TEAM TWO

ANLY482: Analytics Practicum
Executive Presentation

Identifying key predictors that affects the Length-of-Stay (LOS) in the Emergency Department of a local hospital

THE TEAM

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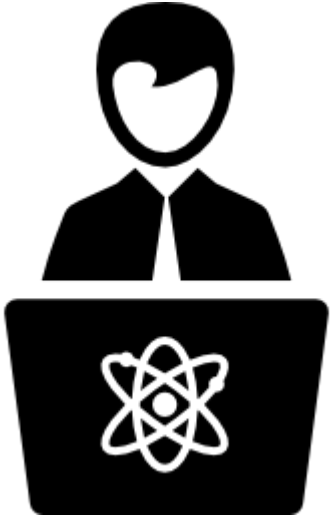

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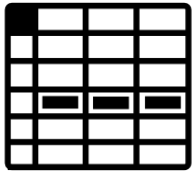
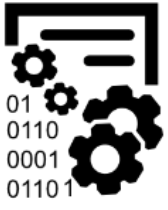
AGENDA

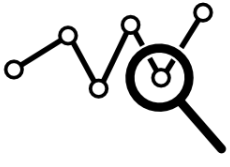
BACKGROUND



DATA DETAILS



FINDINGS



RECOMMENDATIONS

BACKGROUND

MOTIVATION

A&E units flooded with non-emergency cases

Such cases make up more than half of A&E patients in four public hospitals

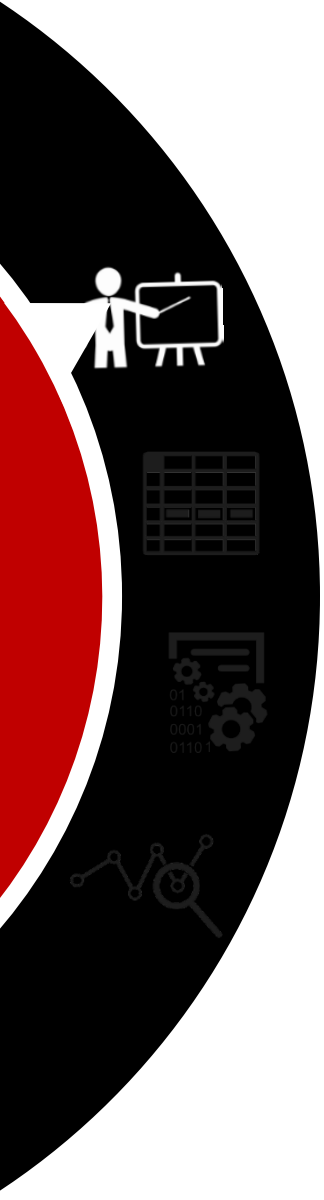
PUBLISHED ON MAR 31, 2013 6:00 AM

Every hospital, like CGH (above), has signs informing patients of the expected waiting time. -- BERITA HARIAN FILE PHOTO

MOTIVATION

High volume of non-critical patients cause some patients to encounter high Length-of-Stay (LoS)

Results in wait-time to exceed national guidelines and patients suffer in terms of service efficiency



OBJECTIVES

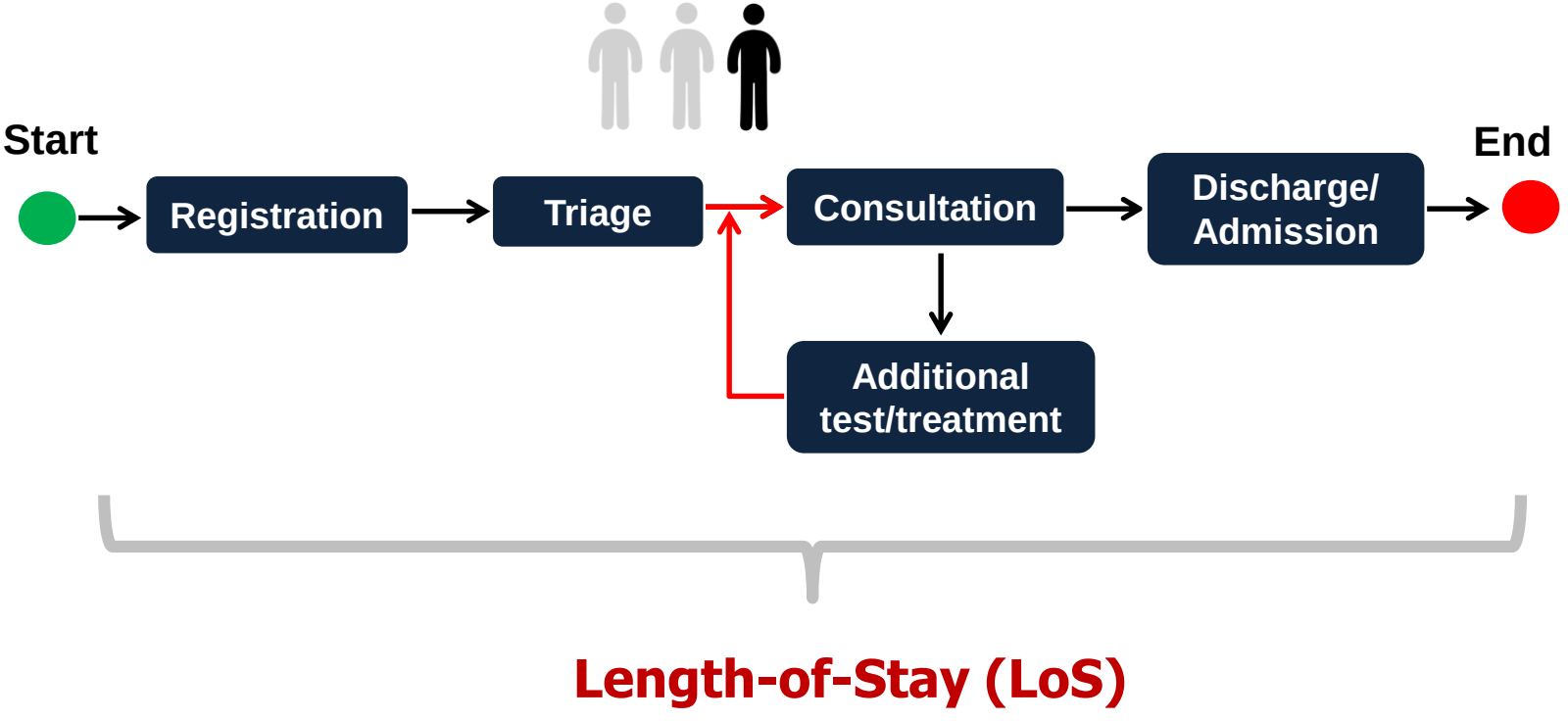
Identify the **key predictors** that affects the P3 patient's Length-of-Stay (LoS) in the Emergency Department

No. Of Re-entries

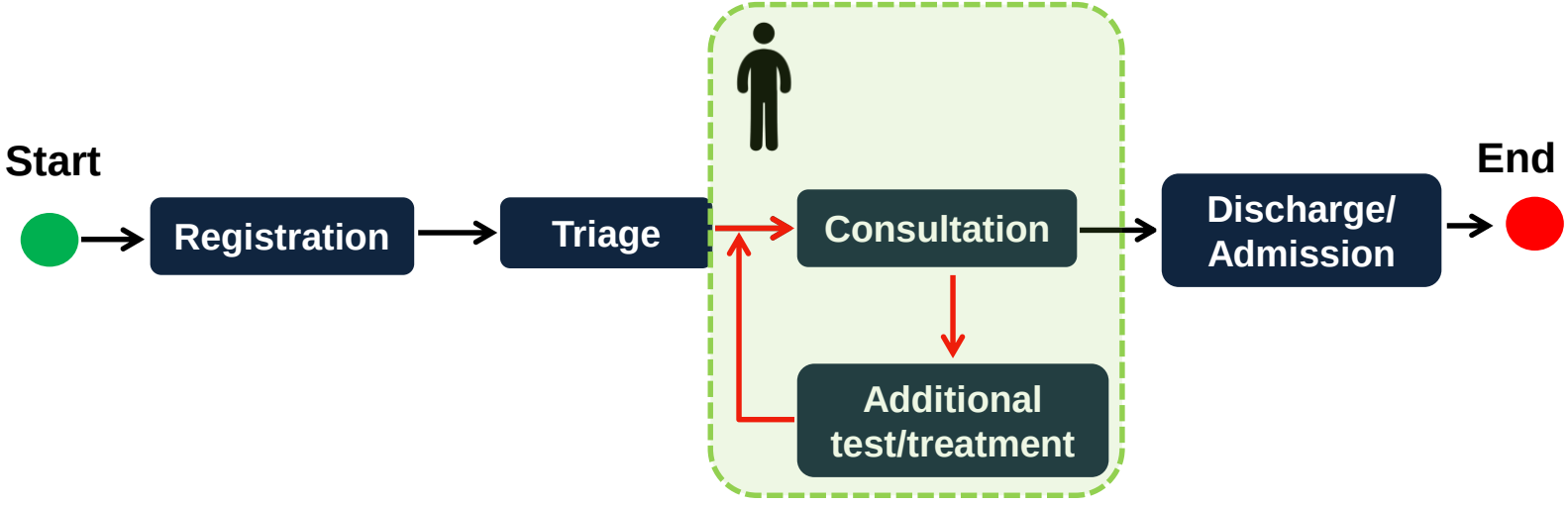
Type of Tests Ordered

Results of Laboratory Test

PROCESS FLOW IN EMERGENCY DEPT

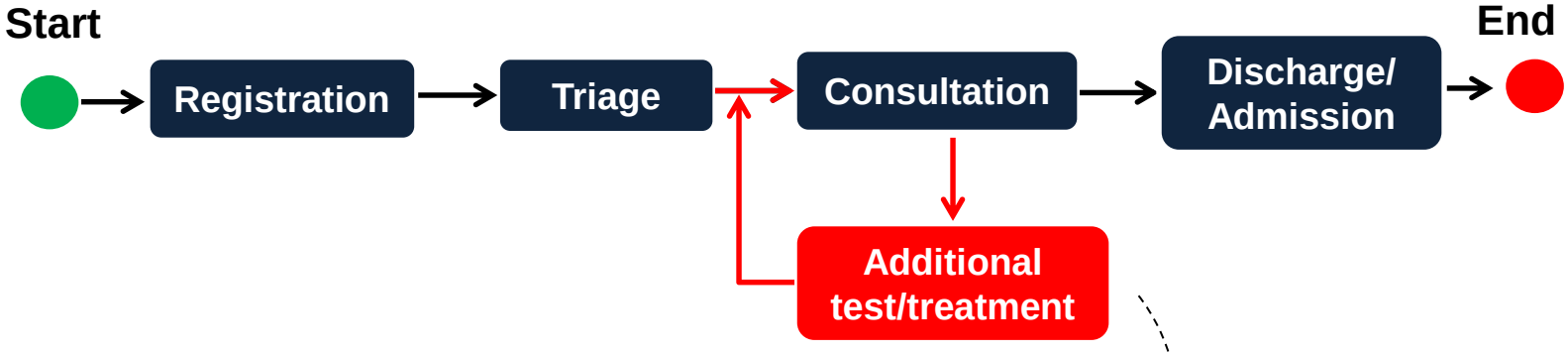


PROCESS FLOW IN EMERGENCY DEPT



NO OF RE-ENTRIES: 2

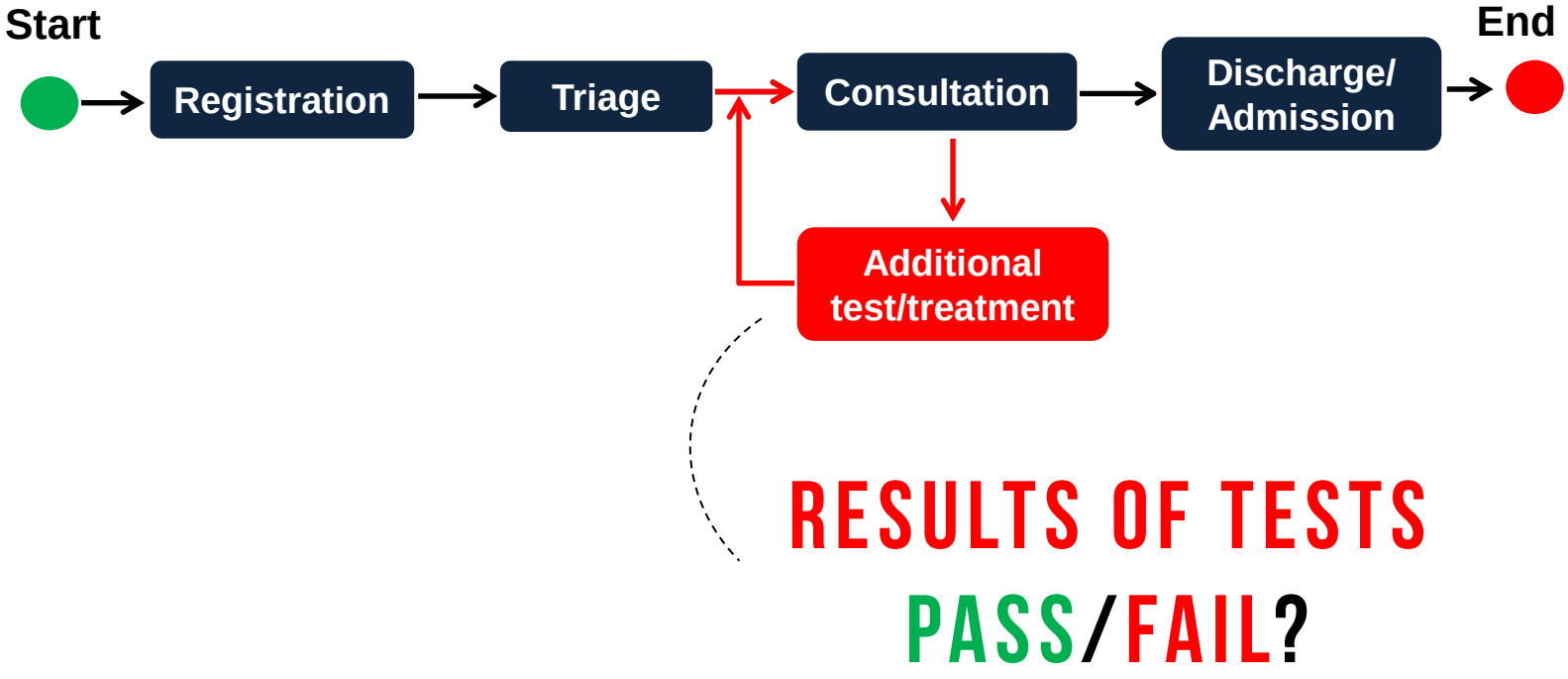
PROCESS FLOW IN EMERGENCY DEPT



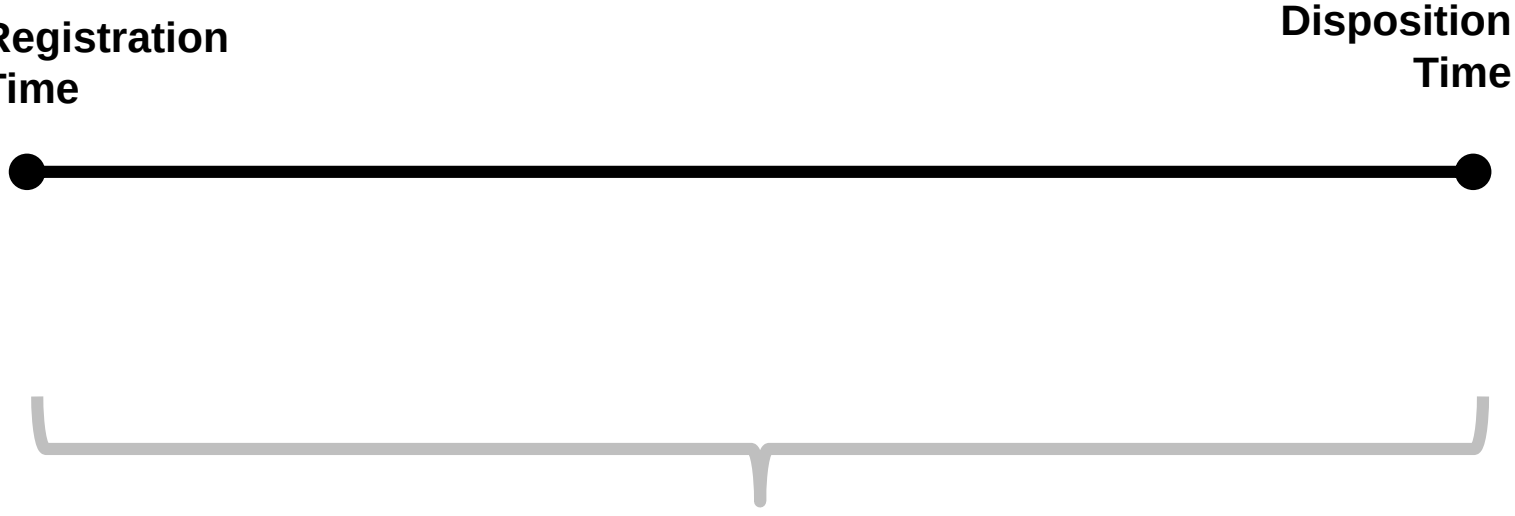
TYPE OF TESTS ORDERED

BLOOD TEST?
X-RAY?
MEDICATION?

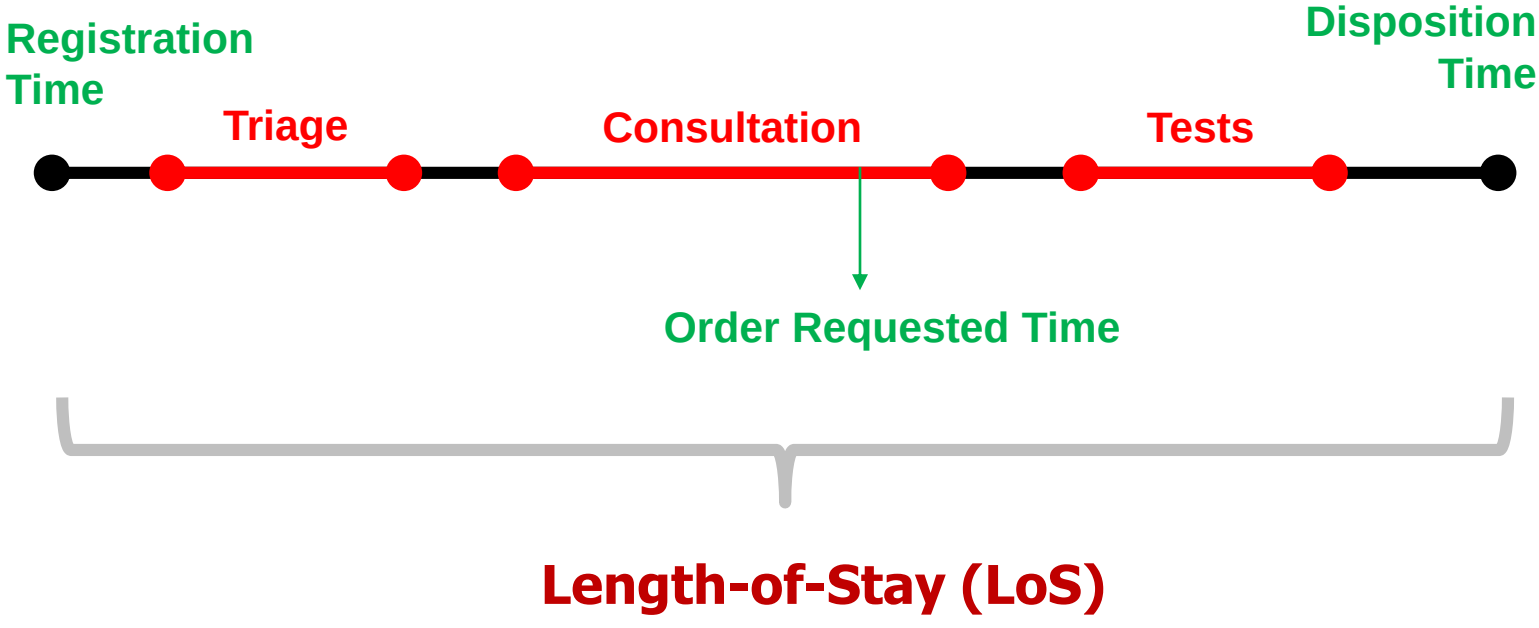
PROCESS FLOW IN EMERGENCY DEPT

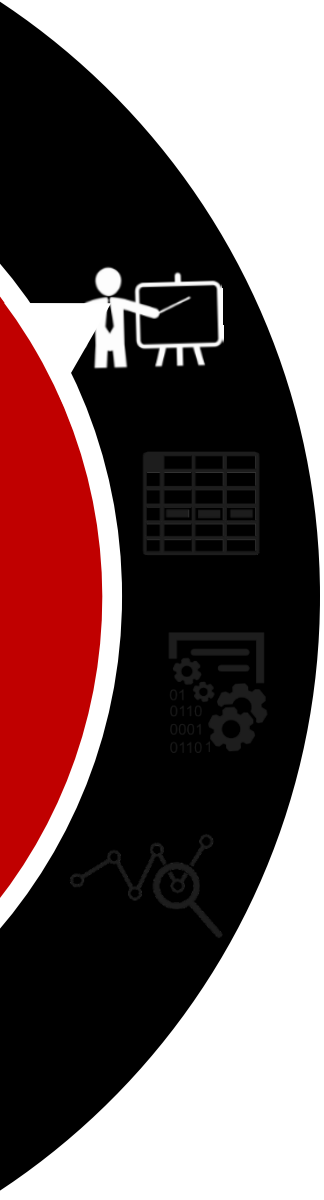


PROCESS FLOW IN EMERGENCY DEPT



PROCESS FLOW IN EMERGENCY DEPT



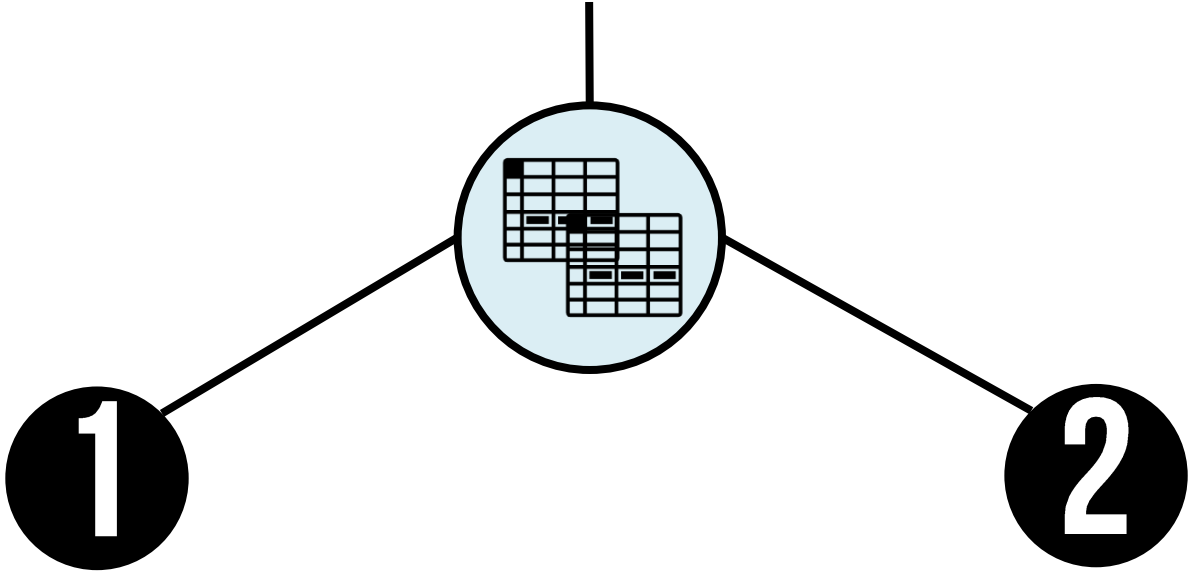


DATA DETAILS

DATA SETS

January 2013 — March 2013

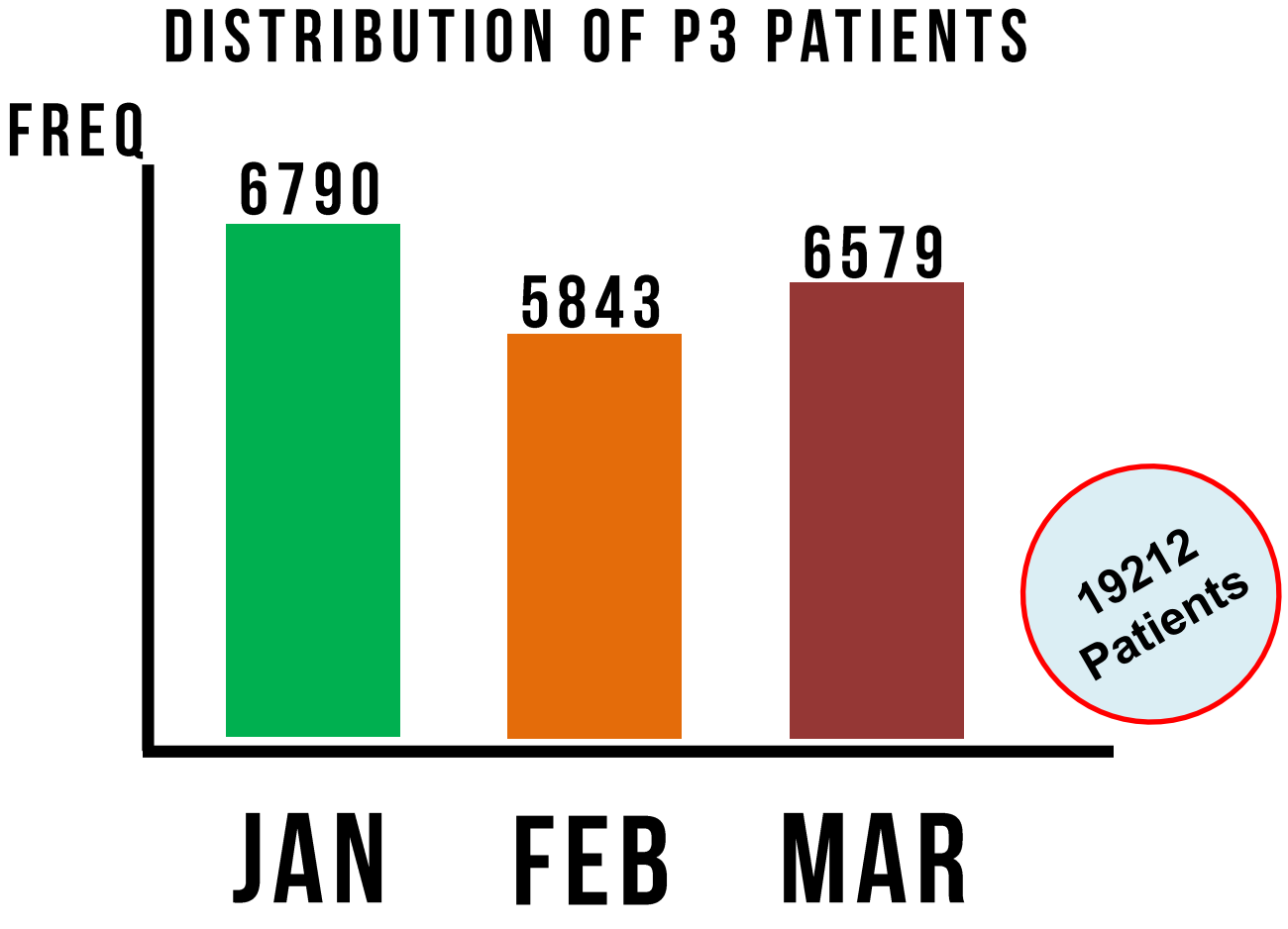
3 Months



1 EMERGE

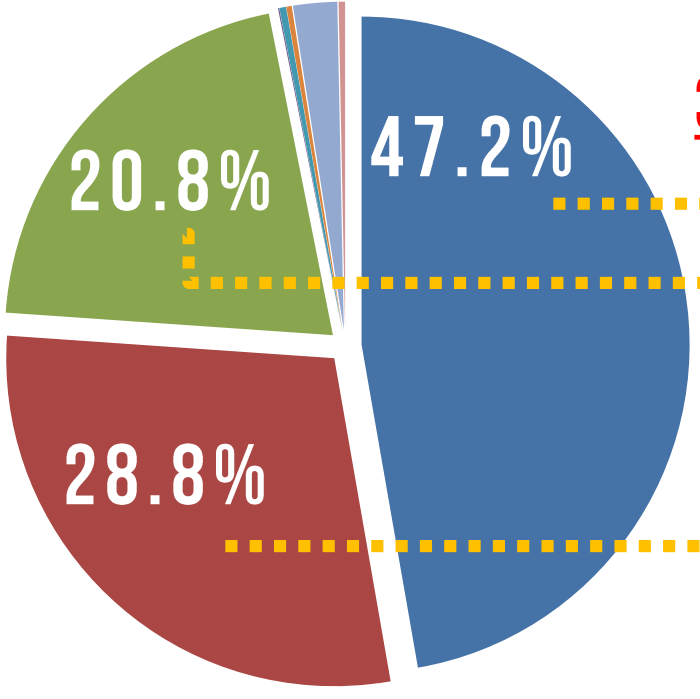
2 CPOE

DATA SETS


DISTRIBUTION OF P3 PATIENTS
FREQ
6790
5843
6579
19212 Patients
JAN
FEB
MAR

DATA SETS

PROPORTION OF TESTS ORDERED



3 MAJOR TEST CATEGORIES

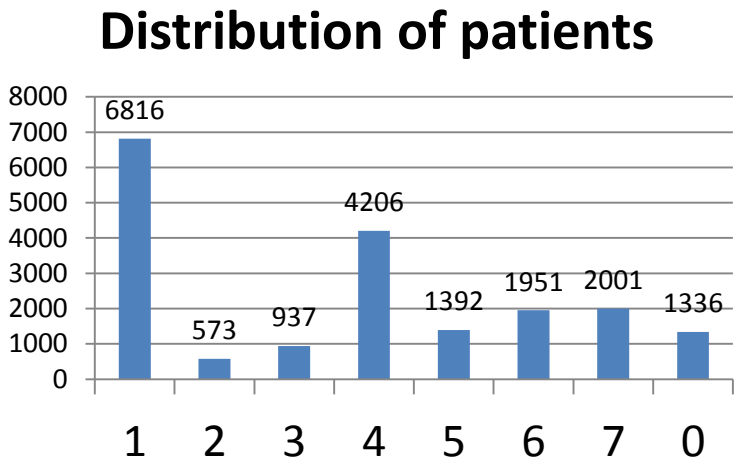
- NON-PARENTERAL
- LABORATORY
- RADIOLOGY

~97%

DATA SETS

7 COMBINATIONS OF TESTS

1. 1 TEST - NON-PARENTERAL
2. 1 TEST - RADIOLOGY
3. 1 TEST - LAB
4. 2 TESTS - NON-PARENTERAL + RADIOLOGY
5. 2 TESTS - NON-PARENTERAL +LAB
6. 2 TESTS - RADIOLOGY + LAB
7. ALL 3 TESTS - NON PARENTERAL + RADIOLOGY + LAB



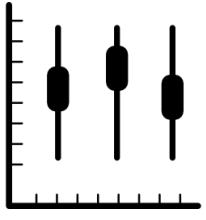
FINDINGS

TOOLS USED

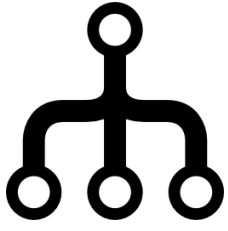
MICROSOFT EXCEL

SAS JMP

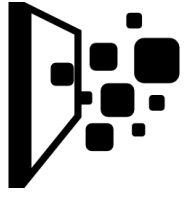
TABLEAU



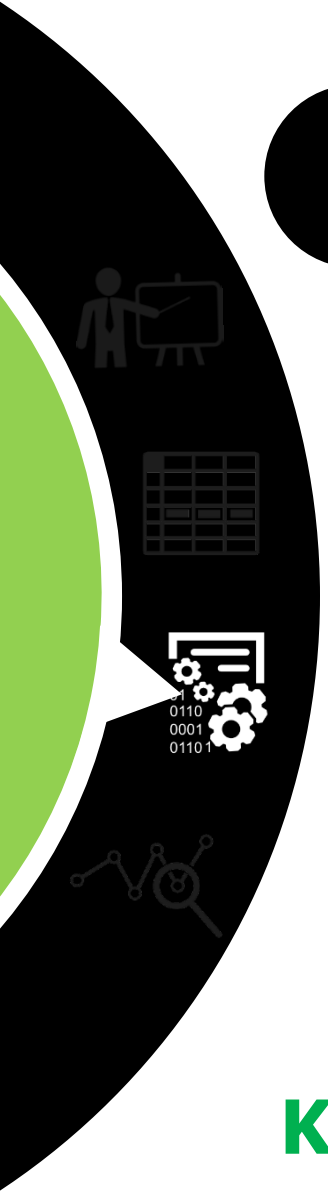
ANOVA & Kruskal Wallis



Machine Learning Techniques

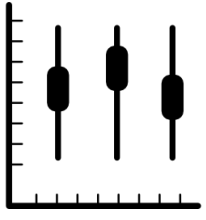


Heat Map Visualization

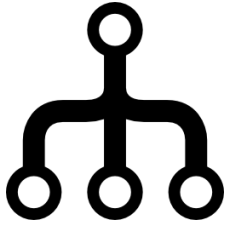


1 LOS VS TESTS ORDERED & RE-ENTRY

2 LOS VS LAB TESTS RESULTS



ANOVA & Kruskal Wallis



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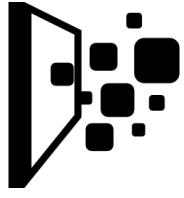
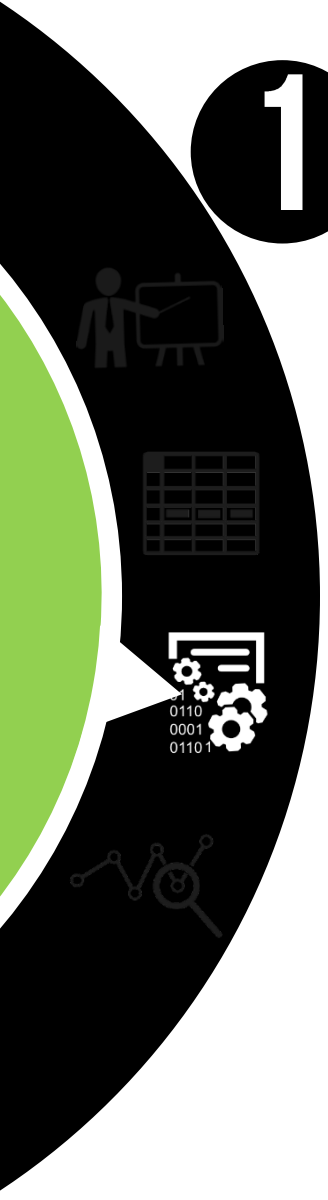


Heat Map Visualization



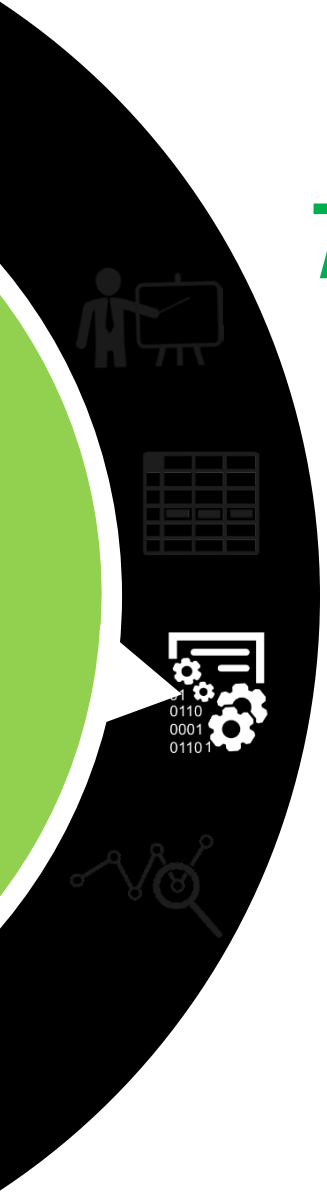
ANALYZE LOS AGAINST DIFFERENT TESTS ORDERED AND RE-ENTRY

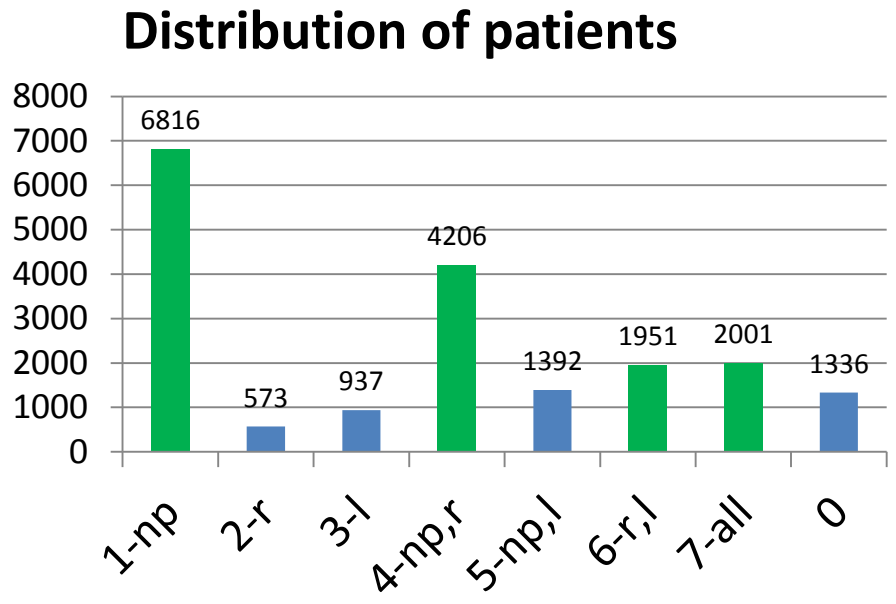
OVERVIEW

Analyze if LoS is affected by

- The combination of tests
- The number of Re-entry

7 COMBINATIONS OF TESTS



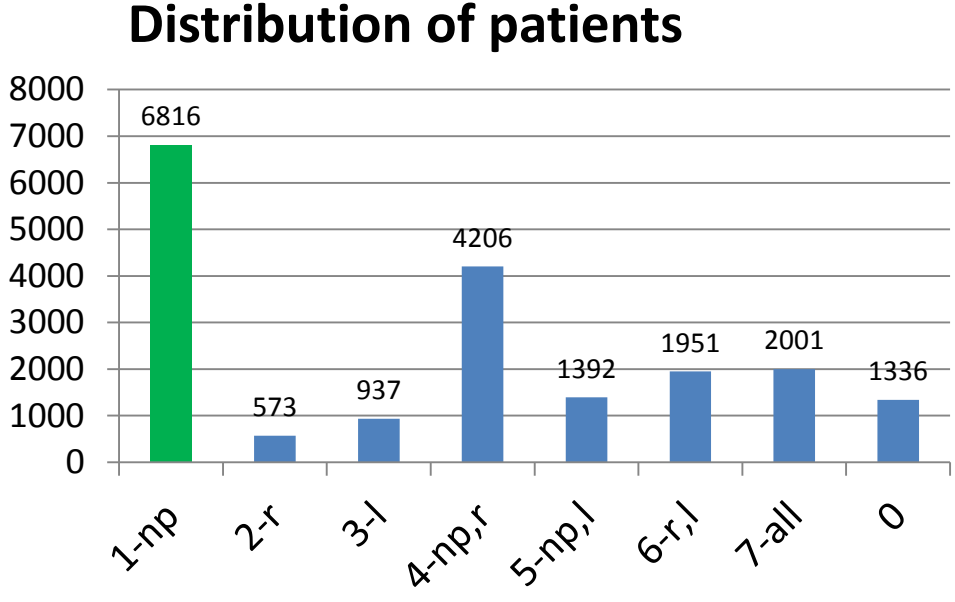


1. 1 TEST - NON-PARENTERAL
2. 1 TEST - RADIOLOGY
3. 1 TEST - LAB
4. 2 TESTS - NON-PARENTERAL + RADIOLOGY
5. 2 TESTS - NON-PARENTERAL +LAB
6. 2 TESTS - RADIOLOGY + LAB
7. ALL 3 TESTS - NON PARENTERAL + RADIOLOGY + LAB

TESTS CONCERNING NON-PARENTERAL MEDICATIONS

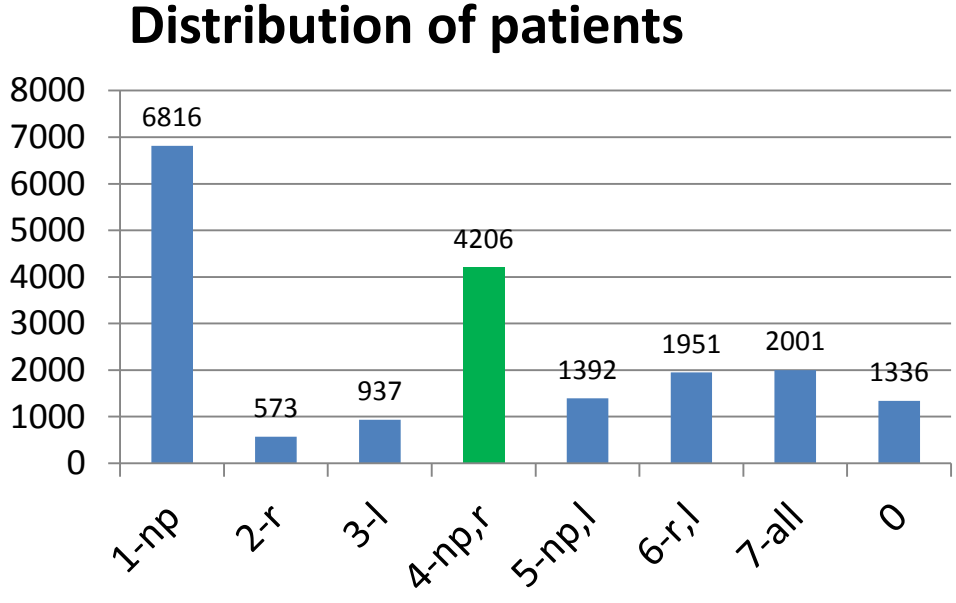
Patients who take 1 Non-Parenteral medication with 1 re-entry

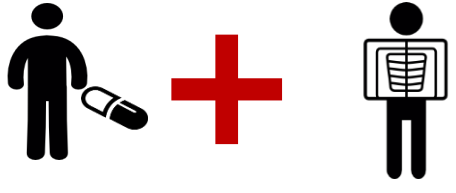
High LoS



TESTS CONCERNING NON-PARENTERAL MEDICATIONS AND RADIOLOGY

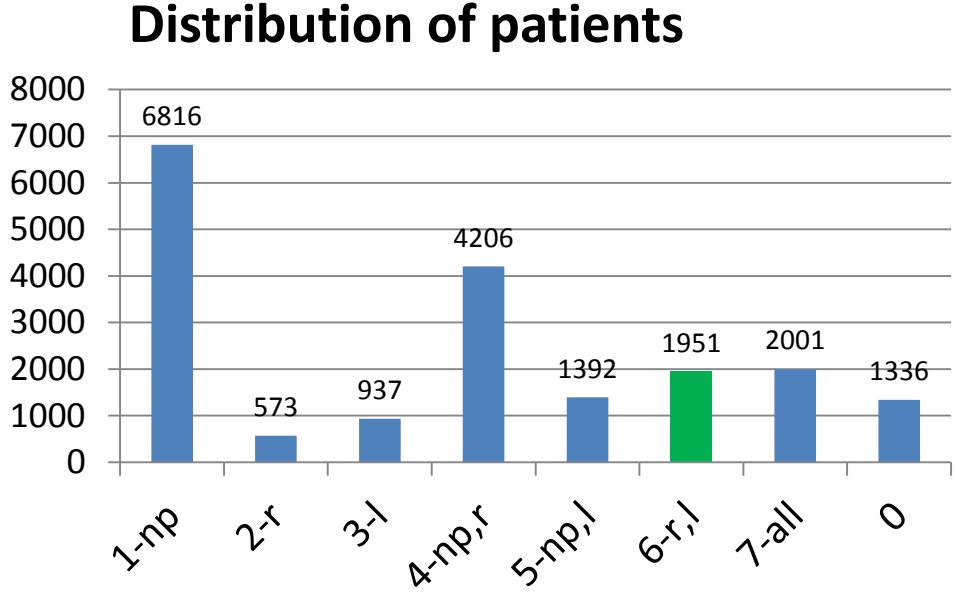
Patients who complete both tests within 1 re-entry will see a significantly lower LoS.





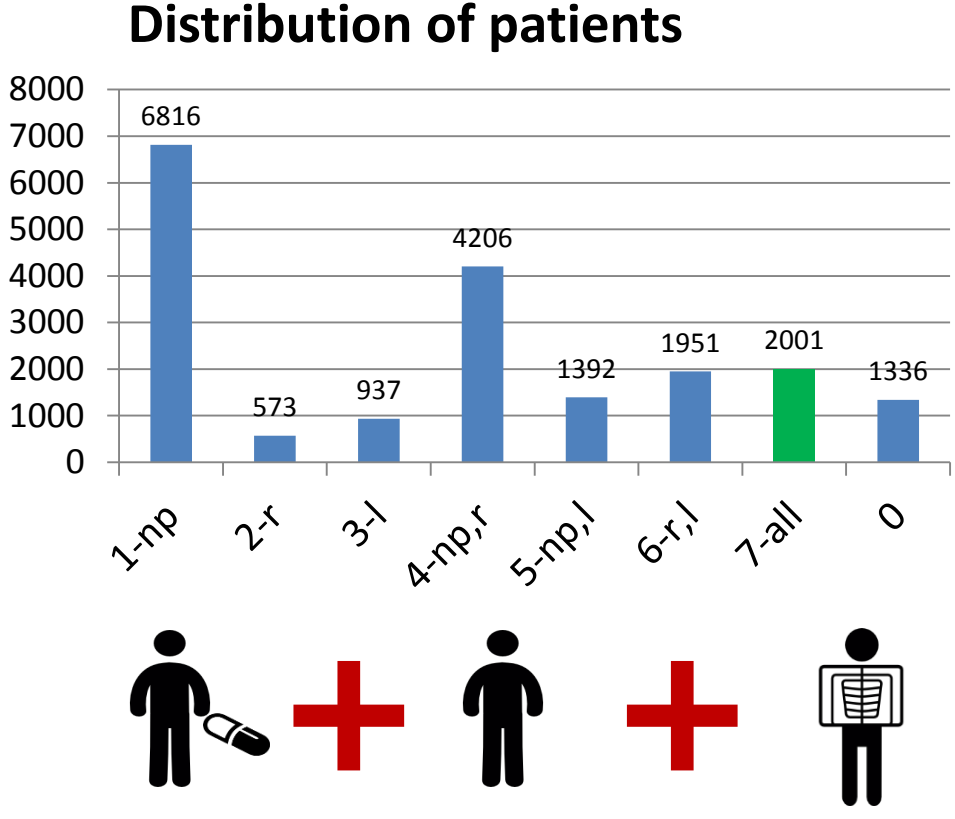
TESTS CONCERNING RADIOLOGY AND LABORATORY TESTS

Patients who undergo both tests with 3 or more re-entry will see a significantly higher LoS.



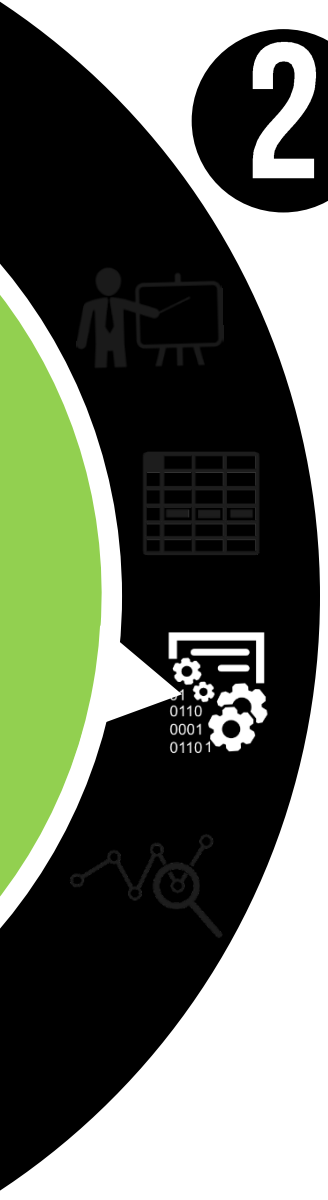
TESTS CONCERNING NON-PARENTERAL, RADIOLOGY AND LABORATORY TESTS

Patients who undergo all 3 tests with only 1 re-entry will see a significantly lower LoS.



HEATMAP OF TEST COMBINATIONS AGAINST REGISTRATION TIME

	Hour of Entry																							
Test Combination	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
1 Test - Lab	138.3	102.0	129.1	101.5	62.5	82.0	92.9	88.0	66.7	95.4	105.0	135.6	142.8	150.2	136.1	159.5	160.8	153.5	169.7	132.8	117.5	134.4	138.8	88.6
1 Test - Non-Parenteral	89.4	95.7	74.9	65.7	51.9	51.5	46.9	53.6	46.3	54.9	71.7	90.3	110.3	107.9	106.7	109.9	99.9	109.8	100.5	94.3	81.9	80.7	86.4	82.4
1 Test - Radio	99.3	121.5	144.5	84.7	49.7	67.7	118.8	80.7	50.3	90.3	119.1	121.9	131.6	136.1	137.9	136.5	152.4	130.7	129.3	84.6	88.5	82.8	93.2	102.9
2 Tests - Lab, Non-Parenteral	156.6	166.6	127.4	123.8	109.1	96.8	108.4	132.0	101.3	115.1	132.1	144.6	158.0	176.8	168.1	185.8	188.4	166.3	149.6	152.5	167.4	141.6	160.3	152.2
2 Tests - Lab, Radio	152.4	134.8	98.4	111.3	83.9	104.7	86.2	123.7	100.6	101.7	127.3	153.1	162.7	172.7	168.6	183.1	183.0	172.0	146.7	133.0	132.4	129.1	147.1	148.2
2 Tests - Non-Parenteral, Radio	113.7	103.2	99.2	82.1	77.3	83.7	78.6	78.7	59.6	83.0	101.5	122.2	140.7	148.4	162.4	142.1	142.8	129.4	141.4	113.2	108.7	97.7	93.1	116.7
3 Tests - All Three	167.8	167.2	175.4	170.9	151.8	125.3	119.2	126.1	113.2	136.4	148.9	173.4	183.9	200.0	198.8	203.8	188.3	183.2	175.2	181.9	157.1	175.2	174.8	195.4
None	69.2	79.3	85.0	63.5	170.0	71.6	49.6	55.2	56.2	59.6	79.1	98.8	103.2	115.7	113.5	106.8	110.3	123.1	121.5	113.6	76.9	88.9	87.2	70.5



2 ANALYZE LOS AGAINST SPECIFIC LABORATORY TESTS AND ITS RESULTS

OVERVIEW

Within those that took **laboratory tests**, whether LoS is affected by

- Results of Tests
- Specific Tests

GENERAL FINDINGS

Results of Tests

No effect on LoS seen

Specific Tests

A few tests potentially identified

RESULTS OF LABORATORY TESTS

Only two tests were taken by more than 25% of the patients:

- **Full Blood Count**
- **Liver Panel**

- Only 2 tests with large enough sample sizes to test relationship between results of tests and LoS.

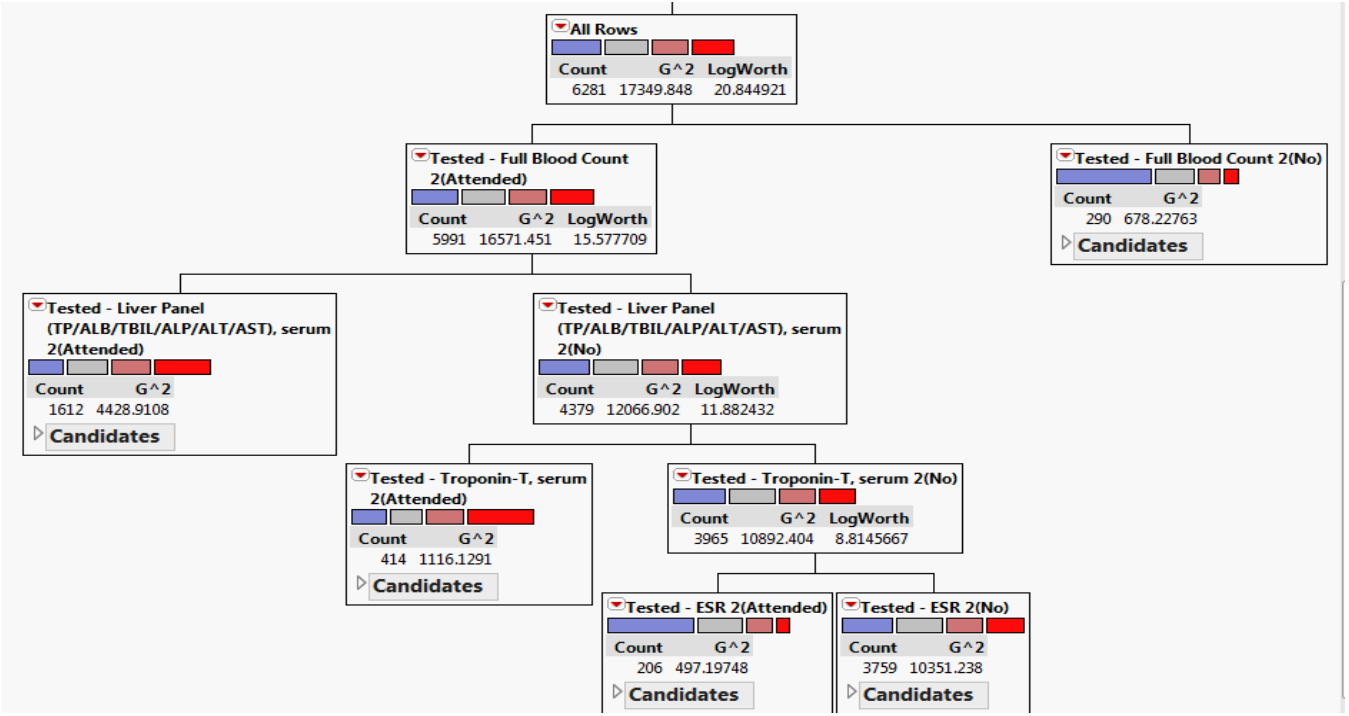
LOS VS LABORATORY TESTS RESULTS

- **No relationship observed**
  - Even when specific groups are analyzed, on the basis of only test results
    - 1 Re-entry
    - No other treatment
    - No other test

- **Both FBC and Renal Panel yielded no observable relationship**

SPECIFIC TESTS

- All tests were looked at in entirety, and using various techniques, were able to isolate a few tests
  - But: Low predictive values



SPECIFIC TESTS

- Better visualized in a heat map chart
- A few tests can be picked out, but as with previous technique, the predictive ability is low
  - Not controlled for other factors

HEATMAP

Lab Test Taken	Minute Band 0-79min	80-139min	140-199m..	>200min
Tested - (CK, MB,TNT)	26.92%	15.38%	21.15%	36.54%
Tested - Aerobic Culture	26.32%	33.33%	29.82%	10.53%
Tested - Albumin, serum	15.22%	19.57%	30.43%	34.78%
Tested - Amylase, serum	18.55%	21.92%	22.52%	37.01%
Tested - APTT & PT	27.01%	29.55%	21.52%	21.93%
Tested - Blood Culture (aerobic)	22.73%	33.01%	25.00%	19.26%
Tested - Blood Culture (anaerobic)	22.73%	33.01%	25.00%	19.26%
Tested - C-Reactive Protein, serum	31.65%	29.50%	20.43%	18.42%
Tested - Ca/PO4/Mg, serum	36.84%	28.95%	23.68%	10.53%
Tested - Calcium Total, serum	14.06%	18.75%	26.56%	40.63%
Tested - Creatine Kinase-MB (Mass), serum	17.50%	19.44%	22.22%	40.83%
Tested - Creatine Kinase, serum	17.59%	19.69%	21.52%	41.21%
Tested - D-Dimer Quantitation	17.86%	22.32%	25.00%	34.82%
Tested - ESR	42.54%	28.51%	16.23%	12.72%
Tested - Eye (aerobic) Culture	51.25%	36.25%	7.50%	5.00%
Tested - Eye (anaerobic) Culture	55.26%	31.58%	7.89%	5.26%
Tested - Eye (Fungal) Culture	52.63%	31.58%	8.77%	7.02%
Tested - Full Blood Count	22.72%	26.22%	22.80%	28.26%
Tested - Gram Stain	47.17%	35.85%	12.26%	4.72%
Tested - HBA1c, blood	37.84%	35.14%	10.81%	16.22%
Tested - HIV Screen	52.94%	26.47%	8.82%	11.76%
Tested - Liver Function Test	21.88%	27.08%	17.71%	33.33%
Tested - Liver Panel (TP/ALB/TBIL/ALP/ALT/AST), serum	16.99%	23.80%	24.05%	35.15%
Tested - Liver Panel (TP/ALB/TBIL/ALP/ALT/AST/GGT), serum	53.01%	22.89%	10.84%	13.25%
Tested - Magnesium, serum	15.00%	21.67%	30.00%	33.33%
Tested - Malaria Parasite, blood film	15.79%	42.11%	13.16%	28.95%
Tested - NT-proBNP, serum	18.12%	21.01%	26.09%	34.78%
Tested - Phosphate I0rganic, serum	16.33%	18.37%	30.61%	34.69%
Tested - Potassium, serum	9.72%	20.14%	22.22%	47.92%
Tested - Procalcitonin	32.38%	34.29%	20.95%	12.38%
Tested - Procalcitonin, serum	35.14%	37.84%	18.92%	8.11%
Tested - PT & INR	26.06%	21.13%	24.65%	28.17%
Tested - Renal Panel (U/E/BICARB/CRE), serum	27.64%	25.61%	14.63%	32.11%
Tested - Renal Panel (U/E/BICARB/GLU/CRE), serum	21.95%	26.15%	23.35%	28.56%
Tested - Swab (aerobic) Culture	52.63%	34.21%	10.53%	2.63%
Tested - Thyroid Panel (FT4/TSH)	23.75%	27.50%	18.75%	30.00%
Tested - Thyroid Stimulating Hormone, serum	22.64%	5.66%	32.08%	39.62%
Tested - Thyroxine (T4) Free, serum	30.30%	6.06%	30.30%	33.33%
Tested - Troponin-T, serum	15.58%	19.86%	22.60%	41.95%
Tested - Uric Acid, serum	22.53%	22.53%	26.92%	28.02%

HEATMAP

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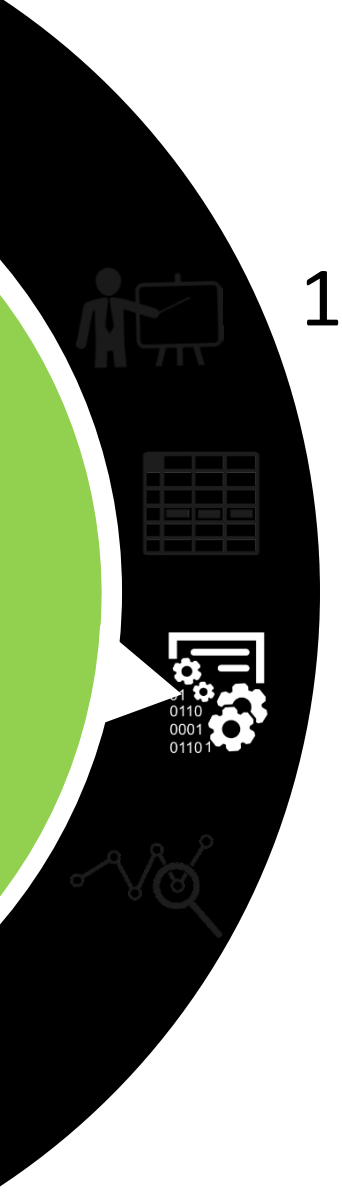
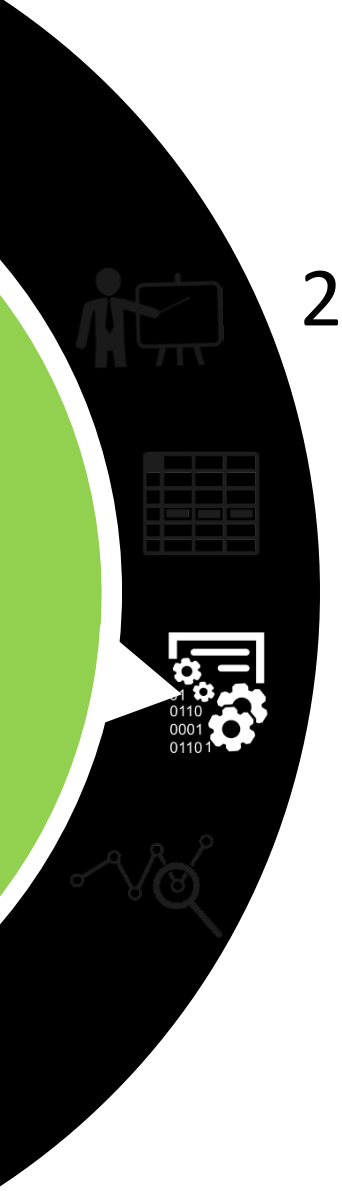
Tested - Aerobic Culture	26.32%	33.33%	29.82%	10.53%
Tested - Albumin, serum	15.22%	19.57%	30.43%	34.78%
Tested - Amylase, serum	18.55%	21.92%	22.52%	37.01%
Tested - APTT & PT	27.01%	29.55%	21.52%	21.93%
Tested - Blood Culture (aerobic)	22.73%	33.01%	25.00%	19.26%
Tested - Blood Culture (anaerobic)	22.73%	33.01%	25.00%	19.26%
Tested - C-Reactive Protein, serum	31.65%	29.50%	20.43%	18.42%
Tested - Ca/PO4/Mg, serum	36.84%	28.95%	23.68%	10.53%
Tested - Calcium Total, serum	14.06%	18.75%	26.56%	40.63%
Tested - Creatine Kinase-MB (Mass), serum	17.50%	19.44%	22.22%	40.83%
Tested - Creatine Kinase, serum	17.59%	19.69%	21.52%	41.21%
Tested - D-Dimer Quantitation	17.86%	22.32%	25.00%	34.82%
Tested - ESR	42.54%	28.51%	16.23%	12.72%
Tested - Eye (aerobic) Culture	51.25%	36.25%	7.50%	5.00%
Tested - Eye (anaerobic) Culture	55.26%	31.58%	7.89%	5.26%
Tested - Eye (Fungal) Culture	52.63%	31.58%	8.77%	7.02%
Tested - Full Blood Count	22.72%	26.22%	22.80%	28.26%
Tested - Gram Stain	47.17%	35.85%	12.26%	4.72%
Tested - HBA1c, blood	37.84%	35.14%	10.81%	16.22%
Tested - HIV Screen	52.94%	26.47%	8.82%	11.76%
Tested - Liver Function Test	21.88%	27.08%	17.71%	33.33%
Tested - Liver Panel (TP/ALB/TBIL/ALP/ALT/AST), serum	16.99%	23.80%	24.05%	35.15%
Tested - Liver Panel (TP/ALB/TBIL/ALP/ALT/AST/GGT), serum	53.01%	22.89%	10.84%	13.25%
Tested - Magnesium, serum	15.00%	21.67%	30.00%	33.33%
Tested - Malaria Parasite, blood film	15.79%	42.11%	13.16%	28.95%
Tested - NT-proBNP, serum	18.12%	21.01%	26.09%	34.78%
Tested - Phosphate (Organic, serum	16.33%	18.37%	30.61%	34.69%
Tested - Potassium, serum	9.72%	20.14%	22.22%	47.92%
Tested - Procalcitonin	32.38%	34.29%	20.95%	12.38%
Tested - Procalcitonin, serum	35.14%	37.84%	18.92%	8.11%
Tested - PT & INR	26.06%	21.13%	24.65%	28.17%
Tested - Renal Panel (U/E/BICARB/CRE), serum	27.64%	25.61%	14.63%	32.11%
Tested - Renal Panel (U/E/BICARB/GLU/CRE), serum	21.95%	26.15%	23.35%	28.56%
Tested - Swab (aerobic) Culture	52.63%	34.21%	10.53%	2.63%
Tested - Thyroid Panel (FT4/TSH)	23.75%	27.50%	18.75%	30.00%
Tested - Thyroid Stimulating Hormone, serum	22.64%	5.66%	32.08%	39.62%
Tested - Thyroxine (T4) Free, serum	30.30%	6.06%	30.30%	33.33%
Tested - Troponin-T, serum	15.58%	19.86%	22.60%	41.95%
Tested - Uric Acid, serum	22.53%	22.53%	26.92%	28.02%

TAKEAWAYS



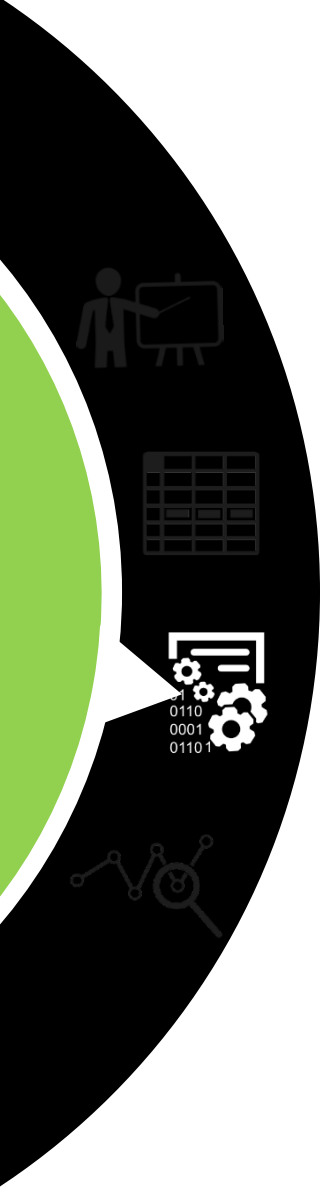
1. Test Results do not affect LoS significantly
   - Runs contrary to observations
   - Observation – more passed tests, shorter consultation time

TAKEAWAYS



2. The lack of data with regards to the specific parts of the process
   - LoS could have evened out due to waiting times in the other parts of the process
   - Diminishing the effect test results

EVALUATION



- Optimization possibilities
  - LoS can be further improved as it seems to be constant now despite observed reduced consultation times

RECOMMENDATIONS

RECOMMENDATION

- Can explore use of RFIDs for accurate tracking

Silicone Rfid Wristband/Rfid Bracelet with TK4100 for access control Free Shipping

is_customized: Yes

Universal RFID Solutions

Offline

US $1.16 / piece

Min. Order: 500 pieces

Sponsored Listing

RECOMMENDATION

KNOWN TIME

Length-of-Stay (LoS)

THANK YOU


TEAM TWO
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