Agile Analytics to Enhance Patient Experiences at the Duke Eye Center

April 24, 2019

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DukeHealth

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Objectives

Objective 1: Describe the benefits and challenges of agile software development as they apply to healthcare analytics

Objective 2: Interpret seven different chart types and understand why they were selected to visualize the data

Objective 3: Identify the six factors that can negatively or positively impact patient wait times.

Who is the PORT Team?

(**P**DC **O**utcomes **R**esearch **T**eam)

What is the PORT Process?

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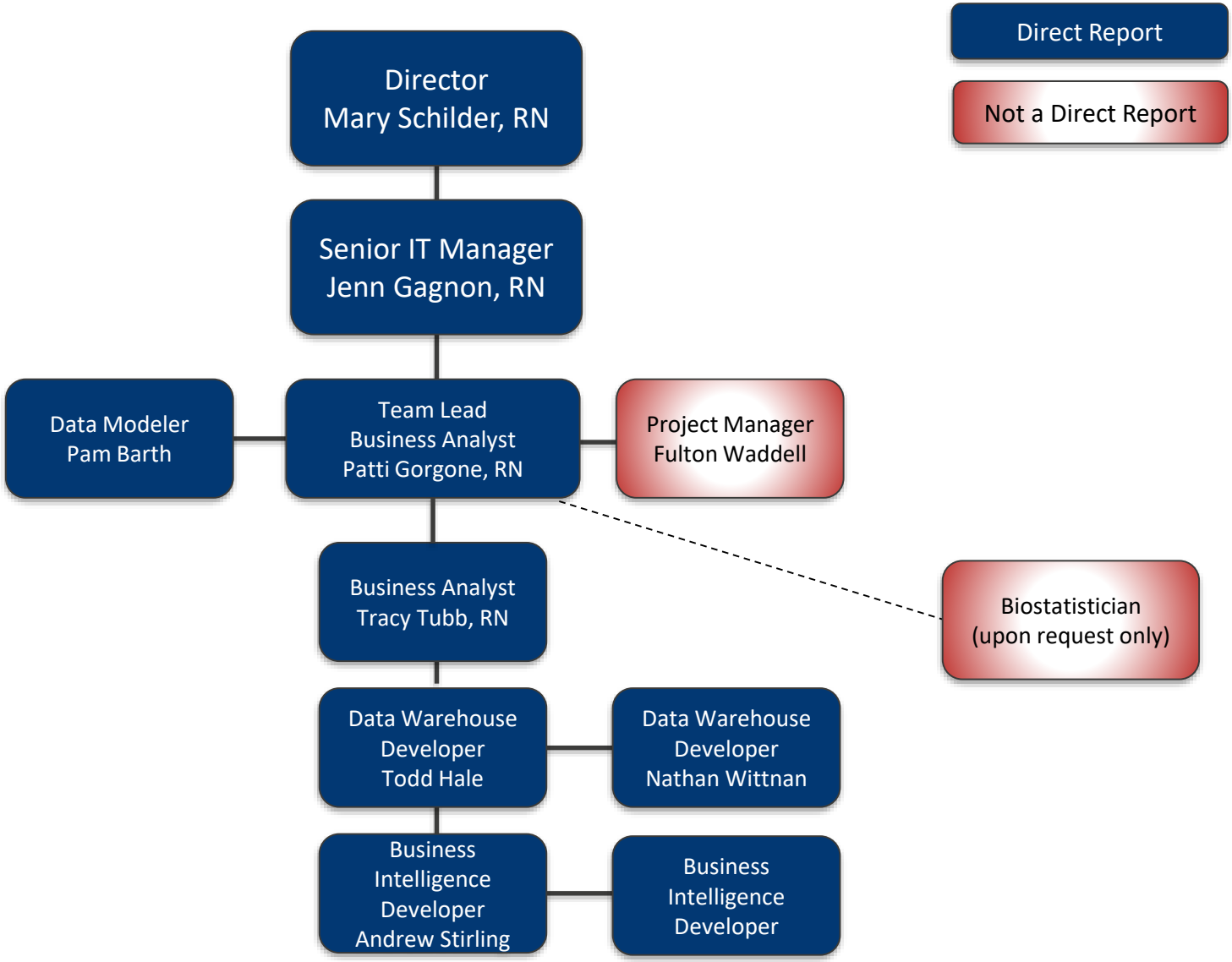
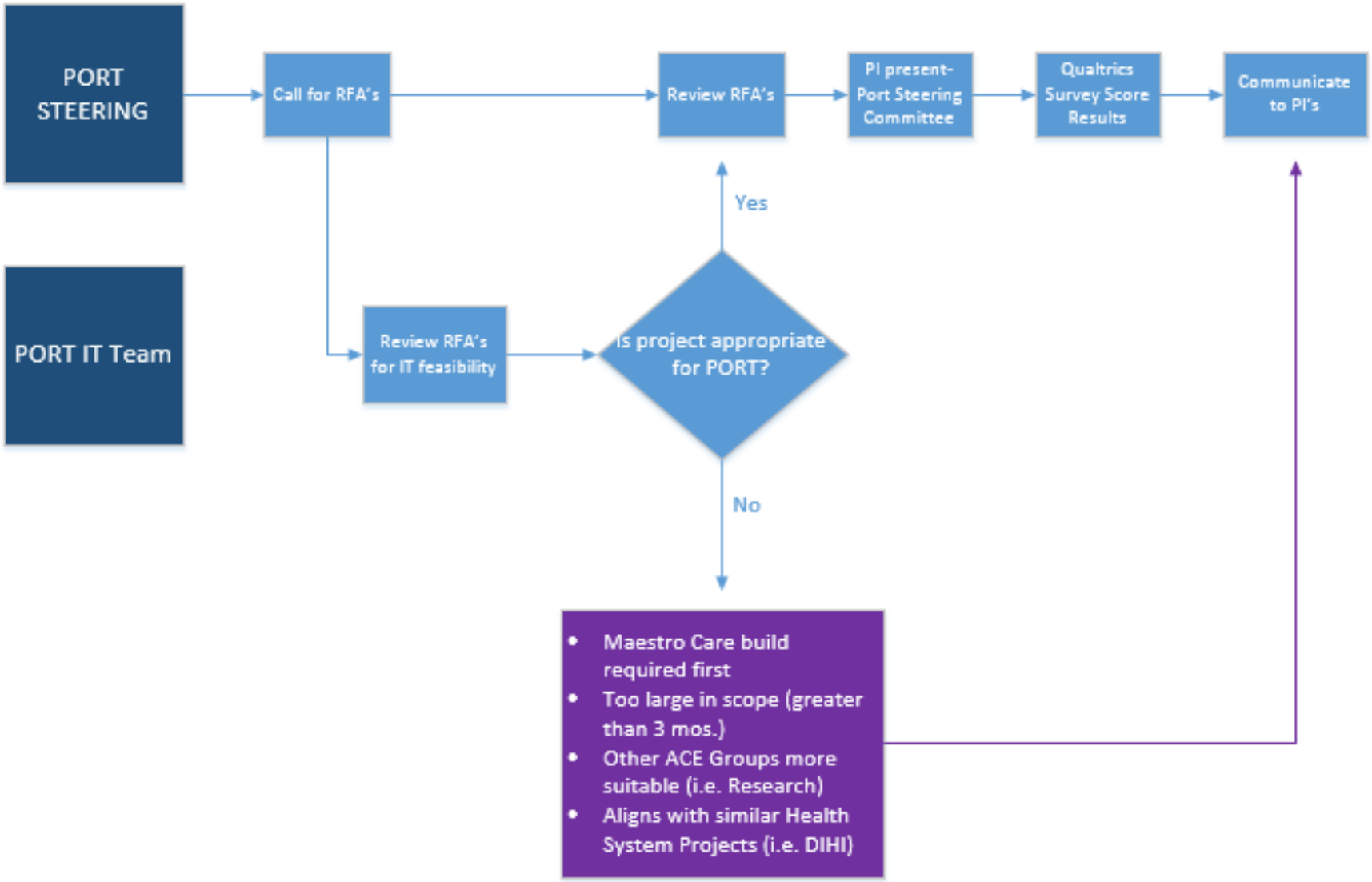
PORT Organizational Structure

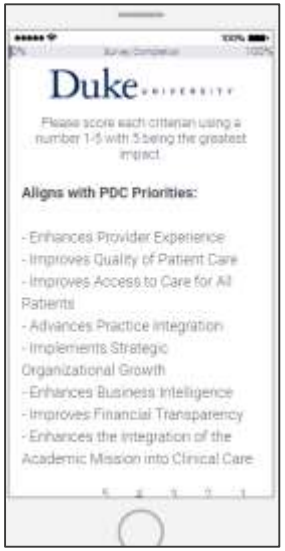


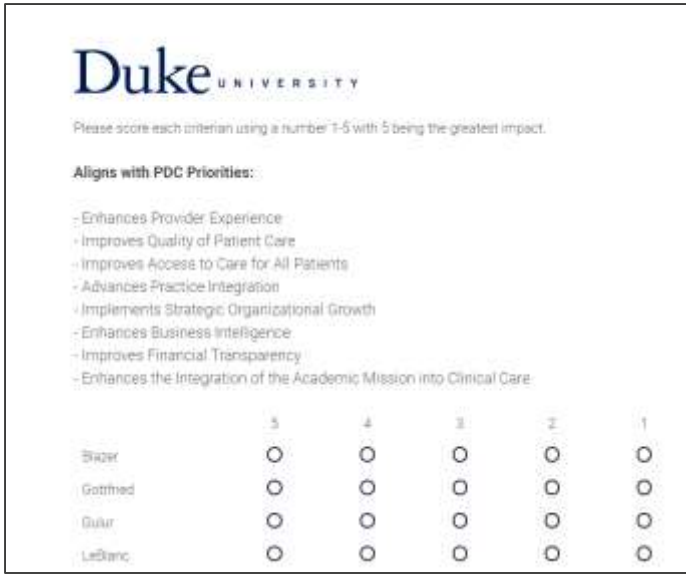
PORT RFA Process



PORT Steering RFA Qualtrics Survey

- **Aligns with PDC Priorities**
  - Enhances Provider Experience
  - Improves Quality of Patient Care
  - Improves Access to Care for All Patients
  - Advances Practice Integration
  - Implements Strategic Organizational Growth
  - Enhances Business Intelligence
  - Improves Financial Transparency
  - Enhances the Integration of the Academic Mission into Clinical Care
- **Impact**: Addresses important problem & contribute to the improvement of significant clinical, financial or operational outcome
- **Approach**: Methods & analyses proposed are well-reasoned, clearly articulated, and suitable to accomplish the specific aims of the proposal
- **Includes readily available data sources at Duke:**
  - Pre-existing Registry Data strongly encouraged
  - Use of high-quality data capture at Duke through clinical and administrative data in Maestro, Financial Systems, Rev Cycle considerations
- **Quality of proposed team**
- **Availability of Clinical Lead** (Requestor) to provide input, clinical impressions and recommendations to the IT Team during 3-month Project period



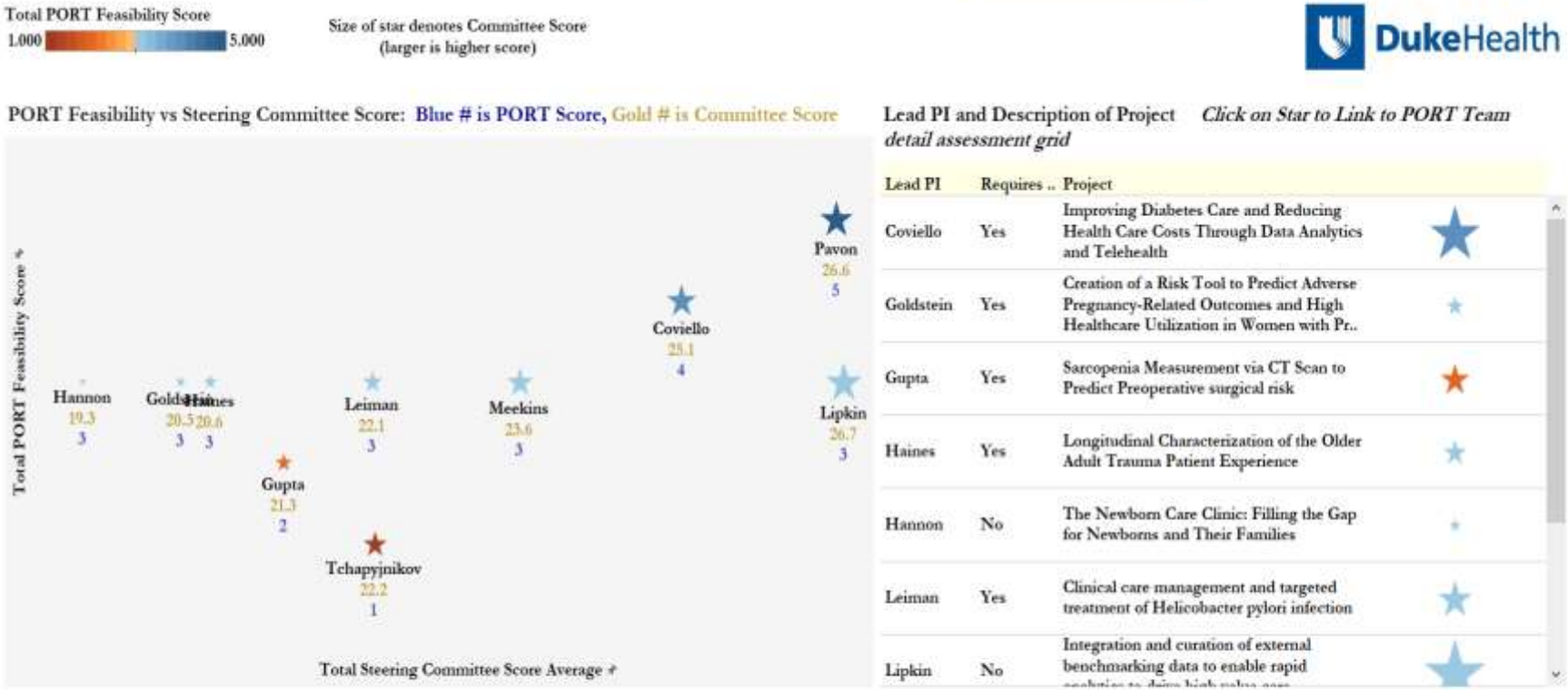


PORT Technical Team Qualtrics

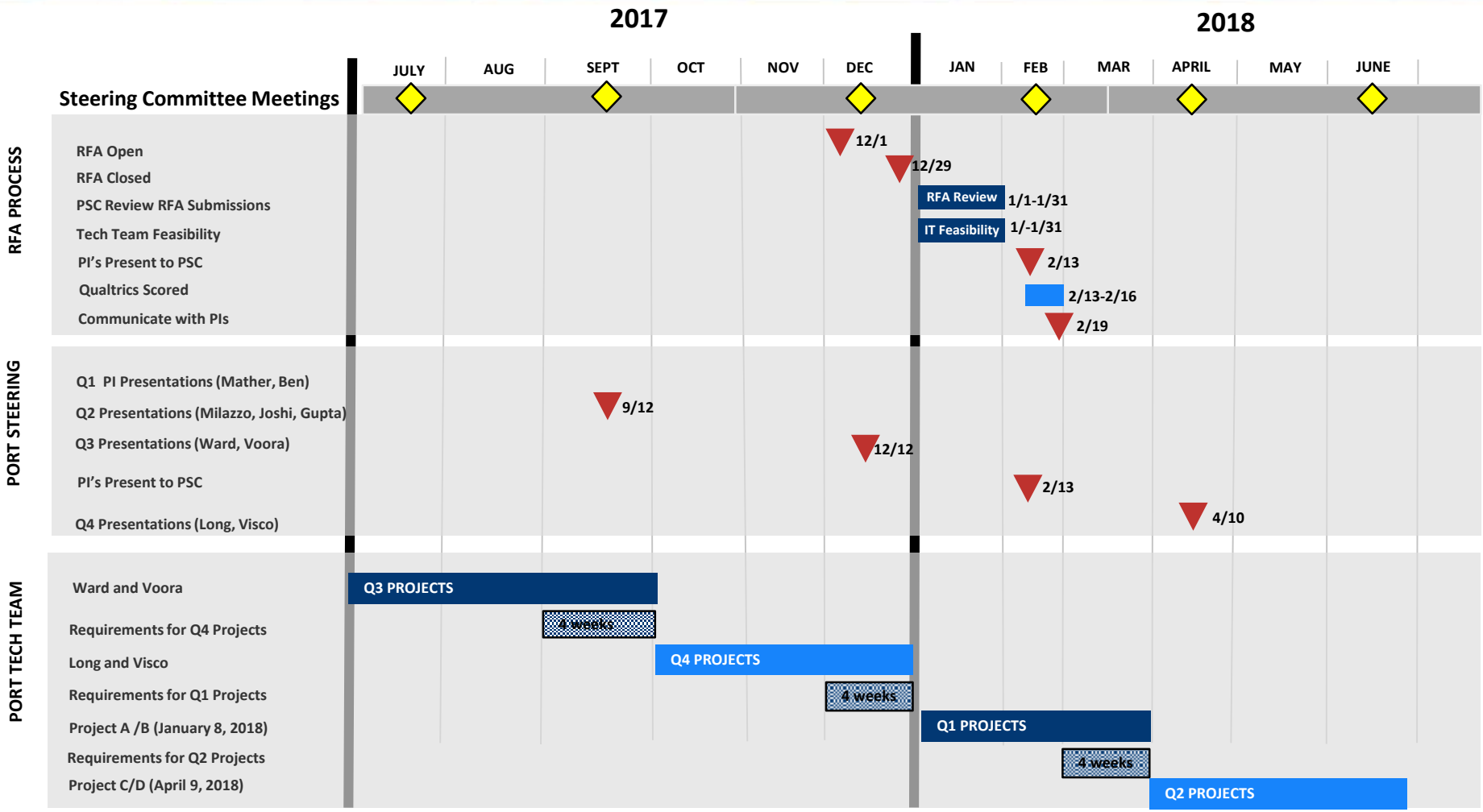
PORT Technical Team Qualtrics IT Feasibility

- Is work effort feasible in 3 months?
- Is this request within the Tech Team ability?
- Will this require a statistician?
- Can any existing work be reused?
- What is the risk that the deliverable(s) cannot be met?

PORT RFA Results: Value vs. Feasibility



PORT Program Timeline



PORT Pre-Embarkation Questionnaire

P.O.R.T Pre-embarkation Questionnaire

Congratulations on your project chosen by the PORT (Patient Outcomes Research Team) Steering Committee. There will be two or three IT professionals to assist with your project for a three-month period. To help PORT get some initial background information, please complete the following questionnaire prior to your scheduled kick-off meeting.

Question	Project Sponsor Feedback:
Have any Duke resources formerly completed work or currently working on this topic? If so, please confirm and provide applicable documentation and contacts. Examples include: • Any requests placed through the GET IT analytics and reporting portal (if yes, include request/ticket number) • Performance Services • Care Redesign Initiatives • Consultants (e.g. Deloitte or Fuqua students) • Research departments such as DCRI, DIHI, or Biostats and Informatics	
How would you like to use the end product(s) of your project? • Full Service: "Made-to-order" analytics deliverables that require minimal interaction and minimal application training • Self Service: An application environment where you will perform ad-hoc analysis (i.e. "play with the data") that requires application training • Hybrid of the approaches	
Do you have access to data you use on a routine basis? If so, please tell us the nature, source, and names of reports or share examples with us. Examples include: • Financial reports (excel reports, Tableau views, Performance Services website) • Excel workbooks or ad-hoc analyses • Maestro Care Reports (Reporting Work Bench, Radar dashboards, or Crystal Reports) • Universes (Business Objects or sometimes called webI "webbie") • **Other:** DEDUCE queries, RedCap Databases, registries or claim databases, P.A.C.E	
Specifically, for EHR (Maestro Care) data of interest, do you know the location of the information of interest or a lead for the information (e.g. "I think it is an ORDER," or "I know I prescribe it electronically,")? Please let us know or keep this in mind as the project progresses.	
Please direct us to a few academic papers to help with basic familiarity on the subject area. We have citations from the proposals, however, we would like your input on which to focus on or ones not cited. Additionally, let us know of any clinical guidelines for your topic (e.g. AAOS guidelines for treating Osteoarthritis).	
Please confirm other contacts for the team. We recommend 1-3 people for the project, including an operations contact such as a clinic manager or HCA.	
Please let us know preferred days and times for project meetings. Please also indicate any unavailable time during the 3-month period that you may not be available (i.e. conferences or other out of office time). This information is so we can schedule meetings in advance. On average, you can expect about 15 meetings for the entire period of the project.	

How does PORT use Agile?

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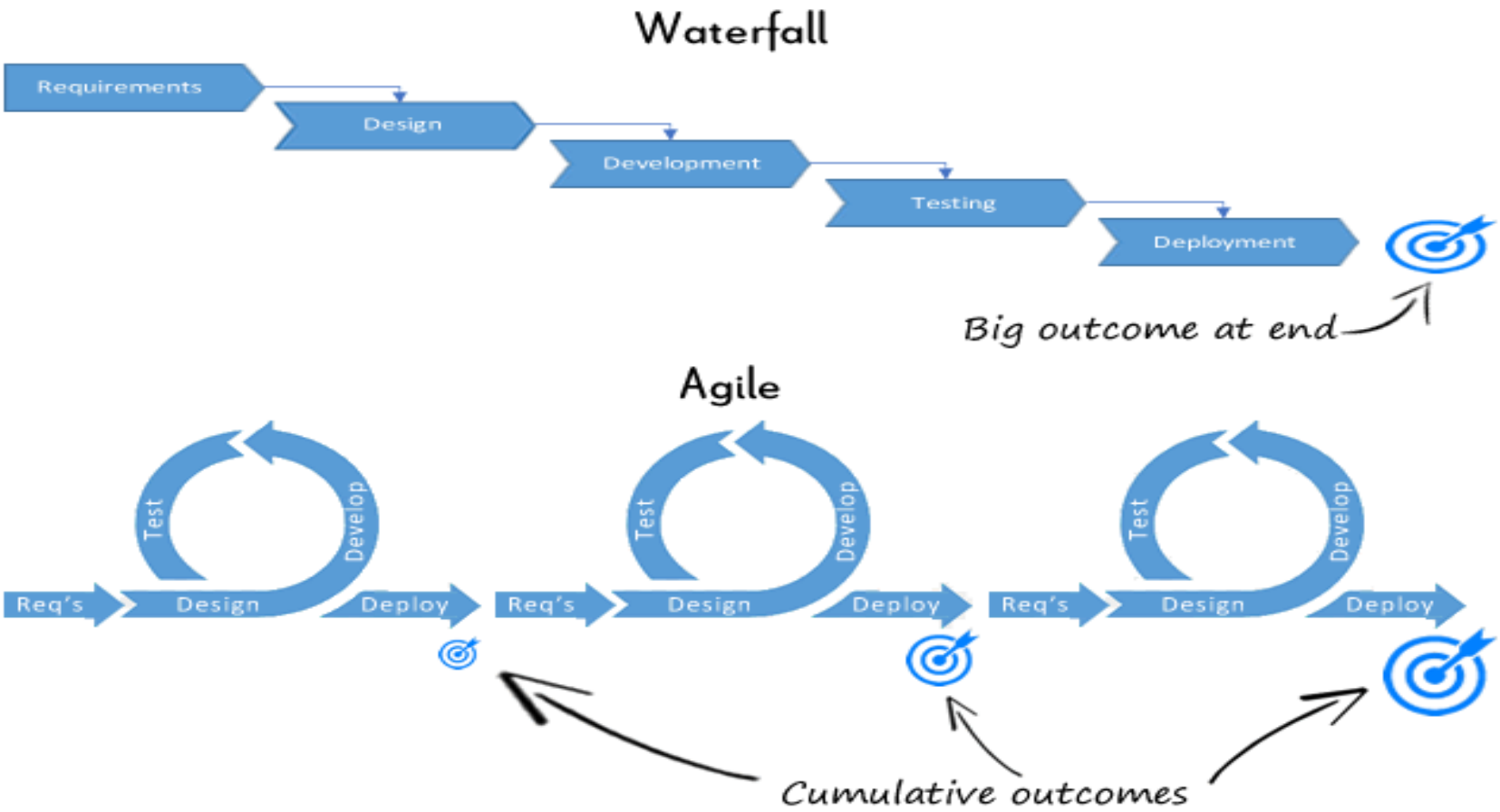
Waterfall vs. Agile



Example Port Team Project Timeline

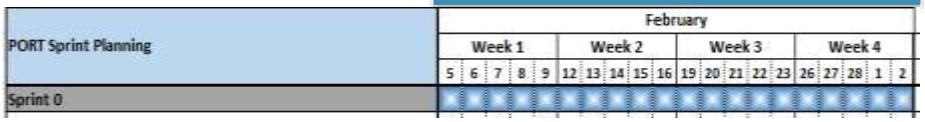
PORT Team
Sprint 0
Sprint 1
Sprint 2
Sprint 3
Sprint 4

Biostatistician (if applicable) - earliest entry point at Sprint 2

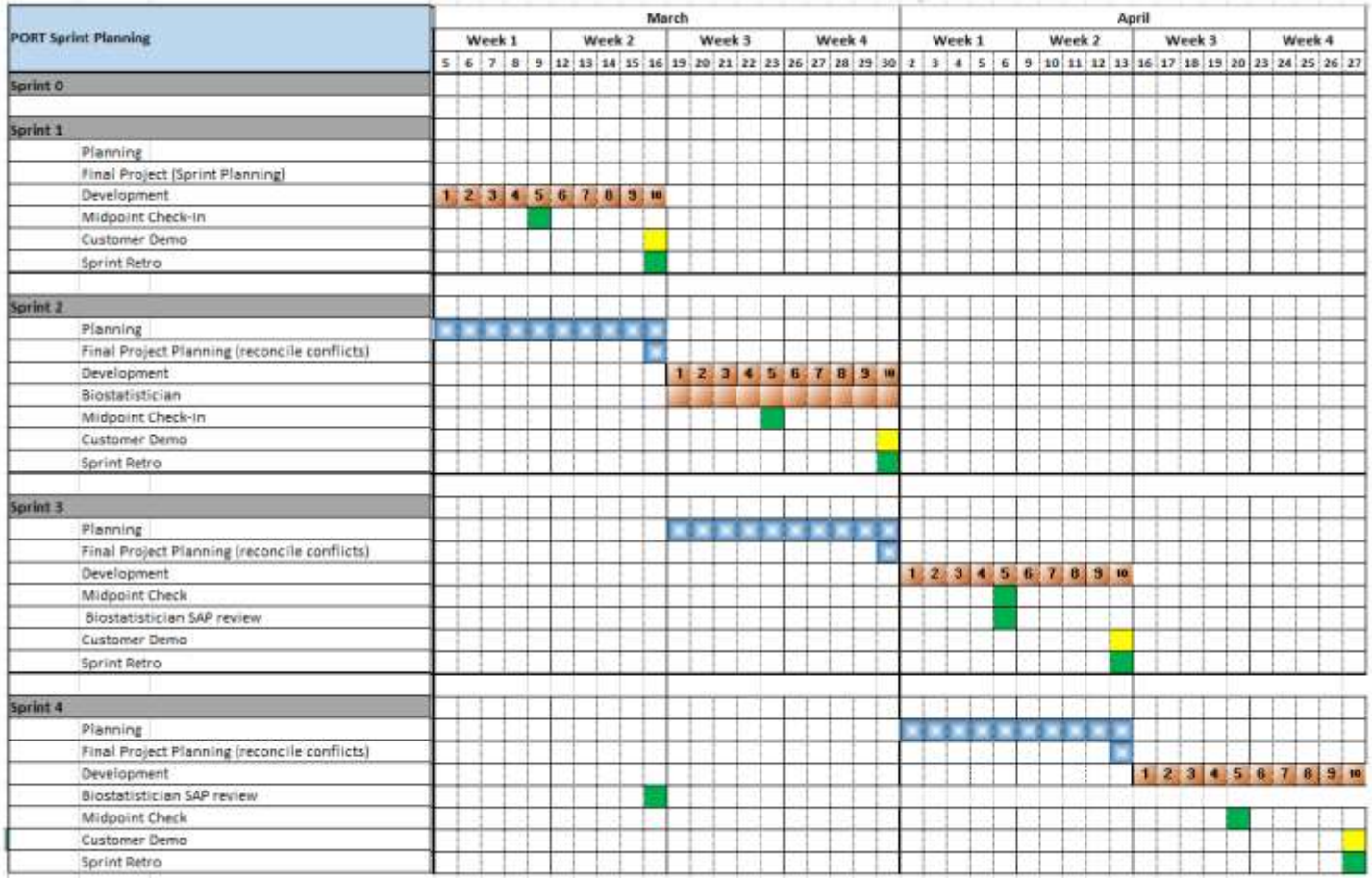
Requirements Gathering

Sprint 0

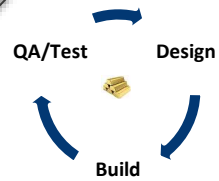
4 weeks



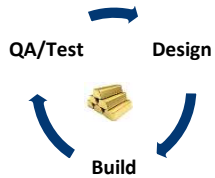
8 weeks



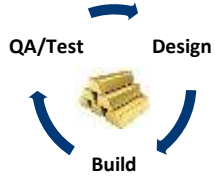
Sprint 1



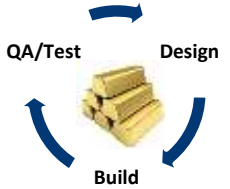
Sprint 2



Sprint 3

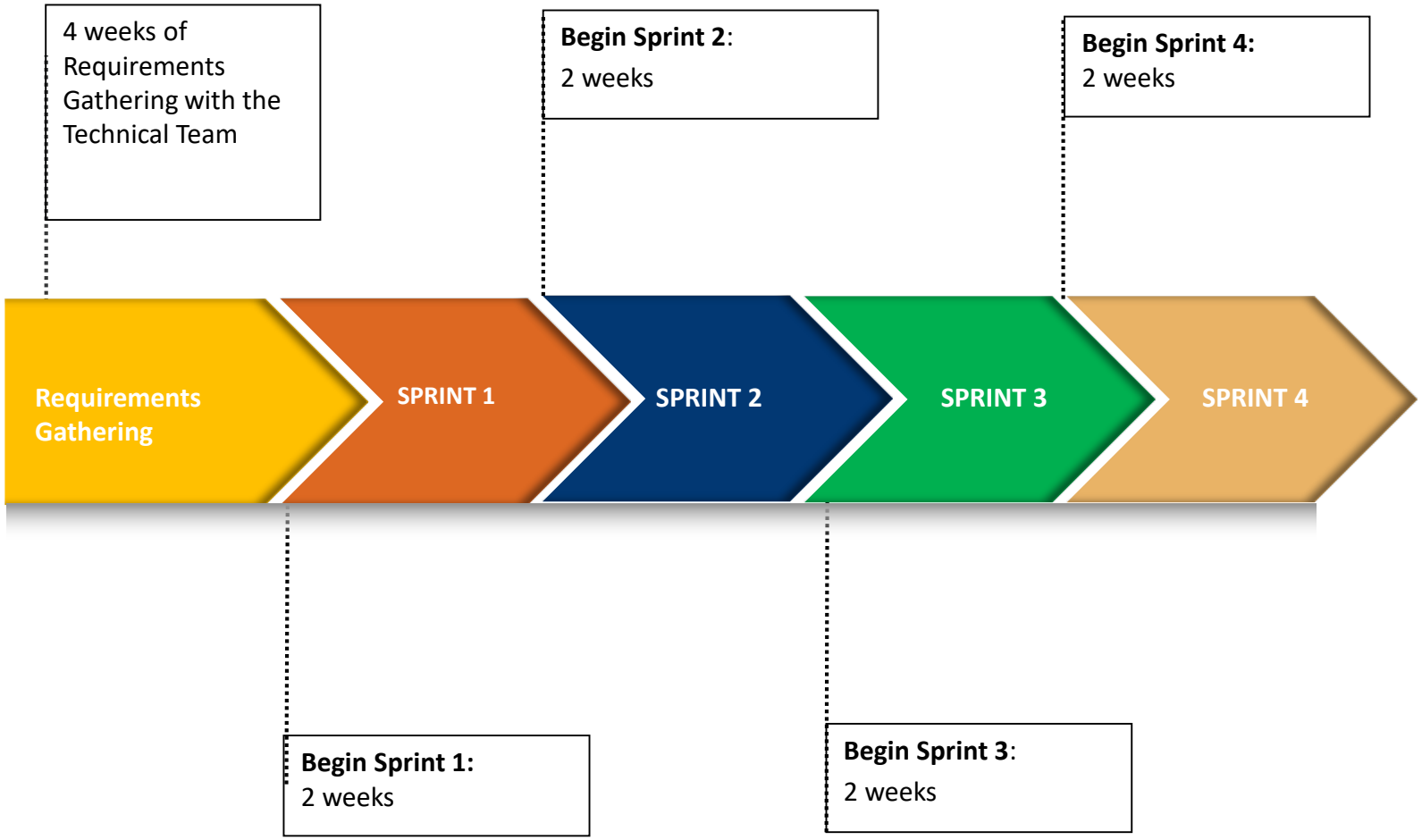


Sprint 4



Agile Process for PORT Project Management

The Eye Center Project duration was over a four month period. The Technical Project Team utilized Agile methodology to gather requirements over four weeks and then completed four, 2-week Sprints. The last month was spent fine-tuning the Tableau Dashboard.



PORT Retrospective: Prime Directive

Regardless of what we discover here today, we understand and truly believe that everyone did the best job they could, given:

- what we knew at the time
- our skills and abilities
- the resources available
- the situation at hand

The Retrospective is a Gold Mine …a learning opportunity to be more efficient… a look back on team performance/collaboration.

Benefits

- Engages PIs
- Enhances team synergy

Examples of Learning Opportunities

- IRB Exemption
- PORT Foundations Meetings
- PORT BA/PM Meetings
- Questionnaire/Checklist
- Team Communication
- PI Communication
- Work Effort Estimation

PORT Project Closing Report

Includes process information…

Project Timeline

Team Members

Sprint Goals, including what was delivered each sprint

And project information…

Data Definition for the project

Product Delivered
e.g., Tableaus, WebI, Data Extract

Ongoing Maintenance

Technical Documentation

The Project:
Agile Analytics to Enhance Patient Experiences at the Duke Eye Center

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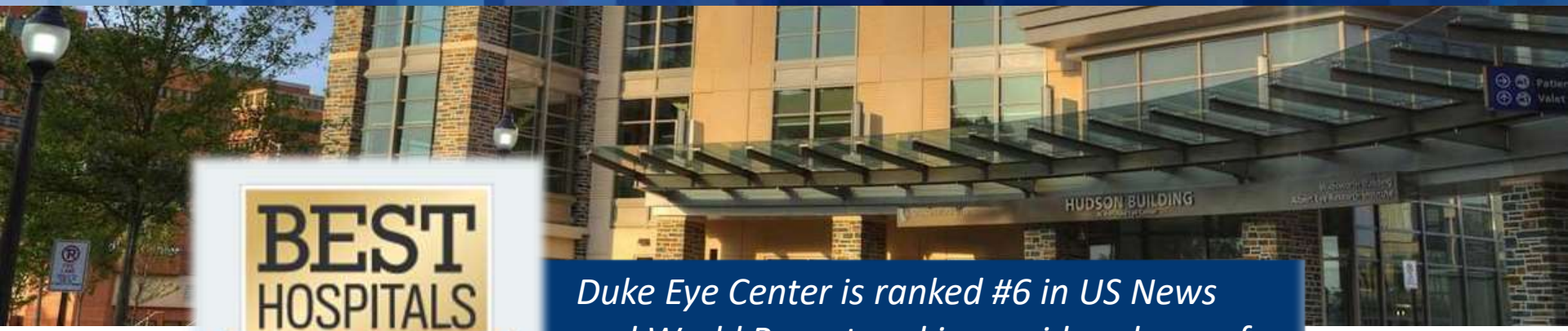
About the Duke Eye Center



BEST HOSPITALS U.S.News & WORLD REPORT RANKINGS

Duke Eye Center is ranked #6 in US News and World Report and is considered one of the top Eye Centers in the Country

- High-volume center, seeing, seeing 400-500 patients per day, 90,000 a year
- Full spectrum eye care including adult & pediatric ophthalmology, retinal disease, visual fields & imaging, glaucoma, cataract and laser vision surgery and neuro-ophthalmology.
- Opened 51 years ago, employs over 150 employees and currently has 35 providers.
- Generated revenue of $12 million clinical revenue for the Eye Center

Modeling of Ophthalmic Imaging Utilization and Workflow for Duke Ophthalmology

Product Owner: Dr. Divakar Gupta, MD
Glaucoma Specialist, Ophthalmologist

Eye Center Goals:

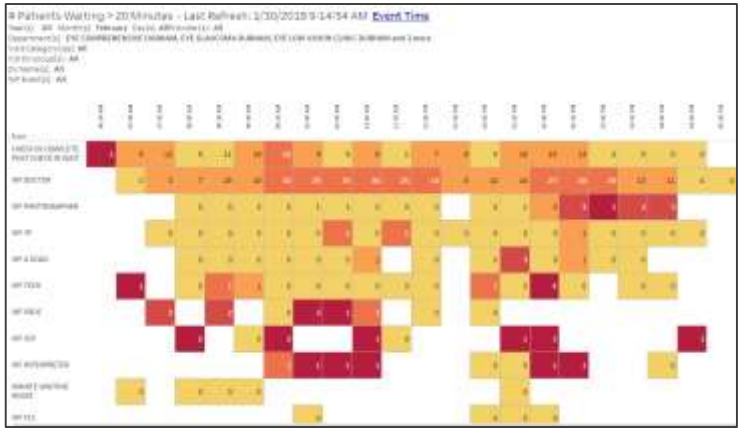
- Decrease patient wait times
  - Identify bottlenecks (staffing, equipment, appt type)
- Increase patient, provider, and staff satisfaction

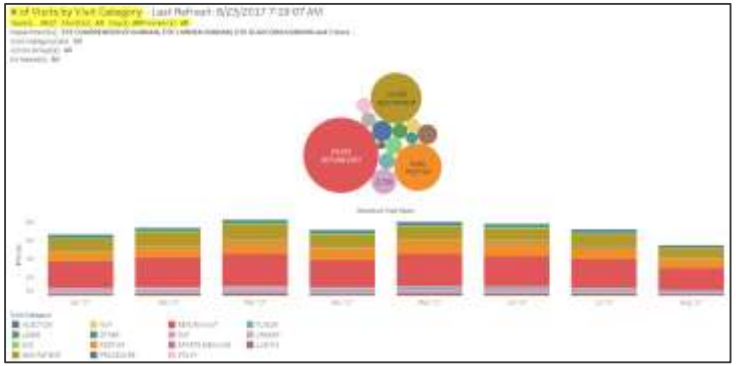
Deliverables:

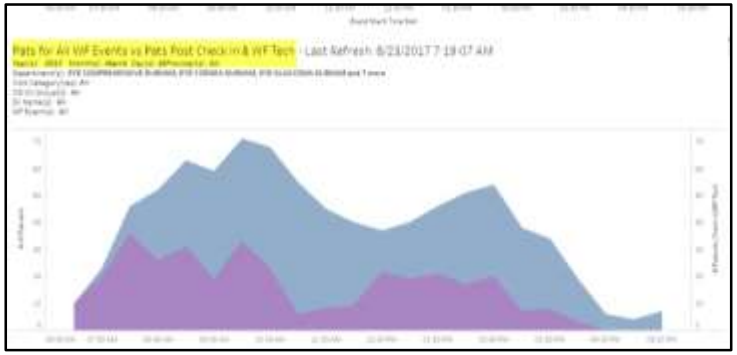
- Tableau Dashboard provides analysis of patient movement patterns by specialty, provider, patient indication and patient appointment type.
- Dashboard helps identify opportunities where appt templates result in excess demand on equipment.
- Dashboard analyzes technician work-up time, imaging times & patient cycle times to aid evaluation of staffing needs.

Project Impact:

- Illustrates patient flow
- Identifies bottlenecks (staffing, equipment, appointment types)
- Provides reports for Eye Center administration
- Provides provider-level metrics
- Automated data analysis saves time & provides scalability, consistency, full view into patient movement data



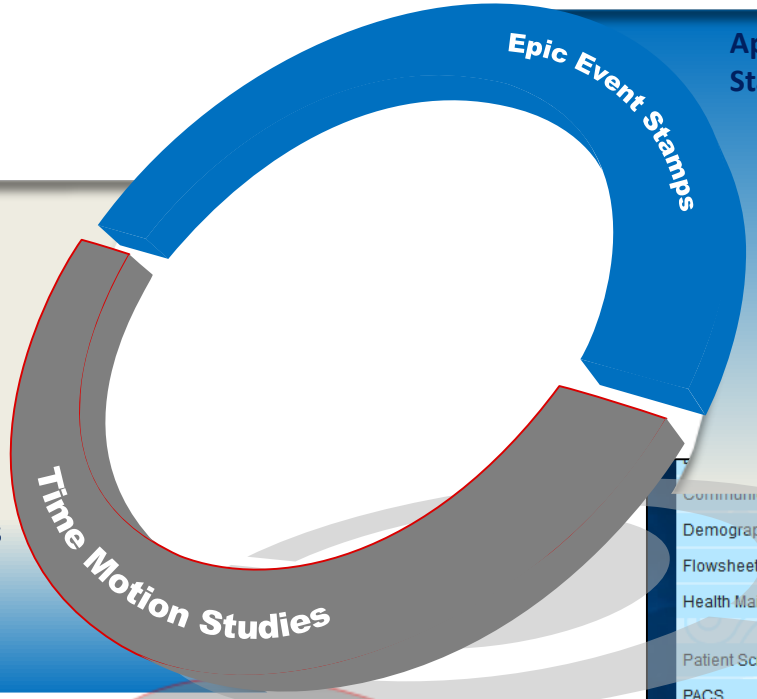




Approach to Getting the Right Data

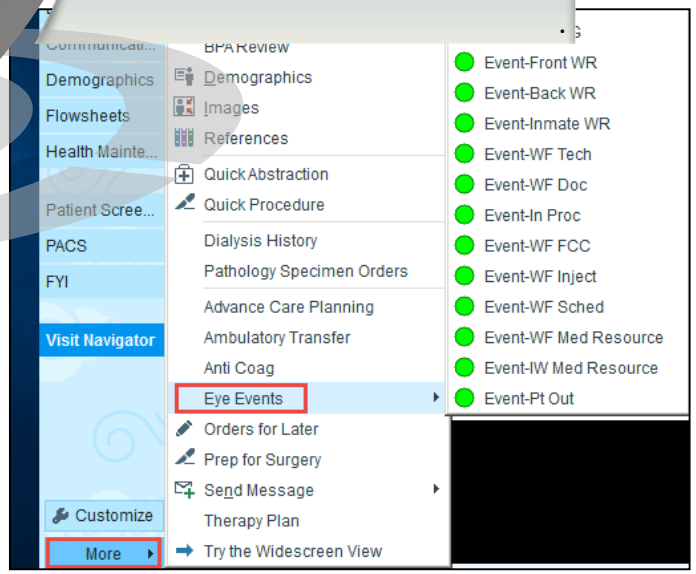
1st Approach: Time Motion Studies

- Inconsistent
- Not easy to understand interactions between patients being seen by different providers and through various points of their clinic visits.



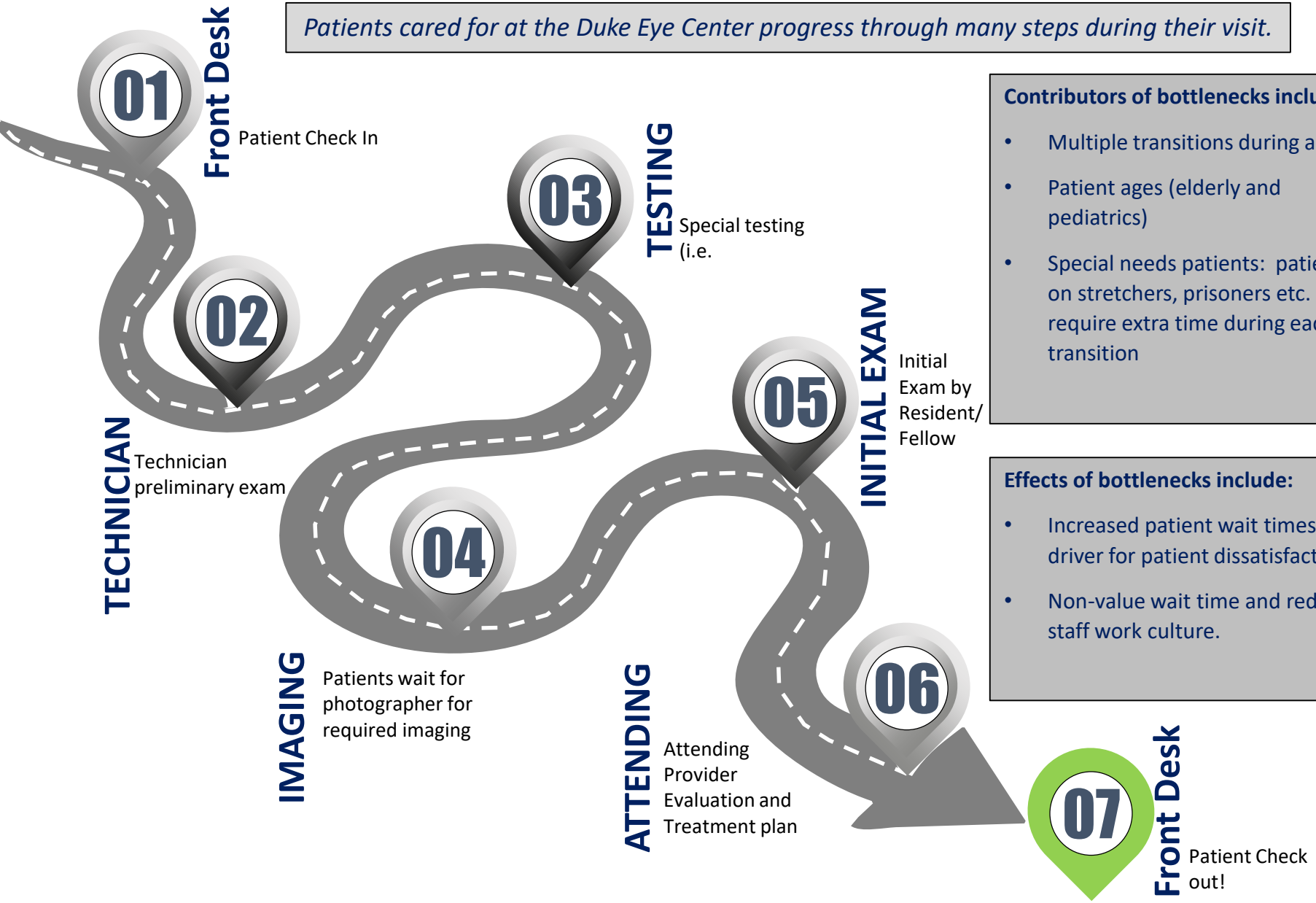
Approach for Project: Event Stamps

- Through the EHR, we utilized automated and unique event time stamps as discrete data points.
- Events determine which activity a patient is in during a clinical encounter (i.e. 'waiting for technician' or 'in with doctor')



Patient Transitions during an Eye Center Visit

Patients cared for at the Duke Eye Center progress through many steps during their visit.



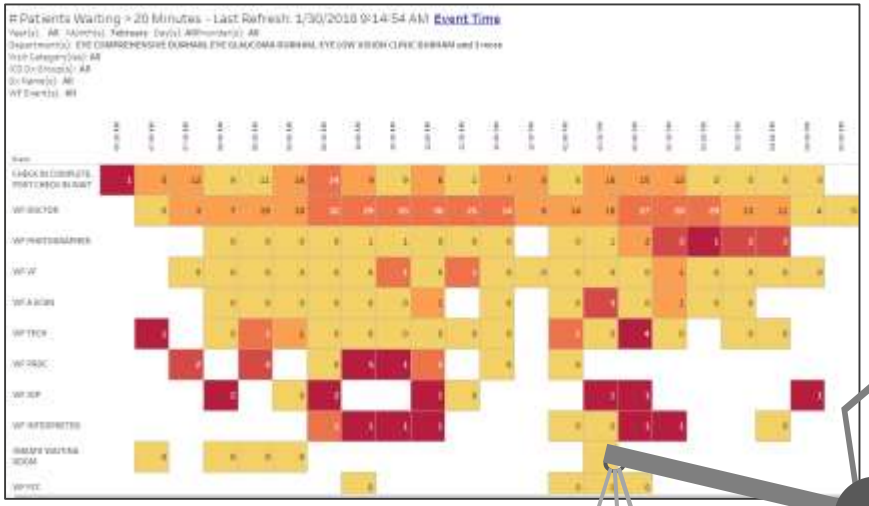
Contributors of bottlenecks include:

- Multiple transitions during a visit
- Patient ages (elderly and pediatrics)
- Special needs patients: patients on stretchers, prisoners etc. that require extra time during each transition

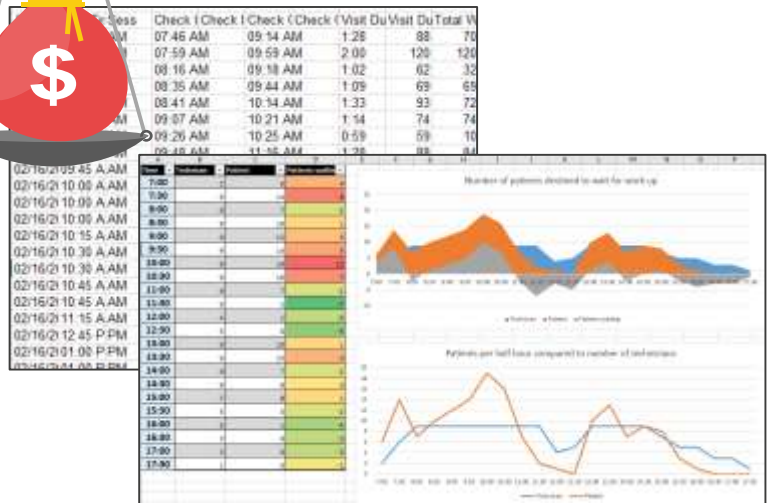
Effects of bottlenecks include:

- Increased patient wait times are a driver for patient dissatisfaction
- Non-value wait time and reduces staff work culture.

Leveraging a New Analytic Process



- Automated Tableau Dashboard
- Identifies efficiencies for bottlenecks
- Reports for Operations & Providers
- Eliminates gap of inconsistent manual data manipulation
- EHR data collection faster, allowing for larger data sets, scalability, consistency & accurate results



- Manual run Epic Reports
- Export of extracts, large, cumbersome & confusing
- Inconsistent manual manipulation of data elements
- Manually created pivots and charts weekly

Outcomes

Total Visit Times

Total visit times were greatest for nearly all Providers in the mid-morning and mid-afternoon

Waiting for Tech

Waiting for tech times were also greatest mid-morning and mid-afternoon. Waiting for Doctor times were the most sizable at the end of the clinic ½ day sessions.

Peak Duration Times

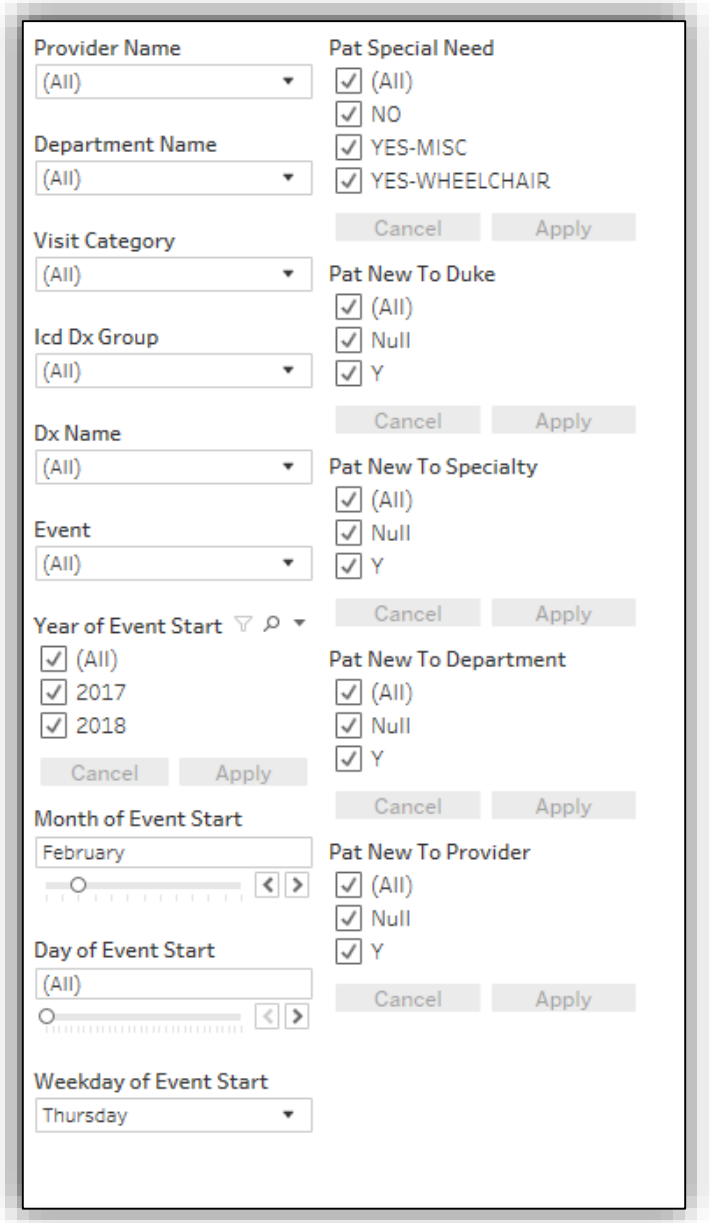
Peak duration aligned with the peak wait time for techs. Wait times for doctors were out of phase from other wait times, peaking in the late morning & late afternoon.

Event Analysis

Shows patient activities (in with MD, imaging etc.) with wait times. All activities and times are separated so comparative analysis can be done on each event.

Project Outcomes

Tableau Filters



Operational Analytics in Action

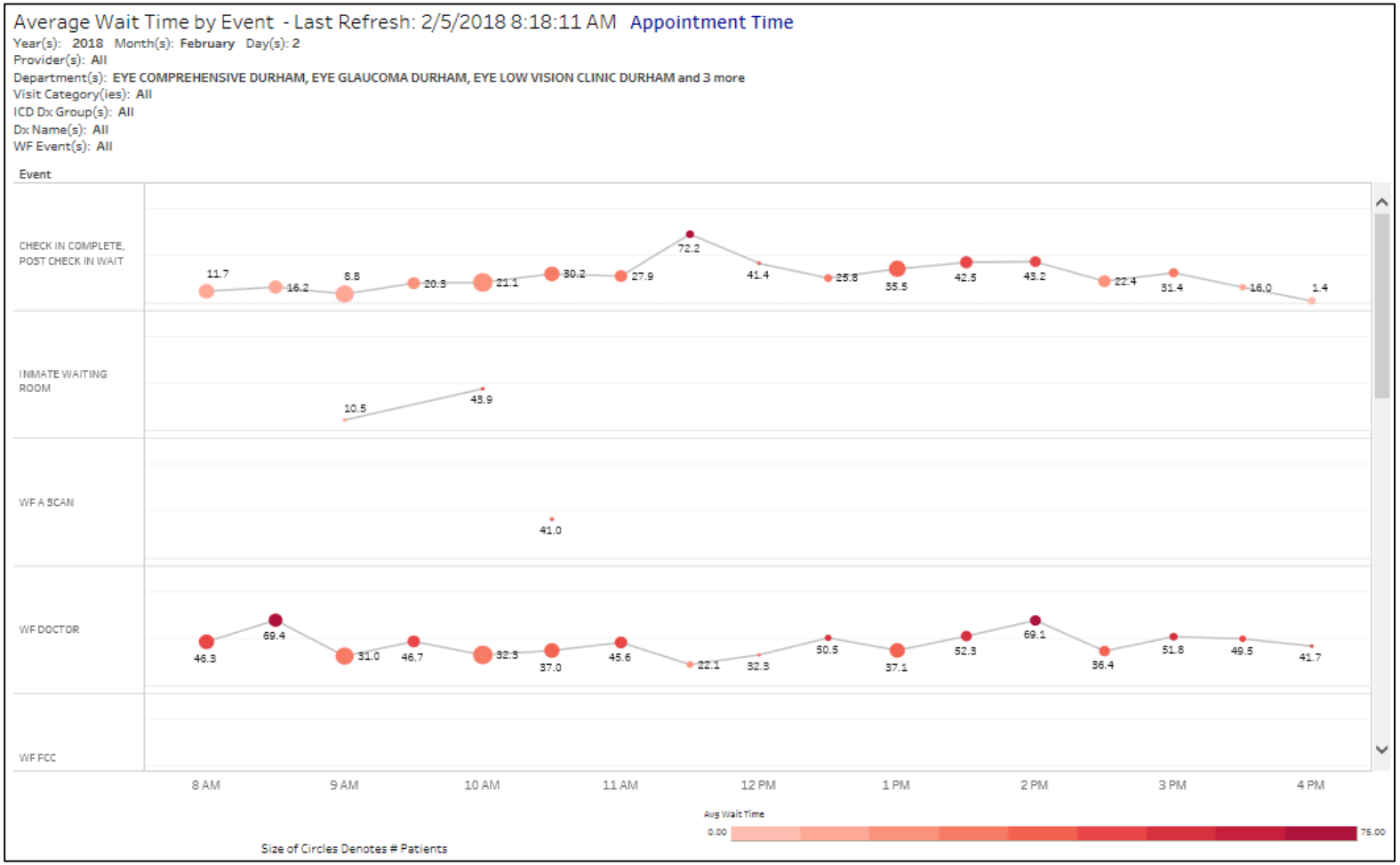
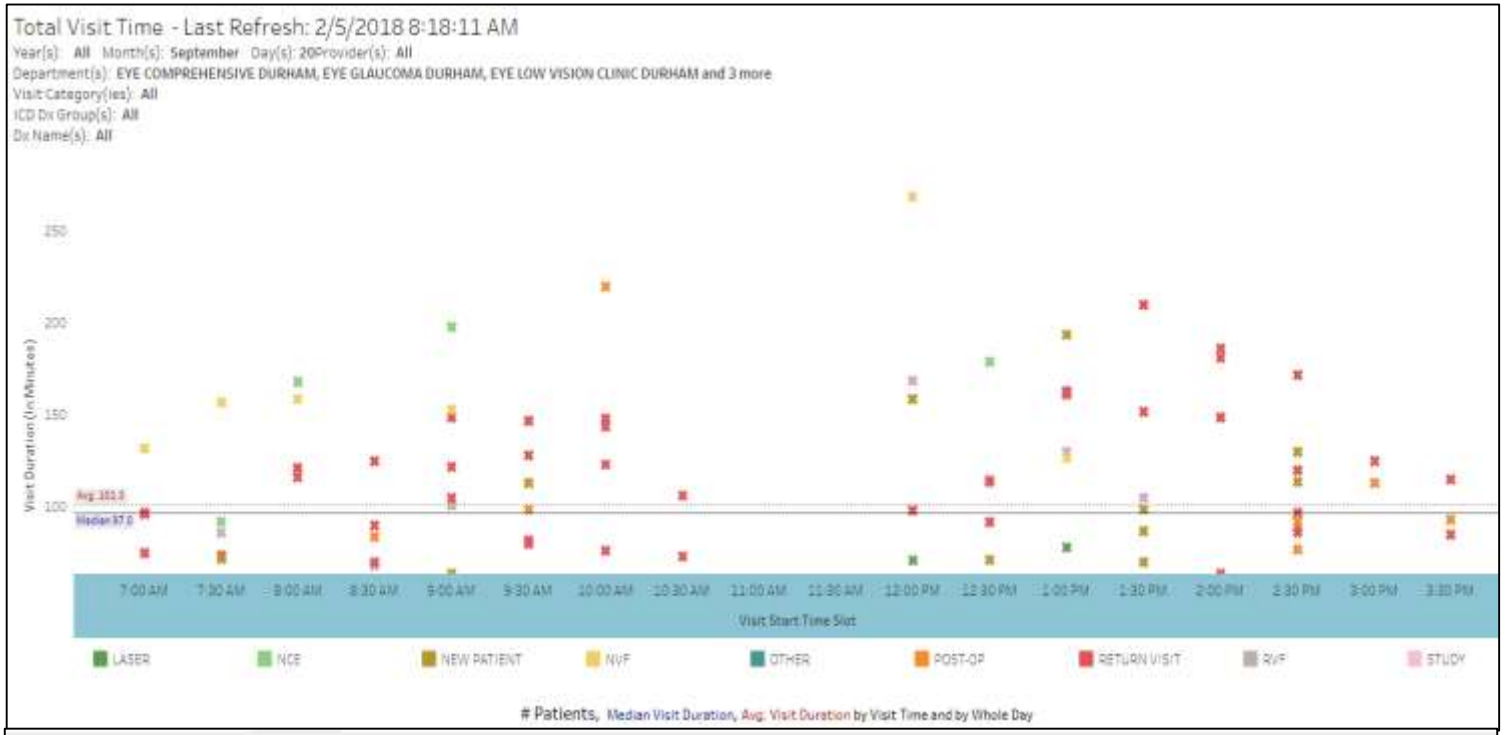


Figure 1. Average Wait Time by Event at the Duke Eye Center

This visualization calculates the average minute duration by event, time slot throughout the day, and time period in the filters (i.e. a user could look at one day versus a previous day for example). The size of the circles on the visualization show how many patients are in that group, so if a circle has a high average wait time but the circle size is small, it's an issue but only affects a small % of the patient count.

Operational Analytics in Action



4	7	10	10	13	9	8	2	3	6	6	12	10	6	11	3	3
96.5	74.0	41.0	61.0	101.0	99.0	123.0	89.5	24.0	159.0	114.0	130.0	87.0	149.0	97.0	119.0	93.0
99.5	86.7	81.8	62.6	96.2	95.9	104.9	89.5	32.3	164.3	111.2	124.3	96.1	148.4	106.5	119.0	96.7

Figure 2. Total Visit Time

This visualization is able to monitor on a daily basis, or over a period of time, the duration of each patient visit by visit type and appointment time, isolating the results by department, provider, and diagnosis. The scatter plot visualization provides average and median for visit times, whereas the ability to further analysis by the number of patients in a given appointment time slot is provided in the table below.

Operational Analytics in Action

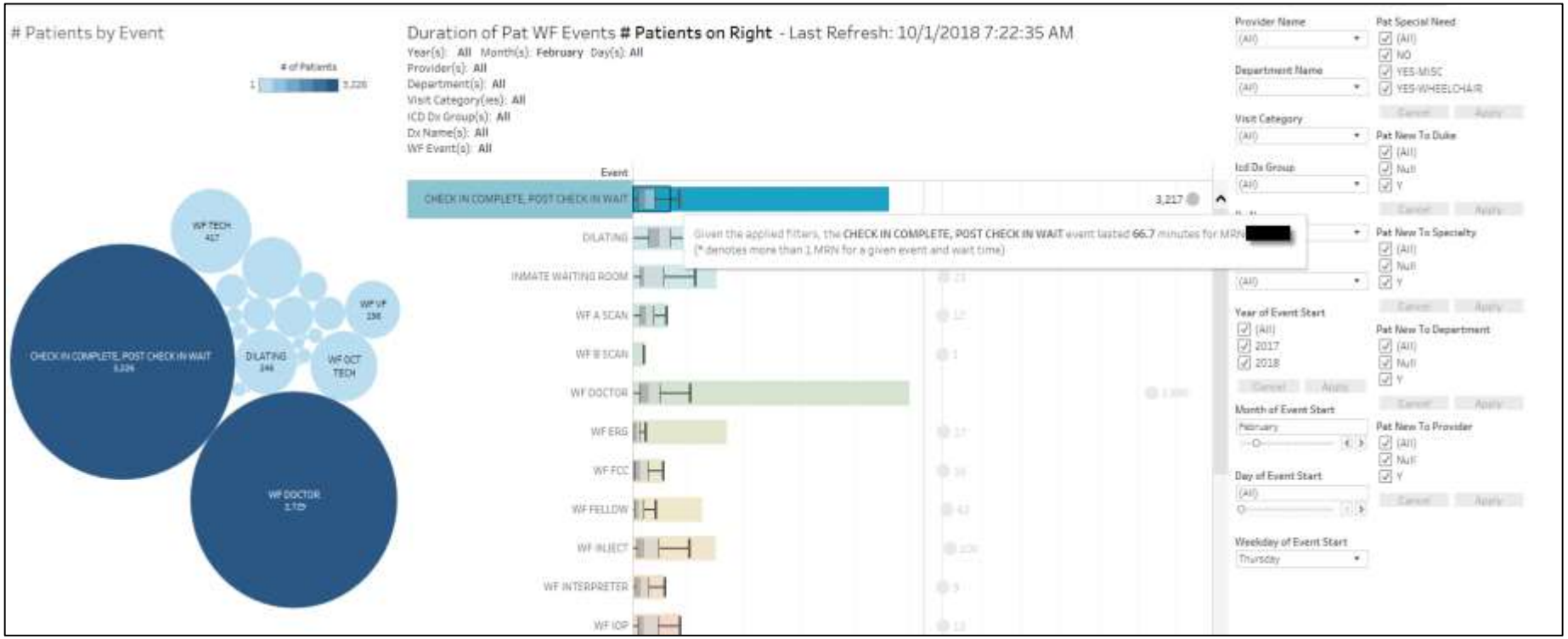


Figure 3. Number of Patients by Event

This visualization is able to track wait time by event by the individual patient. This visualization can help identify outliers by patients in terms of wait times. The size of the circles here gives a relative value to the event to ensure the user is looking at an event that is impactful.

Operational Analytics in Action

Patients Waiting > 20 Minutes - Last Refresh: 2/7/2018 7:44:57 AM Appointment Time

Year(s): 2018 Month(s): February Day(s): 2
Provider(s): All
Department(s): EYE COMPREHENSIVE DURHAM, EYE GLAUCOMA DURHAM, EYE LOW VISION CLINIC DURHAM and 3 more
Visit Category(ies): All
ICD Dx Group(s): All
Dx Name(s): All
WF Event(s): All

Event	08:00 AM	08:30 AM	09:00 AM	09:30 AM	10:00 AM	10:30 AM	11:00 AM	11:30 AM	12:00 PM	12:30 PM	01:00 PM	01:30 PM	02:00 PM	02:30 PM	03:00 PM	03:30 PM	04:00 PM
CHECK IN COMPLETE, POST CHECK IN WAIT	2	3	1	3	10	6	5	4	1	3	10	6	6	3	3	1	0
WF DOCTOR	8	8	8	6	9	7	5	1	1	3	10	6	6	5	4	2	1
WF OCT TECH		0	1	0		0				1	0			0			
WF VF	0	0	0	1	2	1								1			
WF TECH	0	0	0		0			1				1					
WF PHOTOGRAPHER						0								0			
INMATE WAITING ROOM			0		1												
WF FCC					0		1										
WF PROC										1		1					
WF A SCAN						1											
WF FELLOW			0														
WF IOP									0								

Figure 4. Number of Patients Waiting >20 minutes

The Eye Center wants to be able to see groups of patients by wait time (greater than 20 minutes, greater than 30 minutes, and greater than 60 minutes) for each "waiting for" event within a single visualization. By selecting either to display the data by number of patients waiting or percentage of patients waiting, they are able to compare groups of patients by time slot in those specific ranges. The color scheme highlights data of interest based on the metric being displayed: dark red when viewing by percentage of patients points to events and time slots that may require further attention or evaluation, while dark red when viewing the count of patients provides a relative weight of the impact compared to other events and time slots displayed in the visualization.

Operational Analytics in Action

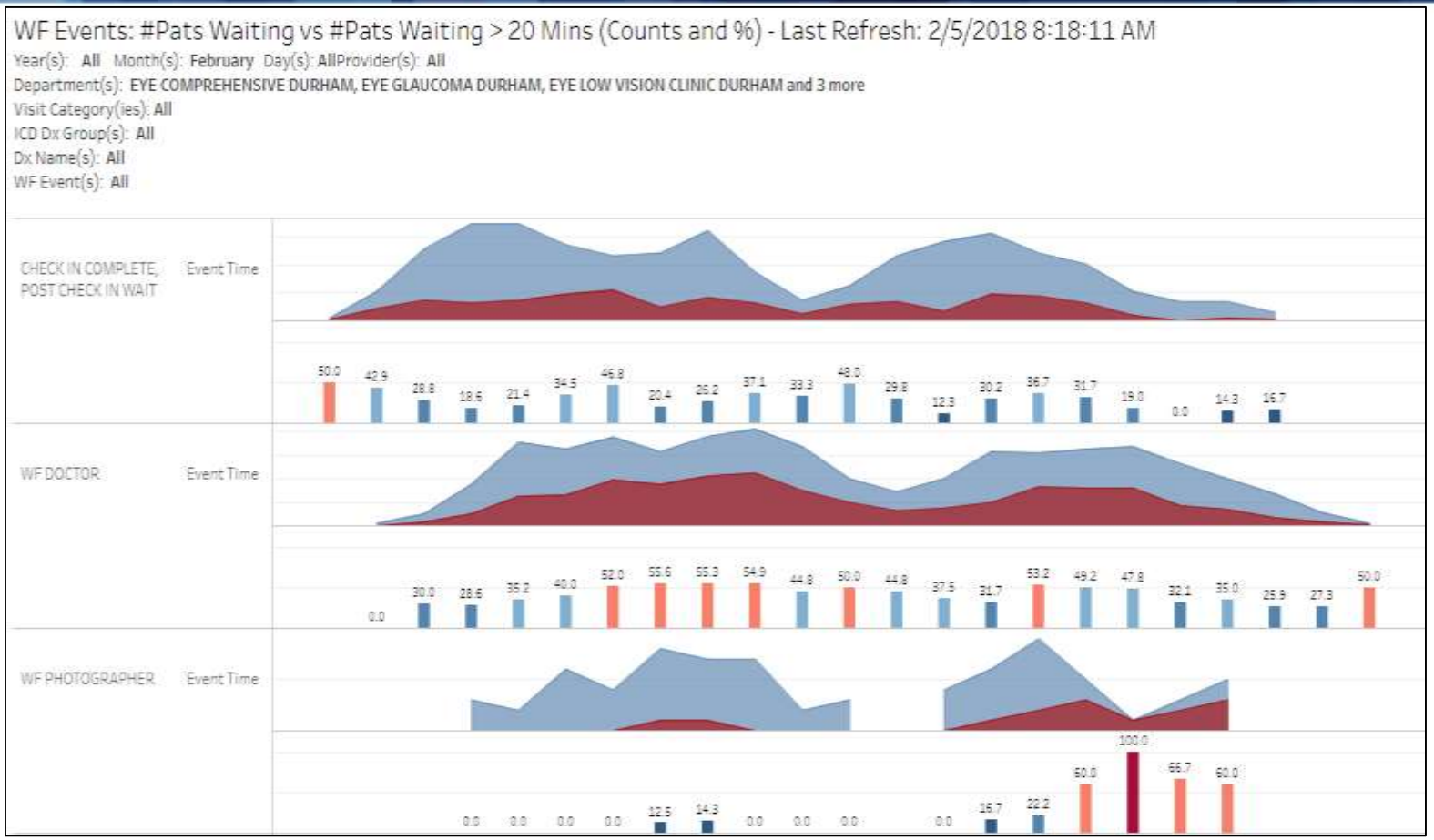


Figure 5. # of Patients Waiting versus # of Patients Waiting >20 minutes

Similar to the previous visualization, this visualization provides Eye Center staff with the ability to determine on a daily basis which events and time slots have the most patients waiting, as well as the most patients waiting more than more than 20, 30, or 60 minutes for an event. The area/mountain chart takes the analysis a step further by allowing for quick comparison between all patients waiting (independent of how much time they've waited) versus a selected subset of patients who are waiting greater than 20, 30, or 60 minutes by event. For some events, it is acceptable for a patient to wait more than 20-30 minutes; however, waiting more than 60 minutes is typically unacceptable. The bar chart below the area/mountain chart provides additional detail for the healthcare administrator by displaying the percentage of patients waiting longer than the selected duration (20, 30, or 60 minutes).

Lessons Learned for Future Projects

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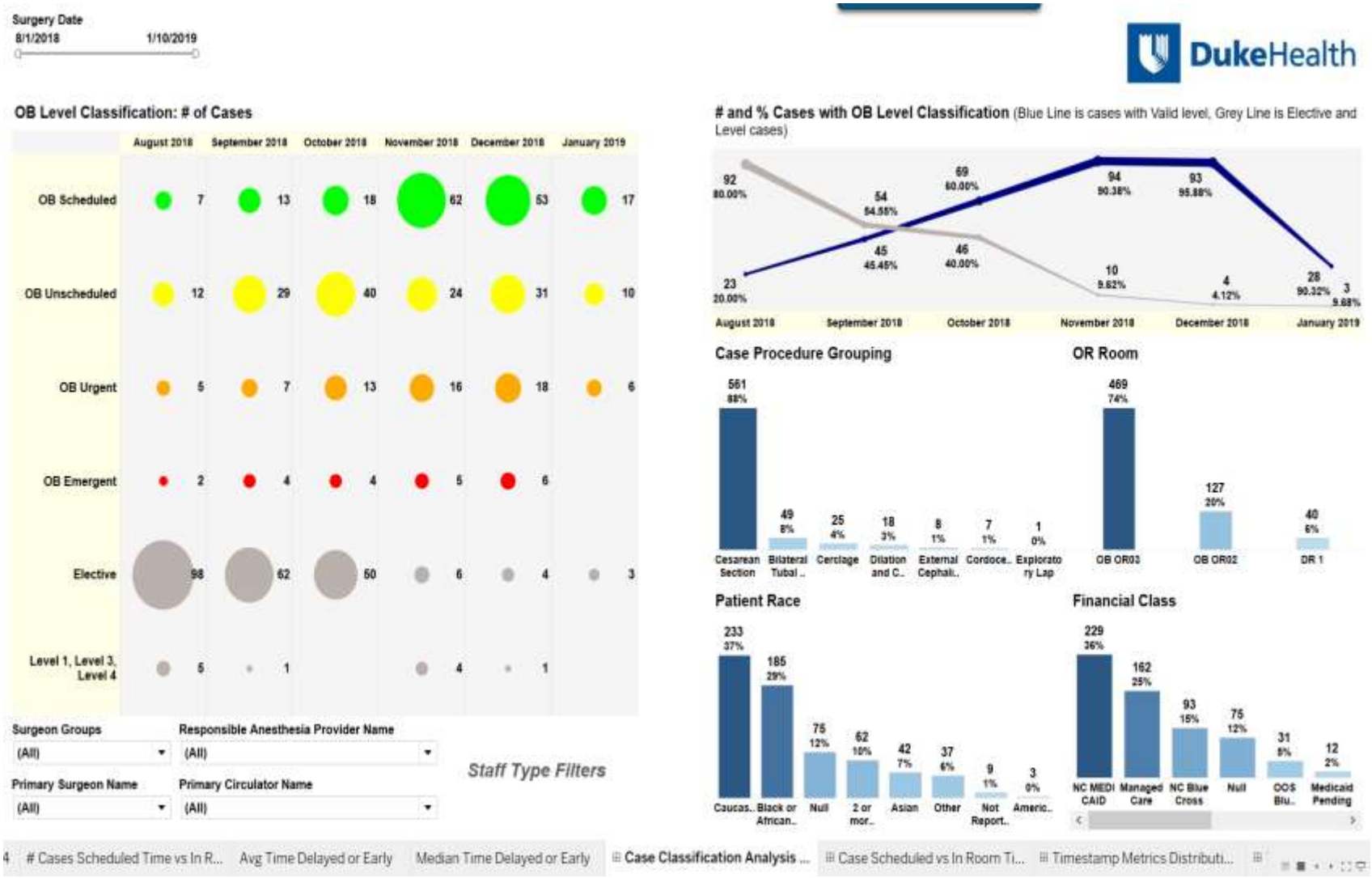
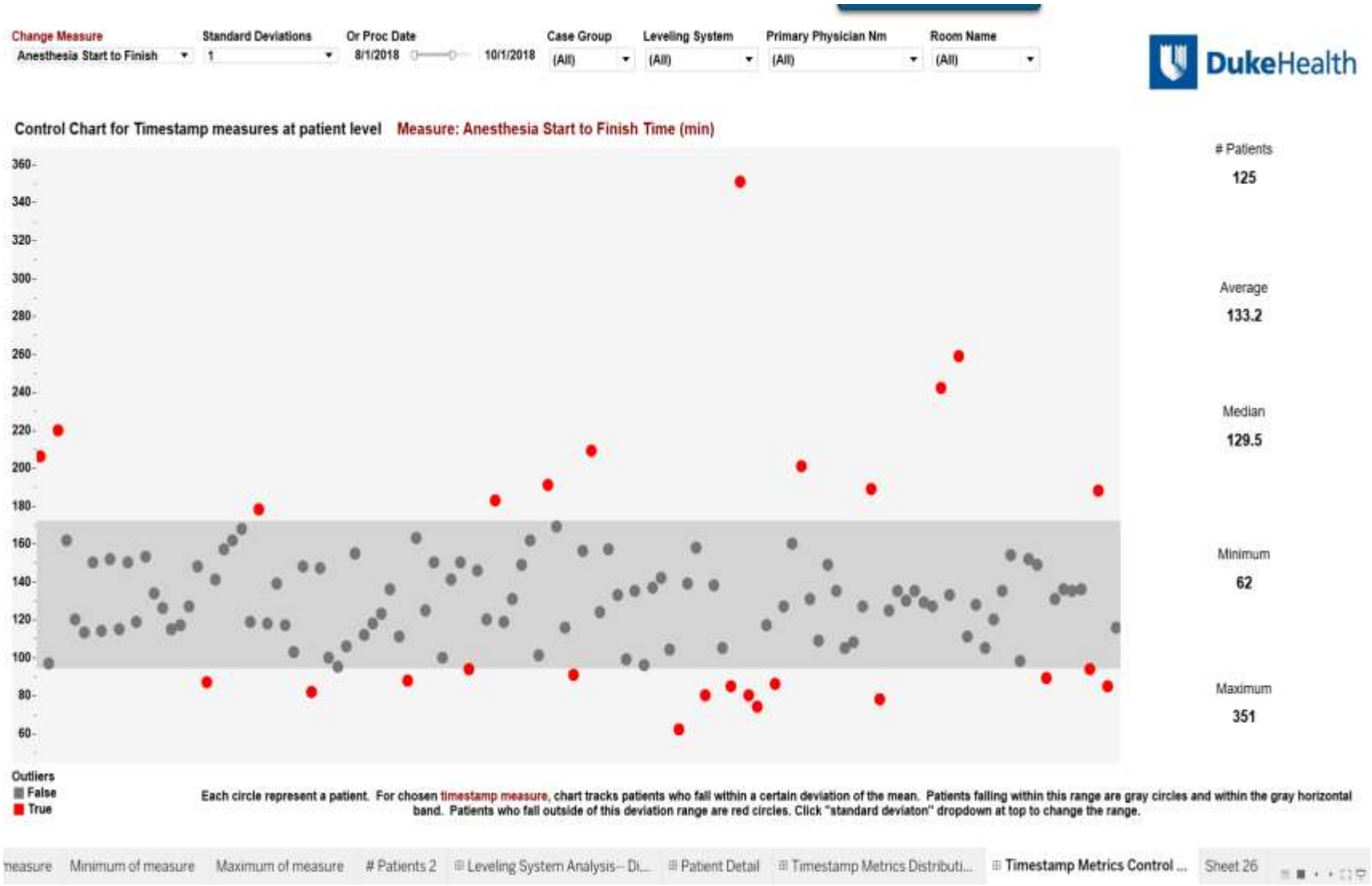
Executive Cohort Analysis Viz

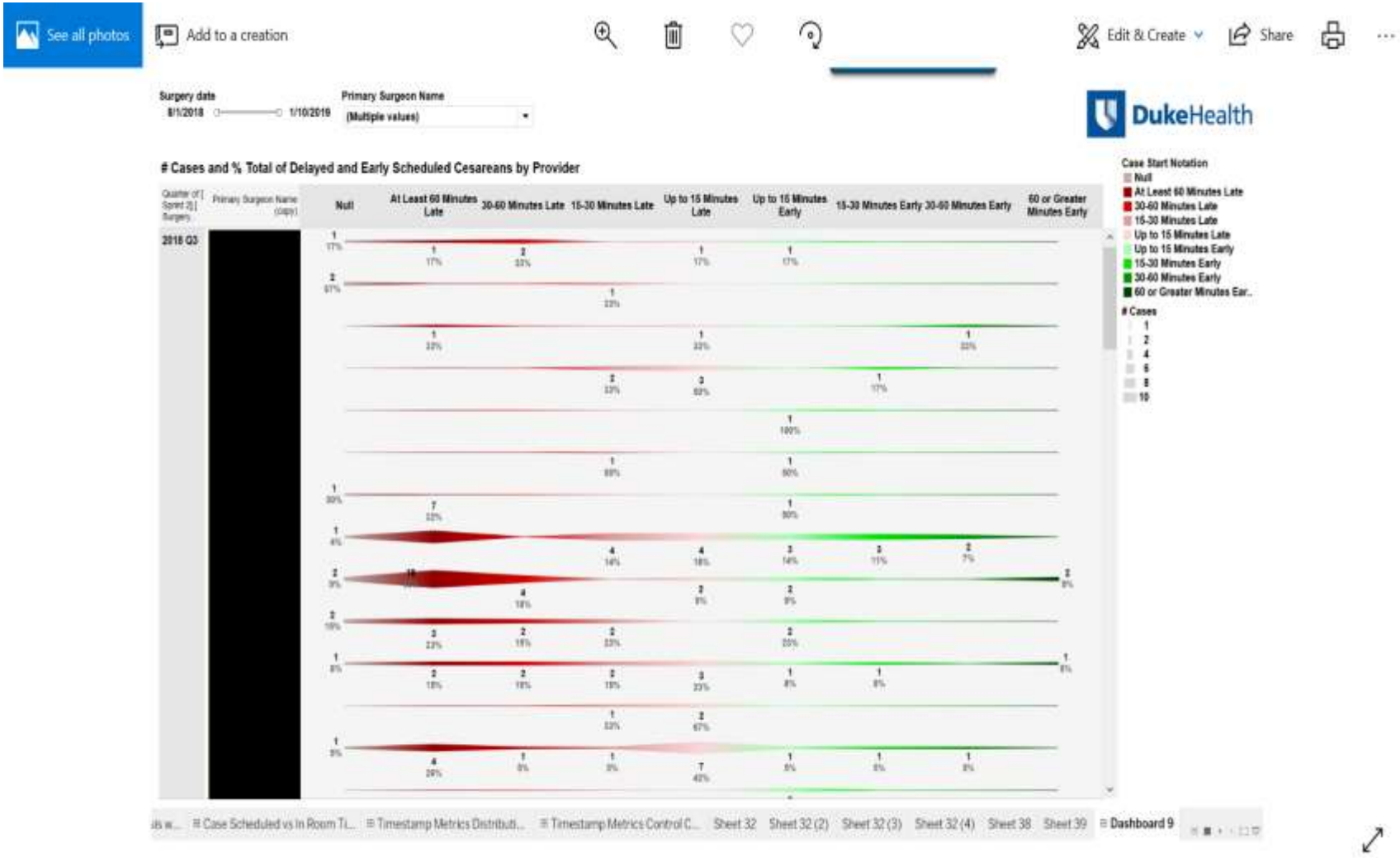


Analytical Planning: Control Charts



Scheduling and Optimization

Provider Comparison Report



Overall Goals to Achieve Clinic Efficiency

Outcome	Analysis	Goals	
Appointment Template optimization based on provider-patient duration times	Provider "with patient" duration times.	• Increased scheduling options for increased slots WITHOUT increased patient wait (non-value) time • Increased revenue • **Increased patient access** • Improved patient survey scores	
Staff allocation	Orthoptist and Technician productivity	• Realigned staff duties to maximize education level • Hired facilitator to off load non-clinical tasks • Realigned staffing models • Decreased patient wait without decreasing scheduling templates and increase availability in templates • Improved staff morale/ work culture	
Patient/provider flow	•Improve overall cycle times •Treatment wait times •Trainee flow	• Prescriptive preparedness of clinic schedule • Improved trainee to doctor patient time • Improved overall patient duration times • Prescriptive ability to predict bottlenecks and minimize effects	
Imaging time	Patient "waiting for imaging" wait time and duration time	• Improved understanding of equipment/staff idle time and bottlenecks • Improved understanding and improved imaging flow • Decreased "ebb and flow" pattern • Decreased overall patient duration • Increased physician satisfaction	

Analytics Champion for the Eye Center

"The PORT team was knowledgeable and efficient. They created a Tableau dashboard that will help the Eye Center more easily identify operational bottlenecks."

– Dr. Divakar Gupta

"The Port team did an excellent job collaborating with the Eye Center. They were able to take an idea all the way to completion. It was great how the PORT team understood what we were trying to do and organized the data efficiently. The visualizations developed will allow not only an easy view but also a tool the stakeholders can use for better patient care."

– Marjorie Veihl, HCA for the Duke Eye Center

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