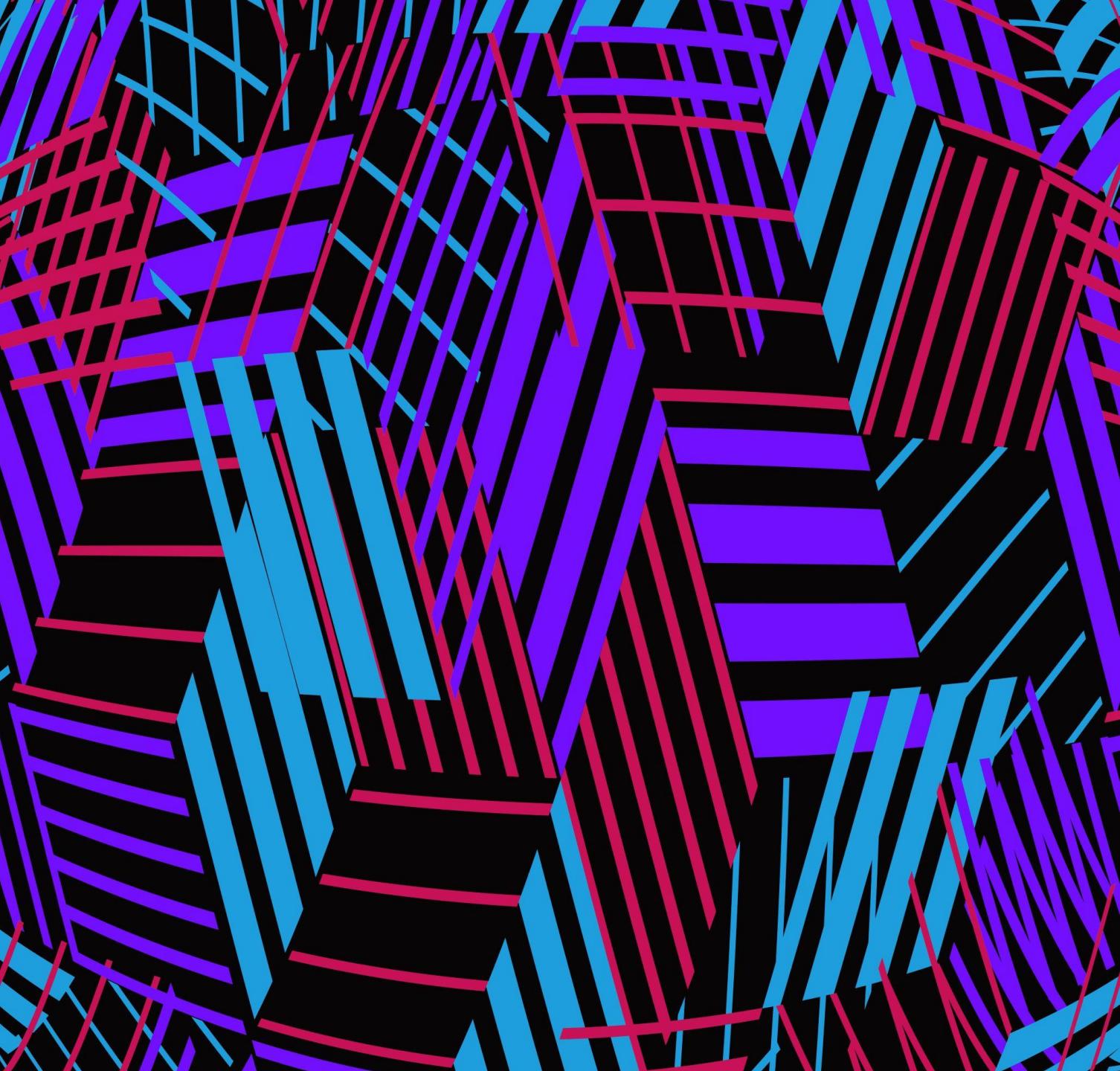


MCDA 5560

**Business Intelligence and
Data Visualization**

**Decision Analytics and
Process Management**

Michael Zhang



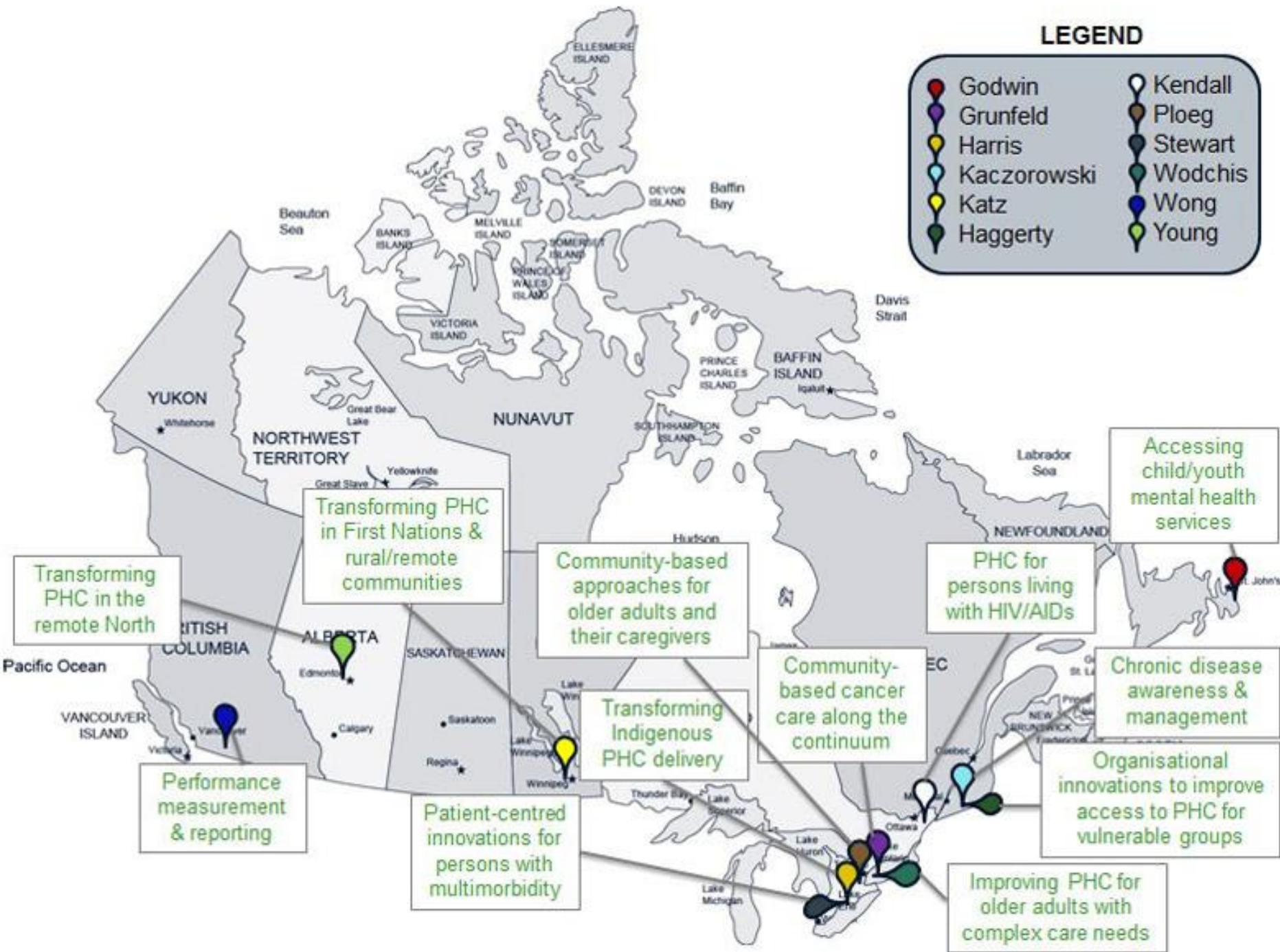
How to use Data to Make Decisions

Analytical & Critical Thinking (finding meaning in data)

- **Statistical literacy** → averages vs. distributions, correlation vs. causation.
- **Business problem framing** → translating vague questions into data queries.
- **Comparative analysis** → trends, cohorts, benchmarks, time-series analysis.
- **Decision logic** → recommending *why* and *what* to act on, not just *what happened*.
- **Scenario & sensitivity testing** → “What if we change this variable?”

- **Business problem framing** → translating vague questions into data queries.

Measuring Primary Care Services



CIHR IRSC

 Canadian Institutes of Health Research Institut de recherche en santé du Canada

Measuring Primary Care Services

Legend - Data sources

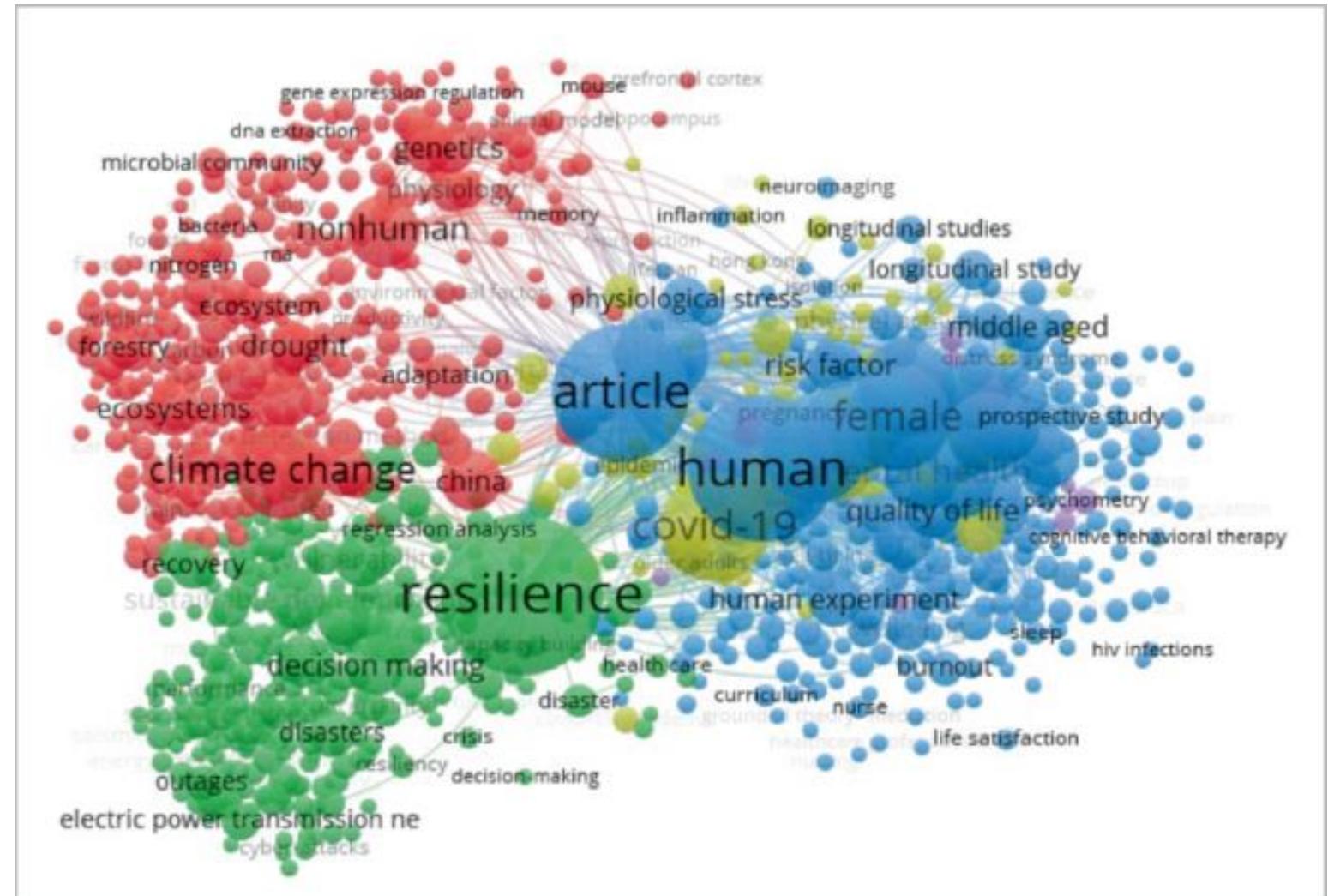
	Patient survey	Provider survey	Organizational survey	Health administrative data	
Access					Comprehensiveness
Difficulties accessing routine or ongoing care					Scope of services provided
					Team functioning (team effectiveness score)
					System integration (collaborative care)
Coordination					Effectiveness
					Continuity (information, relational, management)
Effectiveness					Equity
					Self-efficacy for managing chronic diseases
					Patient centredness
					Patient empowerment
					Hospitalizations for ambulatory care sensitive conditions
Equity					
					Vertical (access and care according to individual needs)
					Horizontal (equal access and care for those with the same need)



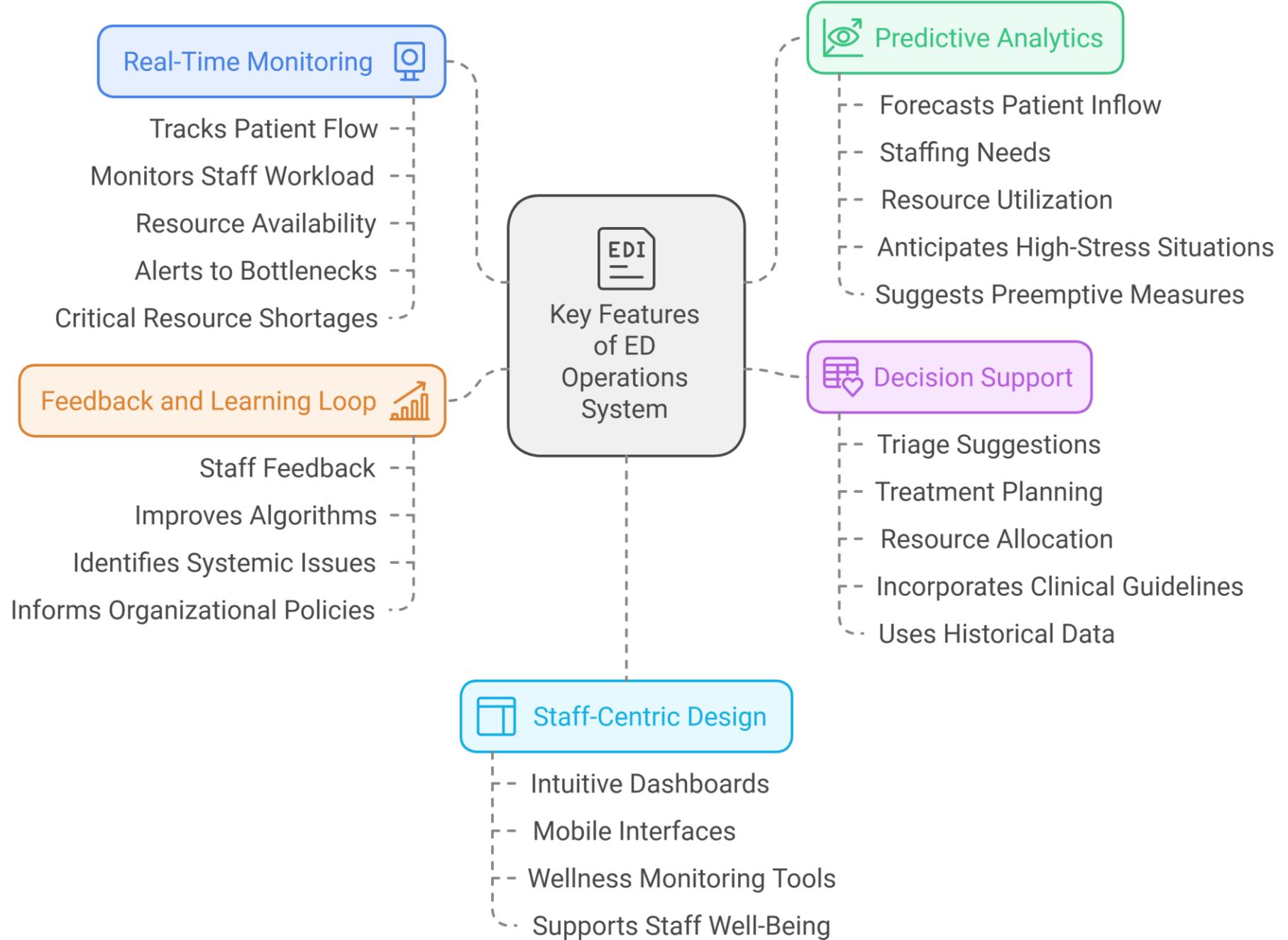
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Emergency Room Resilience



Emergency Room Resilience



QEII

HEALTH SCIENCES CENTRE
FOUNDATION



Solving the MRI Wait List



iCenter

Home Equipment Activity Report

Back to selection screen Utilization Overview Saved reports

Detailed utilization data with interactive on-screen analytics for imaging systems

Cover Disclaimer Summary Data Trends Operator Physician Exam Series Schedule Optimization A1 - Glossary A2 - Assets A3 - Operator A4 - Physician A5 - Exam type

Start 4/2/2024 End 4/29/2024

Schedule Optimization Overview

Assets	Total operational time	Total idle time	Idle percentage
1	247 hours	78 hours	31%

Idle time =

Hover for metric definitions Focus on specific assets?

Select assets 3.0T SIGNA 750 DD 32CH HOS • 902473MR2 • NSHA - HALIFAX IN...

Which assets were idle the most?

3.0T SIGNA 750 DD 32CH HOS • 902473MR2

Idle time as % of operational time

Total idle time hours by week

week starting > April 2024

	1	8	15	22	Grand Total
3.0T SIGNA 750 DD 32CH HOS • 902473MR2	18.9	16.3	21.6	20.8	77.6
Total	18.9	16.3	21.6	20.8	77.6

Idle periods throughout the day hours by day

3.0T SIGNA 750 DD 32CH HOS • 902473MR2

GE iCenter – 3T Efficiency

- April 2024
- 8am-9pm Mon-Fri
- Exams are defined from opening of exam to completion of final MRI series.

Chris Bowen

JR James Ri... KC Kalei Cro...

Alessand... Sharon C...

CD Davis, C... SB Steven B...

D Dave Carlos H...

Idle percentage depends on allowed gap between exams

- 0 min allowed -> 42% Idle
- 5 min allowed -> 31% Idle

Hours of operation

Begin hour	End hour
Mon 8 am	9 pm
Tue 8 am	9 pm
Wed 8 am	9 pm
Thu 8 am	9 pm
Fri 8 am	9 pm
Sat 9 am	5 pm
Sun 9 am	5 pm

Weekday

Monday
 Tuesday
 Wednesday
 Thursday
 Friday
 Saturday
 Sunday

Cancel Apply

Units of time hours

Include days which were fully idle? Exclude fully idle days

See total idle time or average idle period? Total idle time

Idle time adjustment (minutes to subtract from each idle period) 5

Breakdown of the MRI Project

1. MRI 2-bay Workflow Project:

- Simulate staff/patient actions through Siemens 2-bay MRI suite.
- Use sims to identify bottlenecks, staff overtasking and evaluate new patient scheduling proposals.

2. MRI Staff Scheduling Optimization:

- Incorporate MRI technologist preferences into staff schedule generation for all Halifax MR systems while maintaining operational hours.

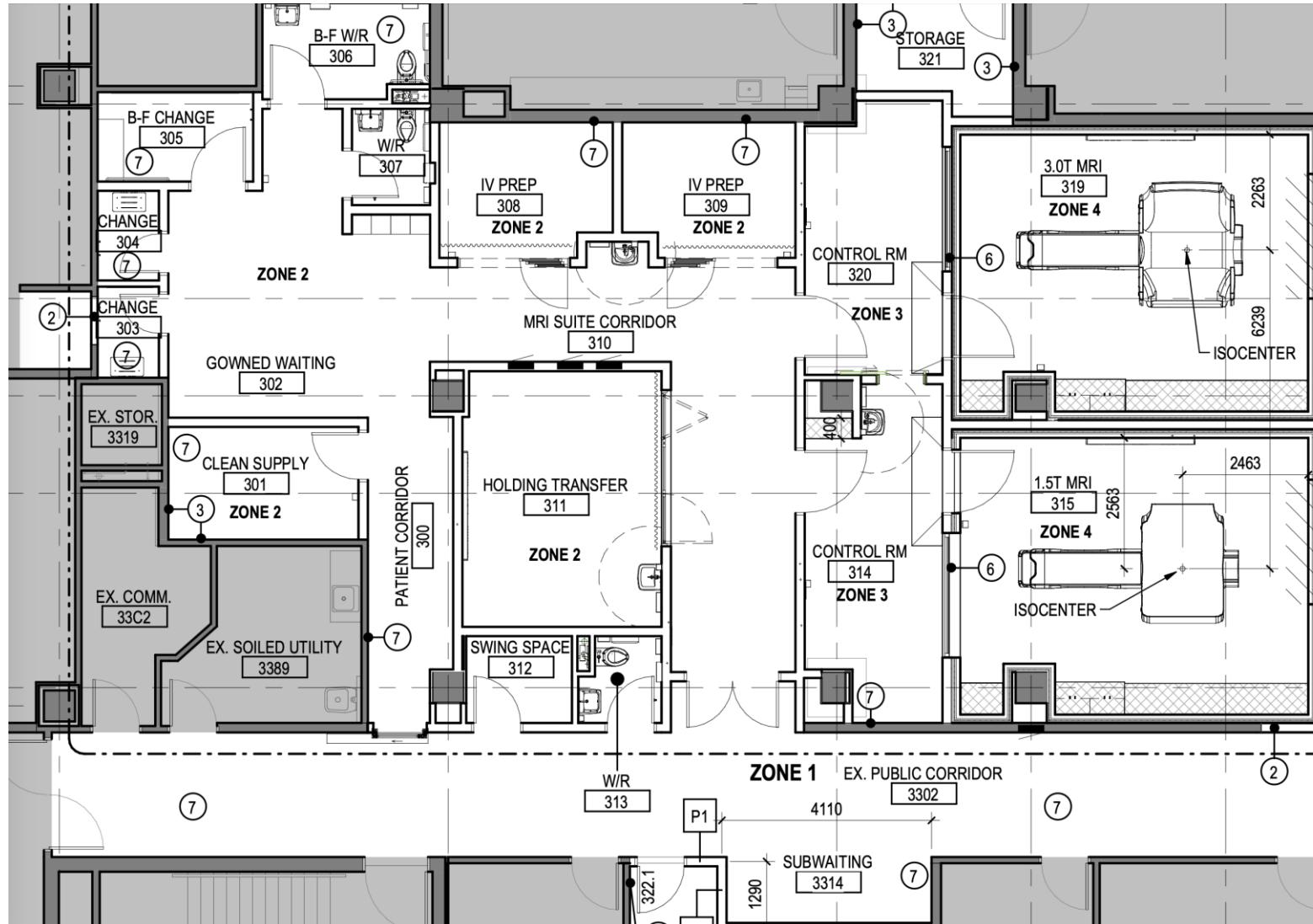
3. MRI Protocol Duration Analytics:

- Use metadata from PACs MRI database to calculate protocol duration for 154 MRI protocols deployed over MRIs across NS.
- Useful for tracking efficiency improvements and as future inputs to patient exam schedulers.

4. MRI Patient Scheduling Optimization (in progress):

- Use protocol duration data and 2-bay workflow sims to create a patient schedule with reduced scanner-idle time (no-shows, late-shows, patient withdraw).

MRI 2-Bay Workflow Project (#1)



3T MRI



- First 2-bay MRI suite in NS
 - 4 safety zone workflow
 - 6 staff operate facility (4 techs, 1 porter, 1 TA)

Can you take patient schedule
and staff workflow step map as
input and identify
bottlenecks/staff over-tasking?

Staff Task Itemization

Task	Staff Primary involved	Backup staff	Room occupied	Time to execute (min)	Probability of action required
Patient Registration Detected (PPF or WLM Dicom scanner)	TA	Scan tech	Z3	1	100
TA Staff notify Admin Tech of patient arrival	TA	Porter	Z2 office	1	100
Patient Sub-waiting detected	TA	Porter	Sub-wait	1	100
Patient fill out screen form	None	None	Sub-wait	5	100
Patient brought to Z2 wait	TA	Float Tech	Z2 wait	2	
Start Millineum	Admin tech		Z2 admin office	1	100
Patient changes (remove jewelry)	None	None	Change room Z2	5	100
Patient washroom	None	None	Bathroom Z2	5	100
Patient stores personal belongings	None	None	Z2 hall locker	3	100
Patient checked by TA and moved to a prep room	TA	Float Tech	Z2 hallway	2	100
Patient interview (safety, process to expect)	Float tech		Prep room (1of2)	5	100
Patient IV setup	Float tech		Prep room (1of2)	10	33
Patient complicated device lookup	Float tech		Prep room(1of2)	60	1
Float Tech/Scan tech private handover discussion	Float tech	scan tech	Z3 scanner	2	100
Patient injected in prep room	Float tech		Prep room(1of2)	1	0.1
Patient brough to scan room and setup	Float tech + scan tech		scan room (3T,1.5T)	5	100
Execute scan	Scan tech		scan room (3T,1.5T)	TBD (30 mins)	100
Remove patient from room and perform bed flip	Scan tech + TA			5	100
Scan paperwork to PACS, ensure data pushes	Scan tech		Z3	1	100
Patient supported in exiting facility	TA			1	
Patient in change room					
Patient in bathroom					
Patient at lockers					
Patient leaves Z2					

- MRI Tech Student Project identifying every step in process.
- Each step involves a primary staff, backup staff if primary unavailable, a space in floorplan, and an execution time.
- Simulate scenarios with varied probabilities (contrast setup, contrast reaction emergency, implant safety lookup).

Do we have the correct step template?

Patient Schedule Inputs (Template)

SIEMENS 1.5T (HIMR5)						
1.5 Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
7:00 STARTUP	STARTUP	STARTUP	STARTUP	STARTUP	STARTUP	STARTUP
7:15 QC	MSK	MSK	MSK	MSK	NEURO NON	NEURO NON
7:30						
7:45 NEURO	MSK	MSK	BODY 30 no rad	MSK	NEURO NON	NEURO NON
8:00						
8:15 CARDIAC (60 Mi	CARDIAC (60 Mi	CARDIAC (60 Mi	BODY 45 RAD CI	CARDIAC (60 Mi	BODY 30 no rad	BODY 30 no rad
8:30						
8:45					BODY 30 no rad	BODY 30 no rad
9:00						
9:15 INPT	CARDIAC (60 Mi	INPT		INPT	BODY 30 no rad	BODY 30 no rad
9:30						
9:45					BODY 45 RAD CHECK	MR ANY 45 min
10:00						
10:15	CARDIAC (60 Min)					
10:30					BODY 45 RAD CHECK	MR ANY 45 min
10:45						
11:00						
11:15	CARDIAC (60 Min)				BODY 45 RAD CHECK	MR ANY 45 min
11:30						
11:45						
12:00 RESEARCH		RESEARCH	CARDIAC (60 Min)		INPT	INPT
12:15		MSK 45 (Radtime)				
12:30						
12:45					INPT	INPT
13:00 CARDIAC (60 Mi	MSK 45 (Radtim	CARDIAC Clinic	INPT	CARDIAC P2	BREAK	BREAK
13:15						
13:30						
13:45		INPT				
14:00 CARDIAC (60 Min)		CARDIAC (60 Min)		CARDIAC (60 Min)		
14:15					INPT	INPT
14:30						
14:45					INPT	INPT
15:00 NEURO						
15:15						
15:30						
15:45						
16:00						
16:15 MSK						

SIEMENS 3T (HIMR6)						
Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
7:00 STARTUP	STARTUP	STARTUP	STARTUP	STARTUP	STARTUP	STARTUP
7:15 QC	NEURO	NEURO	NEURO	NEURO	NEURO	NEURO
7:30						
7:45 NEURO	NEURO	NEURO	NEURO		NEURO	NEURO
8:00				BODY 45 RAD CHECK		
8:15 NEURO				URGENT		
8:30	NEURO					
8:45 NEURO				NEURO		
9:00	NEURO				PROSTATE	PROSTATE
9:15						
9:30 Arthrogram	Arthrogram				INPT	INPT
9:45						
10:00 Arthrogram	Arthrogram				INPT	INPT
10:15						
10:30 Arthrogram	Arthrogram/ Call back Hip arthro				INPT	INPT
10:45						
11:00 MSK 45 (Radtim	INPT					
11:15						
11:30						
11:45 NEURO						
12:00						
12:15 NEURO						
12:30						
12:45 PRE DBS						
13:00						
13:15						
13:30 INPT						
13:45 NEURO						
14:00						
14:15 NEURO						
14:30						
14:45 NEURO						
15:00						
15:15 NEURO						
15:30						
15:45 NEURO ENH P3						
16:00						
16:15 NEURO ENH P3						

- Patient booking staff use these templates to create patient appointments.
- Each block represents an exam with specified duration (Inpatient time varies).
- Do simulations of different daily schedules produce different issues (bottlenecks, staff over-tasking)?
- Can simulations be validated with floor observational measures?
- Can a better template be devised to distribute workload more efficiently?

Dicom Headers

Patient

FRIENDMAN TBI PILOT 001
 PatientID: FRIENDMAN TBI PILOT 001
 PatientBirthDate: Thursday, November 10, 1988
 PatientSex: M

Study

Brain BIOTIC Friedman - TBI
 StudyDate: Sunday, November 10, 2024
 AccessionNumber:
 InstitutionName: Halifax Infirmary
 ReferringPhysicianName:
 StudyInstanceUID: 1.3.12.2.1107.5.2.50.177130.30000241110151822...
 StudyID: 7b1b1860-317b-49

Series

3D Sag T1 TR450 1mm iso
 Status: Unknown
 Modality: MR
 StationName: HMR6
 OperatorsName: CVB
 BodyPartExamined: BRAIN
 ProtocolName: 3D Sag T1 TR450 1mm iso
 SeriesInstanceUID: 1.3.12.2.1107.5.2.50.177130.20241110152659640...
 SeriesNumber: 5
 NumberOfTemporalPositions: 1
 PerformedProcedureStepDescription: Brain BIOTIC Friedman - TBI

Instance

Instance: 1
 SOPInstanceUID: 1.3.12.2.1107.5.2.50.177130.2024111015322589215802869
 NumberofFrames: 176

Labels

Add label +

Send to DICOMweb server

Interact

Delete this instance X

DICOM Tags

Show tag description

Meta header

0002,0000 (FileMetaInformationGroupLength): 200
 0002,0002 (MediaStorageSOPClassUID): 1.2.840.10008.5.1.4.1.1.4.1
 0002,0003 (MediaStorageSOPInstanceUID): 1.3.12.2.1107.5.2.50.177130.2024111015322589215802869
 0002,0010 (TransferSyntaxUID): 1.2.840.10008.1.2.1
 0002,0012 (ImplementationClassUID): 1.2.276.0.7230010.3.0.3.6.8
 0002,0013 (ImplementationVersionName): OFFIS_DCMTK_368

Dataset

0008,0005 (SpecificCharacterSet): ISO_IR 100
 0008,0008 (ImageType): ORIGINAL\PRIMARY\MINONE
 0008,0012 (InstanceCreationDate): 20241110
 0008,0013 (InstanceCreationTime): 152701.275000
 0008,0016 (SOPClassUID): 1.2.840.10008.5.1.4.1.1.4.1
 0008,0018 (SOPInstanceUID): 1.3.12.2.1107.5.2.50.177130.2024111015322589215802869
 0008,0020 (StudyDate): 20241110
 0008,0021 (SeriesDate): 20241110
 0008,0023 (ContentDate): 20241110
 0008,002a (AcquisitionDateTime): 20241110152701.275000
 0008,0030 (StudyTime): 152309.000000
 0008,0031 (SeriesTime): 153225.875000
 0008,0033 (ContentTime): 153226.281000
 0008,0050 (AccessionNumber):
 0008,0060 (Modality): MR
 0008,0070 (Manufacturer): Siemens Healthineers
 0008,0080 (InstitutionName): Halifax Infirmary
 0008,0081 (InstitutionAddress): Summer St 1796, Halifax, CA, B3H 3A6
 0008,0090 (ReferringPhysicianName):
 0008,1010 (StationName): HMR6
 0008,1030 (StudyDescription): Brain BIOTIC Friedman - TBI
 0008,103e (SeriesDescription): 3D Sag T1 TR450 1mm iso
 0008,1070 (OperatorsName): CVB
 0008,1080 (AdmittingDiagnosesDescription):
 0008,1090 (ManufacturerModelName): MAGNETOM Vida
 ▶ 0008,1111 (ReferencedPerformedProcedureStepSequence): []
 ▶ 0008,9092 (ReferencedImageEvidenceSequence): []
 0008,9205 (PixelPresentation): MONOCHROME

Worklist Browser Tools

Hosts: AW Server Filters: All Search:

State	Name	Patient ID	Description	Date	Accession	Exam...	Institu...	Locked	Station	
All	083BD,	038BD	e+1 CALKIN BP	November 10, 2021 1...	083BD	51858	NSHA ...	Locked	HMR2	
...	084,	084	e+1 CALKIN BP	November 24, 2021 11...	084	51905	NSHA ...	Locked	HMR2	
...	09-13-0000, ALLIANCEJA...	09-13-0000	ALLIANCE	January 15, 2016 12:4...		1627	CHD	Locked	HMR2	
...	09-13-8888-DW, 09-13-888...	09-13-8888-A	Alliance	December 4, 2015 12:...	09-13-88...	1466	CHD	Locked	HMR2	
...	Op5T_RNW_S001, Op5T_R...	Op5T_RNW_S...	NSA Stroke	December 1, 2021 11...		1429	Nova S...	Locked	SYNMR...	
...	10,	10	DEMPSTER	May 25, 2022 11:12 AM		24104	NSHA ...	Locked	HMR2	
...	1022627,	NSEPP-CIHR...	CANDICE NODDI CIHR	January 29, 2020 9:45 ...		16380	NSHA ...	Locked	HMR2	
...	1022627, 004-B	NSEPP-CIHR...	CANDICE NODDI CIHR	January 22, 2020 9:56 ...	004-B	16322	NSHA ...	Locked	HMR2	
...				May 6, 2019 8:59 AM		13512	NSHA ...	Locked	HMR2	
...				May 22, 2019 10:50 AM		13690	NSHA ...	Locked	HMR2	
...				May 17, 2019 5:29 PM		13678	NSHA ...	Locked	HMR2	
...				May 6, 2019 7:58 AM		13511	NSHA ...	Locked	HMR2	
...				May 15, 2019 10:49 AM		13648	NSHA ...	Locked	HMR2	
...				May 29, 2019 1:06 PM		13805	NSHA ...	Locked	HMR2	
...				June 21, 2019 3:41 PM		14104	NSHA ...	Locked	HMR2	
...				January 15, 2020 9:01 ...		16232	NSHA ...	Locked	HMR2	
...				January 31, 2020 2:07 ...	072	16408	NSHA ...	Locked	HMR2	
...				January 29, 2020 7:06 ...	073	16386	NSHA ...	Locked	HMR2	
...				May 15, 2019 1:15 PM		13649	NSHA ...	Locked	HMR2	
...				May 25, 2022 11:58 AM		24105	NSHA ...	Locked	HMR2	
...				October 28, 2022 8:32 ...		25974	NSHA ...	Locked	HMR2	
...				January 19, 2022 4:36 ...		22748	NSHA ...	Locked	HMR2	
...				June 15, 2022 2:52 PM	13	24426	NSHA ...	Locked	HMR2	
...				June 24, 2022 1:52 PM	14	24559	NSHA ...	Locked	HMR2	
...				July 13, 2022 11:35 AM	15	24815	NSHA ...	Locked	HMR2	
...				July 20, 2022 2:50 PM	16	24902	NSHA ...	Locked	HMR2	
...				July 27, 2022 11:16 AM	17	25001	NSHA ...	Locked	HMR2	
...				May 15, 2024 4:38 PM		FORBOW	33068	NSHA ...	Locked	HMR2
...				January 9, 2022 8:10 PM		18000	CHD	Locked	HMR2	
...				April 11, 2021 12:00 PM		1317	IWK	Locked	IWGE...	
...				January 19, 2022 5:17 ...		22749	NSHA ...	Locked	HMR2	
...				March 20, 2019 12:00 ...	24	DEFA...	JWIN7	Locked		
...				January 3, 2013 12:00 ...	3	DEFA...	JWIN7	Locked		
...				September 15, 2017 4:...	33A	DEFA...	JWIN7	Locked		
...				September 16, 2017 9:...	33B	DEFA...	JWIN7	Locked		
...				January 30, 2004 9:30 ...	50A	DEFA...	JWIN7	Locked		

Series list

Candice Noddi CIHR

Type	Series	Description	Images	Operat...
Exam: Candice Noddi CIHR				
= Original	1	RM: 3Plane Loc SSFSE	30	JAM
= Original	3	Sag IR FSPGR 1.0	184	JAM
= Original	4	Sag CUBE T2 1.0	184	JAM
= Original	6	DTI Bmap - Rev	608	JAM
= Original	7	DTI NODDI 30x2sh	5168	JAM
= Original	8	MPRAGE TI=400ms 2x2	102	JAM
= Original	9	MPRAGE TI=1000ms 2x2	102	JAM
= Original	10	MPRAGE TI=150ms 2x2	102	JAM
= Original	11	B1 map	40	JAM
= Original	12	DESPO1 FLIP3 TR10 2x1	102	JAM
= Original	13	DESPO1 FLIP20 TR10 2x1	102	JAM
= Original	14	EPI NoMUX Cal	408	JAM

Image preview Image list



S 126
 Ex: 13648/NSEPPCIR-032
 Sx: 3
 Im: 83
 May 15, 2019
 10:51:36 AM

Bowen Procedure Count Dashboard (Central Zone) ❤️ ⓘ

12m ago ⓘ ⓘ ⏺

Procedure Date Range

Individual AE Title Analysis? (default all CZ)

is from 2024/05/01 until 2024/12/31

VGMRVGMR

BLMR1

HIMR2

HIMR3

HIMR4

HIMR5

HIMR6

dgmr1

MRI Procedure Count by Magnet (Central Zone)

	Year - month	>	2024 - MAY	2024 - JUNE	2024 - JULY	2024 - AUGUST	2024 - SEPTEMBER	2024 - OCTOBER	2024 - NOVEMBER	2024 - DECEMBER	Total
	Scanner		#Procedures	#Procedures	#Procedures	#Procedures	#Procedures	#Procedures	#Procedures	#Procedures	#Procedures
1	HI - GE 3T		449	347	382	354	222	Ø	Ø	Ø	1,754
2	HI Trailer - GE 1.5T		332	296	90	1	Ø	Ø	Ø	Ø	719
3	VG - GE 1.5T		281	302	292	278	211	276	278	208	2,126
4	Dartmouth - GE 1.5T		Ø	106	449	382	428	447	480	378	2,670
5	HI - Siemens 1.5T		Ø	Ø	Ø	12	183	358	369	385	1,307
6	HI - Siemens 3T		Ø	Ø	Ø	Ø	182	357	377	929	929
7	Bayers Lake - Siemens 1.5T		Ø	Ø	42	190	152	136	201	120	841
8	HI Neuro - Syn 0.5T		Ø	6	8	13	4	Ø	Ø	Ø	31
Totals			1,062	1,057	1,263	1,230	1,213	1,399	1,685	1,468	10,377

MRI Procedure Count by Section (Central Zone)

	Year - month	>	2024 - MAY	2024 - JUNE	2024 - JULY	2024 - AUGUST	2024 - SEPTEMBER	2024 - OCTOBER	2024 - NOVEMBER	2024 - DECEMBER	Total
	Section		#Procedures	#Procedures	#Procedures	#Procedures	#Procedures	#Procedures	#Procedures	#Procedures	#Procedures
1	Body		241	182	161	150	134	183	316	300	1,667
2	Cardiac		35	24	29	30	46	52	39	32	287
3	Chest		7	3	2	3	4	1	8	10	38
4	Interventional		1	Ø	1	Ø	1	Ø	2	Ø	5
5	MSK		115	173	128	157	209	173	222	173	1,350
6	Neuro		660	565	490	505	385	539	617	571	4,332
7	Other		3	4	3	3	6	4	1	4	28
Totals			1,062	951	814	848	785	952	1,205	1,090	7,707

- Monthly Exam counts in CZ increased from ~1050 to ~1250 in July when DG opened.
- DG performs ~450 exams/month offsetting ~250 lost exams in July from Trailer MRI closure.
- Monthly Exam counts ~1700 in November as both Siemens magnets schedule stabilizing.

Protocol Duration – HI Siemens Site

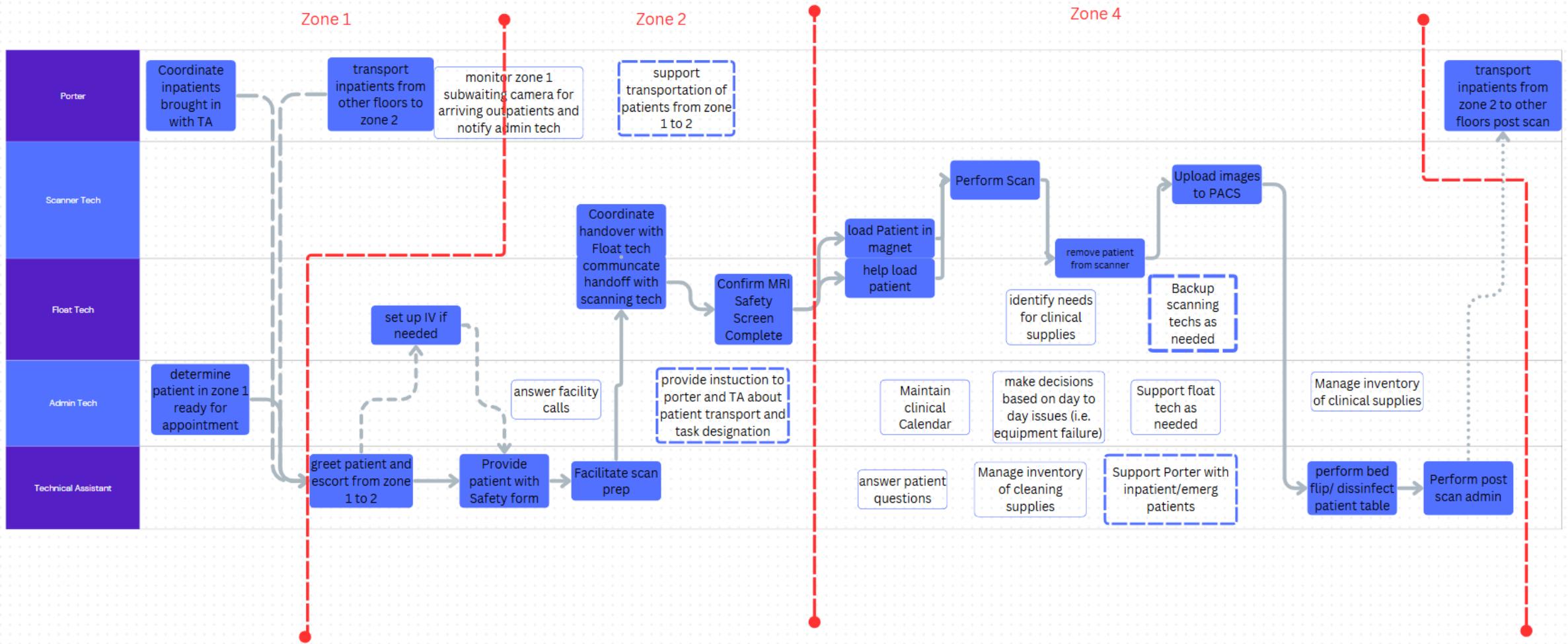
Siemens 3T Body Protocols – Oct 2024

Protocol	Number Exams	Mean Duration	Std Duration	Mean Prep D	Booking Time	Bed Flip Time
Pelvis Prostate Prostate	75	22.0	5.0	1.4	30	8.0
Pelvis Prostate Prostate+Gd	2	38.3	14.9	6.0	45	6.8
Pelvis Rectal/Anal Ca	7	47.4	8.2	5.9	60	12.6
Pelvis Routine Pelvis	3	28.2	9.0	6.7	45	16.8
Pelvis Perianal Fistula	2	49.1	10.7	0.6	45	-4.1
Pelvis Endometrial/Cervical Ca	2	58.2	5.2	0.5	60	1.8
Abdomen Liver	2	50.5	23.5	0.6	45	-5.5
Pelvis Penile	1	39.4	#DIV/0!	1.0	60	20.7
Abdomen Pancreas	3	37.8	12.2	9.4	45	7.2
Abdomen Renals	1	38.3	#DIV/0!	0.6	45	6.7

Siemens 1.5T Cardiac Protocols – Oct 2024

Protocol	Number Exams	Mean Duration	Std Duration	Mean Prep D	Booking Time	Bed Flip Time
Cardiac Infiltrative	21	68.9	14.3	7.4	90	21.1
Cardiac Infiltrative-No Gd	1	27.9	#DIV/0!	8.0	90	62.2
Cardiac Arrhythmia (ARVD)	3	53.3	3.6	0.5	90	36.7
Cardiac Coarctation/Marfan's	1	29.0	#DIV/0!	0.5	45	16.0
Cardiac Hypertrophic Cardiomyopathy (HCM)	4	59.7	13.3	3.8	90	30.3
Cardiac Tetralogy of Falot	3	45.6	12.0	2.7	60	14.4
Cardiac Viability	1	49.5	#DIV/0!	1.3	90	40.5
Cardiac Connective Tissue (CTC)	2	47.7	17.3	13.4	45	-2.7
Cardiac RV Function	2	18.7	2.3	1.1	30	11.3
Cardiac Takayasu	1	61.2	#DIV/0!	0.7	90	28.8

Swimlane Diagram for MRI





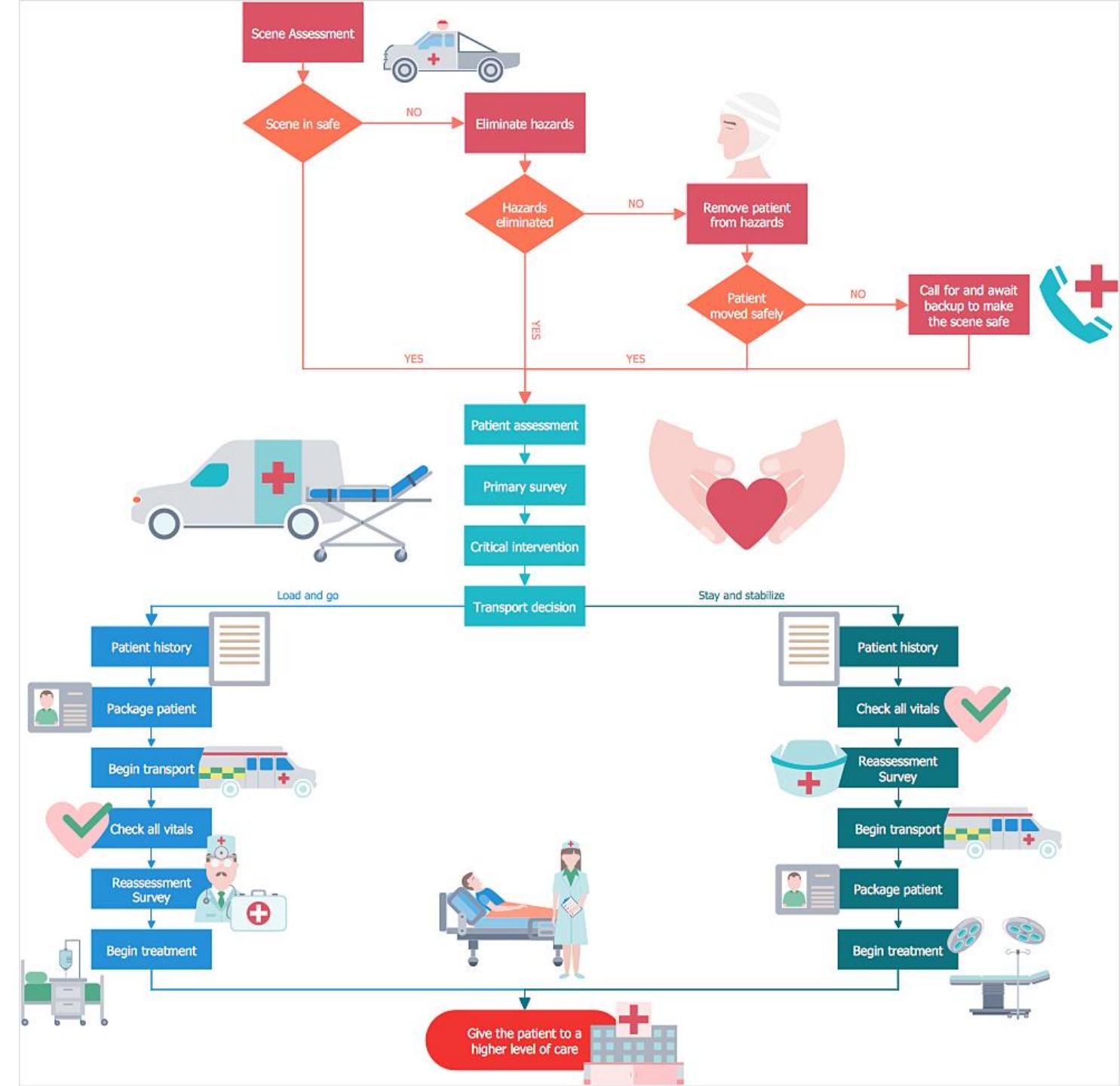
- **Process** refers to a series of actions or steps taken to achieve a specific goal or produce a particular result.
- A well-defined process helps ensure consistency, efficiency, and quality in achieving the desired outcome.

- **Process management** is the discipline of overseeing and improving processes to enhance efficiency, productivity, and quality. It involves identifying, analyzing, designing, executing, monitoring, and optimizing processes within an organization or system.



Process Flow Chart

- A flowchart is a picture of the separate steps of a process in sequential order. It is a generic tool that can be adapted for a wide variety of purposes, and can be used to describe various processes, such as a manufacturing process, an administrative or service process, or a project plan. It's a common process analysis tool and one of the seven basic quality tools.
- Elements that may be included in a flowchart are a sequence of actions, materials or services entering or leaving the process (inputs and outputs), decisions that must be made, people who become involved, time involved at each step, and/or process measurements.



Arena Simulation Software

Take the guesswork out of your decision making. Move confidently forward using Arena software.

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What is Simulation Software?

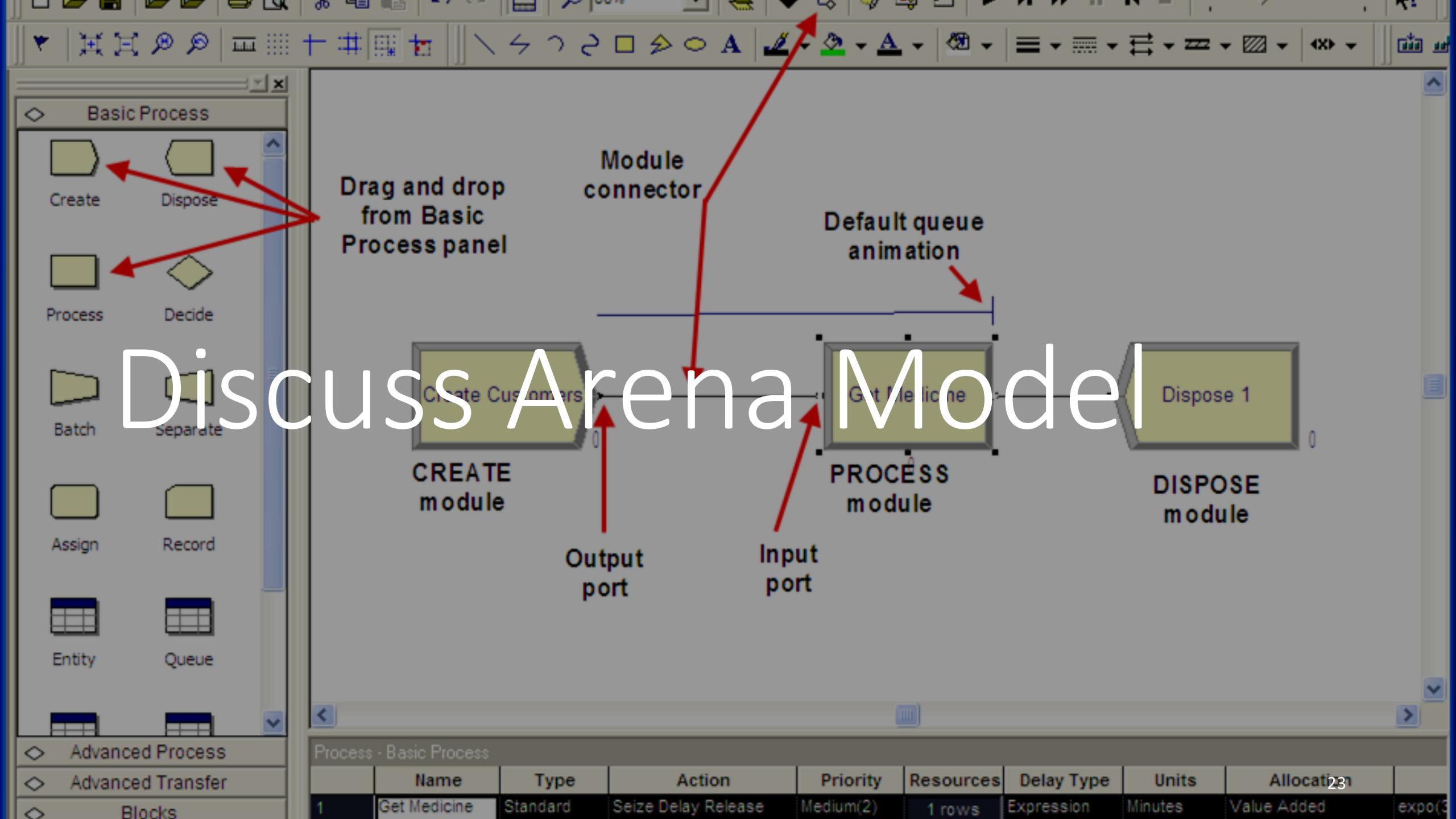
Simulation software is the creation of a digital twin using historical data and vetted against your system's actual results. Arena™ Simulation Software uses the discrete event method for most simulation efforts, but you will see in using the tool that we cover areas in flow and agent-based modeling as well.



Objectives

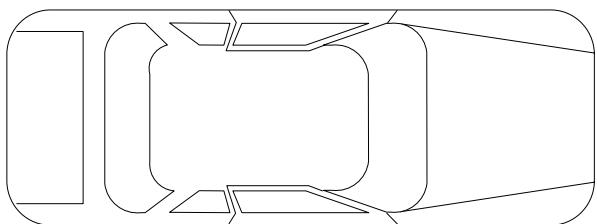
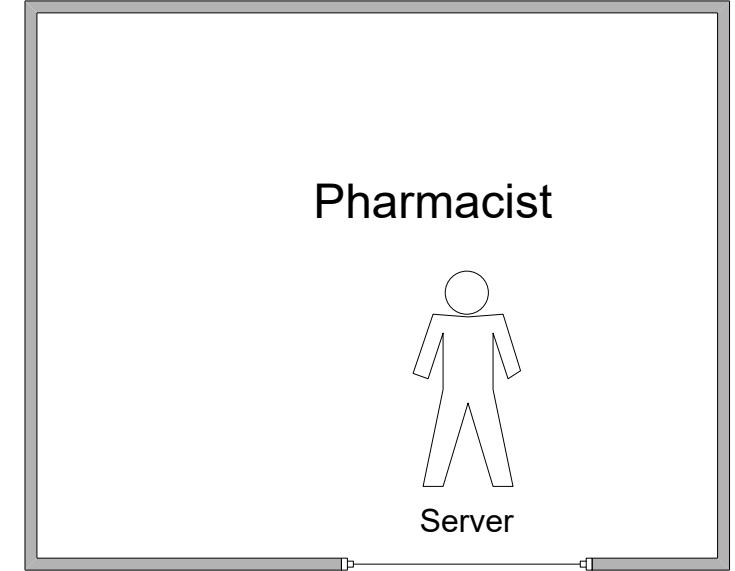
- To provide an overview of process modeling
- To understand the basic components of the Arena Environment
- To be able to perform simple Monte Carlo simulations in Arena
- To be able to recognize and define the characteristics of a discrete-event dynamic system (DEDS)
- To be able to develop and read an activity flow diagram
- To be able to create, run, animate, and examine the results of an Arena model of a simple DEDS

Discuss Arena Model

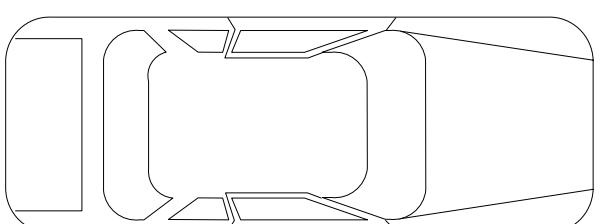
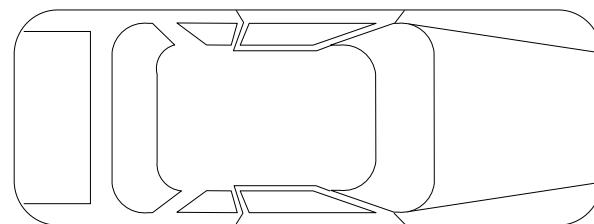


Drive Through Pharmacy

- Customers arrive at a drive through pharmacy window according to a Poisson distribution with a mean of 10 per hour.
- The time that it takes the pharmacist to serve the customer is random and data has indicated that the time is well modeled with an exponential distribution with a mean of 3 minutes.
- Customers who arrive to the pharmacy are served in the order of arrival and we assume that enough space is available within the parking area of the adjacent grocery store to accommodate any waiting customers



Waiting Line of Customers



Customer being served

