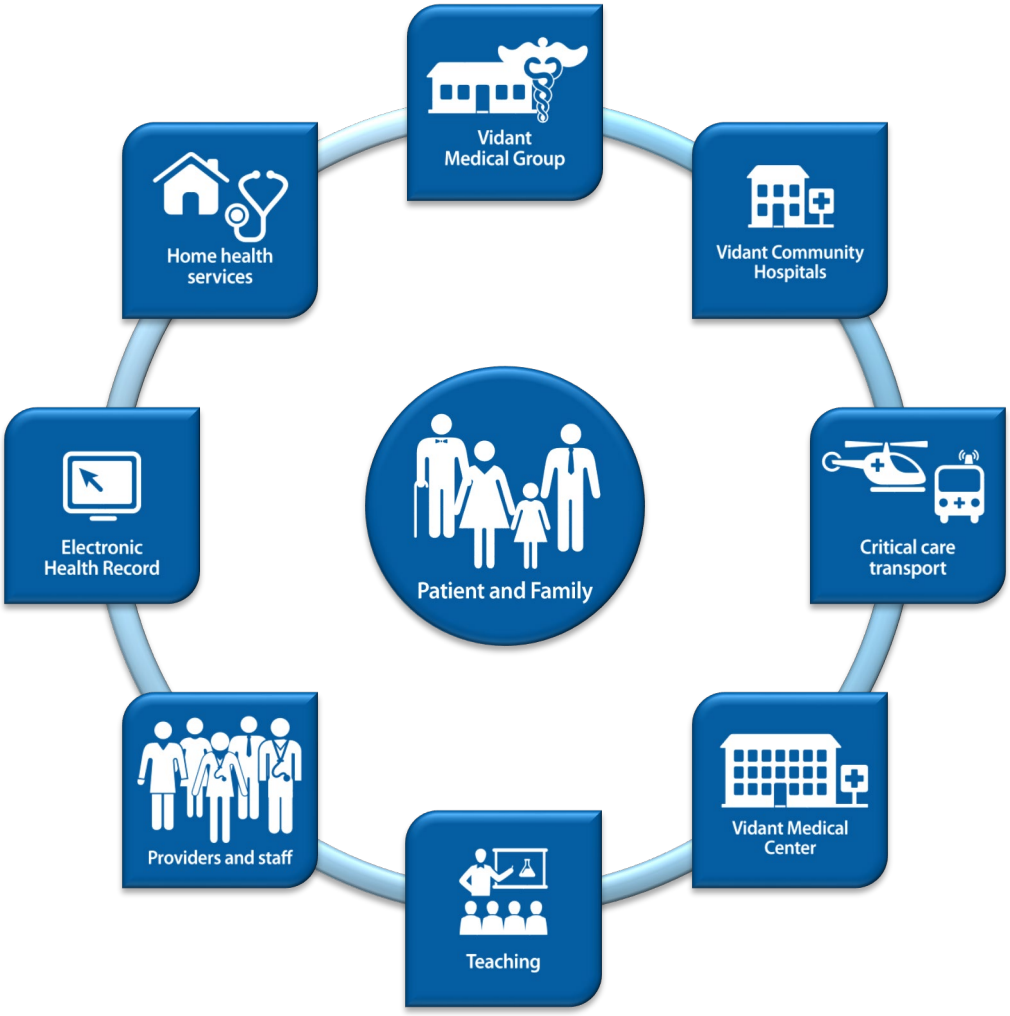
Advanced Simple Techniques:

More ways to CUT a model in the Operating Room

VIDANT HEALTH™

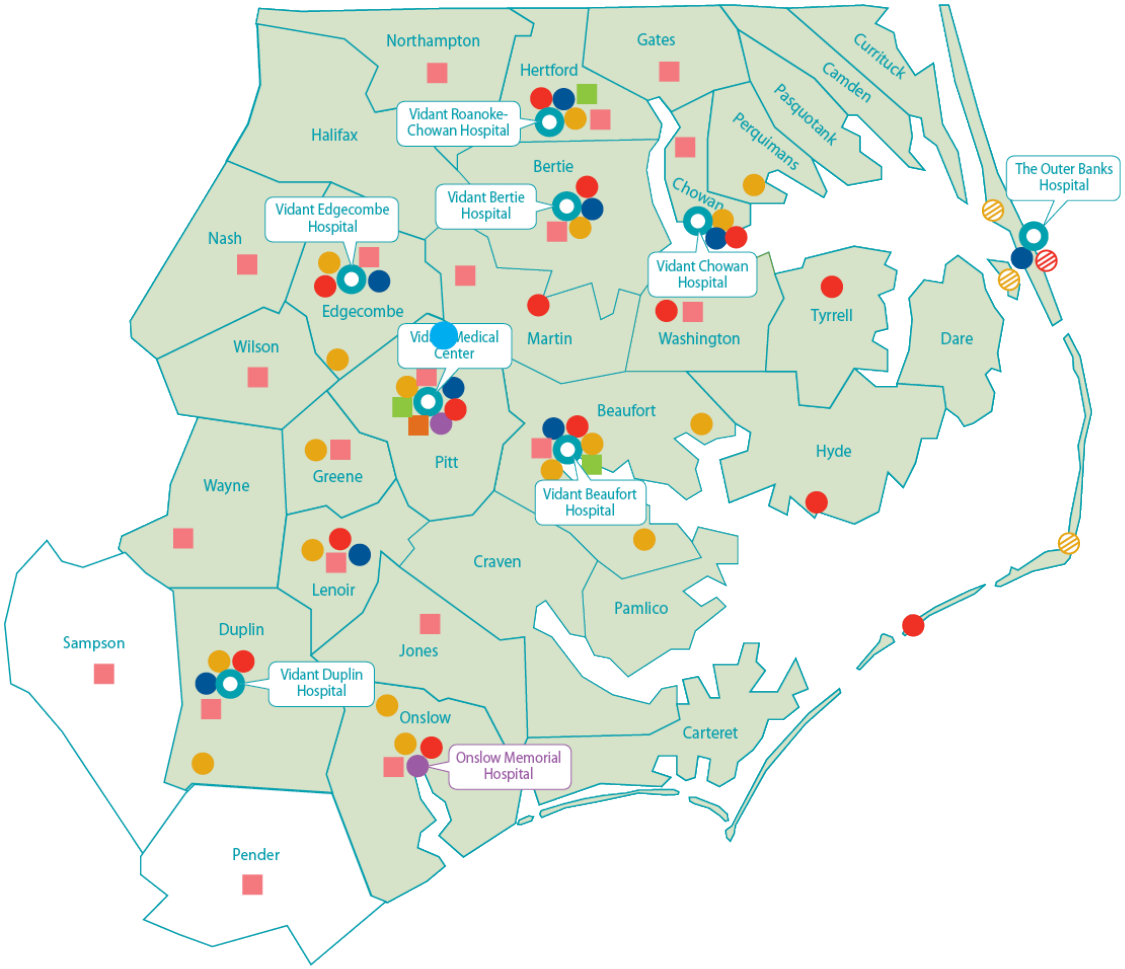
Michael Zimmer, PhD
Sr. Business Consultant
Systems & Procedures
Vidant Health

Our system of care today



- 12,500+ employees
- 8 hospitals
- 95+ physician practices
- Outpatient, home health and hospice services
- Critical care transport
- Serving 1.4 million people in 29 counties, 1/3 of NC
- $1.6 billion of net patient revenue annually

Our service area



- Vidant Health-owned hospital
- Vidant Health primary care physicians
- Vidant Health specialists
- Vidant Healthplex | *opening November 2018*
- Vidant Health hospitalists
- Service management/joint venture
- Vidant Wellness Center
- Vidant Home Health & Hospice service area counties
- Ambulatory surgery
- Outer Banks Medical Group primary care physicians
- Outer Banks Medical Group specialists

Green-shaded counties represent Vidant Health's 29-county service area.

THE ASK – CARDIOVASCULAR SURGERY

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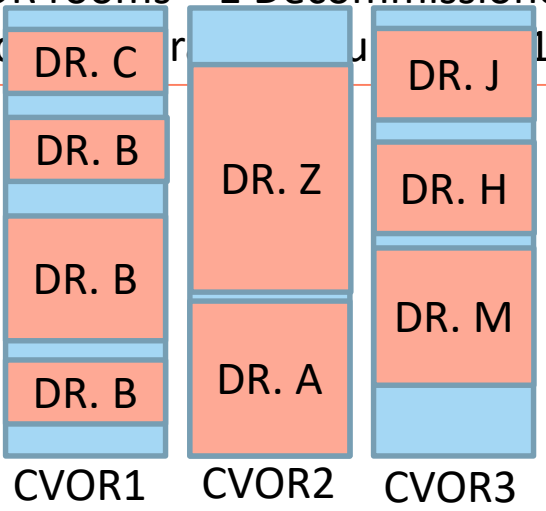
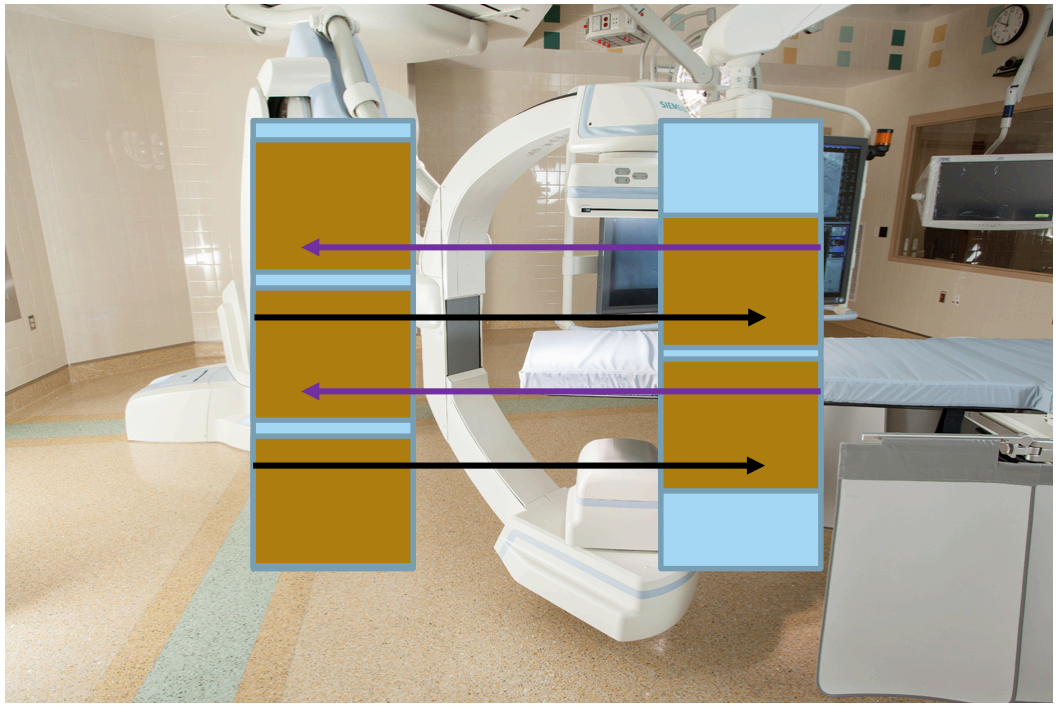
Is there an ability to add 7-9 joint surgical cases daily, Mon-Thurs, amongst the existing CV surgical standard operations?

CURRENT OR OPERATIONS

6 OR rooms – 1 Decommissioned

Stand r u 1900





RAW DATA: 2016-2018

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Room	Procedures	Out Room Proceeding Case	In Room	Out Room	Room Duration	Setup Start	Room Ready
CVOR 07	Ultrasound Guided Access To Brachial Artery, Angiogram With Stent Of Celiac Artery, Angioplasty Of Superior Mesenteric Artery [1070000022]		952	1147	115		
CVOR 04	Replacement Valve Mitral Redo X3 (Tissue), Intraoperative Tee [1070001630], Sternotomy Re-Do [1070001762], Replacement Valve Aortic [1070001629], Repair Valve Tricuspid [1070001587]	1203	1250	2048	478		1243
CVOR 06	Electromagnetic Bronchoscopy Navigational With Biopsy, Tattoo & Fiducial Placement [1070000168], Lower Lobe Wedge Verses Lobectomy [1070001794]		849	1218	209		828
CVOR 06	Esophagogastroduodenoscopy With Savary Dilatation [1070000406], Bronchoscopy [1070000164]	1252	1333	1426	53		1327
CVOR 03	Replacement/Repair Valve Mitral [1070001630], Closure Pfo [1070000236], Maze Procedure [1070001182]		732	1318	346		
CVOR 05	Redo Transhiatal Nissen, Cardiopulmonary Bypass On Standby [1070001053]		741	830	49		740
CVOR 03	Replacement Valve Aortic-Tissue, Redo Sternotomy [1070001629]		828	1354	326		
CVOR 06	Esophagogastroduodenoscopy With Savory Dilatation [1070000406]		735	809	34		
CVOR 07	Transcatheter Replacement Valve Aortic Transfemoral Approach - Edwards #23 Sapien 3 [1070001821]	1120	1210	1429	139		1156
CVOR 07	Transcatheter Replacement Valve Aortic Transfemoral Approach Portico #26 Or #27 (St. Jude Gcj) [1070001821]		752	1120	208		
CVOR 06	Right Lower Lobectomy [1070001794]		802	1131	209	650	728
CVOR 06	Percutaneous Endoscopic Gastrostomy [1070001293], Tracheostomy [1070001816]	1131	1244	1408	84		
CVOR 03	Attempted/Failed Laser Spectranetics Lead Extraction Of Riata Lead; Insertion Of New St. Jude Durata Icd Lead [1070001135]	1149	1244	1530	166		
CVOR 03	Bypass Coronary Artery Graft [1070000185], Takedown Artery Mammary Internal [1070001781], Harvest Vein Saphenous; 1 Vein [1070000852]		803	1350	347		
CVOR 06	Laparoscopic Paraesophageal Hernia Repair [1070001071], Esophagogastroduodenoscopy [1070000406], Bronchoscopy [1070000164]	1218	1312	1721	249		
CVOR 06	Esophagogastroduodenoscopy [1070000406]	1247	1315	1346	31		
CVOR 03	Bypass Coronary Artery Graft X 3; Intraoperative Tee [1070000185], Endoscopic Harvest Of Left Saphenous Vein [1070000852], Takedown Artery Mammary Internal [1070001781]		737	1410	393		713
CVOR 03	Bypass Coronary Artery Graft [1070000185], Left Internal Mammary Artery [1070001781], Endoscopic Harvest Vein Saphenous [1070000852]		729	1149	260		
CVOR 06	Esophagogastroduodenoscopy [1070000406]	921	1009	1041	32	935	945
CVOR 01	Carotid To Subclavian Bypass [1070000184]		732	951	139		

≈8500 cases Mon-Thurs | 7A-7P Check out this word: ESOPHAGOGASTRODUODENOSCOPY

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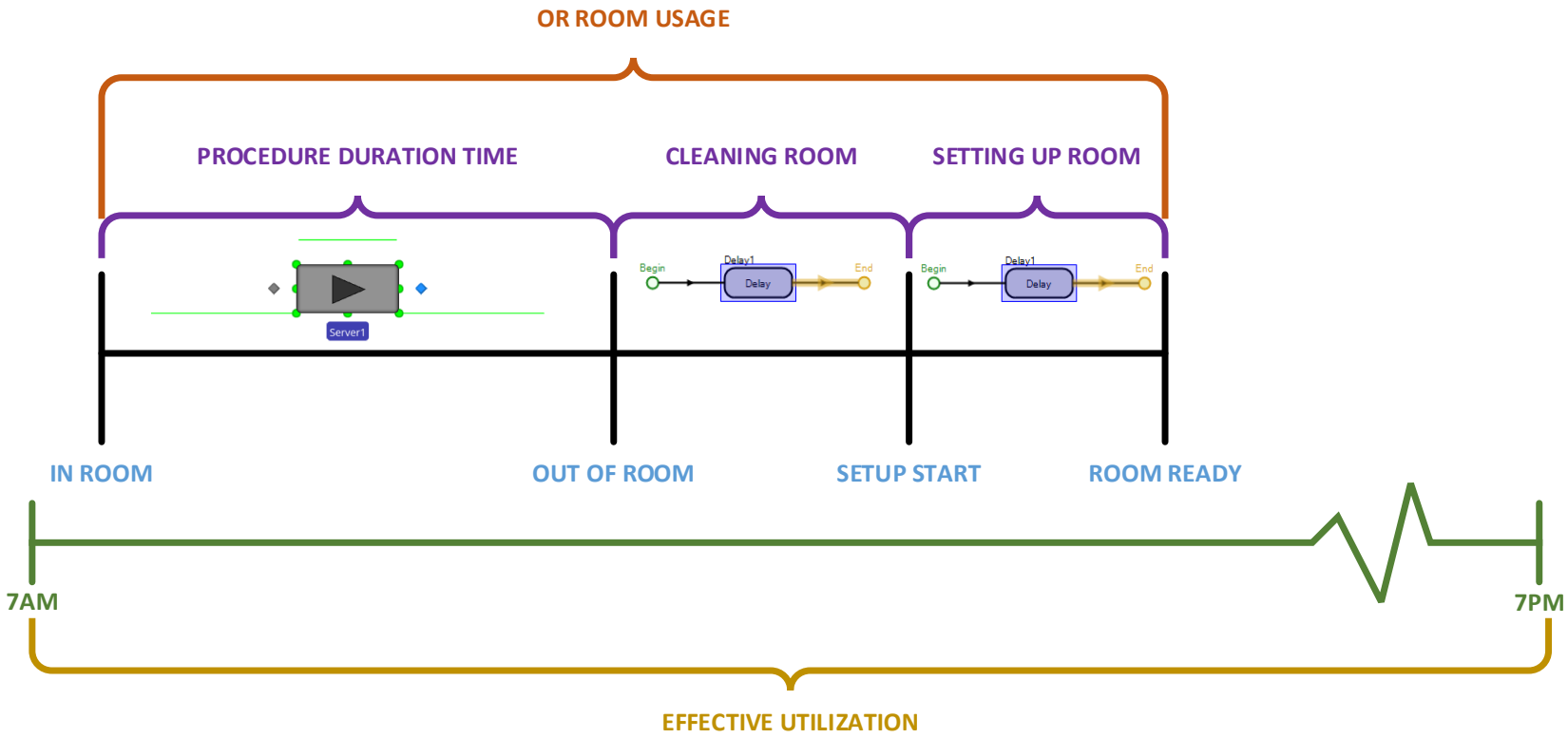
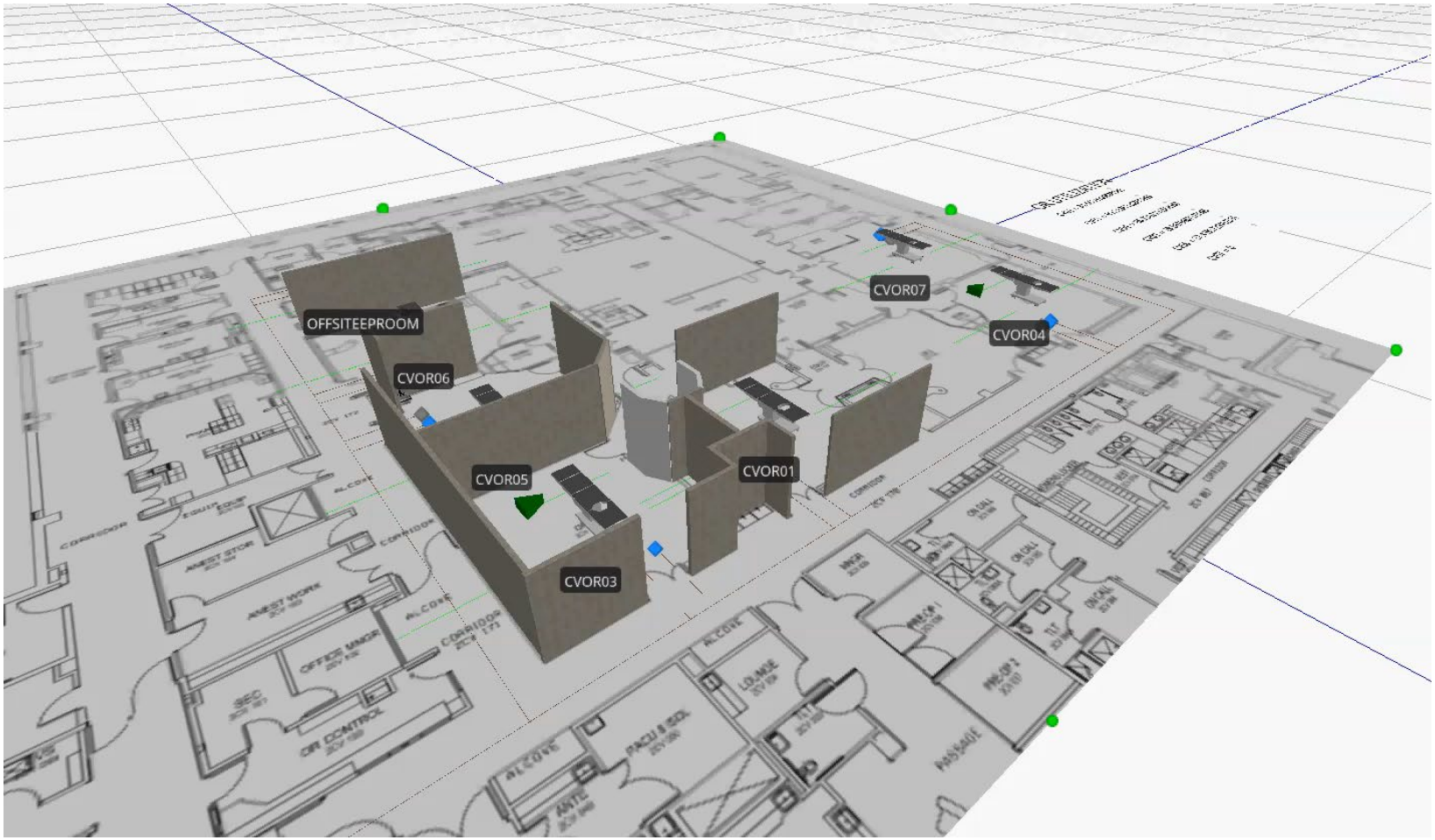
Test feasibility – study OR utilization

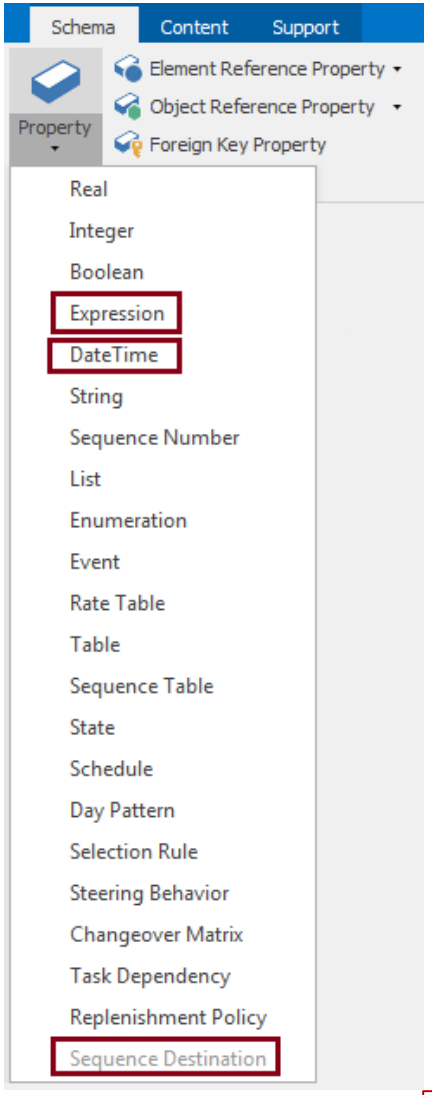
- Is there capacity or time available in the day to add more surgical cases

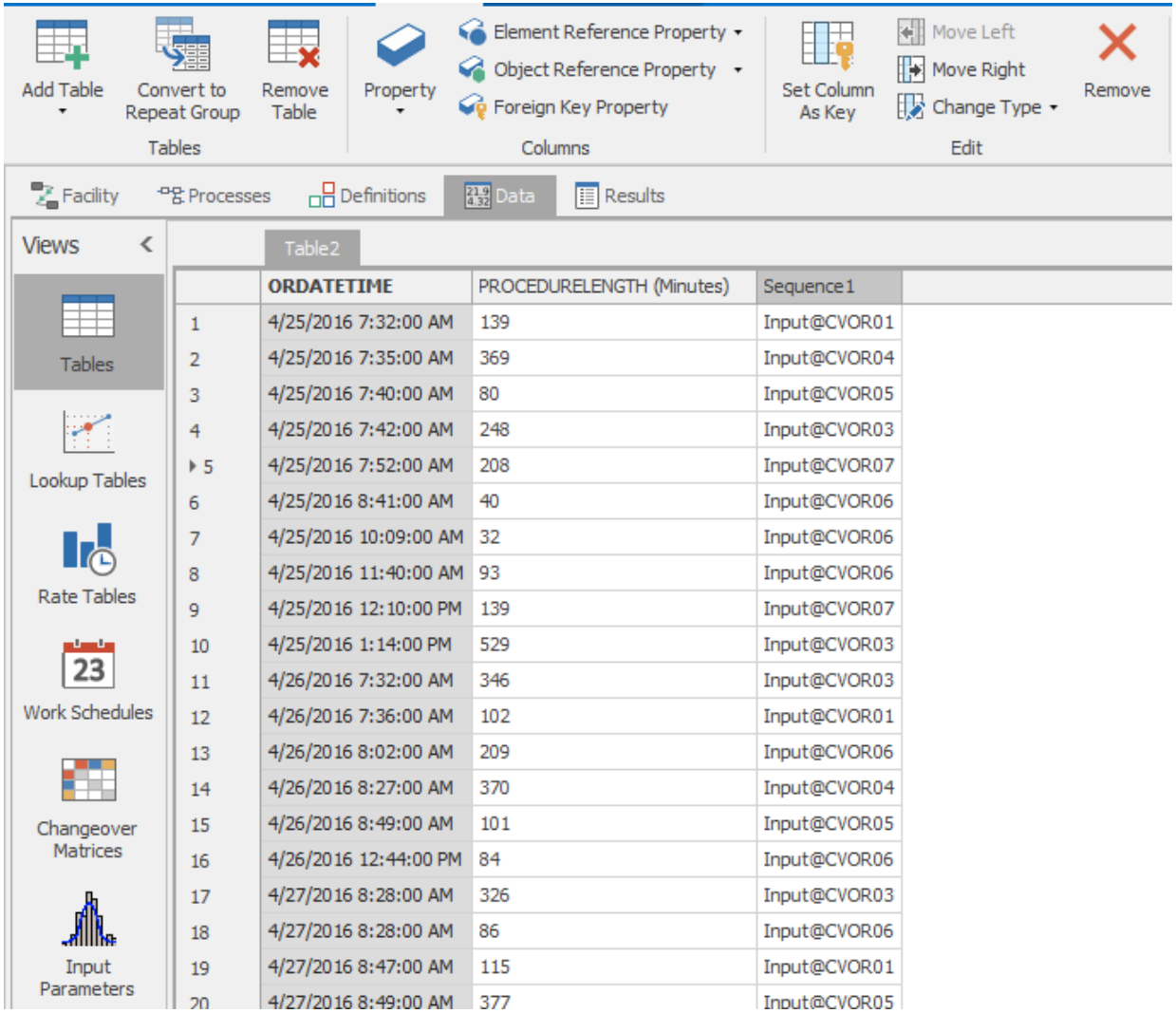


MODEL DESIGN



METHOD 1 – TECHNICALLY METHOD 2





	ORDATETIME	PROCEDURELENGTH (Minutes)	Sequence1
1	4/25/2016 7:32:00 AM	139	Input@CVOR01
2	4/25/2016 7:35:00 AM	369	Input@CVOR04
3	4/25/2016 7:40:00 AM	80	Input@CVOR05
4	4/25/2016 7:42:00 AM	248	Input@CVOR03
5	4/25/2016 7:52:00 AM	208	Input@CVOR07
6	4/25/2016 8:41:00 AM	40	Input@CVOR06
7	4/25/2016 10:09:00 AM	32	Input@CVOR06
8	4/25/2016 11:40:00 AM	93	Input@CVOR06
9	4/25/2016 12:10:00 PM	139	Input@CVOR07
10	4/25/2016 1:14:00 PM	529	Input@CVOR03
11	4/26/2016 7:32:00 AM	346	Input@CVOR03
12	4/26/2016 7:36:00 AM	102	Input@CVOR01
13	4/26/2016 8:02:00 AM	209	Input@CVOR06
14	4/26/2016 8:27:00 AM	370	Input@CVOR04
15	4/26/2016 8:49:00 AM	101	Input@CVOR05
16	4/26/2016 12:44:00 PM	84	Input@CVOR06
17	4/27/2016 8:28:00 AM	326	Input@CVOR03
18	4/27/2016 8:28:00 AM	86	Input@CVOR06
19	4/27/2016 8:47:00 AM	115	Input@CVOR01
20	4/27/2016 8:49:00 AM	377	Input@CVOR05

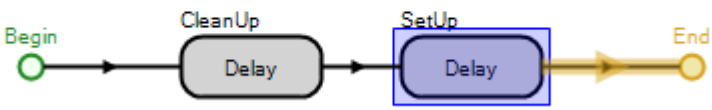
Setup a blank table – Export it – Then import the data

Properties: CVOR01 (Server)

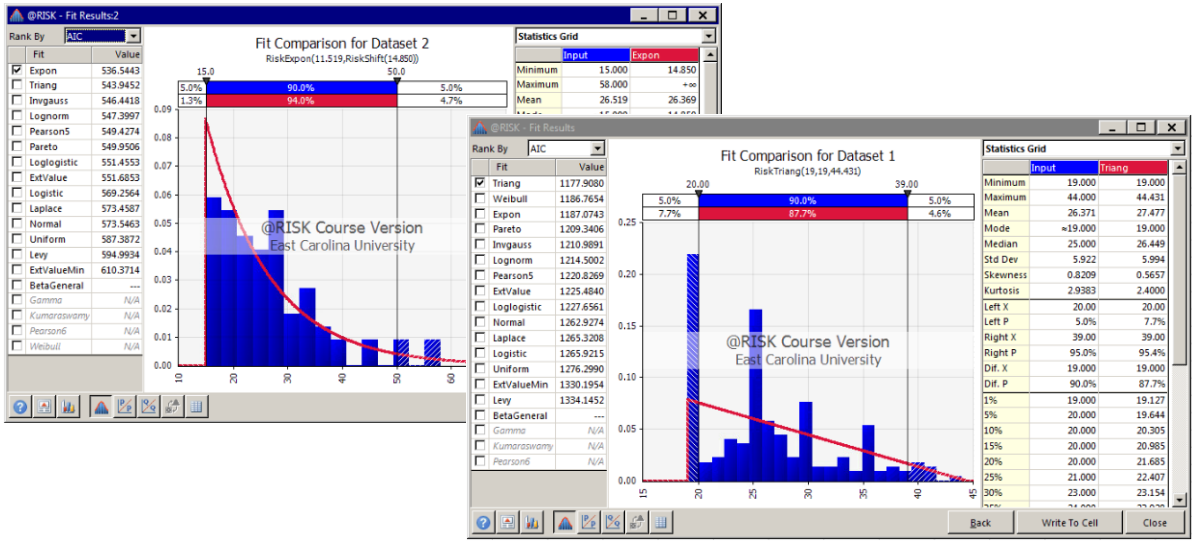
Process Logic	
Capacity Type	**WorkSchedule**
Work Schedule	**ORSchedule**
Ranking Rule	First In First Out
Dynamic Selection Rule	None
Transfer-In Time	0.0
Process Type	Specific Time
Processing Time	**Table2.PROCEDURELENGTH**
Off Shift Rule	**Finish Work Already Started**
Other Processing Options	
Immediately Try Seize	**True**
Immediately Try Alloca...	True
Buffer Logic	
Reliability Logic	
Table Row Referencing	
State Assignments	
Secondary Resources	
Financials	
Add-On Process Triggers	
Run Initialized	
Run Ending	
Entered	
Before Processing	
Processing	
After Processing	**CleanandSetup**
Exited	
Failed	
Repaired	
Evaluating Seize Request	
On Shift	
Off Shift	
Advanced Options	
General	
Animation	

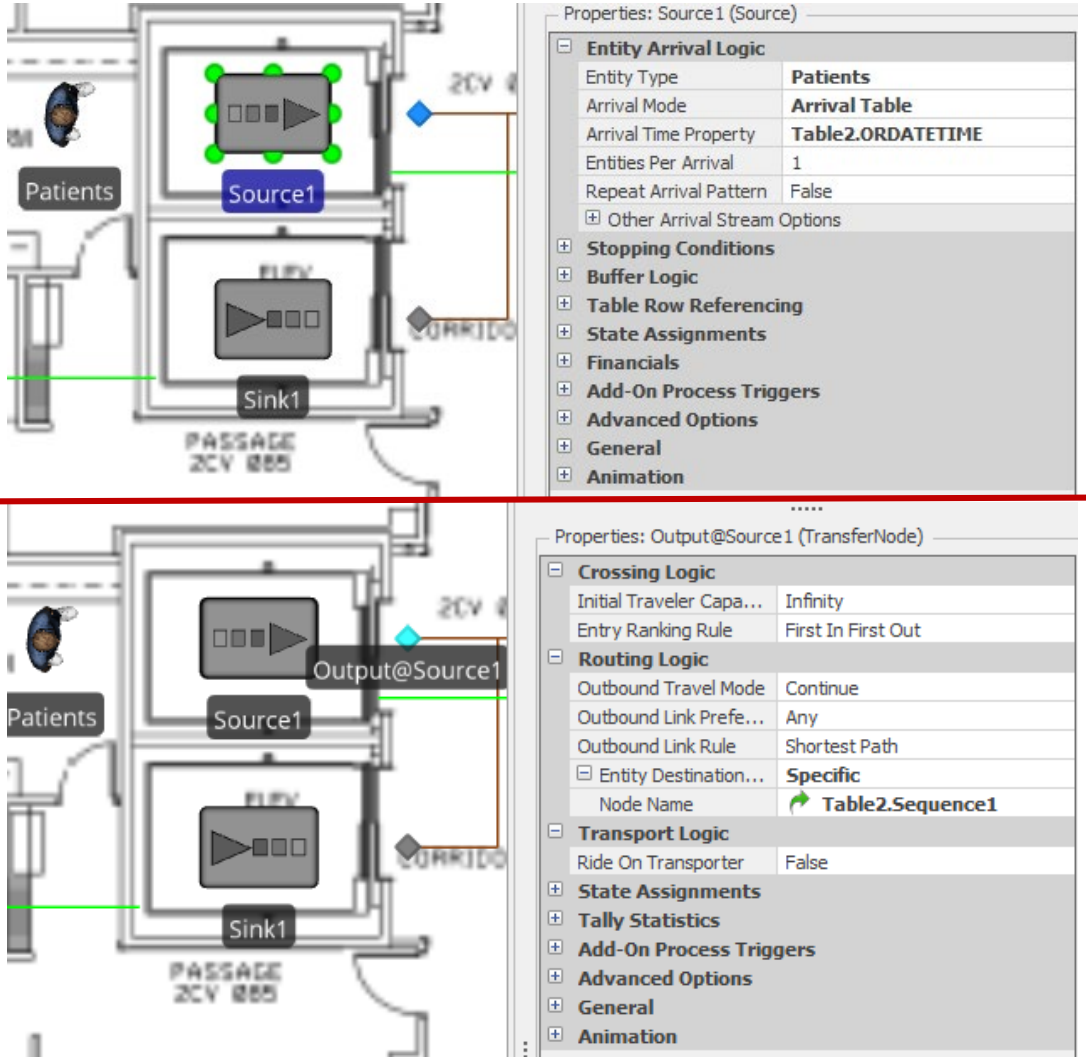
CVOR01 Add-On Processes

CleanandSetup



Name	Object Type	Summary
Input Parameters		
CleanUP	Distribution Input Parameter	Triangular(19 Minutes, 19 Minutes, 44 Minutes)
SetUp	Distribution Input Parameter	Exponential(26.519 Minutes)
CleanUP2	Distribution Input Parameter	Pert(19 Minutes, 19 Minutes. 44 Minutes)




Patients
Source1
Sink1
PASSAGE
2CV 085
Properties: Source1 (Source)
Entity Arrival Logic
Entity Type
Patients
Arrival Mode
Arrival Table
Arrival Time Property
Table2.ORDATETIME
Entities Per Arrival
1
Repeat Arrival Pattern
False
Other Arrival Stream Options
Stopping Conditions
Buffer Logic
Table Row Referencing
State Assignments
Financials
Add-On Process Triggers
Advanced Options
General
Animation
Output@Source1
Properties: Output@Source1 (TransferNode)
Crossing Logic
Initial Traveler Capa...
Infinity
Entry Ranking Rule
First In First Out
Routing Logic
Outbound Travel Mode
Continue
Outbound Link Prefe...
Any
Outbound Link Rule
Shortest Path
Entity Destination...
Specific
Node Name
Table2.Sequence1
Transport Logic
Ride On Transporter
False
State Assignments
Tally Statistics
Add-On Process Triggers
Advanced Options
General
Animation

METHOD 2 – HARDER THAN IT HAD TO BE

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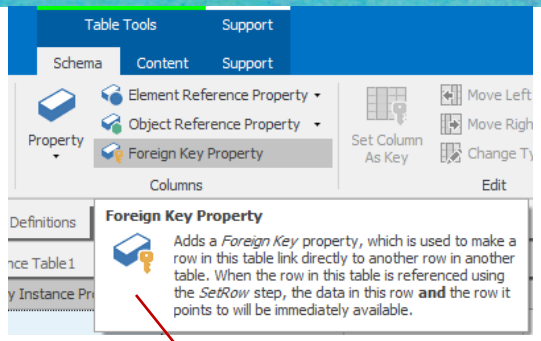

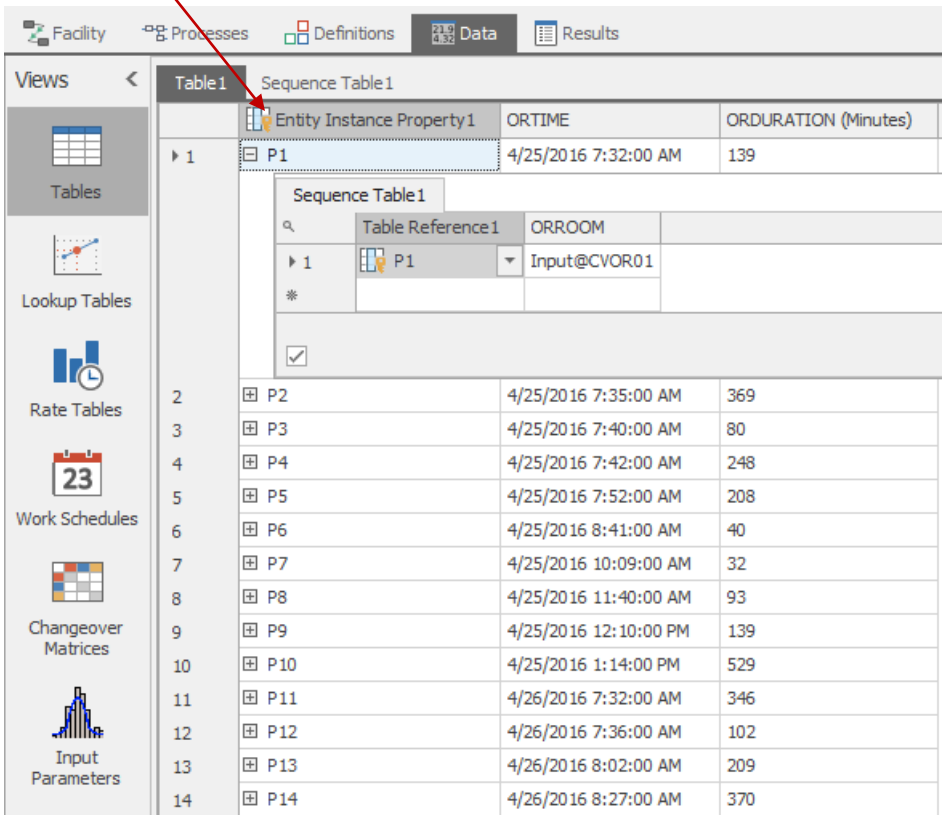

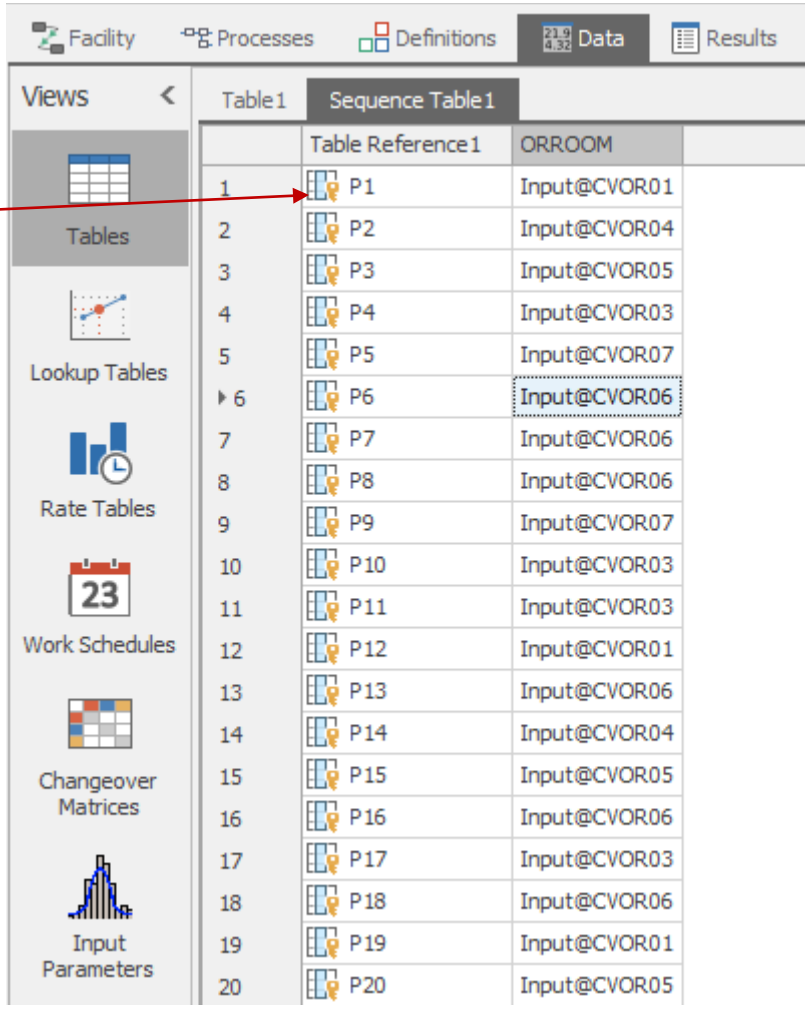

IF ENTITY TYPES MATTER

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Sequence Table1 | Procedure Type

	VIR Procedure	Mix	ProcedureTime (Minutes)
1	VIR_PERM_CATH_HCKMN_NEOSTR_PICC_GRTR_5YR	13.18	32.3
2	VIR_INSERT_CHEST_IMPLANTED_PORT_GRTR_5YR	6.45	42.4
3	VIR_NON_TUNCVC_VASCTH_LUMCVL_5_YEARS	4.7	41.1
4	VIR_CHANGE_CATH_NEPHRO_PERC	4.18	60.2
5	VIR_WRITTEN_CONSULT_INTERVENTIONAL	3.92	75.6
6	VIR_PLCMT_SEL_CATH_INT_CAROTID_W_INTRACRANL_ANGIO_UNI_RT	3.24	43.5

Sequence Table1

	VIR Procedure	Sequence
1	VIR_PLCMT_SEL_CATH_INT_CAROTID_W_INTRACRANL_ANGIO_UNI_RT	Input@BIPLANE
2	VIR_PLCMT_SEL_CATH_INT_CAROTID_W_INTRACRANL_ANGIO_UNI_RT	Input@Sink1

7	VIR_DRN_PERI_RETROPERITONEAL_PERC_W_IMAGE_RT	2.62	106.4

Sequence Table1

	VIR Procedure	Sequence
1	VIR_DRN_PERI_RETROPERITONEAL_PERC_W_IMAGE_RT	SINGLEPLANE
2	VIR_DRN_PERI_RETROPERITONEAL_PERC_W_IMAGE_RT	Input@Sink1

8	VIR_EXCHANGE_CATH_BILIARY_DRAIN	2.43	59
9	VIR_INSERT_INTRAVASC_VENA_CAVA_FLTR	2.01	39.6
10	VIR_REPLACE_PERMCTH_HCKMN_NEOSTAR	1.94	75.8
11	VIR_PLCMT_SEL_CATH_CAROTID_OR_INNOM_W_EXCRANL_ANGIO_UNI_RT	1.91	125
12	VIR_CHOLECYSTOSTOMY_PERC	1.55	110.2

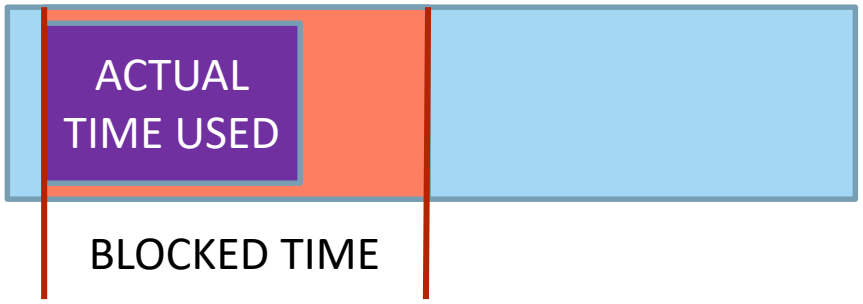
Properties: ENTRANCE (Source)

Show Commonly Used Properties Only

Entity Arrival Logic	
Entity Type	**ProcedureType.VIRProcedure**
Arrival Mode	Interarrival Time
Time Offset	0.0
Interarrival Time	**Random.Exponential(40)**
Entities Per Arrival	1
Stopping Conditions	
Maximum Arrivals	**15**
Maximum Time	Infinity
Stop Event Name	
Buffer Logic	
Table Row Referencing	
Before Creating Entities	
Action Type	Reference Existing Row
Table Name	**ProcedureType**
Row Number	**ProcedureType.Mix.RandomRow**
On Created Entity	
State Assignments	
Financials	
Add-On Process Triggers	
Advanced Options	
General	
Animation	

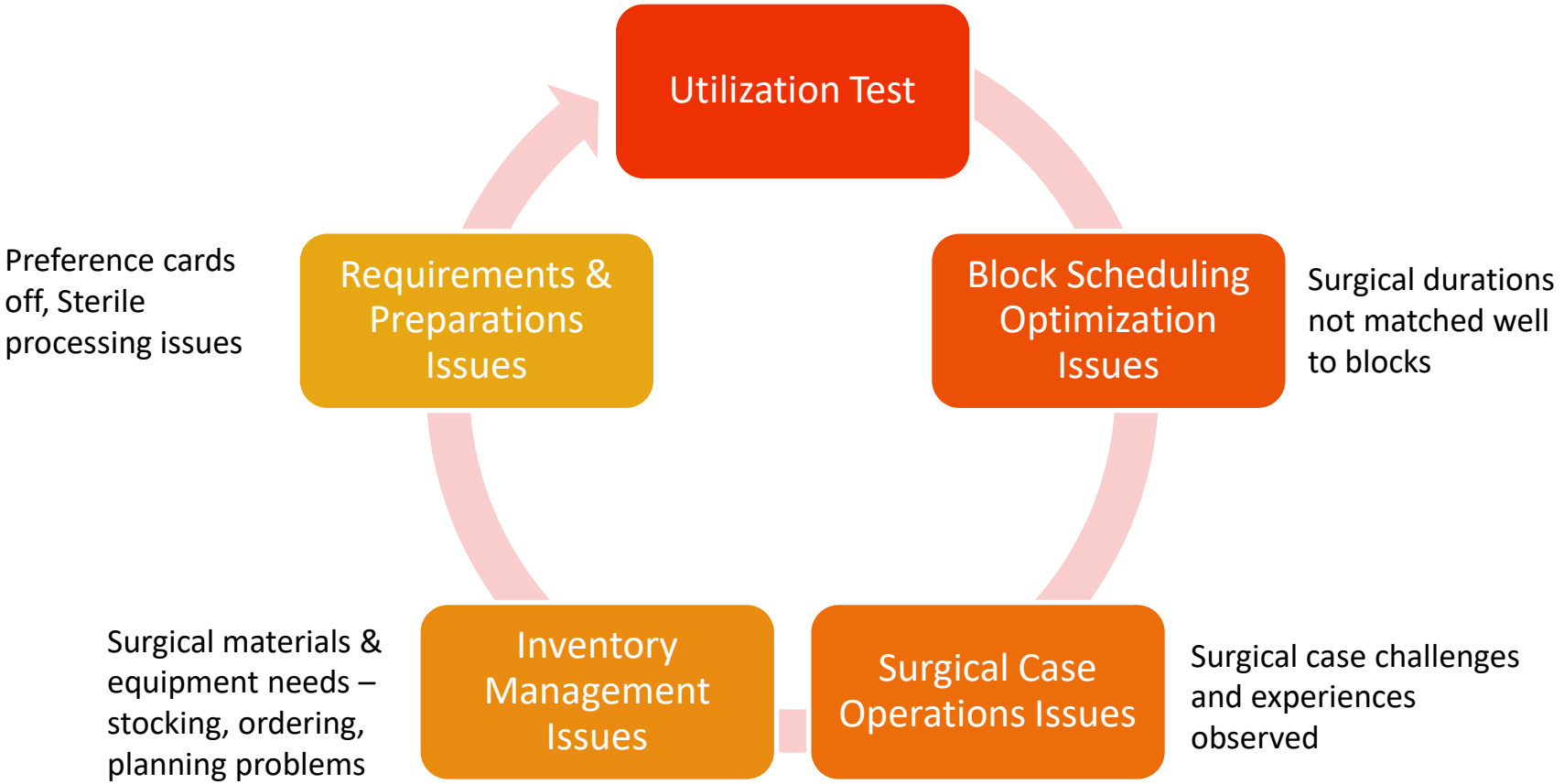
SIMULATION RESULTS

OR ROOM	EFFECTIVE UTILIZATION
CVOR1	47.8
CVOR3	62.0
CVOR4	60.4
CVOR5	56.8
CVOR6	62.7
CVOR7	58.9



- 3 years of data normalized the room utilization values leveling the hours when the OR rooms are shut down between 7A-7P
- Based on utilization values, there is an estimated 4-5 hours of unused time for each OR on a normalized scale
- Depending on block scheduling and if there is no cancelations, some rooms may have more unused time while others may be at full capacity
- Please consider one major factor, the model calculated the exact time the room was in use - the usage could be less than or exceed the time of the block schedule for the cases scheduled

PEELING THE ONION



TAKE-AWAYS

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- Take the time to break the model down in the simplest form
  - What matters and what doesn't
  - Process map to model design
- Translate the information appropriately and directly
  - Don't get fancy
  - Start small – bit by bit

QUESTIONS

What can I do better?