of infection; patency of the line after flushing
   7. Presence or absence of blood return and steps taken for intervention must be documented in the patient's medical record.
C. **Upon removal/discontinuation of access**
   1. Document reason for removal
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SOURCE:

1. Mozaffarian D, Benjamin EJ, Go AS, et al. Heart disease and stroke statistics — 2015 update: A report from the American Heart Association. *Circulation* 2015;131:e29-322.

2. Laver S, Farrow C, Turner D, Nolan J. Mode of death after admission to an intensive care unit following cardiac arrest. *Intensive Care Med* 2004;30:2126-2128.

3. Bernard SA, Gray TW, Buist MD, et al. Treatment of comatose survivors of out-of-hospital cardiac arrest with induced hypothermia. *N Engl J Med* 2002;346:557-563.

4. Hypothermia after Cardiac Arrest Study Group. Mild therapeutic hypothermia to improve the neurologic outcome after cardiac arrest. *N Engl J Med* 2002;346:549-556.

5. Nielsen N, Wetterslev J, Cronberg T, et al. Targeted temperature management at 33°C versus 36°C after cardiac arrest. *N Engl J Med* 2013;369:2197-2206

6. Callaway CW, Donnino MW, Fink EL, et al. Part 8: Post-Cardiac Arrest Care: 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation 2015;132:S465-482.

Document Metadata

Document Name:	Therapeutic Hypothermia (CHI SVHS)
Policy Number:	OC068PCS
Original Location:	/CHI St. Vincent Hospitals/Patient Care Services/1 - General Use
Created on:	09/02/2017
Published on:	05/17/2019
Last Review on:	05/17/2019
Next Review on:	05/17/2020
Effective on:	03/02/2018
Creator:	Wilson, Jessica *Regulatory*
Committee / Policy Team:	Policy Management
Owner/SME:	Sanders, Vicky *Director*
Publisher:	Sanders, Vicky *Director*

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A. Patients will be identified for inclusion in or exclusion from Therapeutic Hypothermia based on the criteria outlined below:

1. Inclusion Criteria: *(Included, but not limited to:)*

a. Non-traumatic Cardiac Arrest with return of spontaneous circulation (ROSC) within 30 minutes of initiation of CPR

b. Cardiopulmonary Resuscitation (CPR) initiated within 10 minutes of cardiac arrest

c. **Initial rhythm:**

- Ventricular Fibrillation (VF)

- Pulseless Ventricular Tachycardia (VT)
- Pulseless Electrical Activity (PEA)
- Asystole

d. Age: 18 years or older

e. Women of childbearing age must have a negative pregnancy test

i Therapeutic hypothermia necessity in a pregnant woman will be determined by the ICU attending on an individual basis.

f. No purposeful movement and Glasgow Coma Scale <8

g. Requires mechanical ventilation

h. Able to maintain mean arterial pressure (MAP) ≥ 60 for at least 30 minutes post ROSC with or without vasoactive medication

i. Initiation of induced Therapeutic Hypothermia must begin within 6 hours of restore of spontaneous circulation (ROSC).

j. Initial body temperature must be greater than 32 °C

k. Non-Contrast Head CT Scan without acute intracranial process

2. Patients for whom hypothermia may theoretically carry increased risk include those with the following conditions:

a. Recent major surgery within 14 days - Possible risk for infection and bleeding

b. Systemic infection/sepsis - Small increase in risk of infection

c. Coma from other causes (drug intoxication, preexisting coma prior to arrest)

d. Known bleeding diathesis or with active ongoing bleeding - Hypothermia may impair the clotting system (however, patients may receive chemical thrombolysis, antiplatelet agents, or anticoagulants if deemed necessary in the treatment of the primary cardiac condition)

e. ***The final determination for the initiation of hypothermia rests with the intensivist at the bedside.***

3. Exclusion Criteria: (none must be met)

a. Prolonged arrest time longer than 30 minutes

b. Age less than 18 years

c. Woman of childbearing age must have a negative pregnancy test

i Therapeutic hypothermia necessity in a pregnant woman will be determined by the ICU attending on an individual basis.

d. Uncontrolled bleeding, thrombocytopenia or other coagulopathy (Platelets < 50, INR>2.0)
e. DNR or DNI status
f. Severely impaired pre-arrest cognitive status
g. Co-morbidities with minimal chance of meaningful survival independent of neurological status
h. Known terminal illness
i. Response to verbal commands after return of spontaneous circulation

4. Once identified as appropriate for cooling, the physician must initiate the therapeutic hypothermia orders (see Targeted Temperature Management Protocol for CHI St. Vincent Hot Springs).

B. Reassessment will occur as outlined on the Therapeutic Hypothermia orders. Shivering will be assessed with vital signs. Scale for management of shivering: Bedside Shivering Assessment Scale (BSAS):

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1. Once the femoral cooling catheter and other invasive monitoring have been placed by the intensivist, the machine should be attached to the catheter as per guidelines.

E. **Temperature Induction with Intravenous Hypothermia Catheter:**

1. Set target temperature based on the Target Temperature Decision Tree (included in the Targeted Temperature Management Protocol for CHI St. Vincent Hot Springs 33°C or 36°C)
2. Final temperature goal should be ordered by the intensivist.
3. If initial temperature <32° C then warm to 33°C.
4. Ensure rectal temperature probe is attached to the cooling machine. Secondary temperature probe (Foley) will be used to correlate to cooling temperature probe.
5. If unable to obtain target core temperature within 3 hours, contact the provider.
6. Be alert for early signs of shivering and initiate shivering protocol (patients most at risk between 35-36°C.)
7. Once target temperature is reached, document this time and maintain for 24hrs.

Note: Please see Hypothermia orders and Intensive Care Unit Management Protocol for CHI St. Vincent Hot Springs in regards to initiation of sedation for management of shivering as well as ongoing assessment/management of patient during the cooling, maintenance, and re-warming phases.

IV. Documentation

A. ED Nurse- Document within a progress note:

1 Time of ROSC after CPR
2 Time cooling started
3 Time cooling completed
4 Hourly RASS scale & Shiver scale

B. The unit nurse will document the name of the physician calling the tip verification and confirming use of catheter.

C. The unit nurse will document the following assessment:

1. All dressing/cap changes in the patient medical record
2. The nurse will document all flushes and fluid changes on eMAR.
3. IV tubing changes and dressing changes in the patient's electronic health record.
4. Assessments before and after insertion or removal of temperature controlled CVL and all interventions.
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CHI St. Vincent Hot Springs

EMERGENCY DEPARTMENT TRIAGE PROTOCOL

EMS communication/Documentation:

The following information should be obtained by the nurse or physician staff in the ER and documented in the electronic medical record (EMR), where possible.

- Time and ECG rhythm on arrival
- Time person found unresponsive
- Actions performed (CPR, shock, medications)
- Duration of CPR
- Time of ROSC and GCS (no response to pain)
- Temperature measurement and device used
- Cooling initiated and type (per protocol)
- Time of transfer
- Time of arrival at ED

Inclusion Criteria:

- Non-Traumatic cardiac arrest with ROSC
- CPR initiated within 10 minutes of cardiac arrest
- ROSC within 30 minutes of recognition of the cardiac arrest
- MAP >60 for at least 30 minutes post ROSC with or without vasoactive medication
- Initiation of Induced Hypothermia begun within 6 hours of ROSC
- Initial body temperature must be greater than 32°C
- No purposeful movement to command and GCS <8
- Age >18
- Non-Contrast Head CT Scan without acute intracranial process
- Females must have urine HCG to determine pregnancy status. Therapeutic hypothermia in a pregnant woman will be determined by the ICU attending on an individual basis.

Patients for whom hypothermia may theoretically carry increased risk include those with the following conditions:

- Recent major surgery within 14 days- possible risk for infection and bleeding
- Systemic infection/sepsis- small increase in risk of infection
- Coma from other causes (drug intoxication, preexisting coma prior to arrest)
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- **The final determination for the initiation of hypothermia rests with the intensivist at the bedside.**

Exclusion Criteria:

- Prolonged arrest time longer than 30 minutes
- Age less than 18 years
- Pregnancy will be determined on an individual basis
- Uncontrolled bleeding, thrombocytopenia or other coagulopathy (platelets <50, INR >2.0)

- DNR/DNI status
- Severely impaired pre-arrest cognitive status
- Comorbidities with minimal chance of meaningful survival independent of neurological status
- Known terminal illness
- Response to verbal commands after ROSC

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- Pastoral Support should be offered

Gather Equipment for Cooling

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- Quattro Cooling catheter
- Arterial line set up
- Central line set up
- Consent for catheter placement and invasive monitoring

Set up the Zoll machine according to manufacturer guidelines in the manual provided.

- Once the femoral cooling catheter and other invasive monitoring have been placed by the intensivist, the machine should be attached to the catheter as per guidelines

Temperature induction with Intravenous Hypothermia Catheter

- Set target temperature 33°C. If initial temp 32°C then warm to 33°C
- Final temperature goal should be ordered by the intensivist
- Ensure the rectal temperature probe is attached to the cooling machine. Secondary temperature probe (Foley) will be used to correlate to cooling temperature probe.
- If unable to obtain target core temperature within 3 hours contact intensivist
- Be alert for early signs of shivering and initiate shivering protocol (patients most at risk between 35°-36°C)
- Once target temperature is reached, document this time and maintain for 24hrs
- Notify ARORA

MAINTENANCE PHASE

Maintenance

- Acetaminophen 650 mg PO Q 6 hrs during induction and maintenance.
- Maintain patient temperature at target for 24 hours from initiation of cooling

- If shivering develops see shivering orders
- Maintain MAP >90
- Order for EEG ASAP after initiating cooling. If on night shift order EEG for AM

Hypotension & Volume Management

- Assess for medical causes of hypotension
- Adjust/titrate down any analgesic/sedative/shivering medications
    - If shivering consider neuromuscular blockade
- Observe closely for fluid overload
- Initiate vasopressors if MAP continues <90 after fluid resuscitation

Hypertension

For patients who develop hypertension (MAP>100mmHg) notify the intensivist

Electrolyte Replacement/ LABS

- Check, BMP, Magnesium, Phosphorus for any cardiac dysrhythmias and every 4 hours
- ABGs every 8 hours
- Troponin Q 6 hours for 3 occurrences
- CMP One time
- Glucose Q 4 hours
- CBC with Differential Q 12 hours
- PTT, PT/INR daily early
- Replace electrolytes according to the electrolyte protocol for Potassium and Calcium. Call for Mag <2.0
- After any replacement, check electrolyte level 1 hour after completion of replacement
- Discontinue K replacements 4 hours prior to rewarming
- Call intensivist if K <3.0
- Discontinue Mg and Ca replacements once warming has begun
- Initiate insulin drip per glucommander for 3 fsbs>300

Analgesia/sedation & Shivering

- Propofol or Dexmedetomidine will be utilized to maintain a RASS of -3
- Shivering should be measured using the BSAS
    - A score of 0 is desirable
    - Meperidine 50mg IV q 6 hrs PRN
    - Buspirone 30mg PO q 8 hrs PRN
    - Deep sedation (Versed, Fentanyl, Propofol)
    - Neuromuscular blockade (Nimbex infusion)

DVT Prophylaxis

- Sequential compression devices
- Enoxaparin unless patient on heparin
- Heparin gtt if clinically indicated by scenario and negative head CT

PUD Prophylaxis

- Famotidine

REWARMING PROCESS

- Discontinue K replacements 4 hours prior to rewarming
    - Call intensivist if K <3.0
- Discontinue Mg and Ca replacements once warming has begun
- Once the patient has been maintained at the target temperature for 24 hours, slow rewarming is recommended at a rate of 0.25°C/ hour to 37°C. Confirm with MD if pt has TBI diagnosis.
- Once the patient is rewarded the temperature should be maintained at 37°C for 48 hours to avoid rebound hyperthermia
- The femoral QUATTRO cooling catheter should be removed after normothermia is maintained for 48 hours (day 4)
- Discontinue paralytics once the patient has achieved a core temp of 36°C
- Acetaminophen 650 mg PO Q 4 hrs PRN during rewarming phase and for temperature >37°C after warming
- Neurological prognostication can be performed once the patient is rewarmed
    - Order for EEG after pt has been rewarmed for 48 hours

References

Scirica, B. M., Benjamin M. Scirica From the Levine Cardiac Intensive Care Unit, & Scirica, C. to B. M. (2013, January 15). *Therapeutic hypothermia after cardiac arrest*. Circulation. Retrieved June 13, 2022, from https://www.ahajournals.org/doi/10.1161/circulationaha.111.076851

Jeejeebhoy, F. M., Farida M. Jeejeebhoy Search for more papers by this author, Zelop, C. M., Carolyn M. Zelop Search for more papers by this author, Lipman, S., Steve Lipman Search for more papers by this author, Carvalho, B., Brendan Carvalho Search for more papers by this author, Joglar, J., Jose Joglar Search for more papers by this author, Mhyre, J. M., Jill M. Mhyre Search for more papers by this author, Katz, V. L., Vern L. Katz Search for more papers by this author, Lapinsky, S. E., Stephen E. Lapinsky Search for more papers by this author, Einav, S., Sharon Einav Search for more papers by this author, Warnes, C. A., … The American Heart Association makes every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal. (2015, October 6). *Cardiac arrest in pregnancy*. Circulation. Retrieved June 13, 2022, from https://www.ahajournals.org/doi/10.1161/cir.0000000000000300

Therapeutic Hypothermia after Cardiac Arrest Guidelines of Care

Inclusion Criteria:
- Within 6 hrs following cardiac arrest (up to 12 hours at attending physician' s discretion)
- Successful restoration of a perfusing rhythm and the ability to maintain a blood pressure with/without inotropes or vasopressors
- Comatose state – *Lack of meaningful response to verbal commands*

Yes →

Exclusion Criteria:
- Major head trauma
- Major surgery within prior 14 days
- Systemic infection/sepsis
- Patients with clinically significant bleeding / risk of bleeding

Yes → Stop

No ↓

Initiation of Cooling

- Initiate cooling as rapidly as possible
- Either method of cooling – ice packs/cooling blankets or Artic Sun System – can be used to initiate cooling and should be started as soon as possible.
- Remove ice packs once the [Arctic Sun] system initiated to prevent overcooling of the patient
- Defibrillator pads may be placed under the Arctic Sun gel pads. It is safe to defibrillate the patient with the Arctic Sun pads on the patient.
- Ensure two methods (bladder, esophageal, core, rectal, groin, axillary) of measuring patient temperature

Shivering / Sedation / Analgesia

- **Non-Pharmacologic Prevention of Shivering**
  Wrap hands/feet, cover head w/ blankets
- **Magnesium** 4 grams IVB over 4hrs
- **Sedation/Analgesia:**
  Goal sedation level of RASS -4 to -5
- **Sedative Agents:** Patients should receive low dose, continuous infusion of a sedative agent
  1) Propofol – 1st line agent; or 2) midazolam (if propofol contraindicated)
- **Analgesic agents**
  1) Fentanyl or 2) Hydromorphone

Shivering →

Shivering tends to occur most often with induction of hypothermia
If present, follow Algorithm in Full TH Guidelines
- Place the Bair Hugger on the patient
- Give extra boluses of analgesia
- Increase basal sedative rate
- Bolus NMBA –Cisatracurium
- NMBA infusion

*Never stop sedation and analgesic regimens while paralyzed

Monitoring/Supportive Therapy

- **Heart Rate** - Bradycardia is associated with hypothermia and should be treated if associated with hemodynamic instability. There is no need to treat normotensive bradycardia.
- **Mean Arterial Pressure (MAP)**: MAP goal of >90 mmHg is preferred to theoretically improve cerebral perfusion, lower MAP goals (65-100mmHg) have shown benefit
- **Central Venous Pressure:** Goal 10-12 mmHg
- **Oxygenation:** Goal oxygen saturation of 94-96%
- **Ventilation:** Maintain normocarbia and avoid hyperventilation or hypoventilation
- **Electrolyte Repletion:** Basic chemistries should be monitored at least q 4 hours and replaced as necessary
- **Glucose Control:** Initiate BHIP for glucose is >200 mg/dl and monitor q hour while cooling q 30 min if glucose <80 mg/dl at any time. (Do not exceed 50 units of insulin / hour)
- **Miscellaneous**: EEG ASAP after initiation on TH via EEG Lab or on-call Fellow or if any suspician of seizure. Blood cultures 12 hrs post initiation. Skin care check q 2 hr for burns caused by cold blankets.

Rewarming

- Begin re-warming 24 hrs after initiation of cooling at a rate of 0.25ºC (0.5º F) every hour until the patient returns to normothermia (37ºC/98.6º F).
- Keep Artic Sun pads on for 48hr and set temperature at 37ºC/98.6º F to maintain normothermia.
- Maintain paralytic (if started) and sedation until temperature of 36C/96.8F degrees is reached.
- Hypotension, hyperkalemia, hypoglycemia, and hyperthermia may occur during and after the re-warming.
- Stop IV insulin when glucose <200 mg/dl, unless T1DM.
- Testing to assess for neurologic prognsosis should be delayed to at least 72 hours after the return to normothermia as patients who have TH have delayed neurologic recovery

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Document Name:	Therapeutic Hypothermia (CHI SVHS)
Policy Number:	OC068PCS
Original Location:	/CHI St. Vincent Hospitals/Patient Care Services/1 - General Use
Created on:	09/02/2017
Published on:	07/20/2022
Last Review on:	06/22/2022
Next Review on:	06/22/2023
Effective on:	03/02/2018
Creator:	Wilson, Jessica *Regulatory*
Committee / Policy Team:	Policy Management
Owner/SME:	Lambert, Teresa *Vice President*
Manager:	Lambert, Teresa *Vice President*
Author(s):	Fechuch, Renee *Director*
Approver(s):	Ross, Douglas *Chief Medical Officer* Lambert, Teresa *Vice President*
Publisher:	Wilson, Jessica *Regulatory*