Hospital Operation Room – Utilization Analysis

Problem Statement

- Operating room (OR) inefficiency is a significant financial burden on healthcare organizations, impacting both cost and patient care.
- While booked OR time represents a planned utilization metric, it often deviates from the actual time procedures take due to workflow delays, inaccurate booking estimates, and cancellations.
- This project aims to leverage a dataset containing surgical timestamps throughout the OR workflow to identify and quantify these areas of inefficiency.
- By analyzing this data, we can develop actionable insights to optimize OR utilization, potentially saving healthcare organizations substantial time and financial resources, and ultimately improving patient care delivery

Expectation from this Report

- Analyze OR workflow data to pinpoint delays and inaccuracies in booking estimates.
- Provide actionable insights to improve scheduling and reduce cancellations.
- Estimate potential cost savings and increase procedure throughput.
- Propose strategies to streamline OR processes, reducing wait times and improving outcomes.
- Apply data analytics techniques and improve proficiency in statistical tools.
- Create clear visualizations and comprehensive reports to communicate recommendations.
- By completing this project, healthcare organizations can expect to save time and resources while enhancing patient care delivery.

Description/Terminology of Features in Dataset

- Encounter ID → Unique/Primary Key for the Record
- Date --> The date of the surgery.
- OR Suite --> The operating room where the surgery will take place.
- Service --> The surgical specialty.
- CPT Code --> The code for the surgical procedure.
- CPT Description --> A description of the surgical procedure.
- Booked Time (min) --> The amount of time that was booked for the surgery.
- OR Schedule --> The time that the surgery was scheduled to start.
- Wheels In --> The time that the patient arrived in the operating room.
- Start Time --> The time that the surgery started.
- End Time --> The time that the surgery ended.
- Wheels Out --> The time that the patient left the operating room.

New Features Extracted

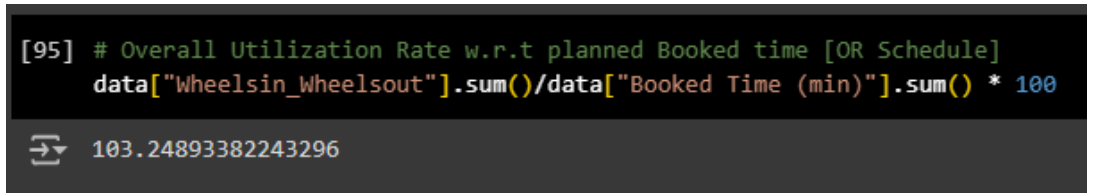
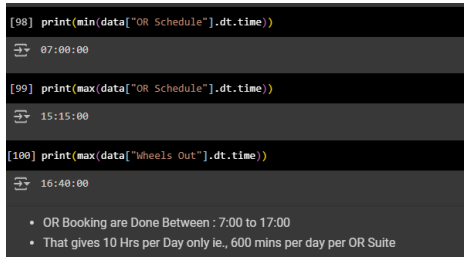
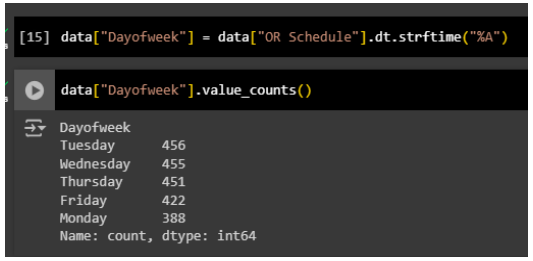
- 'Week#' → Week Number of the Year
- 'Dayofweek' → Day of the Week (Monday ~ Sunday)
- BookingHr → Schedule Hr of the Day
- 'ORSchedule_Wheelsin', → Duration from OR Schedule to Wheelsin
- 'Wheelsin_Start' → Duration from Wheelsin to Start
- 'Start_End' → Duration from Start to End
- End_Wheelsout' → Duration from End to Wheelsout
- 'Wheelsin_Wheelsout' → Duration from Wheelsin to Wheelsout
- 'ORSchedule_Wheelsout', → Duration from ORSchedule to Wheelsout
- 'ORSchedule_Wheelsin Ratio' → OR Schedule to Wheelsin Ratio w.r.t Booked Time
- 'Wheelsin_Start Ratio' → Wheelsin_Start Ratio w.r.t Booked Time
- 'Start_End Ratio', → Start_End Ratio w.r.t Booked Time
- 'End_Wheelsout Ratio' → End_Wheelsout Ratio w.r.t Booked Time
- 'ORSchedule_Wheelsout Ratio' → 'ORSchedule_Wheelsout Ratio w.r.t Booked Time

Business KPI's

Time Period : 3rd Jan ~ 31st Mar 2022

No of Services [Specialties]	**No of CPT** [Surgical Procedures]	**Weekly Working Days**	**Avg No of Procedure/Week**
10	32	5	167
No of OR Suite	**OR Working Hours**	**OR Engaged** Ratio/Day	**OR Actual Usage** Ratio/Day
8	7:00 ~ 17:00 [10 Hrs - 600 Minutes]	0.84	0.58 [349 Minutes]

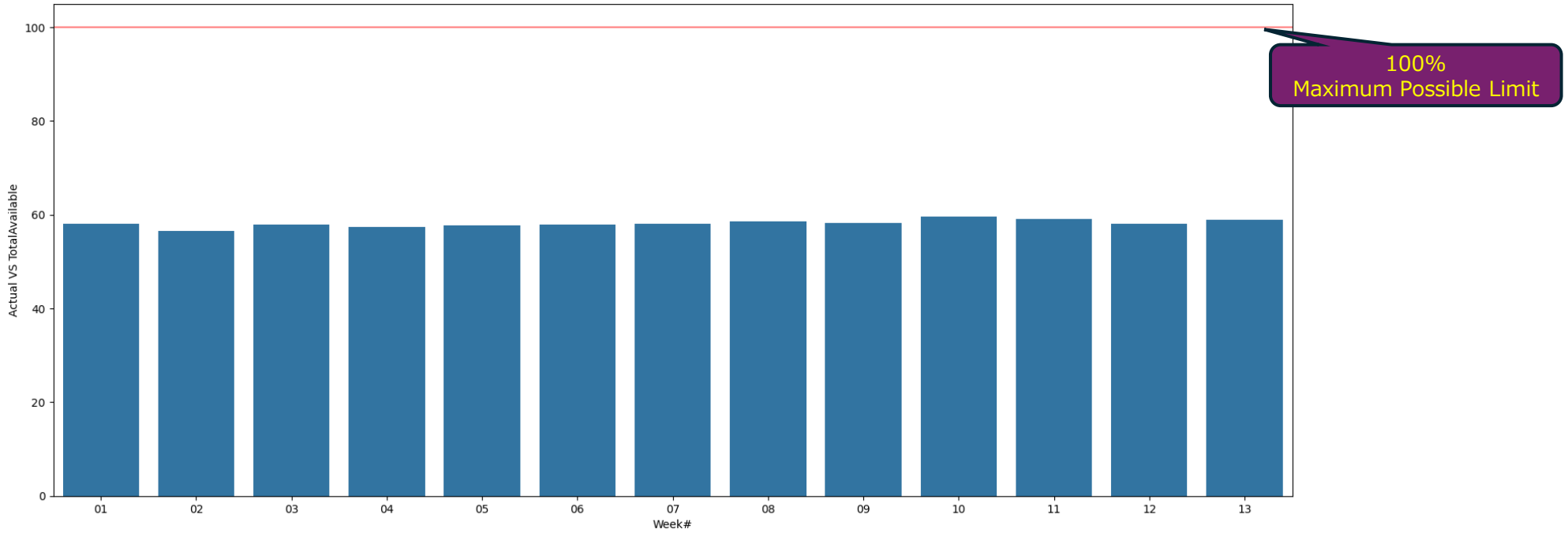
Utilization Rate

Actual Utilization Rate w.r.t Booked Time	103%	
OR Engagement Rate w.r.t Booked Time	149%	
Actual Utilization Rate w.r.t Available time in a Day [7:00 ~ 17:00]	58%	  

- OR Rooms are used only between 7:00 ~ 17:00 and only on Weekdays i.e., 5 Days
- Actual Usage time is 3% More than the Booked time, But Overall Engaged time is 49% more than booked time
- But Utilization rate w.r.t. to Total Available OR Suite Time is Low i.e, 58% only

Week wise Utilization Rate

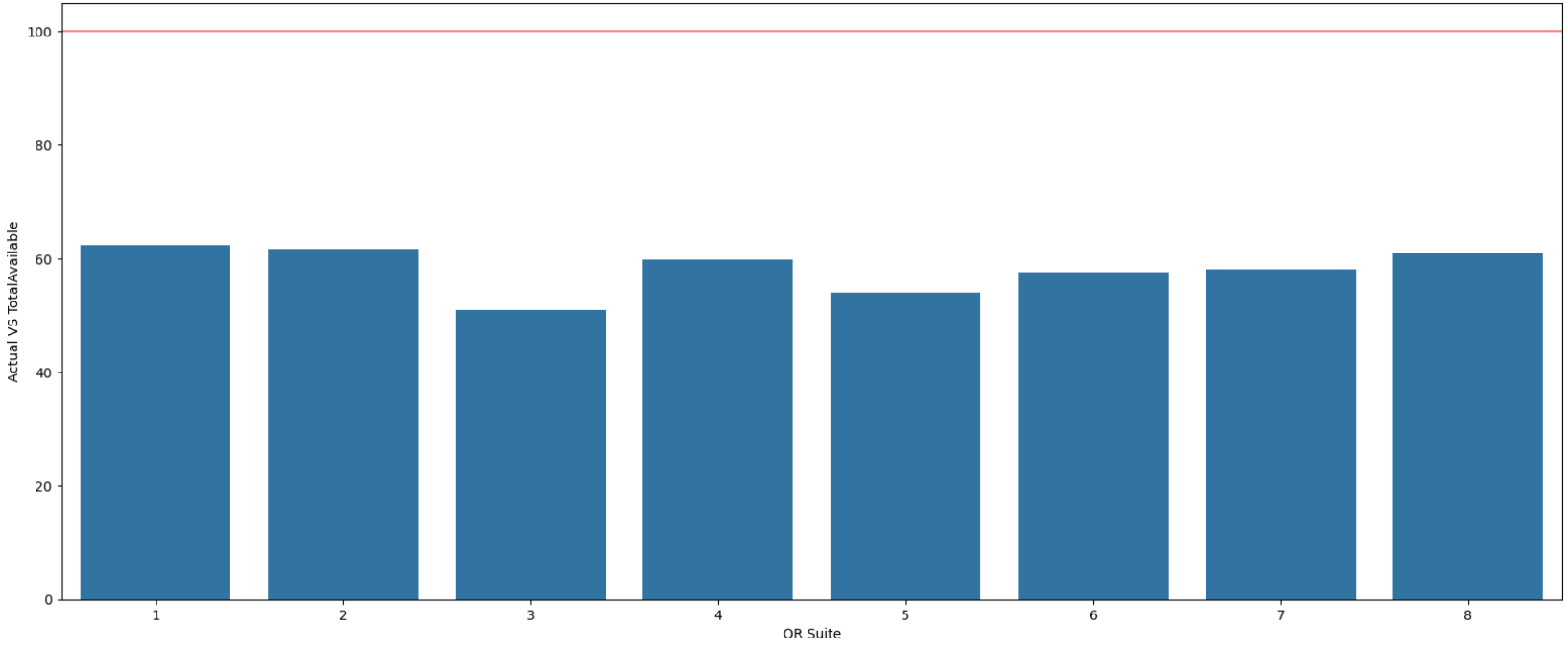
Overall Utilization rate w.r.t Available time in a Day [No of Working Days * 600 Mins]	56.61~59.57%	[108] A = data.groupby("Week#").aggregate({"Date":"nunique","Booked Time (min)":"sum","Wheelsin_Wheelsout":"sum"}).reset_index [109] A.loc[:,"Available Time"] = A["Date"]* 600 * data["OR Suite"].nunique() [110] A["Actual VS Planned"] = A["Wheelsin_Wheelsout"]/A["Booked Time (min)"] * 100 A["Actual VS TotalAvailable"] = A["Wheelsin_Wheelsout"]/A["Available Time"] * 100



- Utilization rate was almost same for all week.. Varied around 56.61 ~ 59.57%

OR Suitewise Utilization Rate

Overall Utilization rate w.r.t Avaiable time	50.83~62.37%	[103] A = data.groupby("OR Suite")[["Booked Time (min)","Wheelsin_Wheelsout"]].sum().reset_index() [104] A.loc[:,"Available Time"] = 62* 600 [105] A["Actual VS Planned"] = A["Wheelsin_Wheelsout"]/A["Booked Time (min)"] * 100 A["Actual VS TotalAvailable"] = A["Wheelsin_Wheelsout"]/A["Available Time"] * 100

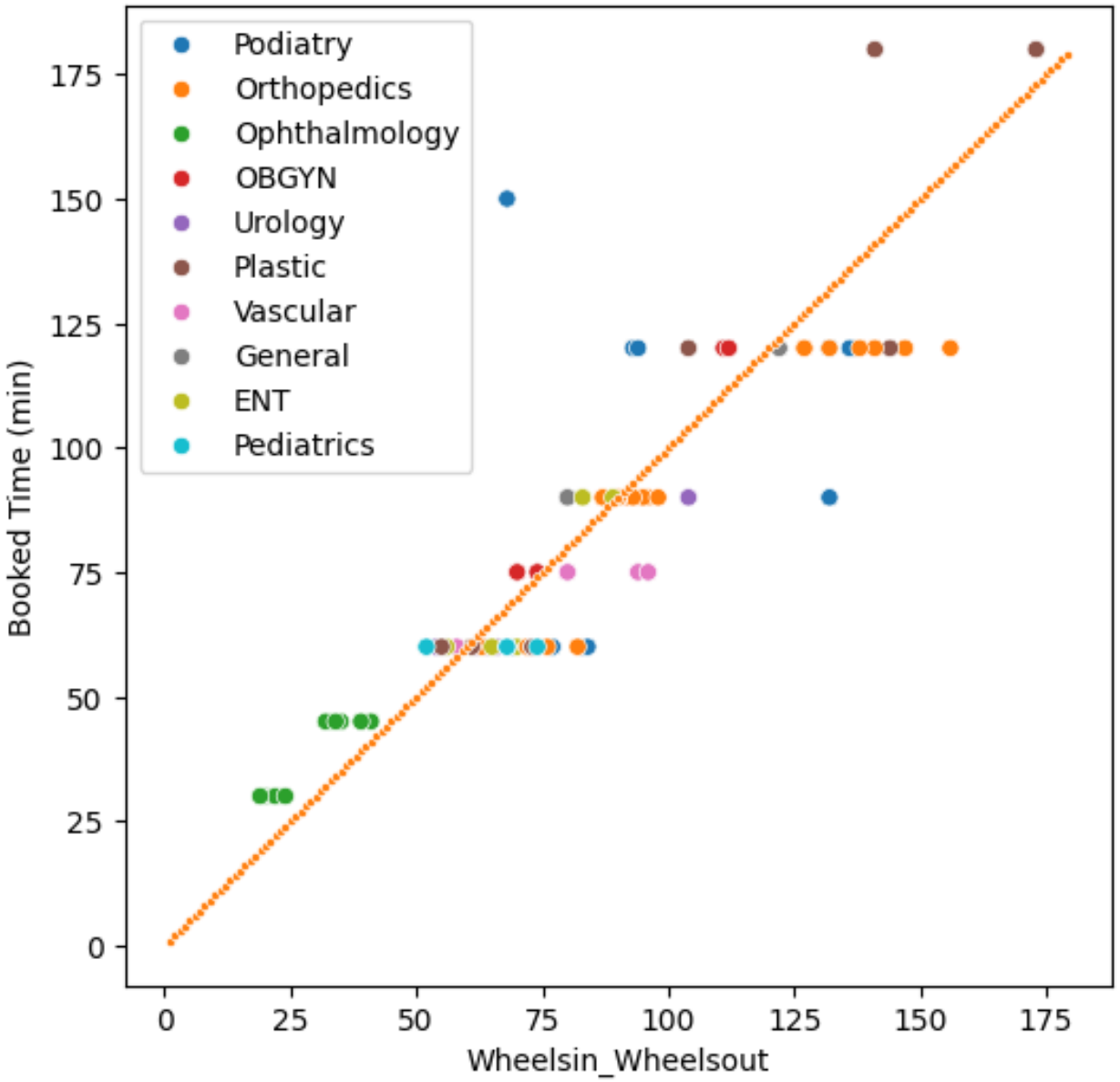



```
pd.crosstab(data["Service"], data["OR Suite"])
```

Service \ OR Suite	1	2	3	4	5	6	7	8
ENT	0	0	0	0	197	0	0	0
General	0	0	0	0	0	0	0	117
OBGYN	0	0	0	164	0	0	0	0
Ophthalmology	0	0	334	0	0	0	0	0
Orthopedics	0	252	0	0	0	0	0	69
Pediatrics	0	0	105	0	0	0	115	0
Plastic	0	0	0	0	0	207	0	0
Podiatry	246	0	0	0	0	0	0	0
Urology	0	0	0	104	89	0	0	0
Vascular	0	0	0	0	0	0	173	0

- Utilization rate Varied w.r.t OR Suites.. Varied around 50.83 [OR:3]~62.37%[OR:1]
- Even though High number of Procedure conducted by Ophthalmology, their overall usage rate is less compared to others [may be due to 30 Min Procedure time].. Resource Balancing can be done with external agencies as time frame followed are also accurate
- OR1 has Highest Utilization rate which is used by Podiatry Service

Planned Vs Actual Usage – Service Wise



OR Suite & Service Mapping

```
data.groupby("Service").agg({"Booked Time
```

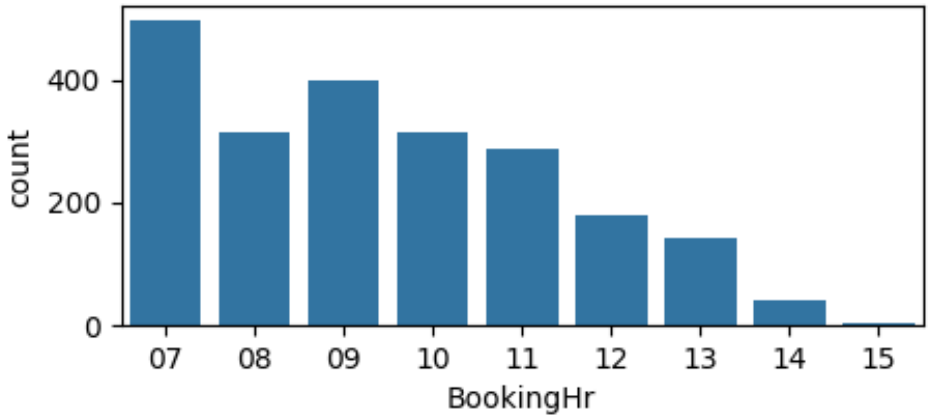
	Service	Booked Time (min)		
		mean	min	max
0	ENT	67.005076	60	90
1	General	110.000000	90	120
2	OBGYN	97.500000	75	120
3	Ophthalmology	44.640719	30	45
4	Orthopedics	87.383178	60	120
5	Pediatrics	60.000000	60	60
6	Plastic	110.434783	60	180
7	Podiatry	89.512195	60	150
8	Urology	66.062176	60	90
9	Vascular	68.236994	60	75

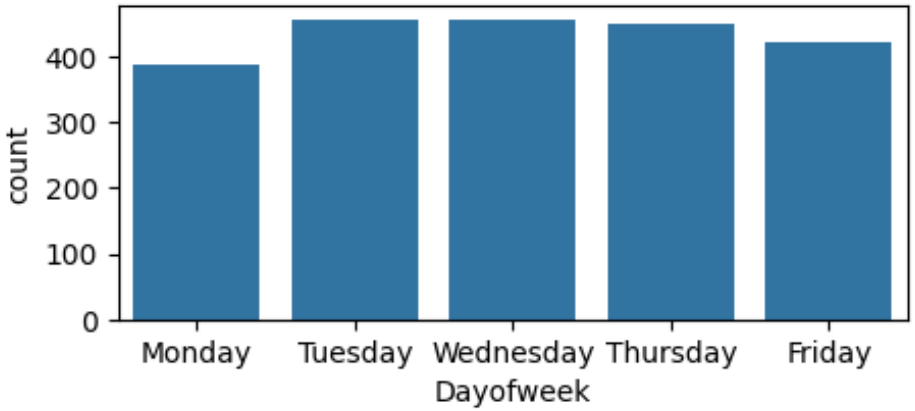
Planned : OR Schedule (min)
Actual Usage : Wheelsin_Wheelout

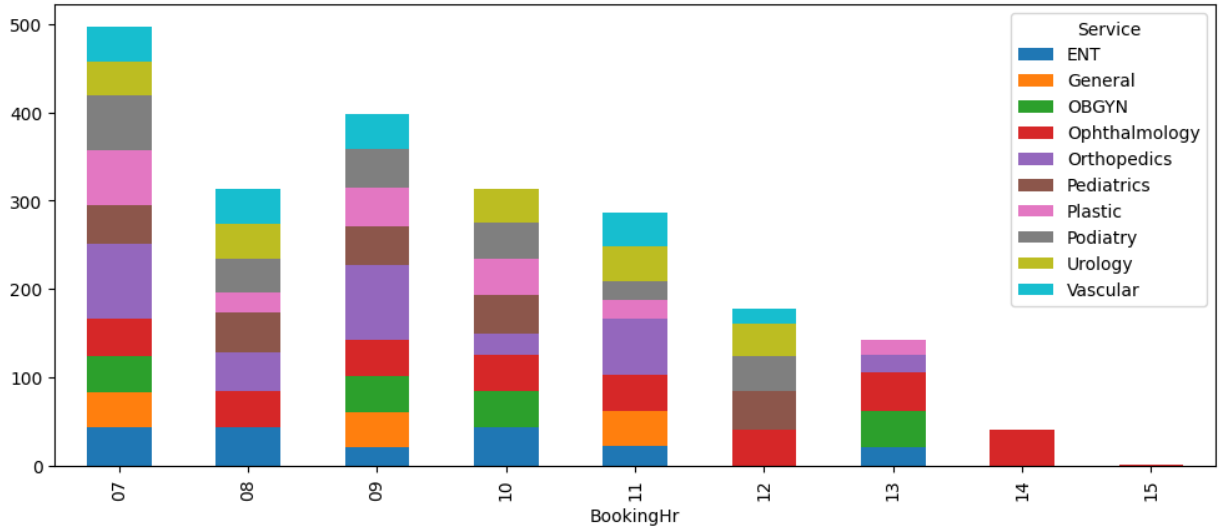
- Ophthalmology & OBGYN Completed Procedure before the Booked time Slot
  [Their booking Time slot are accurate]

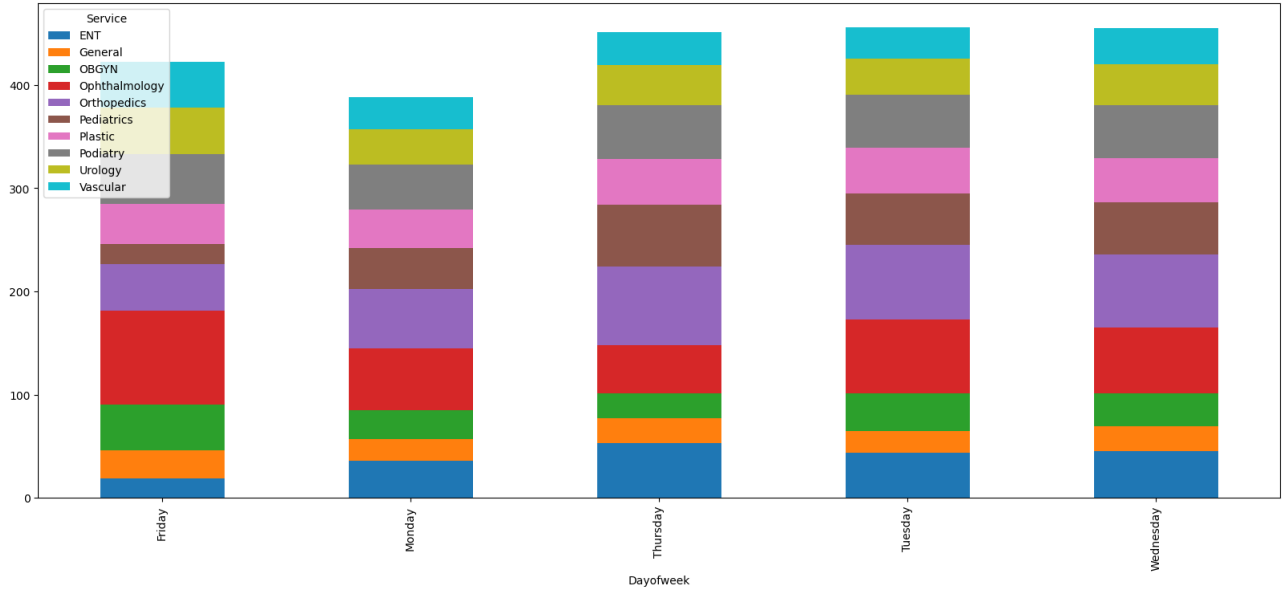
- How ever Rest all Services Vary actual time w.r.t Booking time → **Need to analyze the Actual Time Requirement as per the CPT Procedure**

WeekDay And BookingHr Analysis









- OR Suites Booking is High in the Morning Session & Bookings Decreases as the Day Progresses
- Also Booking rate is comparatively high in the Middle of Week and Low on Monday & Friday
- Only Ophthalmology Service conducts Procedure in Afternoon Session also, rest all plans only in Morning Session

Service – CPT Procedure Analysis

Total CPT Procedures:

```
[34] data["CPT Code"].nunique()
0s
32
```

Top 5 CPT Procedure in Qty:

```
data.groupby(["Service","CPT Code","CPT Description"])["Encounter ID"].coun
```

	Service	CPT Code	CPT Description	Encounter ID
6	Ophthalmology	66982	Extracapsular cataract removal	334
1	ENT	42826	Tonsillectomy	151
15	Pediatrics	69436	Tympanostomy, general anesthesia	132
12	Orthopedics	29877	Arthroscopy, knee, surgical	112
31	Vascular	36901	AV fistula	95

Service – CPT Procedure Mapping

```
data.groupby(["Service"])["CPT
```

	Service	CPT Code
0	ENT	2
1	General	2
2	OBGYN	2
3	Ophthalmology	1
4	Orthopedics	7
5	Pediatrics	2
6	Plastic	4
7	Podiatry	7
8	Urology	3
9	Vascular	2

Bottom 5 CPT Procedure in Qty:

```
ata.groupby(["Service","CPT Code","CPT Description"])["Encounter ID"].count(
```

	Service	CPT Code	CPT Description	Encounter ID
19	Plastic	30400	Rhinoplasty	16
26	Podiatry	28297	Lapidus bunionectomy	18
22	Podiatry	28110	Partial ostectomy, fifth metatarsal head	18
20	Podiatry	28055	Neurectomy, intrinsic musculature of foot	18
8	Orthopedics	26356	Flexor tendon repair	20

Planned Vs Actual Usage – CPT Procedure Wise

Top 10 Overusing Procedures

```
A= data.groupby(["Service","CPT Code","CPT Description"]).agg({"Booked Time (min)": "mean","Wheelsin_Wheelsout":
A["Delay"] = A["Wheelsin_Wheelsout"] - A["Booked Time (min)"]
A.sort_values(by ="Delay",ascending = False, inplace = True)
A.head(10)
```

	Service	CPT Code	CPT Description	Booked Time (min)	Wheelsin_Wheelsout	Delay
22	Podiatry	28110	Partial ostectomy, fifth metatarsal head	90.0	132.000000	42.000000
20	Podiatry	28055	Neurectomy, intrinsic musculature of foot	60.0	84.000000	24.000000
23	Podiatry	28285	Correction, hammertoe	60.0	83.500000	23.500000
11	Orthopedics	27445	Arthroplasty, knee, hinge prothesis	120.0	143.085366	23.085366
10	Orthopedics	27130	Arthroplasty, hip	120.0	138.000000	18.000000
31	Vascular	36901	AV fistula	75.0	92.315789	17.315789
24	Podiatry	28289	Hallux rigidus correction with cheilectomy	60.0	77.000000	17.000000
29	Urology	55873	Cryosurgery of the prostate gland	90.0	104.000000	14.000000
12	Orthopedics	29877	Arthroscopy, knee, surgical	60.0	73.473214	13.473214
21	Podiatry	28060	Plantar fasciotomy	60.0	71.500000	11.500000

Scope to Plan The OR Schedule Booking Time Accurately to eliminated Safety Precautions of Time Duration taken by Other Procedure While Booking

Top 10 Underusing Procedures

```
A= data.groupby(["Service","CPT Code","CPT Description"]).agg({"Booked Time (min)": "mean","Wheelsin_Wheelsout":"mean"}
A["Delay"] = A["Wheelsin_Wheelsout"] - A["Booked Time (min)"]
A.sort_values(by ="Delay",ascending = True, inplace = True)
A.head(10)
```

	Service	CPT Code	CPT Description	Booked Time (min)	Wheelsin_Wheelsout	Delay
26	Podiatry	28297	Lapidus bunionectomy	150.000000	68.000000	-82.000000
17	Plastic	15773	Liposuction	180.000000	157.000000	-23.000000
3	General	47562	Laparoscopic cholecystectomy	90.000000	80.000000	-10.000000
19	Plastic	30400	Rhinoplasty	120.000000	111.000000	-9.000000
6	Ophthalmology	66982	Extracapsular cataract removal	44.640719	35.871257	-8.769461
5	OBGYN	58562	Hysterectomy, surgical	120.000000	111.500000	-8.500000
16	Plastic	14060	Adjacent tissue transfer, eyelids, nose, ears,...	120.000000	112.011628	-7.988372
25	Podiatry	28296	Bunionectomy with distal osteotomy	120.000000	115.435294	-4.564706
0	ENT	30520	Septoplasty	90.000000	86.000000	-4.000000
4	OBGYN	57460	Cervical biopsy	75.000000	72.000000	-3.000000

Scope to Reduce Over booking to Make OR Suite Available for Booking

- **Duration Booking time for for a Procedure is Almost Same** for all CPT Procedure Except for “Extracapsular Cataract removal”
- Very High Over booking done for “Podiatry Service - Lapidus Bunionectomy “ with Excess time of 82 Mins
- Further Over usage of 42 Mins is Observed in “Podiatry – Pastial Ostectomy, fifth metatarsal head”

- Podiatry and Orthopedics Services Booking time must be correctly Recalibrated as per the Actual CPT Procedure to increase Usage Efficacy

Analysis of time between key stages

(OR Schedule -Wheels In, Wheels In - Start Time, Start Time - End Time, End Time - Wheels Out)

Service wise Average Booking Time

```
# Average booking time for Each Service
data.groupby("Service")["Booked Time (min)"].mean()
```

```
Service
ENT                67.005076
General           110.000000
OBGYN              97.500000
Ophthalmology      44.640719
Orthopedics        87.383178
Pediatrics         60.000000
Plastic           110.434783
Podiatry           89.512195
Urology            66.062176
Vascular           68.236994
Name: Booked Time (min), dtype: float64
```

- Each Service has Different Procedure time
- So, We cannot Directly Compare the Time of Key Stage
- So, we will take Parameter in the Form of Ratio W.r.t Booked Time as Below for Uniform Analysis across all Categories

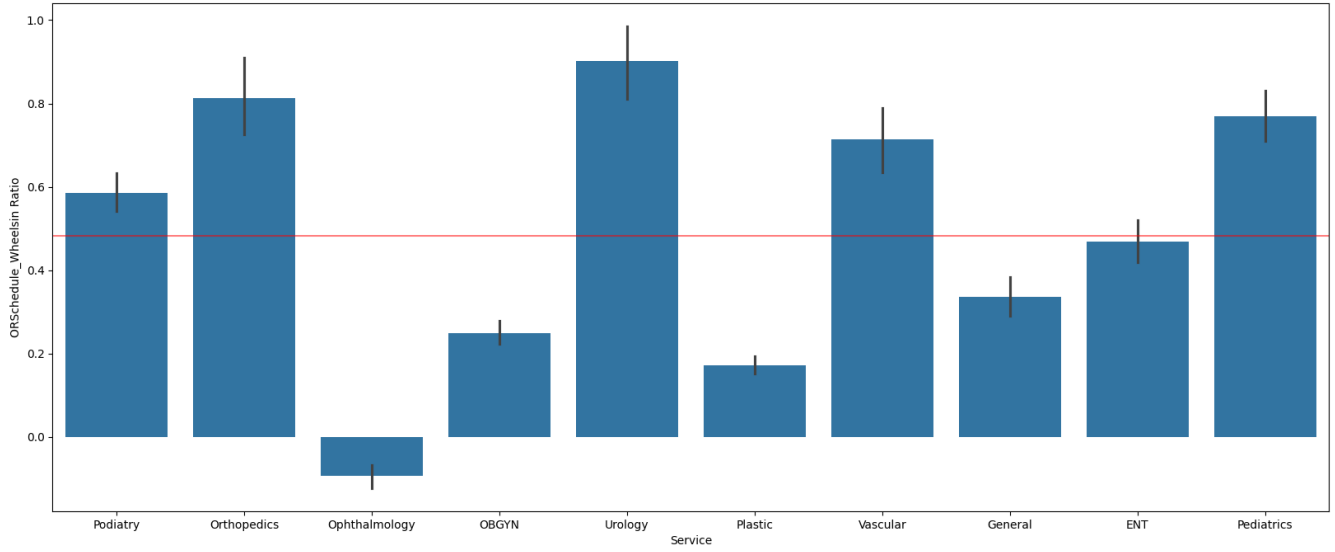
```
[17] data["ORSchedule_Wheelsin"] = (data["Wheels In"] - data["OR Schedule"])/np.timedelta64(1,"m")
     data["Wheelsin_Start"] = (data["Start Time"]-data["Wheels In"])/np.timedelta64(1,"m")
     data["Start_End"] = (data["End Time"]-data["Start Time"])/np.timedelta64(1,"m")
     data["End_Wheelsout"] = (data["Wheels Out"]-data["End Time"])/np.timedelta64(1,"m")
     data["Wheelsin_Wheelsout"] = (data["Wheels Out"]-data["Wheels In"])/np.timedelta64(1,"m")
     data["ORSchedule_Wheelsout"] = (data["Wheels Out"] - data["OR Schedule"])/np.timedelta64(1,"m")

[18] data["ORSchedule_Wheelsin Ratio"] = data["ORSchedule_Wheelsin"]/data["Booked Time (min)"]
     data["Wheelsin_Start Ratio"] = data["Wheelsin_Start"]/data["Booked Time (min)"]
     data["Start_End Ratio"] = data["Start_End"]/data["Booked Time (min)"]
     data["End_Wheelsout Ratio"] = data["End_Wheelsout"]/data["Booked Time (min)"]
     data["ORSchedule_Wheelsout Ratio"] = data["ORSchedule_Wheelsout"]/data["Booked Time (min)"]
```

ORSchedule_Wheelsin

Avg Ratio W.r.t Booked time	0.48	`data["ORSchedule_Wheelsin Ratio"].mean()` → `0.48301642111724985`

Complete Waste Time due to Inaccurate Planning of Operator

Service Wise:



- Urology[90%],Orthopedic[81%], Pediatrics[77%] are very Irregular in Meeting the Planned Schedule
- However, Ophthalmology Starts Procedure Quite Before Planned Schedule

Top10 CPT Procedure:

```
data.groupby(["Service","CPT Description"])["ORSchedule_Wheelsin Ratio"].mean().reset_inde
```

	Service	CPT Description	ORSchedule_Wheelsin Ratio
6	Ophthalmology	Extracapsular cataract removal	-0.093114
25	Podiatry	Partial ostectomy, fifth metatarsal head	0.055556
17	Plastic	Liposuction	0.097222
19	Plastic	Rhinoplasty	0.116667
16	Plastic	Adjacent tissue transfer, eyelids, nose, ears,...	0.136047
5	OBGYN	Hysterectomy, surgical	0.150000
3	General	Sleeve gastrectomy	0.170833
0	ENT	Septoplasty	0.194444
8	Orthopedics	Arthroplasty, knee, hinge prothesis	0.227947
31	Vascular	Digital amputation, metatarsophalangeal joint	0.248077

Bottom10 CPT Procedure:

```
[136] data.groupby(["Service","CPT Description"])["ORSchedule_Wheelsin Ratio"].mean().r
```

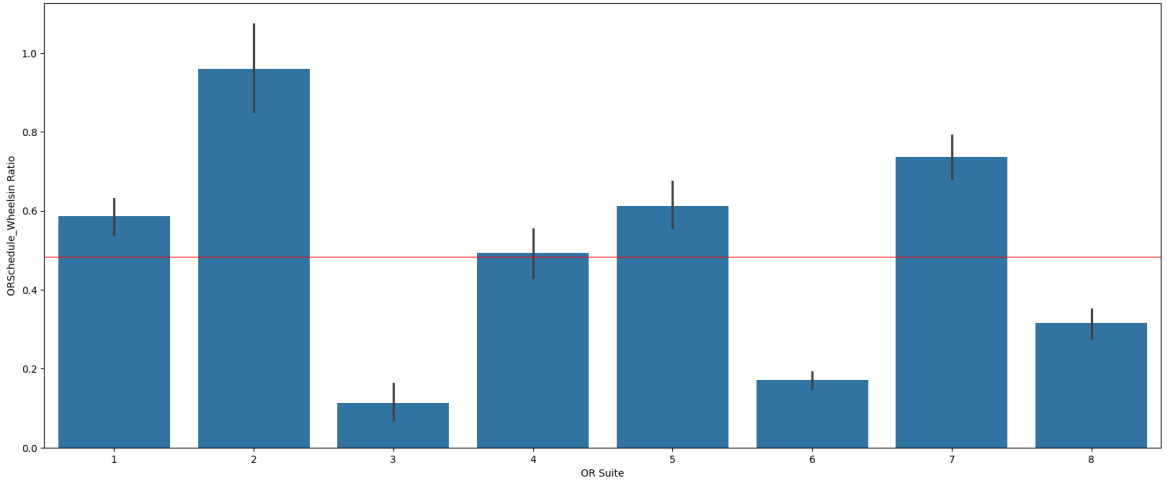
	Service	CPT Description	ORSchedule_Wheelsin Ratio
9	Orthopedics	Arthroscopy, knee, surgical	1.490923
28	Urology	Cystourethroscopy	1.361404
14	Pediatrics	Myringotomy, general anesthesia	1.283333
12	Orthopedics	Flexor tendon repair	1.144444
30	Vascular	AV fistula	1.095018
24	Podiatry	Neurectomy, intrinsic musculature of foot	1.050000
21	Podiatry	Correction, hammertoe	1.000000
29	Urology	Vasectomy	0.771795
23	Podiatry	Lapidus bunionectomy	0.733333
13	Orthopedics	ORIF, phalangeal shaft fracture	0.691667

ORSchedule_Wheelsin

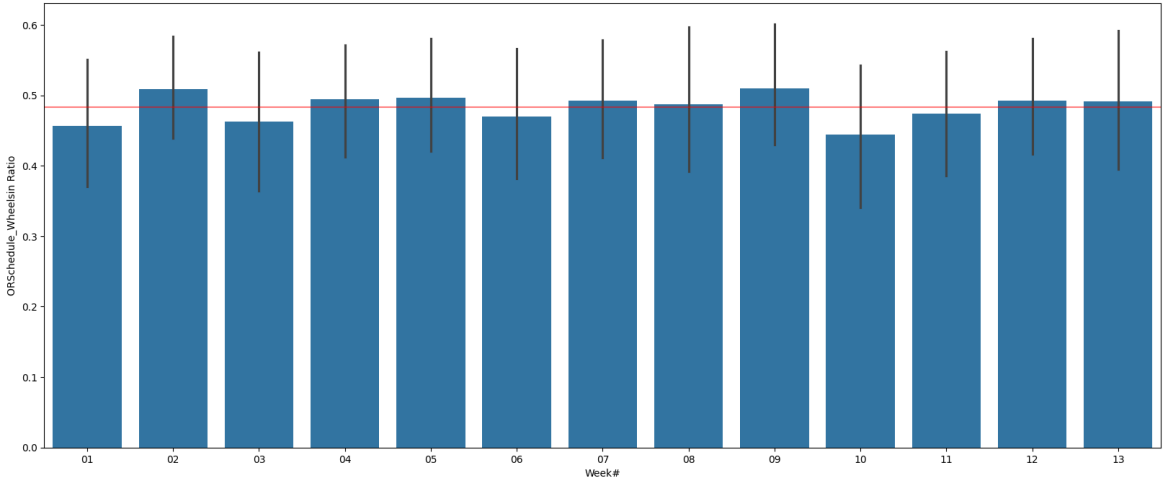
Avg Ratio W.r.t Booked time	0.48	`data["ORSchedule_Wheelsin Ratio"].mean()` → `0.48301642111724985`

Complete Waste Time due to Inaccurate Booking

OR Suite



Week Wise



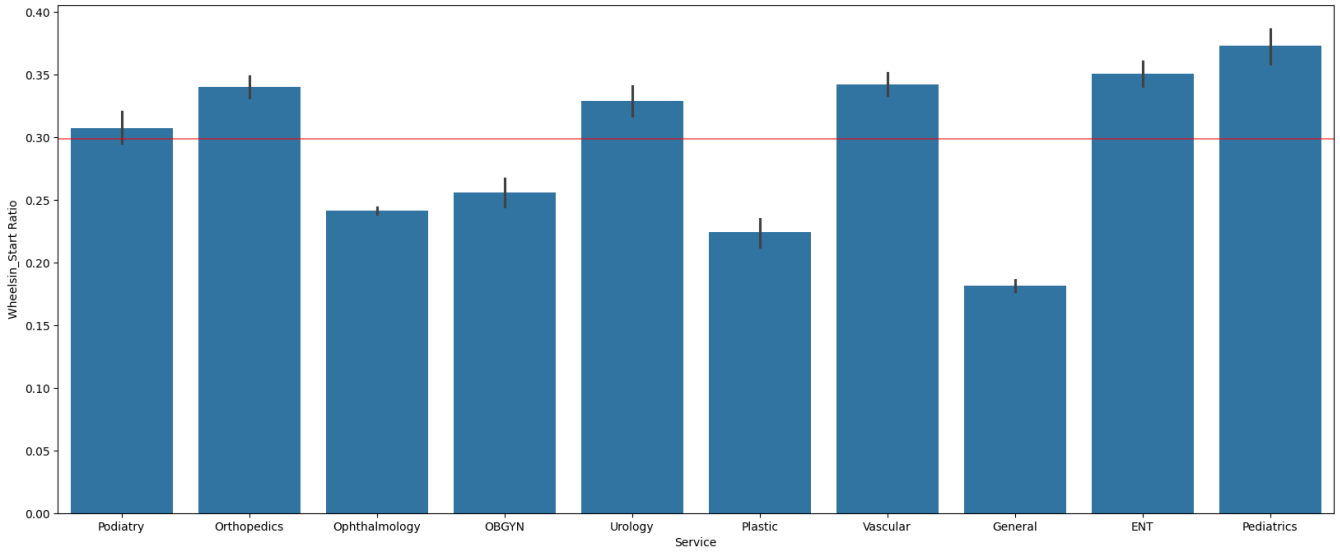
- Although OR Suites Show Some Trend, they are correlated to Service as OR Suite are Directly Related to Service
- Week wise not Much Variation Observed

Wheelsin_Start

Avg Ratio W.r.t Booked time	0.29	[146] data["Wheelsin_Start Ratio"].mean() 0.29888121546961327

Can be Optimised by Proper Planning

Service Wise:



- Pediatrics[37%],ENT[35%],Orthopedics & Vascular[34%] takes Comparatively High Preparation Time before Procedure Starts

Top10 CPT Procedure:

[150] data.groupby(["Service","CPT Description"])["Wheelsin_Start Ratio"].mean().reset_i

	Service	CPT Description	Wheelsin_Start Ratio
17	Plastic	Liposuction	0.116667
3	General	Sleeve gastrectomy	0.166667
5	OBGYN	Hysterectomy, surgical	0.179167
16	Plastic	Adjacent tissue transfer, eyelids, nose, ears,...	0.187791
20	Podiatry	Bunionectomy with distal osteotomy	0.196078
23	Podiatry	Lapidus bunionectomy	0.200000
2	General	Laparoscopic cholecystectomy	0.211111
13	Orthopedics	ORIF, phalangeal shaft fracture	0.214683
19	Plastic	Rhinoplasty	0.216667
12	Orthopedics	Flexor tendon repair	0.233333

Bottom10 CPT Procedure:

[151] data.groupby(["Service","CPT Description"])["Wheelsin_Start Ratio"].mean().res

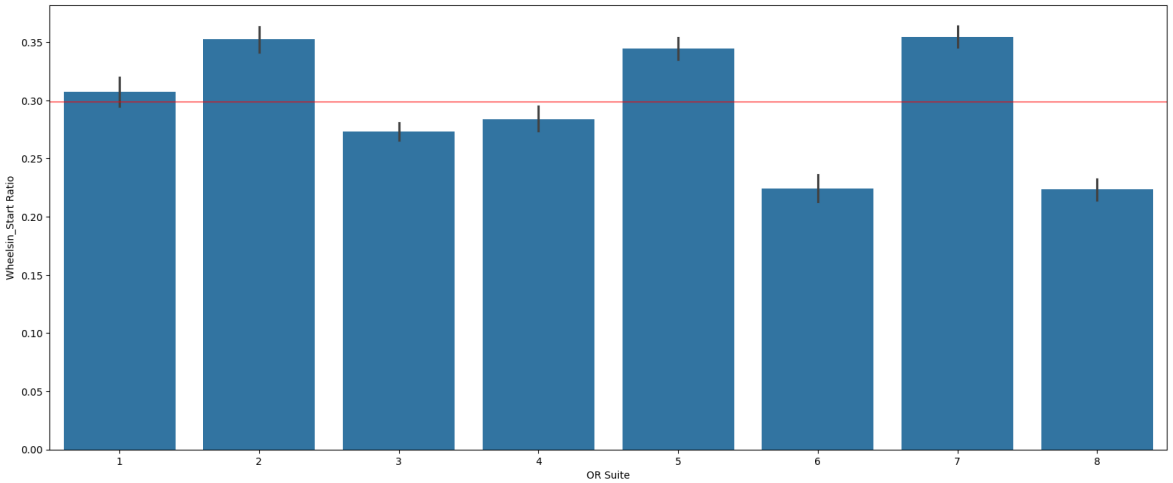
	Service	CPT Description	Wheelsin_Start Ratio
9	Orthopedics	Arthroscopy, knee, surgical	0.422321
22	Podiatry	Hallux rigidus correction with cheilectomy	0.416667
24	Podiatry	Neurectomy, intrinsic musculature of foot	0.416667
26	Podiatry	Plantar fasciotomy	0.408333
15	Pediatrics	Tympanostomy, general anesthesia	0.405556
1	ENT	Tonsillectomy	0.385210
28	Urology	Cystourethroscopy	0.380044
21	Podiatry	Correction, hammertoe	0.375000
10	Orthopedics	Carpal tunnel release, open	0.375000
31	Vascular	Digital amputation, metatarsophalangeal joint	0.360256

Wheelsin_Start

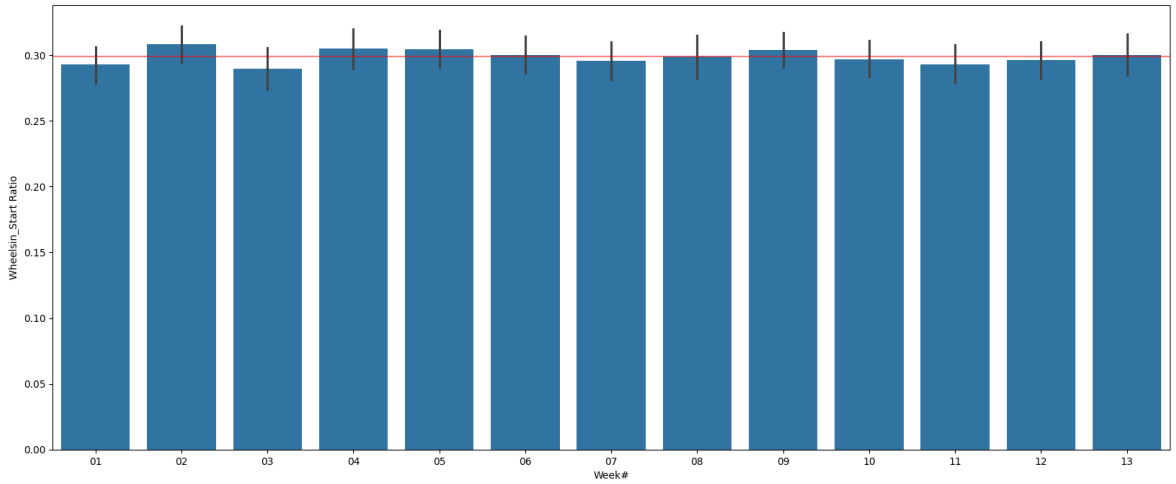
Avg Ratio W.r.t Booked time	0.29	[146] data["Wheelsin_Start Ratio"].mean() 0.29888121546961327

Can be Optimised by Proper Planning

OR Suite:



Week Wise:



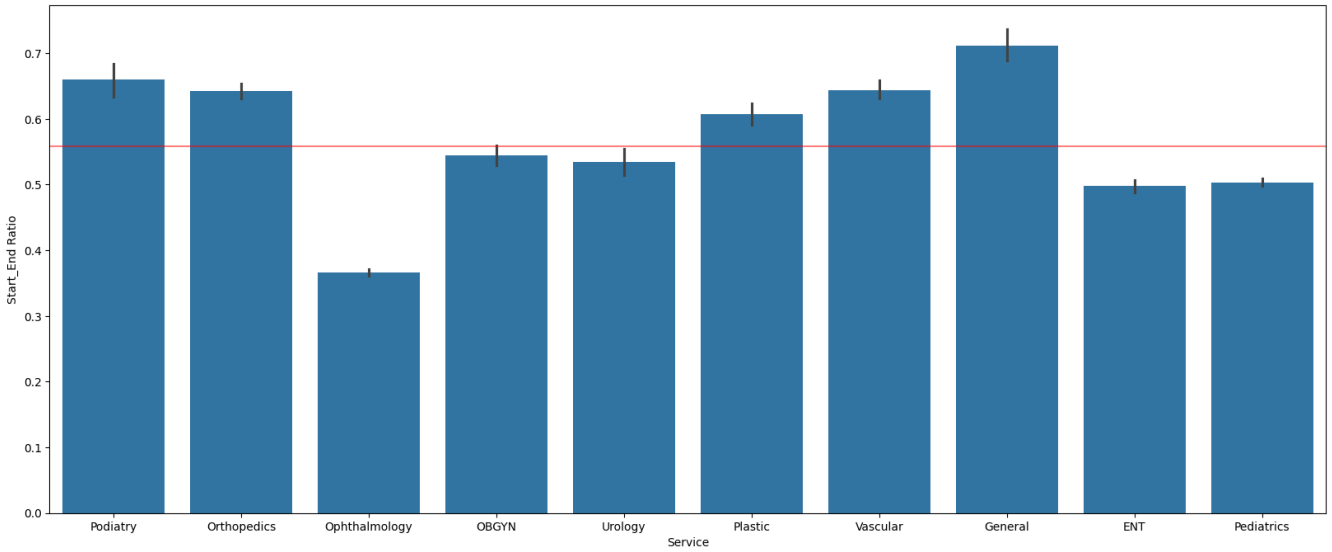
- Although OR Suites Show Some Trend, they are correlated to Service as OR Suite are Directly Related to Service
- Week wise not Much Variation Observed

Start_End

Avg Ratio W.r.t Booked time	0.55	[157] data["Start_End Ratio"].mean() 0.5582450890116636

Depends on Procedure being done… Cannot be Judged on basis of this Data

Service Wise:



- Start_End Depends on the CPT Procedure & patient Condition, so We cannot Analyze this Key stage with Present Dats

Top10 CPT Procedure:

```
data.groupby(["Service","CPT Description"])["Start_End Ratio"].mean()
```

	Service	CPT Description	Start_End Ratio
23	Podiatry	Lapidus bunionectomy	0.146667
6	Ophthalmology	Extracapsular cataract removal	0.365935
28	Urology	Cystourethroscopy	0.399781
4	OBGYN	Cervical biopsy	0.446667
14	Pediatrics	Myringotomy, general anesthesia	0.458333
1	ENT	Tonsillectomy	0.471523
12	Orthopedics	Flexor tendon repair	0.522222
15	Pediatrics	Tympanostomy, general anesthesia	0.533333
2	General	Laparoscopic cholecystectomy	0.533333
18	Plastic	Removal of benign skin lesion	0.544444

Bottom10 CPT Procedure:

```
data.groupby(["Service","CPT Description"])["Start_End Ratio"].mean()
```

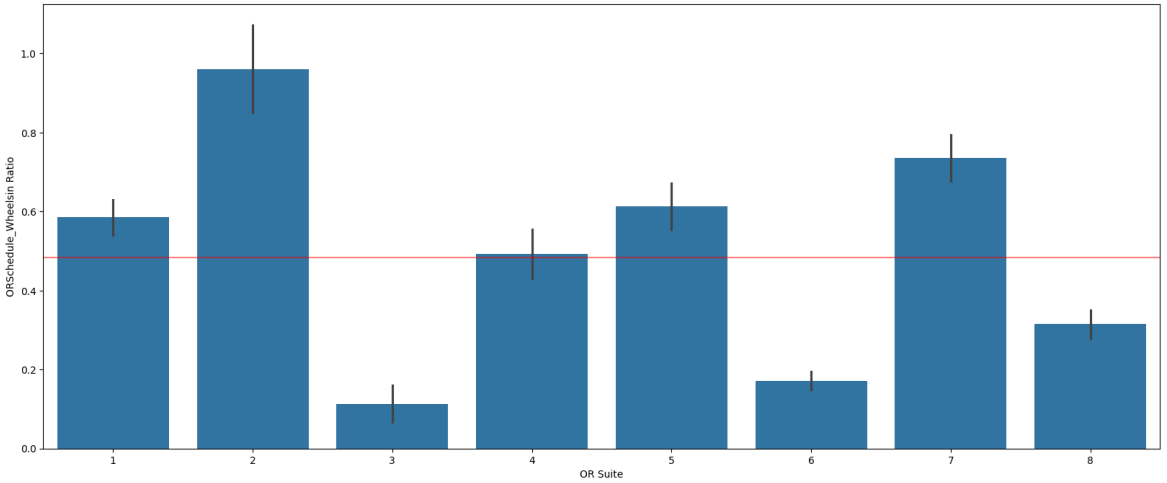
	Service	CPT Description	Start_End Ratio
25	Podiatry	Partial ostectomy, fifth metatarsal head	1.033333
3	General	Sleeve gastrectomy	0.800000
24	Podiatry	Neurectomy, intrinsic musculature of foot	0.800000
8	Orthopedics	Arthroplasty, knee, hinge prothesis	0.751423
21	Podiatry	Correction, hammertoe	0.750000
7	Orthopedics	Arthroplasty, hip	0.733333
27	Urology	Cryosurgery of the prostate gland	0.733333
30	Vascular	AV fistula	0.721404
13	Orthopedics	ORIF, phalangeal shaft fracture	0.700000
22	Podiatry	Hallux rigidus correction with cheilectomy	0.700000

Start_End

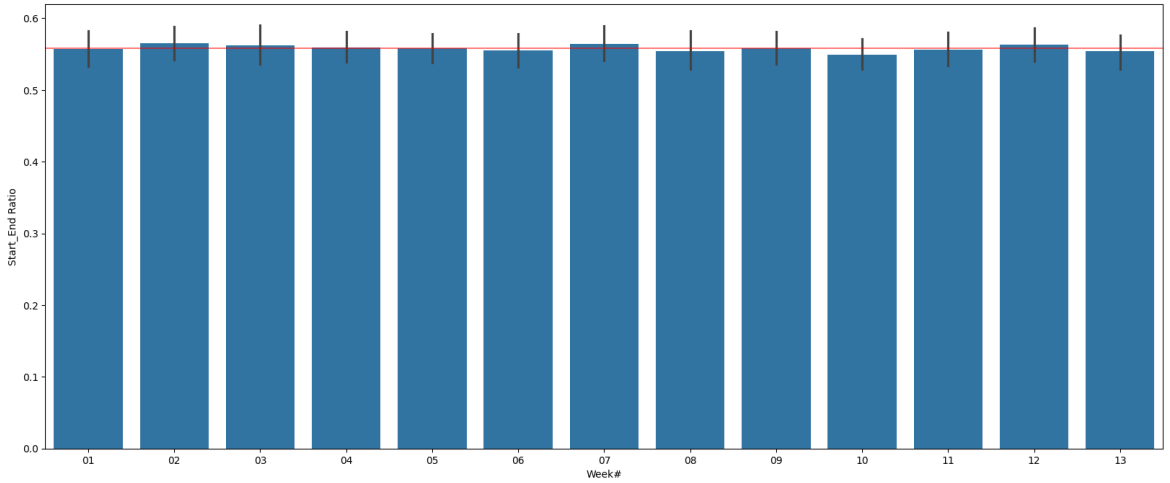
Avg Ratio W.r.t Booked time	0.55	[157] data["Start_End Ratio"].mean() 0.5582450890116636

Depends on Procedure being done… Cannot be Judged on basis of this Data

OR Suite:



Week Wise:



- Although OR Suites Show Some Trend, they are correlated to Service as OR Suite are Directly Related to Service
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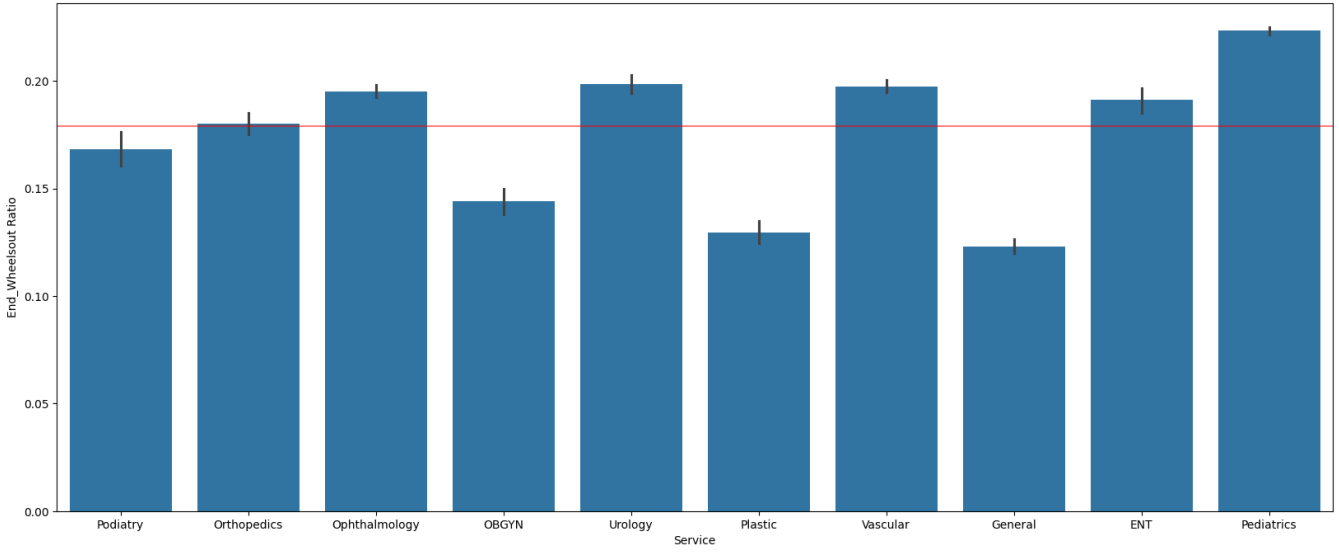
End_Wheelsout

Avg Ratio W.r.t Booked time	0.179	`[170] data["End_Wheelsout Ratio"].mean()` → `0.1790011765909556`

Can be Optimised by Proper Planning

Service Wise:



- Pediatrics ,ENT, Urology, Vascular ,Ophthalmology has high closing time after Procedure Ends

Top10 CPT Procedure:

```
[174] data.groupby(["Service","CPT Description"])["End_Wheelsout Ratio"].mean().reset
```

	Service	CPT Description	End_Wheelsout Ratio
17	Plastic	Liposuction	0.077778
23	Podiatry	Lapidus bunionectomy	0.106667
5	OBGYN	Hysterectomy, surgical	0.108333
19	Plastic	Rhinoplasty	0.108333
3	General	Sleeve gastrectomy	0.112500
16	Plastic	Adjacent tissue transfer, eyelids, nose, ears,...	0.116860
20	Podiatry	Bunionectomy with distal osteotomy	0.118039
11	Orthopedics	Fasciotomy, palmar, open	0.132275
0	ENT	Septoplasty	0.133333
25	Podiatry	Partial ostectomy, fifth metatarsal head	0.133333

Bottom10 CPT Procedure:

```
75] data.groupby(["Service","CPT Description"])["End_Wheelsout Ratio"].mean().rese
```

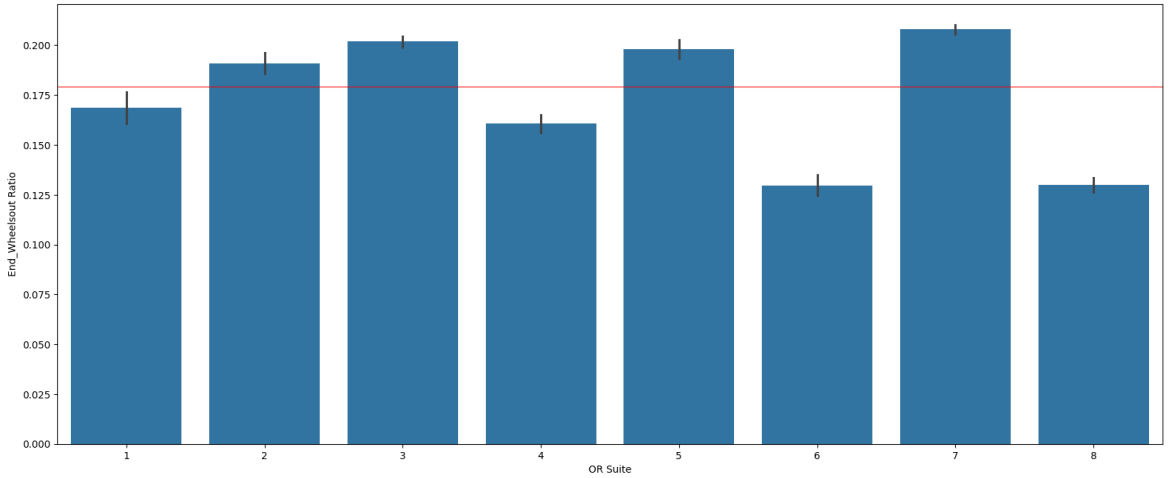
	Service	CPT Description	End_Wheelsout Ratio
21	Podiatry	Correction, hammertoe	0.266667
15	Pediatrics	Tympanostomy, general anesthesia	0.227778
9	Orthopedics	Arthroscopy, knee, surgical	0.223958
31	Vascular	Digital amputation, metatarsophalangeal joint	0.216667
14	Pediatrics	Myringotomy, general anesthesia	0.216667
28	Urology	Cystourethroscopy	0.213596
12	Orthopedics	Flexor tendon repair	0.211111
1	ENT	Tonsillectomy	0.209051
26	Podiatry	Plantar fasciotomy	0.208333
10	Orthopedics	Carpal tunnel release, open	0.200000

End_Wheelsout

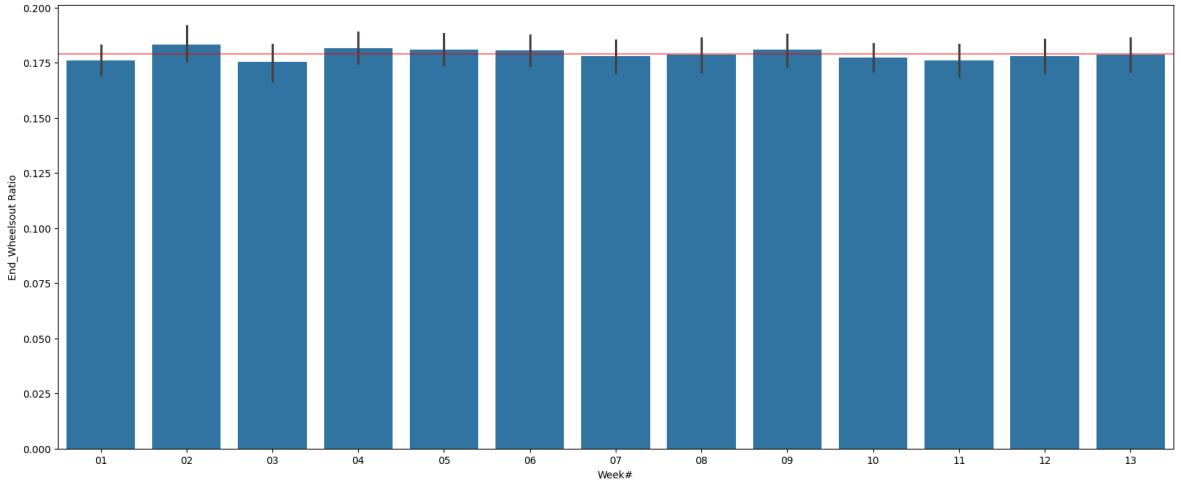
Avg Ratio W.r.t Booked time	0.179	[170] data["End_Wheelsout Ratio"].mean() 0.1790011765909556

Can be Optimised by Proper Planning

OR Suite:



Week Wise:



- Although OR Suites Show Some Trend, they are correlated to Service as OR Suite are Directly Related to Service
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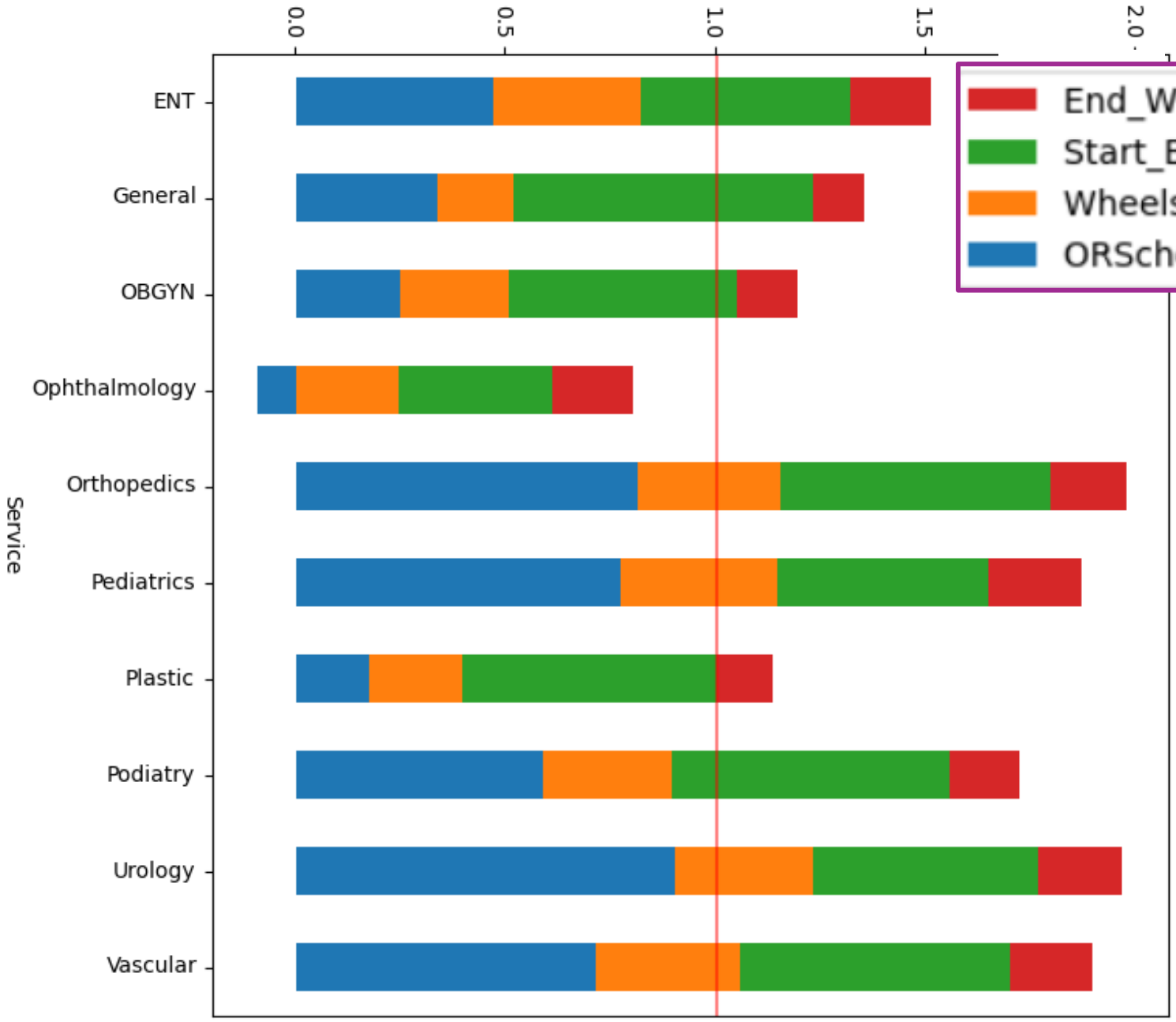
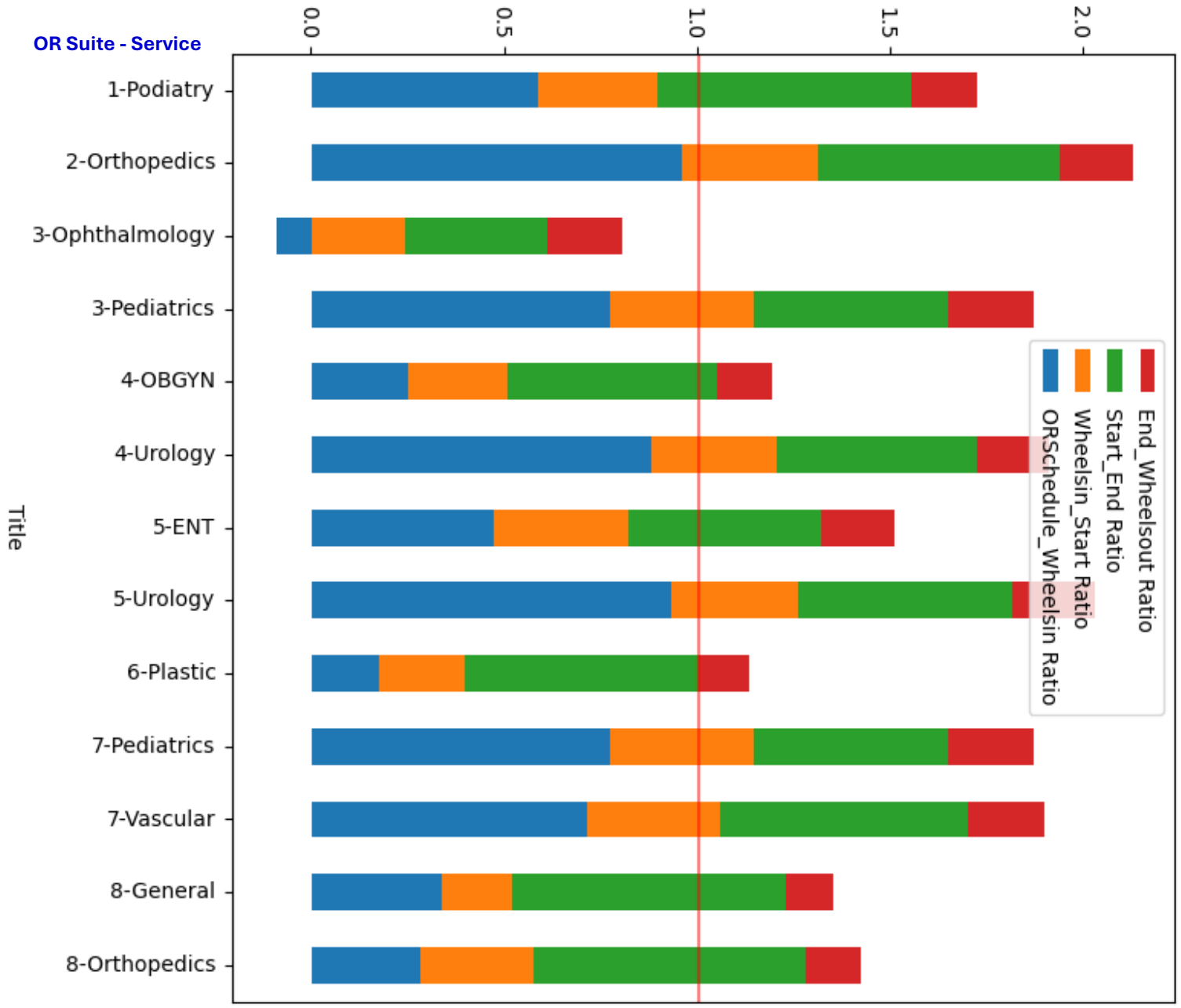
Overall Analysis of key stages Duration Ratio – Service Wise



- Overall OR Engagement ratio wr.t Booked time is High with Orthopedics, Pediatrics, Urology, Vascular & Podiatry → Drastic need to Work on Improvement of Planning in these Services

- Ophthalmology has Best Overall OR Engagement ratio wr.t Booked time → Booking Time & Planning is good

Overall Analysis of key stages Duration Ratio – OR Suite & Service Wise



- We can Confirm that OR Suite Has less Dominance on the Overall Ratio, rather Service & CPT Procedure done has impact on the Overall Usage ratios
- So, We must Focus on CPT Procedure to Optimize Resources
- Orthopedics Procedures in OR Suite 8 have better usage Efficacy Comparatively, may be due to CPT Procedure done in OR Suite-8

Potential cost savings and increase procedure throughput

To calculate Potential Cost Saving, we will consider below Assumptions

- Consider **ORSchedule_Wheelsin to be "0"**
- Assume **Minimum Time** for Each CPT Procedure among Data
  1. Wheelsin_Start
  2. End_Wheelout
- We will not assume Start_End as it might Vary for each patient to Patient

```
[255] A= data.groupby(["Service","CPT Code"]).agg({"Encounter ID":"count",
                                                   "ORSchedule_Wheelsin":"mean",
                                                   "Wheelsin_Start":["min","mean"],
                                                   "Start_End": "mean",
                                                   "End_Wheelsout":["min","mean"] }).reset_index()
      A.columns = A.columns.map('|'.join).str.strip('|')
      A
```

```
A[['Service', 'CPT Code', 'Encounter ID|count',"Present","Improved"]].head(5)
```

	Service	CPT Code	Encounter ID|count	Present	Improved
0	ENT	30520	46	4761.0	3749.0
1	ENT	42826	151	14668.0	8802.0
2	General	43775	78	11700.0	9828.0
3	General	47562	39	5460.0	3120.0
4	OBGYN	57460	82	8036.0	5863.0

```
[257] A["Present"] = A["Encounter ID|count"]*(A["ORSchedule_Wheelsin|mean"]+A["Wheelsin_Start|mean"]+A["Start_End|mean"]+A["End_Wheelsout|mean"])
      A["Improved"] = A["Encounter ID|count"]*(A["Wheelsin_Start|min"]+A["Start_End|mean"]+A["End_Wheelsout|min"])
```

```
[260] efficiacy_Impprovement = (A["Present"].sum() - A["Improved"].sum())/A["Present"].sum()
      efficiacy_Impprovement*100
```

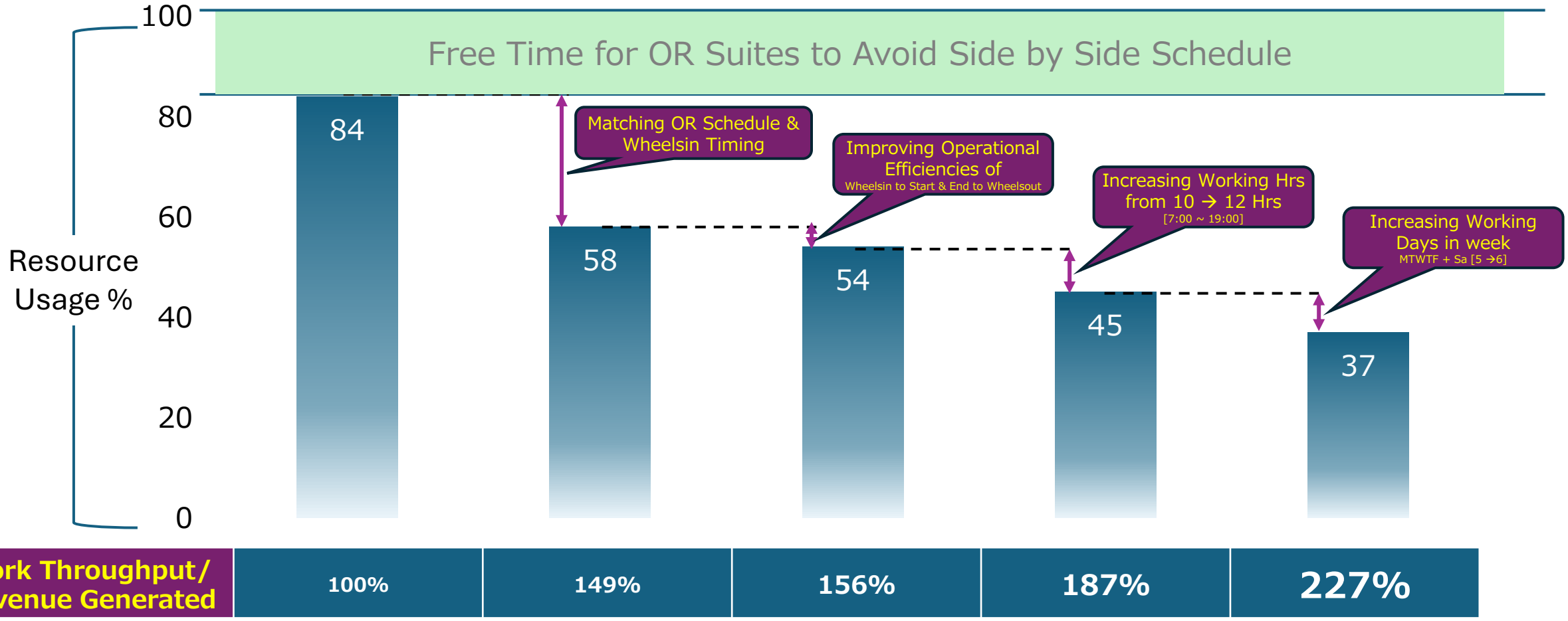
```
35.83645291069552
```

By Improving Operational efficiencies, we will be able to Optimize the Resource utilization by 36%

Road Map For Improvement

For the Road map , we will have below Assumptions for Understanding Reference

- We will consider the Present Workload and Compare Resource Usage % against All Conditions
- We will Consider Revenue Generated /Procedure Throughput as 100% and use it for Representation against All Conditions
- Let us Assume the Present 84% as the Maximum tight Schedule Possible for all OR Suite to remove Side by Side Schedule



By Improving Operational efficiencies & Working Hrs, Revenue can be Increase by 127%

Final Analysis Summary

Insights	Recommendations
❑ OR Rooms are used only between 7:00 ~ 17:00 and only on Weekdays i.e., 5 Days ❑ Actual Utilization rate w.r.t. to Total Available OR Suite Time is Low i.e, 58% only	❑ By Increasing the Working Hrs [10 – 12 Hrs] & Working Days [5 →6], Procedure Throughput can be Increase by 127%
❑ Actual Usage time is 3% More than the Booked time, But Overall OR Suite Engaged time is 49% more than booked time meaning its is blocked but not used	❑ Timely Reminders with continuous Intimation before 1day, 1hr, 15min to ensure team's minimized time between ORSchedule_Wheelsin ❑ By Improving Operational efficiencies, we will be able to Reduce the OR Suite Engagement time by 36%
❑ Utilization rate Varied w.r.t OR Suites.. Varied around 50.83 [OR:3]~62.37%[OR:1]	❑ Resource Balancing & Utilization can be done with external agencies in the Unused OR Suite Time like in Afternoon
❑ 80% of the OR Procedures are done only in the Morning 7:00 ~ 12:00	
❑ Booking rate is comparatively high in the Middle of Week and Low on Monday & Friday	
❑ Podiatry and Orthopedics Services Booking time must be correctly Recalibrated as per Each CPT Procedure, as present Bookings are Inaccurate [Sometime Overbooking & under booking] irrespective of CPT Procedure	❑ CPT Procedure wise Booking Slots With historical Data like Mean ± 1 Std Dev can be Prefixed in the System to avoid overbooking and underbooking for given procedure
❑ Urology[Delay 90% of Booked Time],Orthopedic[81%], Pediatrics[77%] in Meeting the Planned Schedule	❑ Timely Reminders with continuous Intimation before 1day, 1hr, 15min to ensure team's minimized time between ORSchedule_Wheelsin
❑ Pediatrics[Delay 37% of Booked Time],ENT[35%],Orthopedics & Vascular[34%] takes Comparatively High Preparation Time before Procedure Starts	❑ Pre & Post Preparation to be done to Reduce Wheels n to Start Time as Almost Different OR Suites are Used by Different Services
❑ Comparatively Pediatrics ,ENT, Urology, Vascular ,Ophthalmology has high closing time after Procedure Ends	
❑ Overall OR Engagement ratio wr.t Booked time is High with Orthopedics, Pediatrics, Urology, Vascular & Podiatry → Drastic need to Work on Improvement of Planning in these Services	❑ Ophthalmology has Best Overall OR Engagement ratio wr.t Booked time → Booking Time & Planning is good → Panning Methodology used by Opthalmology can be Horizontaly Knowledge Transferred to Other Specialities