



Acute Kidney Injury(AKI) and Hypotension in Total Elective Joints

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Total Joint Arthroplasty

- By 2030, total knee replacement surgeries are expected to increase by 673%
- Across the United States, over 700,000 knee replacements and 400,000 hip replacements are performed every year.
- The incidence of this procedure is projected to increase exponentially -- Aging population and the Affordable Care Act (ACA)
- AKI in Orthopedic patients is associated with increased morbidity and mortality

Kimmel, Laura, et al. Incidence of acute kidney injury following total joint arthroplasty: A retrospective review by RIFLE criteria. CKJ: Clinical Kidney Journal(6):546551November, 2014]



Identifying A Problem

- St. Luke's Orthopedic Care performs 1000 arthroplasty cases per year
- Non-Narcotic pain regimen implemented to decrease post-operative complications
- Acute Kidney Injury (AKI) and Hypotension rates noted to increase
- No protocols in place to prevent or deal with this issue





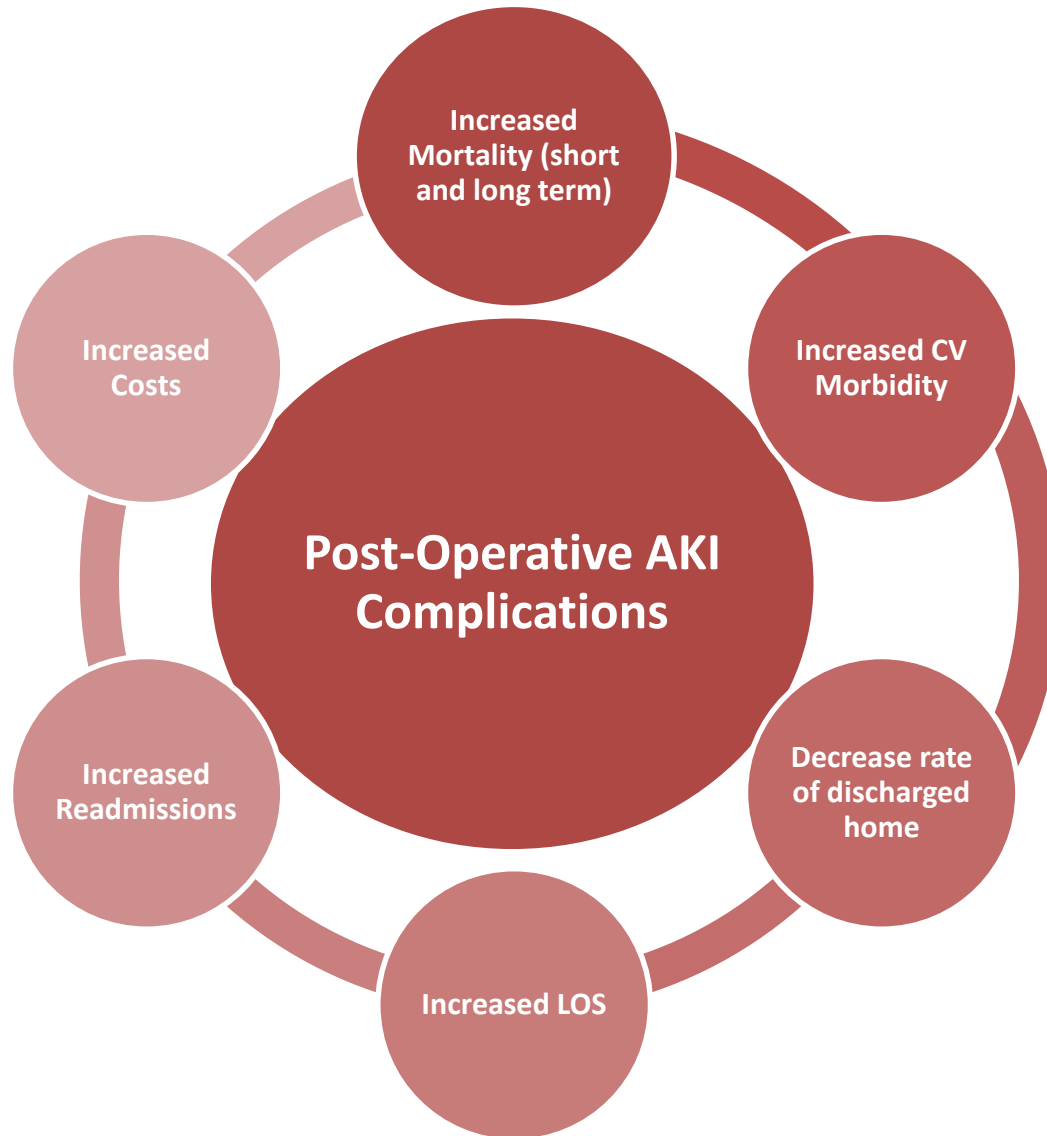
Orthopedic Acute Kidney Injury(AKI)

Publication	AKI after TJR
Nephrology; 2018	7.5%
BMC Nephrology; 2015	6.8%
Acta Orthopodica Belgica; 2015	9.7%
Clinical Kidney Journal; 2015	15.0%
British Journal of Anesthesia; 2017	9.4%

AVERAGE AKI RATE = 9.7%



Orthopedic AKI





AKI Complications - MORTALITY


Mortality up to 37%



Defining AKI

- Diagnosis: **KDIGO** criteria
- Defining Factors: **Serum Creatinine and Urine Output**

Stages of AKI	Hazard Ratio	Creatinine	Urine Output
AKI 1	1.46	1.5-1.9x / ≥ 0.3	$<0.5\text{ml/kg/h/6h}$
AKI2	2.08	2.0-2.9x	$<0.5\text{ml/kg/h/12h}$
AKI 3	2.77	3.0x or Cr ≥ 4.0 or HD	$<0.3\text{ml/kg/h/24h}$ or anuria $>24\text{h}$

1 Year Survival: **1.28 Hazard Ratio** 

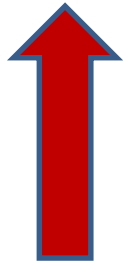
****AKI is associated with DEATH!****



AKI Impact



- **LOS**
- **Mortality**
- **Discharge to SNF**
- **Incidence of CKD**

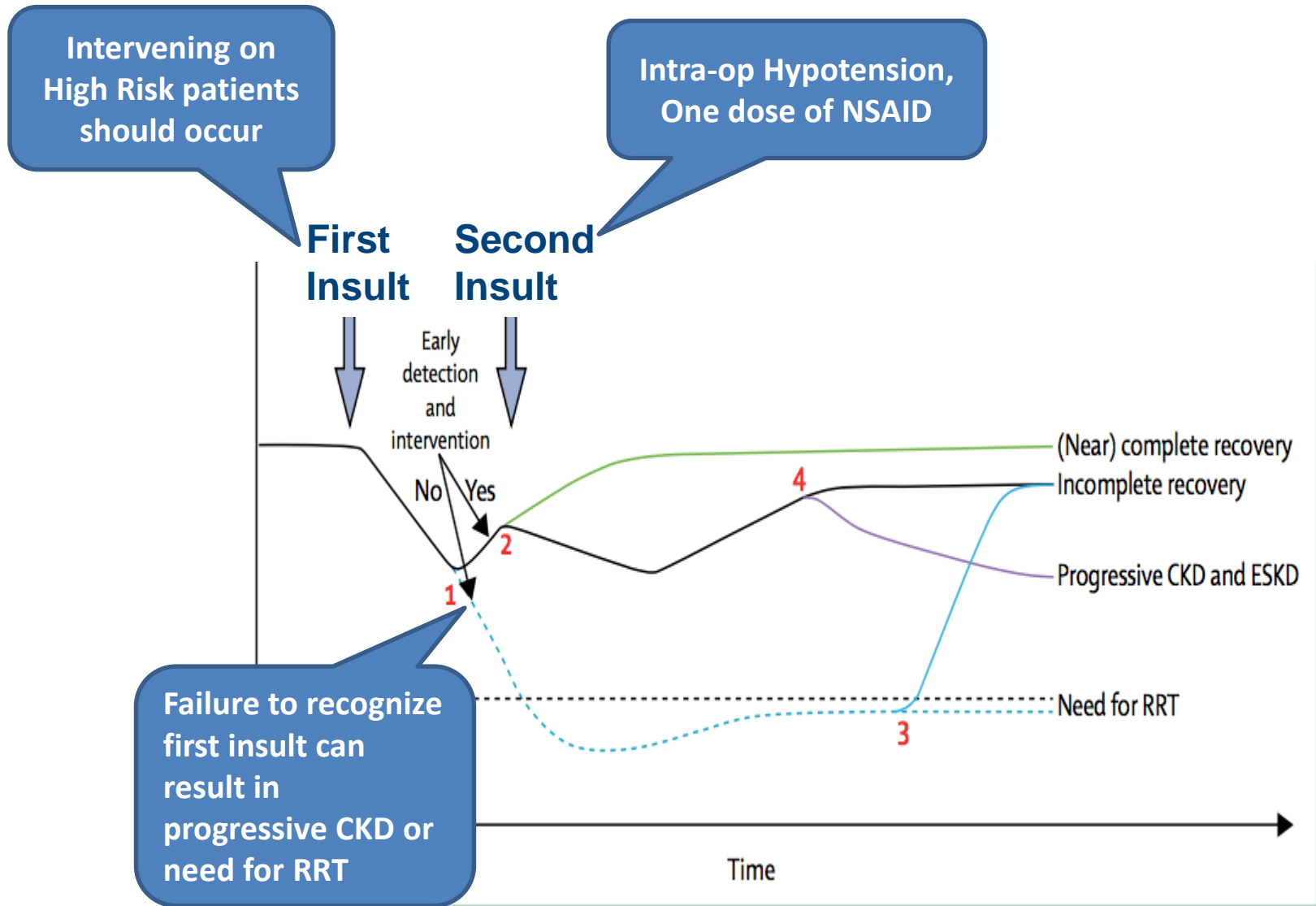


- **7-15%**
- **Under-reporting**
- **Criteria defining AKI**
- **Lack of routine surveillance**

<u>AKI Severity</u>	
Stage1	\$2900
2	\$4900
3	\$5300
3+ Dialysis	\$11,000



AKI – Prevention & Early Detection is Key





Reducing the incidence of Acute Kidney Injury in the Elective Total Joint Population

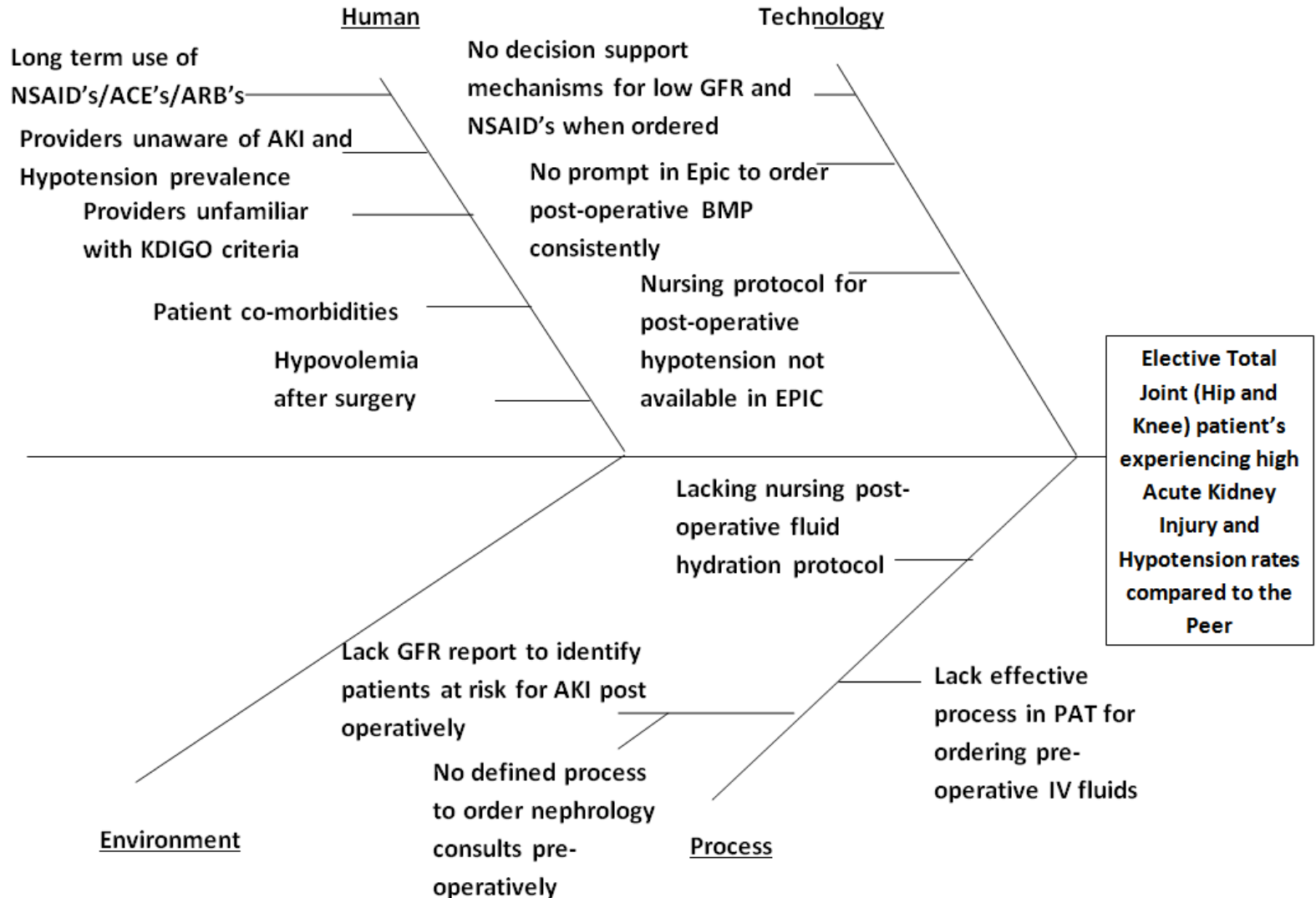


Project Scope

- Population: Elective Total Hip and Total Knee Arthroplasty
- Problem: 12% complication rate for Total Hip and Total Knee Arthroplasty
 - Hypotension 14.54%
 - Acute Renal Failure (AKI) **6.02%** versus top decile of **2.03%**
- Evidence:
 - Increased risk for hospital mortality
 - Increased length of stay
 - Discharge to long term care
 - Increased costs

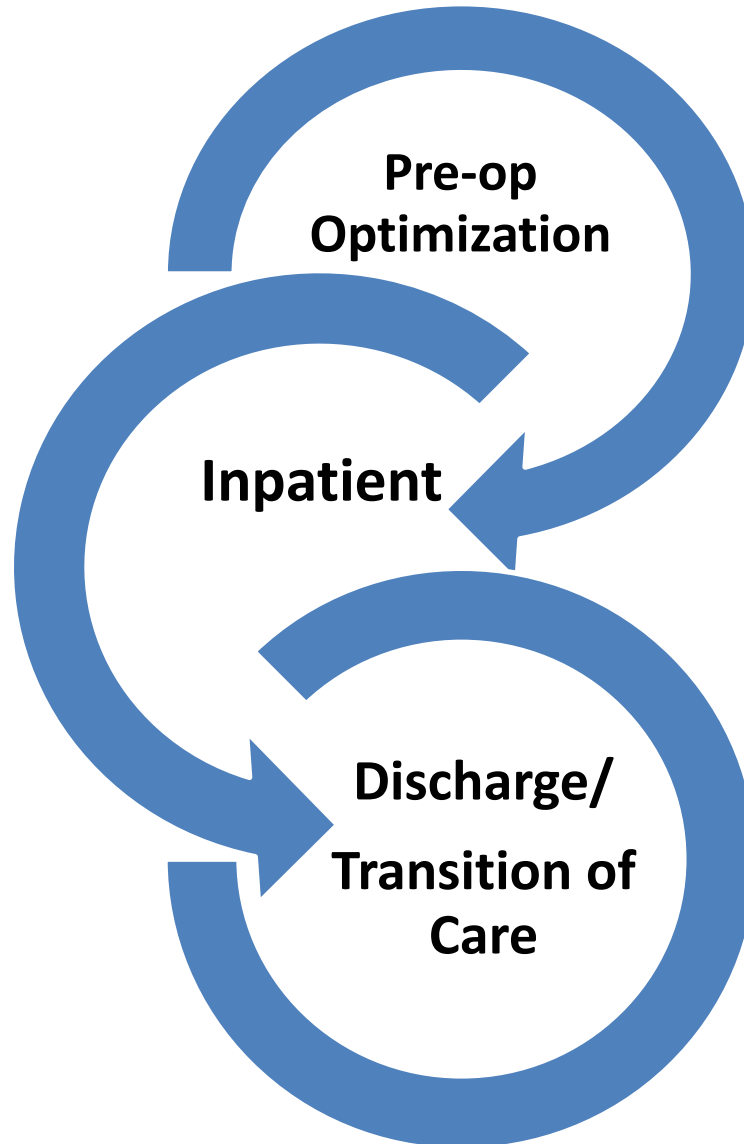


Identified Causes



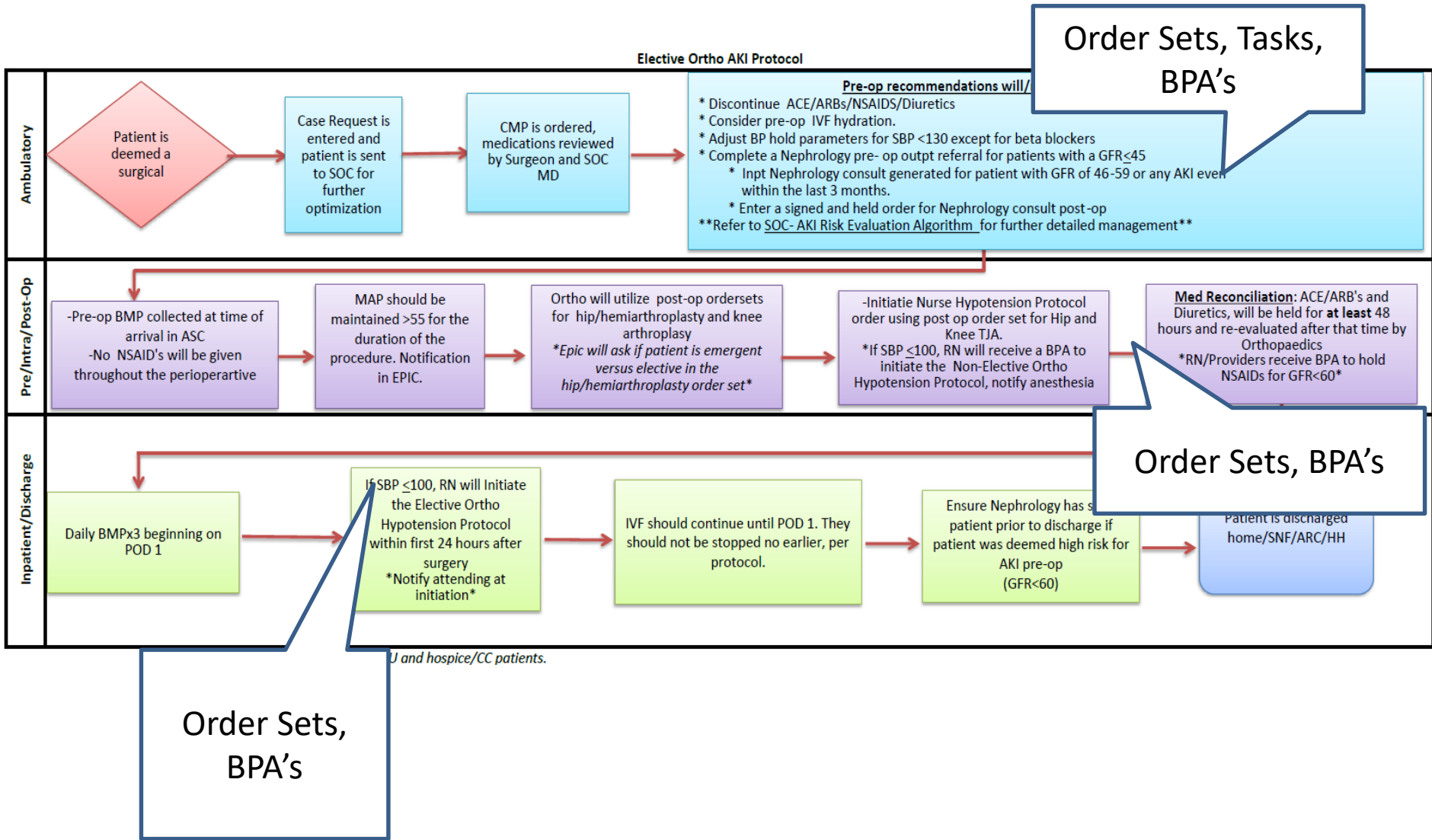


Where Do We Begin?





Perioperative/Inpatient Workflow





Pre Operative Phase of Care



Ambulatory Prep-One Stop Shop

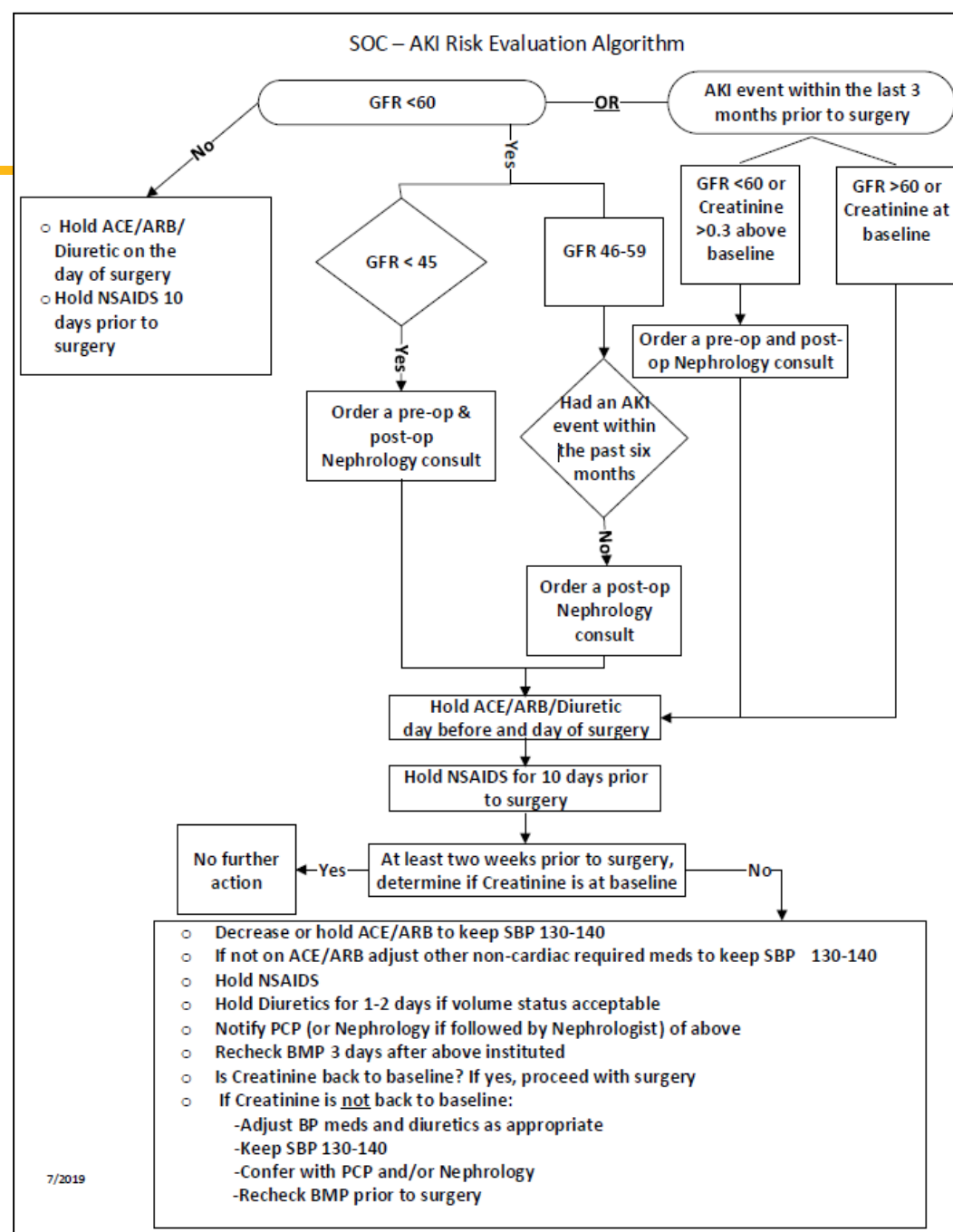
■ Ortho office

- staff can use an order set to enter the case request
- tasks for the Pre-Admission Testing dept
- orders to be carried out Pre Op on the day of surgery

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Surgical Optimization Risk Evaluation





Pre-Operative Tasks



AKI Risks – Task Build

- GFR lab results trigger tasks for the SOC
- Procedure Pass:

results.				
Alkaline Phosphatase	83	55 - 165	U/L	Final
Total Protein	7.1	6.4 - 8.9	g/dL	Final
Albumin	4.0	3.5 - 5.7	g/dL	Final
Total Bilirubin	0.40	0.20 - 1.00	mg/dL	Final
eGFR	50		ml/min/1.73sq m	Final

The screenshot shows the Epic task builder interface. At the top, there is a search bar labeled "Search for new task" with a "+ Add" button. To the right, there are buttons for "Send Message" and "Rebuild Task List" with a refresh icon. Below this, the task is categorized as "Not Started". The task name is "AKI High Risk" with a dropdown arrow. Below the task name, there are three status buttons: "Started" (with a clock icon), "Complete" (with a checkmark icon), and "Not Needed" (with a slash icon). At the bottom, there is a "+ Add Comments" button. A red arrow points from the "50" value in the eGFR row of the table above to the "AKI High Risk" task name.



Electronic Hard Stops

ROUND 1 HARD STOPS

Results must be:

Hgb ≥ 11

HgA1c ≤ 7

GFR > 60

BMI ≤ 40

If any parameter not met,
patient cannot move
forward until referrals /
next steps completed.



Referrals/Next Steps

Hgb <11	Hematology
HgA1c > 7	PCP/Endocrine
<i>*Case postponed up to 90 days for repeat HgA1c</i>	
GFR < 45	Nephrology
GFR 45-60	PCP or SOC
BMI > 40	Weight Management

CHG Bathing Education	Final result - Abnormal - Registered Nurse
Complete Blood Count (CBC)	Final result - Abnormal - Registered Nurse
Comprehensive Metabolic Panel (CMP)	Final result - Abnormal - Registered Nurse
C-reactive protein (CRP)	Final result - Abnormal - Registered Nurse
Geriatric Nurse Appointment	Completed - 8/30/2019
Hemoglobin A1C	Final result
Inpatient Consult to Nephrology	1 orders found
Iron Panel	Final result
MECHANICAL VTE PROPHYLAXIS	1 orders found
Presence of Pre-op orders	11 orders found
PT/INR	Final result

AMB referral to Hematology	No procedures found
AMB referral to Medical (Family Practice / Internal Medicine)	No procedures found
C-reactive protein (CRP)	No procedures found
ECG	No procedures found
Refer to Weight Management Program	1 Started, 1 Complete, 1 Not Needed
Hematology Clearance / Referral	3 Use This (with dates and times)

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AKI Risks – Medication Education

The screenshot displays the Epic PAT interface. The 'Home Medications' section lists various medications with checkboxes for 'Taking?' and 'Last D'. A 'Patient Education' pop-up window is overlaid on the right, showing an 'Education Index' with categories like ACE/ARB Med Class, Beta blocker Med Class, Calcium Channel Blocker Med Class, Inhalational Med Class, NSAID Med Class, and Statin Med Class. Each class has specific instructions regarding surgery/procedure timing.

Medication	Taking?	Last D
albuterol (VENTOLIN HFA) 90 mcg/act inhaler	<input checked="" type="checkbox"/>	
amLODIPine (NORVASC) 10 mg tablet	<input checked="" type="checkbox"/>	
atenolol (TENORMIN) 50 mg tablet	<input checked="" type="checkbox"/>	
atorvastatin (LIPITOR) 20 mg tablet	<input checked="" type="checkbox"/>	
fluticasone-vilanterol (BREQ ELLIPTA) 200-25 MCG/INH inhaler	<input checked="" type="checkbox"/>	
ipratropium-albuterol (DUO-NEB) 0.5-2.5 mg/3 mL nebulizer solution	<input checked="" type="checkbox"/>	
levothyroxine 100 mcg tablet	<input checked="" type="checkbox"/>	
lisinopril (ZESTRIL) 40 mg tablet	<input checked="" type="checkbox"/>	
Magnesium Gluconate 550 MG TABS	<input checked="" type="checkbox"/>	
naproxen (NAPRELAN) 375 MG TB24	<input checked="" type="checkbox"/>	
ofloxacin (OCUFLOX) 0.3 % ophthalmic solution	<input type="checkbox"/>	
pantoprazole (PROTONIX) 40 mg tablet	<input type="checkbox"/>	
sucralfate (CARAFATE) 1 g/10 mL suspension	<input type="checkbox"/>	

Notes: Takes 4 x daily

Mark as Reviewed Last Reviewed by Diane Hoffman, RN on 9/10/2019 at 10:15 AM

Outside Medication Reconciliation

Patient Education

- Education Index
 - Med Instructions
 - Troubleshoot
- ACE/ARB Med Class
 - Continue this medication up to the evening before surgery/procedure, but do not take the morning of the day of surgery.
- Beta blocker Med Class
 - Continue to take this heart medication on your normal schedule. If this is an oral medication and you take it in the morning, then you may take this medicine with a sip of water.
- Calcium Channel Blocker Med Class
 - Continue to take this heart medication on your normal schedule. If this is an oral medication and you take it in the morning, then you may take this medicine with a sip of water.
- Inhalational Med Class
 - Continue to take these inhaler medications on your normal schedule up to and including the day of surgery.
- NSAID Med Class
 - Stop taking this medication at least 3 days prior to surgery/procedure.
- Statin Med Class
 - Continue to take this medication on your normal schedule. If this is an oral medication and you take it in the morning, then you may take this medicine with a sip of water.

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Intra Operative Phase of Care



Intra Op MAP Notification

Anesthesia, Screen Four
 F, 54 y.o., 05/04/1965
 Pregnancy results: **Not ordered**

MRN: 50005002871
 CSN: 1000295683
 HAR: <NONE>

Ht, Wt: None, None
 BMI: None
 Allergies: No Known Allergies
 Active FYIs: None

Infection: None
 Code: **Inactive**
 Isolation: None

Attending: Mark Schadt, MD
 Outpatient Surgery

APPENDECTOMY (N/A Abdomen), 5/9/19
 Surgeons: Mark Schadt, MD
 An Record ID, Case #: 91996, 6325
 MyChart: Inactive

Responsible Provider: (none)

Chart Review
 Care Everywh...
 Summary
 Results Review
 MAR
 Notes
 Manage Orders
 Intraoperative
 Infections
 Blood Orders
 Procedure Pass
 Preprocedure
 Postprocedure
 Follow-up

Macro Check
 Staff Attest
 Position Timeout
 Handof...
 Meds Blood
 Airways Lines
 Docum... Px Note
 Orders Vitals
 Deep Anes

The Mean BP is Less than 55mmHg.
 Apply Macro 1035
 Post-Op Fluids/Orders 1035

	2019 5/10 1005	1010	1015	1020	1025	1030	1035	Totals
Agents								
Cell Saver Return mL								
Urine mL								
Est. Blood Loss mL								
Other mL								
NG/OG Tube Output mL								
O2 L/min								
O2 Manual L/min								
O2 Device								
Vent Mode								
Other								
Lab Results								
Events								
NBP mmHg								
BP mmHg								

BestPractice Advisory - Anesthesia, Screen Four
Patient Safety (1)
The Mean BP is Less than 55mmHg
 Acknowledge Reason
 Trauma
 Accept Dismiss

ASA Status
 ASA Status: Not documented
 Emergent Status: Not documente

Allergies
 No Known Allergies



Inpatient Phase of Care



Order Set Decision Support Mechanisms

▼ Labs

▼ Chemistry Basic

To reduce the risk of an acute kidney injury event, it is recommended that a Nephrology consult be ordered if $GFR \leq 45$. Review result of last eGFR via the BMP and/or CMP order below

Basic metabolic panel

Morning Draw x 3 Days, First occurrence tomorrow at 0600, Last occurrence on Sat 7/20 at 0600, for 3 days

Post-procedure

Blood

Sign & Hold

Basic metabolic panel

Once, Starting 7/18/19, Post-procedure

Comprehensive metabolic panel

Post-procedure

Magnesium

Once, Starting 7/18/19, Post-procedure

Phosphorus

Post-procedure

▶ Hematology

▶ Coagulation

▶ Tomorrow

Click for more

Click for more

Click for more

How do you know you do not have a problem if you are not looking??



Nurse Hypotension Protocol

Orthopedic Total Joint Hypotension Protocol for Nursing [30400001234]

For Any SBP <80 mmHg Page Orthopedic Surgery
[SLUHN POST-OP AKI PREVENTION POCKET CARD](http://pnp.slhn.org/doc.aspx?rID=2851) URL: <http://pnp.slhn.org/doc.aspx?rID=2851>

Step 1
Repeat BP in Opposite Arm
SBP <100 mmHg: Confirm

<input checked="" type="checkbox"/> Step 1: Repeat BP in opposite arm to confirm	Routine, Once, Starting today For 1 Occurrences Step 1: Repeat BP in opposite arm to confirm
--	---

Step 2
Confirmed SBP < 100 mmHg
Give 1000 ml LR bolus over 30 minutes and recheck BP one hour after completed

<input type="checkbox"/> Give 1000 mL LR over 30 minutes and recheck BP one hour after completed	"And" Linked Panel
<input type="checkbox"/> Step 2: Recheck BP one hour after LR bolus completed	Routine, Until discontinued, Starting today Step 2: Recheck BP one hour after LR bolus completed
<input type="checkbox"/> lactated ringers bolus	1,000 mL, Intravenous, for 30 Minutes, Once, For 1 Doses Step 2: Recheck BP one hour after LR bolus completed

Step 3
1 hour re-check: if SBP < 100mmHg:
Give 1000 ml LR bolus over 30 minutes and recheck BP one hour after completed

<input type="checkbox"/> Give 1000 mL LR over 30 minutes and recheck BP one hour after completed	"And" Linked Panel
<input type="checkbox"/> Step 3: Recheck BP one hour after LR bolus	Routine, Until discontinued, Starting today



BPA for Nurse for Systolic BP ≤ 100

New BPA

Who?: Inpatient Nurses

What?: New BPA for Systolic BP ≤ 100

When a patient with a systolic blood pressure ≤ 100 has an order set used for a total hip replacement post-op or a total knee post-op, and does **NOT** also have an order for “**Ortho Total Joint Hypotension protocol for nursing**”, a BPA will fire to prompt the nurse to open order set and accept the protocol, or give a reason as to why they are not initiating the protocol.

The BPA will look like this, giving the nurse the option to open the order set to order the protocol, or choose “do not open”, and an acknowledgement reason **must be charted**. If the protocol is chosen not to be ordered and documented in this BPA, the BPA will not fire again for one hour. When a choice is made, click Accept. Sign the order with an order mode of “**Per Protocol, No Cosign required**”.

BestPractice Advisory - Clindoc, Hipcheck

Quality and Compliance (1)

Systolic Blood Pressure of ≤ 100 / Initiate Ortho Hypotension Protocol

Open Order Set Do Not Open Orthopedic Total Joint Hypotension Protocol for Nursing Preview

Acknowledge Reason

Other (speci

Accept



Modifying BP Parameters

New Orders

metoprolol tartrate (LOPRESSOR) tablet 25 mg
25 mg, Oral, Every 12 hours scheduled, First Dose Today at 2100
Hold for heart rate less than 50 beats per minute. LOOK ALIKE SOUND ALIKE MED
Hold for systolic blood pressure less than (mmHg): 110

MAR | Report | MAR Note | Messages | Legend | Show All Actions | Link Lines

ALL | Scheduled | PRN | Continuous | Respiratory | Due/Overdue Meds | Override Pulls | Chem

Go to Now or Select Date: | **Overdue** | **Not Scanned** | Show Med Education | Show All

Monday July 09, 2018

1300 | 1400 | 1500 | 1600 | **1700** | 1800

Future Medications

metoprolol tartrate (LOPRESSOR) tablet 25 mg : Dose 25 mg : Oral : Every 12 hours scheduled

Admin Instructions:
Hold for heart rate less than 50 beats per minute.
Product Instructions:
LOOK ALIKE SOUND ALIKE MED

Ordered Admin
Amount: 1 tablet (1 x 25 mg tablet)

Order Questions/Answers
Hold for systolic blood pressure less than 110 (mmHg)

SBP 90



SBP 110

Network change in collaboration with Cardiology, Pharmacy, and Medicine to decrease risk of AKI by modifying SBP parameters for antihypertensive medications

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Physician GFR BPA

- GFR is a laboratory value that reflects kidney function.
- A GFR less than 60 will generate the BPA.

Summary Orders

Manage Orders Go to Order Sets

tora + New ! Next

New Orders

! ketorolac (TORADOL) 30 mg/mL injection
Starting Today at 1402
LOOK ALIKE SOUND ALIKE MED

BestPractice Advisory

▼ Patient Safety (Advisory: 1)

!! Patient has a GFR <60 NSAIDS are contraindicated. Review all medication at this time

Remove the following orders?

Remove Keep ketorolac (TORADOL) 30 mg/mL injection Starting Today at 1402 LOOK ALIKE SOUND ALIKE MED

Acknowledge Reason

See Comments

Accept

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Nursing BPA

BestPractice Advisory

✓ Patient Safety (Advisory: 1)

!! Patient has GFR less than 60. Collaborate with provider before administering NSAID.

Acknowledge Reason

Administration approved by provider (ent...

! Enter comment

✓ Accept

Cancel



Monitoring Effectiveness

Filter Filters Alert
 Hospital Admission Date: Last 3 months
 Legend: GFR < 60 AND ON NSAID (light blue), MORPHINE WITH GFR<30 (medium blue), KDIGO (dark blue), NSAIDS WITH GFR <60 (darkest blue), Grand Total (black)

3PA's by Specialty

Click on a specialty and alert desc to see detail data (Grand totals do not provide detailed data)

Specialty	GFR < 60 AND ON NSAID	MORPHINE WITH GFR<30	KDIGO	NSAIDS WITH GFR <60
Internal Medicine	65	74	132	103
Emergency Medicine	15	60	148	109
Critical Care Medicine	4	26	73	8
General Surgery	12	10	7	2
Family Medicine	2	8	10	13
Physician Assistant	6	6	9	4
Urology	36	6	3	13
Nurse Practitioner		4	1	
Obstetrics and Gynecology	2	3		
Anesthesiology	33	2	1	
Intensive Care		1	2	2
Medical Surgical		1		10
Podiatry		1	1	
Radiology		1		
Bariatrics	2		5	2
Cardiology	1			3
Cardiothoracic Surgery	5		2	1

BPA's by Provider

Click on a provider and alert desc to see detail data (Grand totals do not provide detailed data)

Prov Name	Grand Total	GFR < 60 AND ON NSAID	MORPHINE WITH GFR<30	KDIGO	NSAIDS WITH GFR <60
GYARMATY, ASHLEY	13	3		6	4
SMUDDE, BRENNIA	12	5	1	4	2
DODGE, DANIELLE	11	1	3		7
KARIA, NIDHI	10			10	
KREBS, CHRISTOPHER	10	3		1	6
MANGANI, BIREN V	10	5			5
IASIELLO, ANNETTE D	9	3	1	4	1
FLY, ERIN M	8	2	2		4
RIZVI, SARDAR A	8		3	3	2
ERNST, EMILY	7	4			3
KEMMERER, EMMA	7	3	4		
BAYAT, HASAN	6	3	1	2	
BROWN, COURTNEY	6	1	1	1	3
CAREY, SHANNYN M	6	2	2		2
FAUST, CYNTHIA M	6		2	3	1
JAHOOOR, ANIL	6	1	5		
WERNER, RAINIE	6		4	1	1

Campus	Prov Name	Specialty	Department	Pat Enc Csn Id	Pat Name	DOB	Day of Hosp Admsn Time	Comfort Care Order?	Emergency Visit Y/N?	Minute of Alert Date	Ac
St. Luke's	GYARMATY, ASHLEY	Internal Medicine	AL EAST 5 MED ..	1051983435	KALE, BRYAN	08/03/1977	July 7, 2019	No	Yes	July 7, 2019 10:38 PM	
St. Luke's	GYARMATY, ASHLEY	Internal Medicine	AL EAST 5 MED ..	1051983435	KALE, BRYAN	08/03/1977	July 7, 2019	No	Yes	July 7, 2019 10:38 PM	
St. Luke's	WERNER, RAINIE	Cardiothoracic Surgery									
St. Luke's	JAHOOOR, ANIL	Cardiology									
St. Luke's	FAUST, CYNTHIA M	Bariatrics									



Tweaking our Process





Updated Hypotension Protocol Order Set

■ Surgery General Post-op Order set

▼ General Surgery Hypotension Protocol for Nurses

"Use only for patients at St Luke's Bethlehem Campus"

Follow General Surgery Hypotension Nursing Protocol

Order Sets

General Surgery Hypotension Protocol for Nurses

"Use only for patients at St Luke's Bethlehem Campus"

Follow General Surgery Hypotension Nursing Protocol

Follow General Surgery Hypotension Nursing Protocol

Routine, Once, First occurrence today at 0907

General Surgery Hypotension Protocol for Nursing Monitor Vital signs for the first 4 hours every hour, then every 4 hours for 24 hours Step 1: For any SBP < 90 mmHg Repeat BP in opposite arm to confirm manually page General Surgery STAT or escalate care For SBP < 100 mmHg Repeat BP in opposite arm to confirm manually. If SBP < 100mmHg, notify provider and proceed to Step 2 Step 2: Give 1000ml bolus of selected fluid over 1 hour based on the following criteria: If K level is < 4.8, give 1000L LR bolus OR If K level is 4.8, give 1000L NS bolus Recheck BP one hour after completed If blood pressure remains below SBP < 100 after 1st bolus, notify the provider and proceed to Step 3. Step 3: Give another 1000ml bolus over 1 hour and recheck BP 1 hour after bolus is completed. If SBP remain > 100 mmHg, notify the provider for further evaluation. (Orders will automatically discontinue 24 hours from patient's post-op arrival time on the unit), Post-procedure, Sign & Hold

Vital Signs every 1 hour for the first four hours

Routine, Every hour, First occurrence today at 1000, for 4 hours

Hypotension Protocol: Vital Signs will be monitored every hour for the first 4 hours. More frequent if BP are less than SBP 100, Post-procedure, Sign & Hold

Vital Signs every 4 hours for the remaining 24 hours

Routine, Every 4 hours, First occurrence today at 1200, for 24 hours

Hypotension Protocol: Vital Signs will be monitored every 4 hours for the remaining 24 hours. More frequent if BP are < SBP 100, Post-procedure, Sign & Hold

Notify Physician - For any SBP < 90 mmHg, page General Surgery STAT

Routine, Until discontinued, starting today at 0907, until tomorrow, for 24 hours

For any SBP < 90 mmHg, page General Surgery STAT for the first 36 hours post-op while on General Surgery Hypotension Protocol, Post-procedure, Sign & Hold

Nursing Communication Hypotension Protocol: Repeat BP on opposite arm to confirm blood pressure each time SBP < 100 mmHg.

Routine, Until discontinued, starting today at 0907, until tomorrow, for 24 hours

Hypotension Protocol: Repeat BP on opposite arm to confirm blood pressure each time SBP < 100 mmHg, Post-procedure, Sign & Hold

LR IV Bolus

lactated ringers bolus 1,000 mL

1,000 mL, Intravenous, Administer over 1 Hours, Once as needed, For SBP less than 100mmHg and K level less than or equal to 4.8 as per General Surgery Hypotension Protocol,

Starting today at 0906, For 24 hours, Post-procedure

For SBP less than 100mmHg and K level less than or equal to 4.8 as per General Surgery Hypotension Protocol. Recheck BP 1 hour after bolus is completed

Sign & Hold

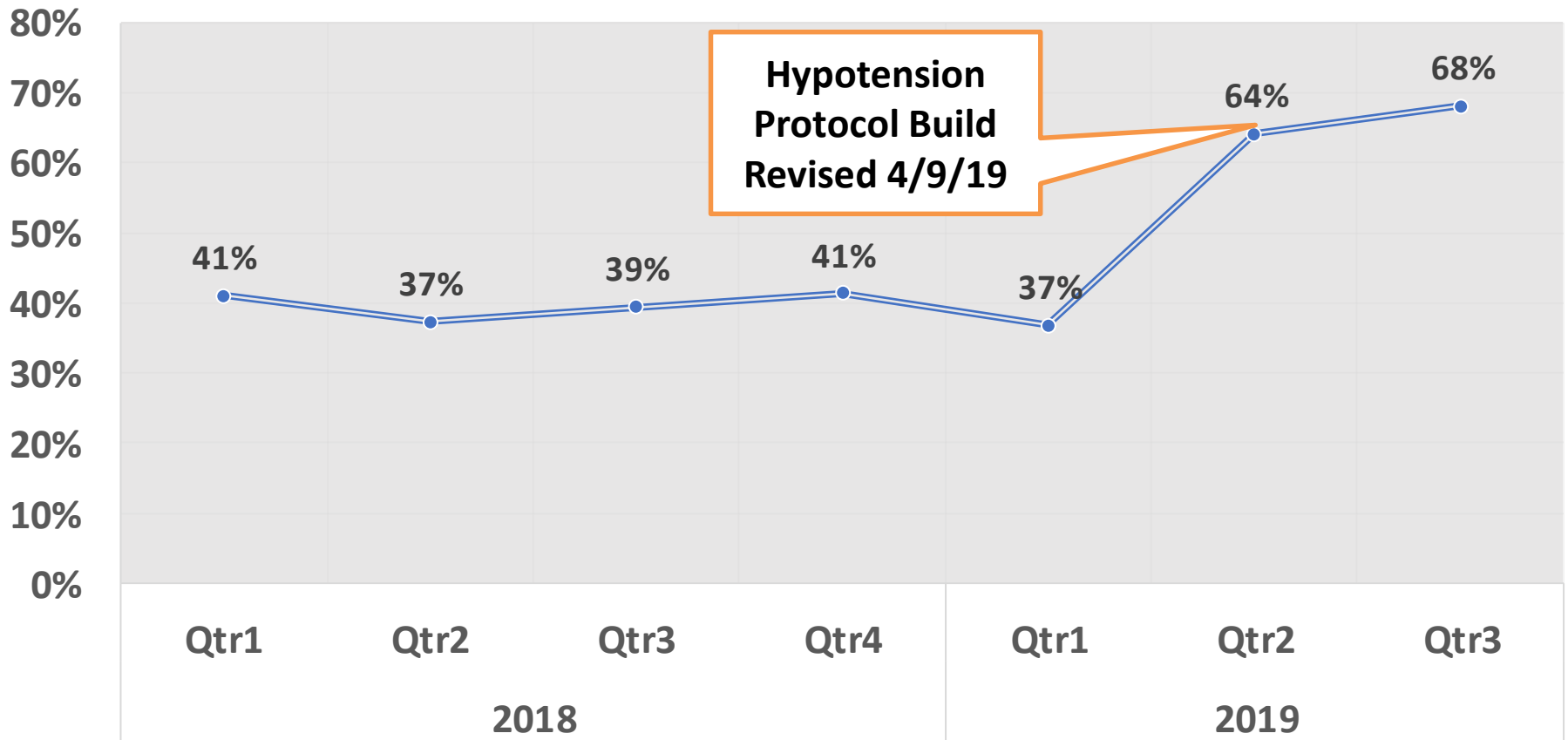
Note: Each specialty has their own Protocol. However, the functionality is the same across all order sets.

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Order Set Utilization

NURSE HYPOTENSION PROTOCOL ORDER SET UTILIZATION





Check

Bethlehem:

- Hypotension rate decreased to from 14.54% to 5.97%
- AKI pre-pilot rate of **6.02%** → FY19 **0.24%**

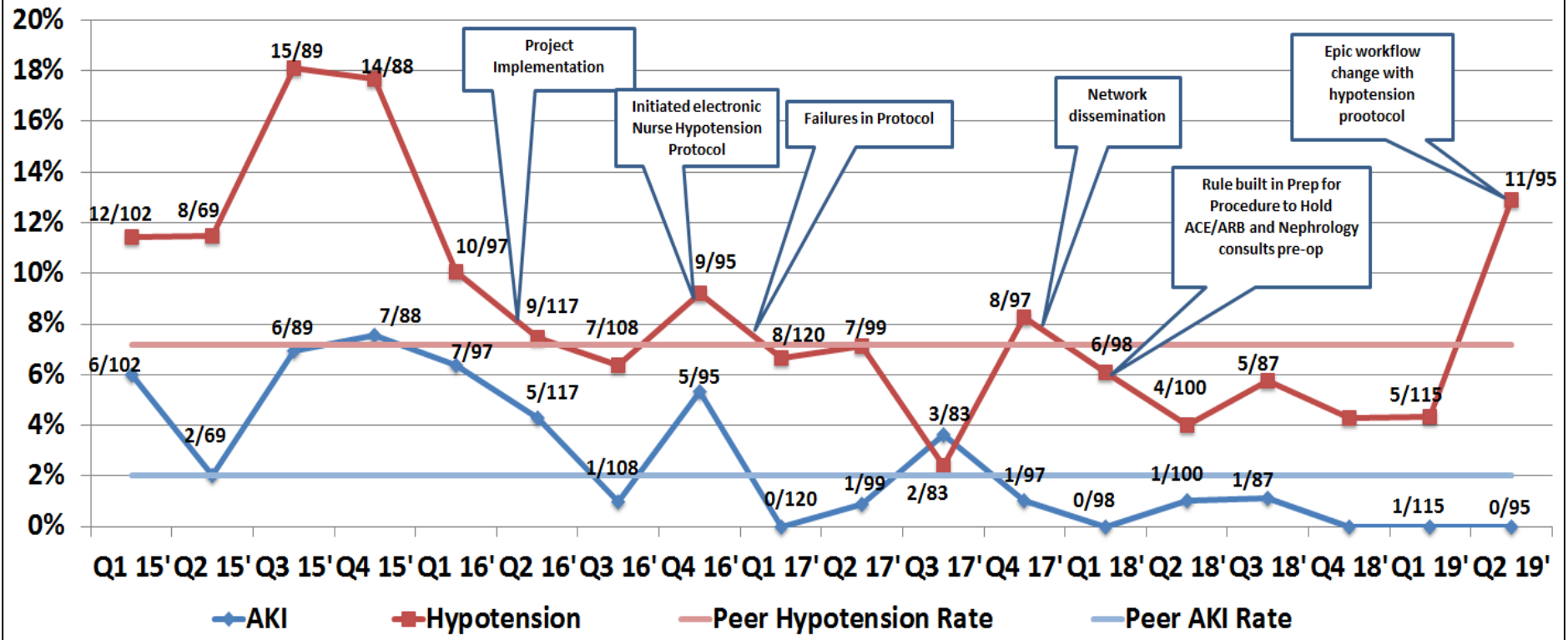
Network:

Fiscal Year	Hypotension Rate	AKI Rate	ALOS Index
2016	9.54%	3.49%	1.02
2017	7.56%	1.75%	.97
2018	6.06%	1.37%	.90
2019	6.35%	.71%	.85



AKI/Hypotension Quarterly Progress

SLUH: AKI and Hypotension QTR Rate





Return on Investment

- From FY16 - FY19, cumulative cost savings of:
> \$ 585,000!



Check/Act

- Pre-operative Clearances
 - Hard Stops:
 - Bilateral Knee Procedures
 - GFR- Nephrology Consults- Decision Support builds
 - Remove Celebrex from Pre and Post-op order sets
- Physician Documentation
- Staff engagement
- Network dissemination
 - December 2017
- Ongoing Multidisciplinary Workgroups



Discharge/Transition of Care Phase of Care

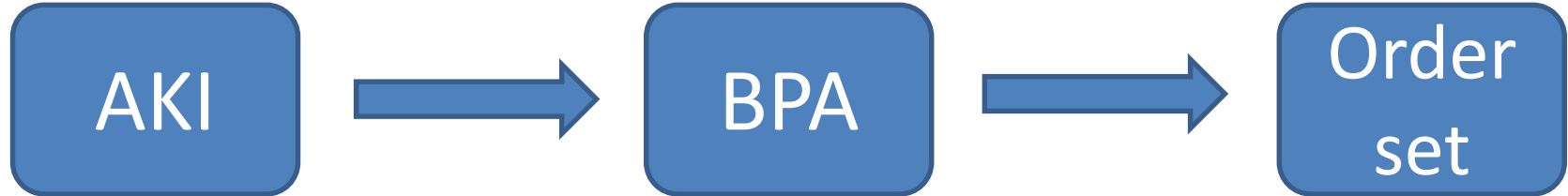


AKI Beyond Joint Replacement...

- Addressing those with an AKI event:
 - KDIGO BPA
 - AKI Bundle Order Set
 - SNF Geriatric AKI Pathway
 - Discharge Home AKI Pathway **November roll out**




AKI Event



Patient Safety (1)

This patient has developed AKI based on KDIGO criteria. Follow the link to the AKI Order set.



KDIGO guidelines define AKI as an increase in creatinine of 0.3 mg/dL over a 48 hour period or a greater than 1.5 times baseline increase over 7 days. Complete KDIGO AKI criteria and AKI staging can be found in the AKI Order Set

Last CREATININE, Collected: 10/19/2018 9:46 AM = 1.40 mg/dL
 Prev CREATININE, Collected: 10/19/2018 9:41 AM = 1.00 mg/dL

[Open Order Set](#) [Do Not Open](#) **AKI Best Practice Advisory (BPA) Smart Set** [Preview](#)

Acknowledge Reason

[Does not meet KDIGO criteria](#) [Attending physician notified, I'm not th...](#) [I am not the attending physician](#)

[Accept](#)

Nephrology KDIGO Guidelines for AKI Focused [Personalize](#) [^](#)

D ehydration	Correct volume depletion Consider IV fluid bolus and/or maintenance IV fluids
O bstruction	Check bladder scan Consider straight catheterization if indicated Consider renal ultrasound
N ephrotoxins	Discontinue and avoid all potentially nephrotoxic medications: <ul style="list-style-type: none"> • NSAIDs • ACEi or ARB • Diuretics (loop, thiazide, potassium sparing) • Aminoglycosides • Statins (if LFTs are elevated) • Iodinated dye and Gadolinium Renal dose adjust medications
U rine	Order strict I/O's Check urinalysis
T hink Sepsis	Sepsis protocol if evidence of sepsis
S ystolic BP	Avoid relative hypotension Adjust hold parameters on BP meds to maintain SBP 130-140 as clinical condition allows.

KDIGO Guidelines for AKI - an increase in creatinine of 0.3 mg/dL over a 48 hour period or a greater than 1.5 times baseline increase over 7 days or a urine output less than 0.5 ml/kg/h for 6 hours.

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Addressing KDIGO BPA Through Order Sets

Nephrology KDIGO Guidelines for AKI Focused [Personalize](#)

Dehydration

Correct volume depletion
Consider IV fluid bolus and/or maintenance IV fluids

Obstruction

Check bladder scan
Consider straight catheterization if indicated
Consider renal ultrasound

Nephrotoxins

Discontinue and avoid all potentially nephrotoxic medications:

- NSAIDs
- ACEi or ARB
- Diuretics (loop, thiazide, potassium sparing)
- Aminoglycosides
- Statins (if LFTs are elevated)
- Iodinated dye and Gadolinium

Renal dose adjust medications

Urine

Order strict I/O's
Check urinalysis

Think Sepsis

Sepsis protocol if evidence of sepsis

Systolic BP

Avoid relative hypotension
Adjust hold parameters on BP meds to maintain SBP 130-140 as clinical condition allows.

KDIGO Guidelines for AKI - an increase in creatinine of 0.3 mg/dL over a 48 hour period or a greater than 1.5 times baseline increase over 7 days or a urine output less than 0.5 ml/kg/h for 6 hours.

The linked order set provides guidance for addressing AKI

AKI Orders

Diet

Please determine what diet your patient requires. A renal diet is pre populated here, but based on the assessment of your patient's current need, please make the appropriate changes.

Renal Diet

Diet effective now, Starting 9/3/19

Nursing Orders

Click for mo

Intake and Output

Routine, Every shift, First occurrence today at 1037, Until Specified

Daily weights

Routine, Daily, First occurrence today at 1037, Until Specified

Bladder Scan

Routine, Once, First occurrence today at 1037
Please call if bladder scan measurement is > 300 cc.

Urinary retention protocol

Routine, Until discontinued, starting today at 1037, Until Specified
Please initiate protocol if post void residual is greater than 300 cc

If SBP is less than 130 or HR less than 50, please notify physician before giving BP medication

Routine, Until discontinued, starting today at 1037, Until Specified
Systolic blood pressure less than: 130
Heart rate less than: 50

Click for mo

Lab Orders

Urinalysis with microscopic (\$\$)

Once, First occurrence today at 1037

Consultation

Click for mo

Fluid Bolus

Click for mo

Maintenance Fluid

If the potassium level is less than 4.8 meq/L, then LR or Isolyte are the preferred IV solutions if your patient requires maintenance fluids.

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Audit: KDIGO BPA and Order Set

Row Labels	Total BPA's Fired	Total No Action Taken	Total Overrides	Total Open Order set
Apr	3055	2910	89	56
May	867	733	92	42
Jun	740	600	99	41
Jul	996	726	194	76
Aug	695	491	148	56
Sep	177	135	31	11
Grand Total	6530	5595	653	282



Discharges to Skilled Nursing

▼ Geriatric AKI Discharge Pathway

****For nursing home patients on the AKI Pathway****

- Medications to avoid: phosphate or magnesium based laxatives, NSAIDs
Routine, Clinic Performed, Should notify patient's pharmacy and flag in patient's nursing home chart
- Maintain SBP between 120-140 mm/Hg
Routine, Clinic Performed, Call Nursing Home physician with any abnormality
- Call Nursing Home MD for decreased oral intake
Routine, Clinic Performed, Call NH MD if oral liquid intake < 1 L for 2 consecutive days or meal intake < 30% for 2 consecutive days
- Daily Weights
Routine, Clinic Performed, For 30 days, call Nursing home physician if weight increases or decreases > 3 lbs from initial admission/return weight to nursing home. Any further orders will be per the discretion of nursing home physician
- Bladder Scan
Day #2 after discharge, if bladder scan is greater than 250ml call nursing home physician
- Strict Intake and Output
Routine, Clinic Performed, For 30 days, Strict I&O and document. Any further orders will be per the discretion of nursing home physician.
- Follow up bloodwork
Routine, Clinic Performed, BMP to be performed day #3 and day #9 after hospital discharge Call nursing home MD if creatinine increases > 0.3 from discharge creatinine, refer to After Visit Summary for the latest serum creatinine.
- No BP's, IV's or Labs in nondominant arm for GFR < 45

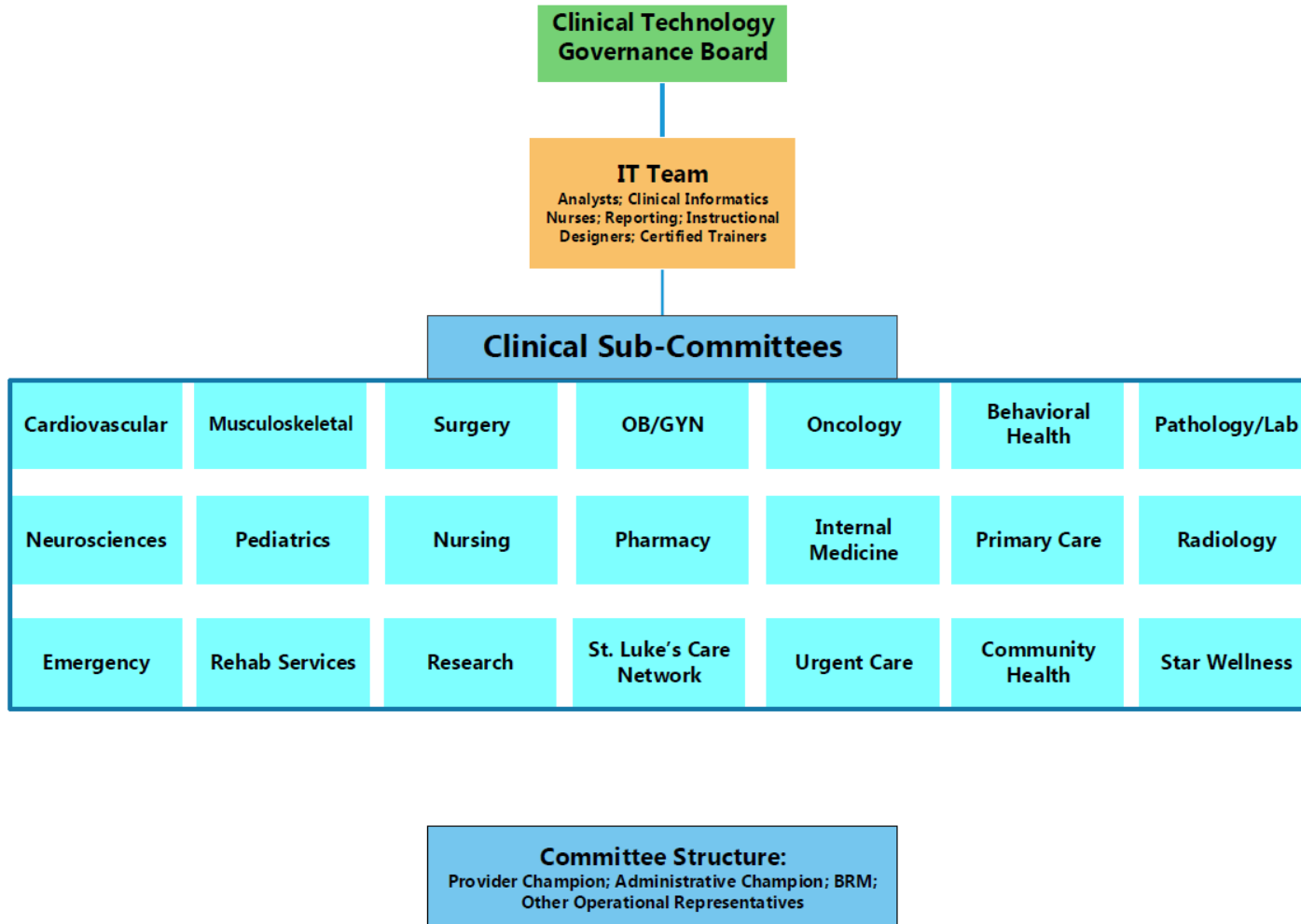


Key Lessons Learned

- Utilizing Electronic Medical Record (EMR) to drive adherence/compliance
 - Include reporting early on
- Simple measures done well and consistently can have a huge positive impact
 - NSAID Holds, fluid management, Nephrology Consults, Systolic Blood Pressure (SBP) parameters and intra-op monitoring
 - Defining a high risk population
- Keep your eye on the ball or results can slip
 - Sustaining behavior
 - Accountability
- Keep up with education because of resident, provider turnover
- Empowering nurses works



Clinical Technology Governance





Recognitions

- Hospital and Healthsystem Association of Pennsylvania (HAP) Achievement Awards Program
- I am Patient Safety- Pennsylvania Safety Authority
- Journal of Arthroplasty
- National Association of Healthcare Association (NAHQ)
- Institute for Healthcare Improvement
- Premier Breakthroughs
- Network Quality Award
- EPIC AKI Module
- Community Health