



Clinical Safety & Effectiveness

Cohort # 23, Team #5

Improve the efficiency of inpatient care of
patients with a diabetic foot ulcer



Educating for Quality Improvement & Patient Safety

The Team

- Lalithapriya Jayakumar, MD
 - CS&E Participant [vascular surgery faculty]
- Tracy Cheun, MD
 - CS&E Participant [general surgery resident]
- Consultant team members:
 - Christina Bird, MD [emergency medicine faculty]
 - Kathryn Vela, APRN [vascular surgery]
 - Gloria Ynostrosa, RPVT [vascular surgery]
 - Crystal Ramanujam, DPM [podiatry]
- Team facilitators
 - Ventrice Shillingford Cole
 - Jan Patterson, MD
- Sponsor Chief, Department of Vascular & Endovascular Surgery
 - Mark Davies, MD, PhD, MBA

What We Are Trying to Accomplish?

The aim of this project is to streamline the care of foot ulcer patients presenting in the Emergency Room (ER) to reduce the mean ER length of stay by 30% by

May 2019

Project Milestones

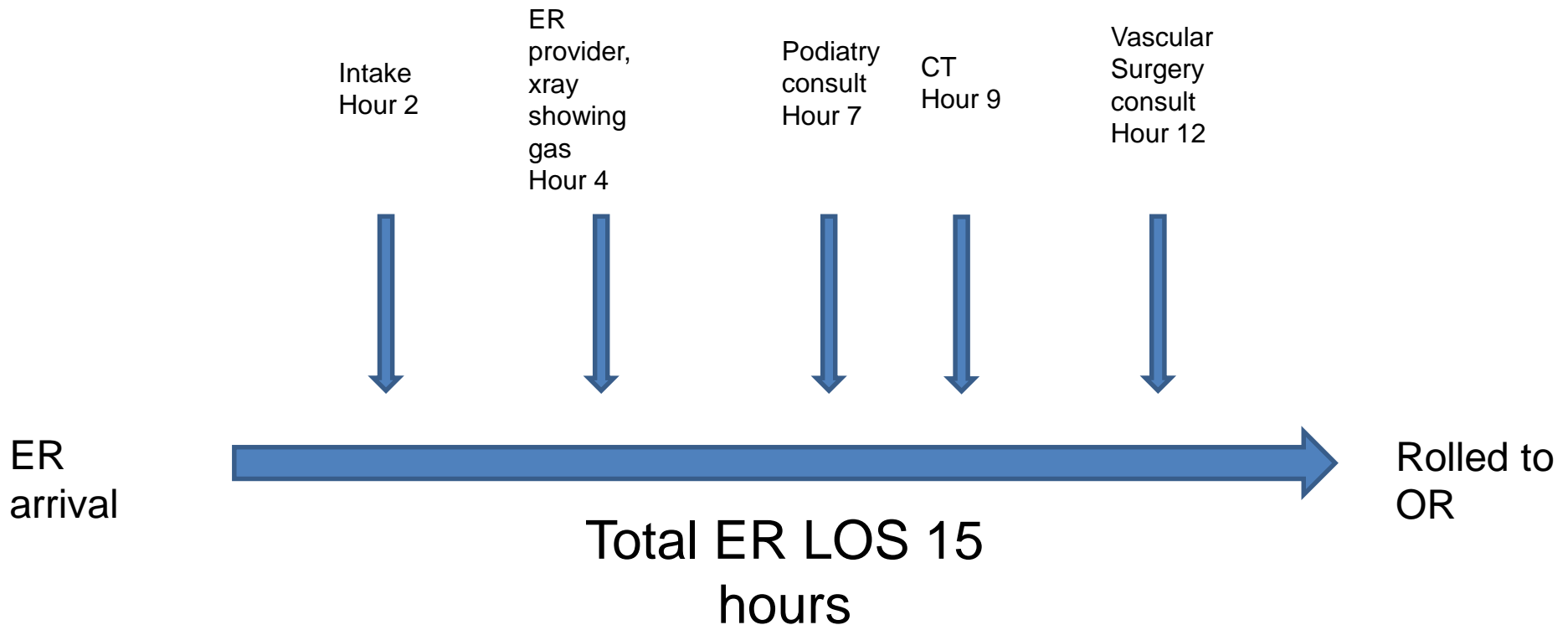
- Team Created Jul 2018
- AIM statement created Aug 2018
- Weekly Team Meetings
- Background Data, Brainstorm Sessions, Workflow and Fishbone Analyses Sept – Oct 2018
- Interventions Implemented Nov 2018 – May 2019
- Data Analysis Dec 2018 – May 2019
- CS&E Presentation Jan 2019

Background

- Diabetes and peripheral vascular disease coincide in the form of foot ulcers.
 - The economic costs associated with diabetic foot care including amputation care represent the single largest category of excess medical costs associated with diabetes.
- These patients can often present with acute illness and decompensation with need for urgent surgical intervention as well as possible intensive care monitoring.
- Patients with acute infections with foot ulcers, often critically ill, have prolonged length of stay in the Emergency Department waiting for a myriad of consultants and diagnostic tests that may constitute unnecessary delays in definitive care.

Case narrative

- 60yoM with PAD, HTN, DM, and COPD presenting with 2 days of worsening fevers, chills, weakness, and worsening pain and cloudy drainage from his recent TMA site
- Hypotensive, tachycardic, altered
- TMA site dehisced, erythema halfway up foot, purulent drainage



What Changes Can We Make That Will Result in an Improvement?

- Create an algorithm for ER triage to trigger vascular surgery involvement earlier in the ER process flow for patients with chronic diabetic foot ulcer.
- Streamline chronic foot ulcer care to vascular team for assistance with timely and parallel triage.
- Resolve confusion over which team to consult, reduce erroneous consultations.
- Create consensus on inter-service agreements regarding admission criteria.
- Create a channel for clearer, more timely communication between ER and consultants to expedite patient care planning.

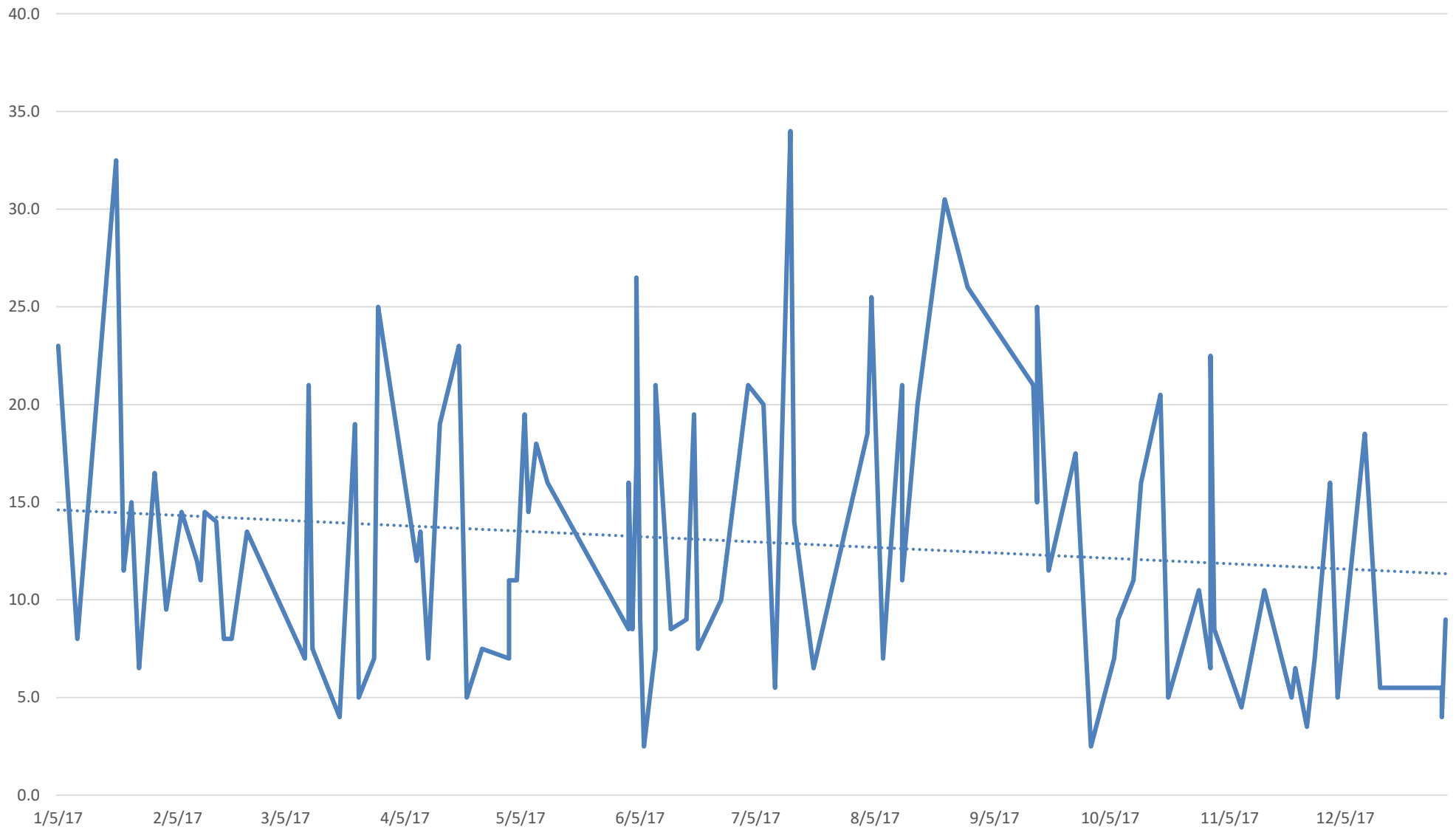
How Will We Know That a Change is an Improvement?

- Primary measure:
 - ER length of stay
 - Cost of ER stay
- Additional measures:
 - Pre-and post-intervention surveys of ER providers
 - Time to vascular contact
 - Number of consultants prior to vascular contact
 - Number of MRIs obtained in ER
 - Time to intervention
 - Length and cost of hospital stay

Selected Process Analysis Tools

- Brainstorming
- Background data
 - Retrospective chart review
- Affinity sorting (ER process)
 - ER survey
 - Pareto
- Flowchart (ER process and disposition)
- Fishbone – ER to OR process
- Process run control chart

ER LOS (prior to intervention)



Background Data (Jan 2017 – Dec 2017)

Retrospective review of patients who underwent major lower limb amputation for foot ulcer secondary to diabetic foot ulcer and/or non-healing foot wound

presenting through ER, #	95
average ER length of stay, hours	13
average time to VS consultation by ER, hours	8.1
average hospital LOS, days	13.3
required ICU, %	21.2%
MRI prior to VS consultation, %	22.1%

Of those who met 2+ SIRS criteria AND required urgent amputation,
mean ER LOS was 12 hours, time to VS consult 7.7 hours, and 30%
required ICU care post-operatively

NO significant difference in ER LOS between these patients and other more
ambiguous patients

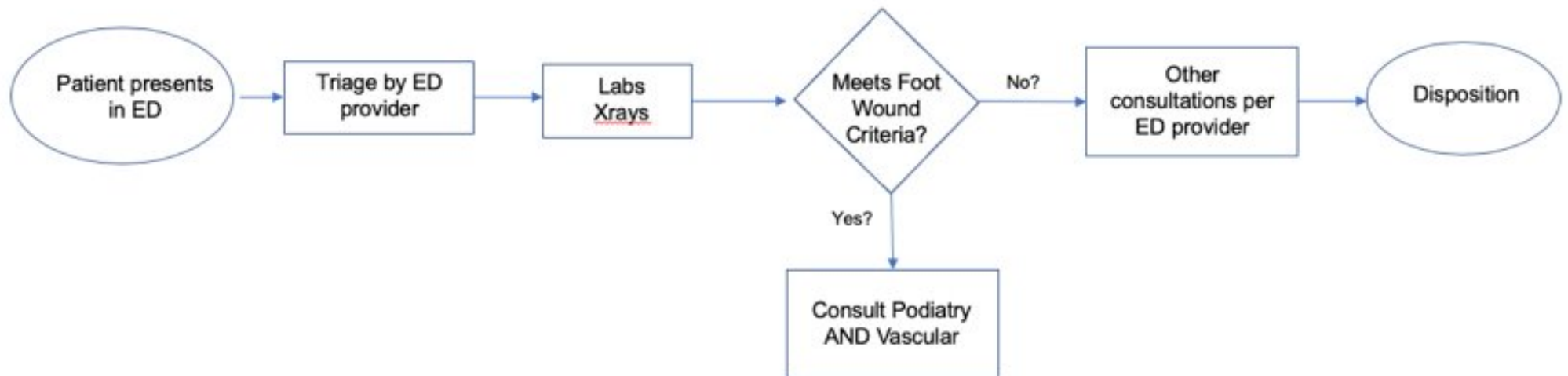
Possible intervention points

Presentation	Triage	ER provider	Consultation	Disposition
<ul style="list-style-type: none">• Waiting room	<ul style="list-style-type: none">• Vitals• Interview• +/- ER provider	<ul style="list-style-type: none">• Labs• Tests• Handoffs• Consultations	<ul style="list-style-type: none">• Initial encounter• Labs• Tests, Vascular lab vs bedside ABI• Staffing with faculty• Interdisciplinary discussion	<ul style="list-style-type: none">• Bed request• OR• Discharge

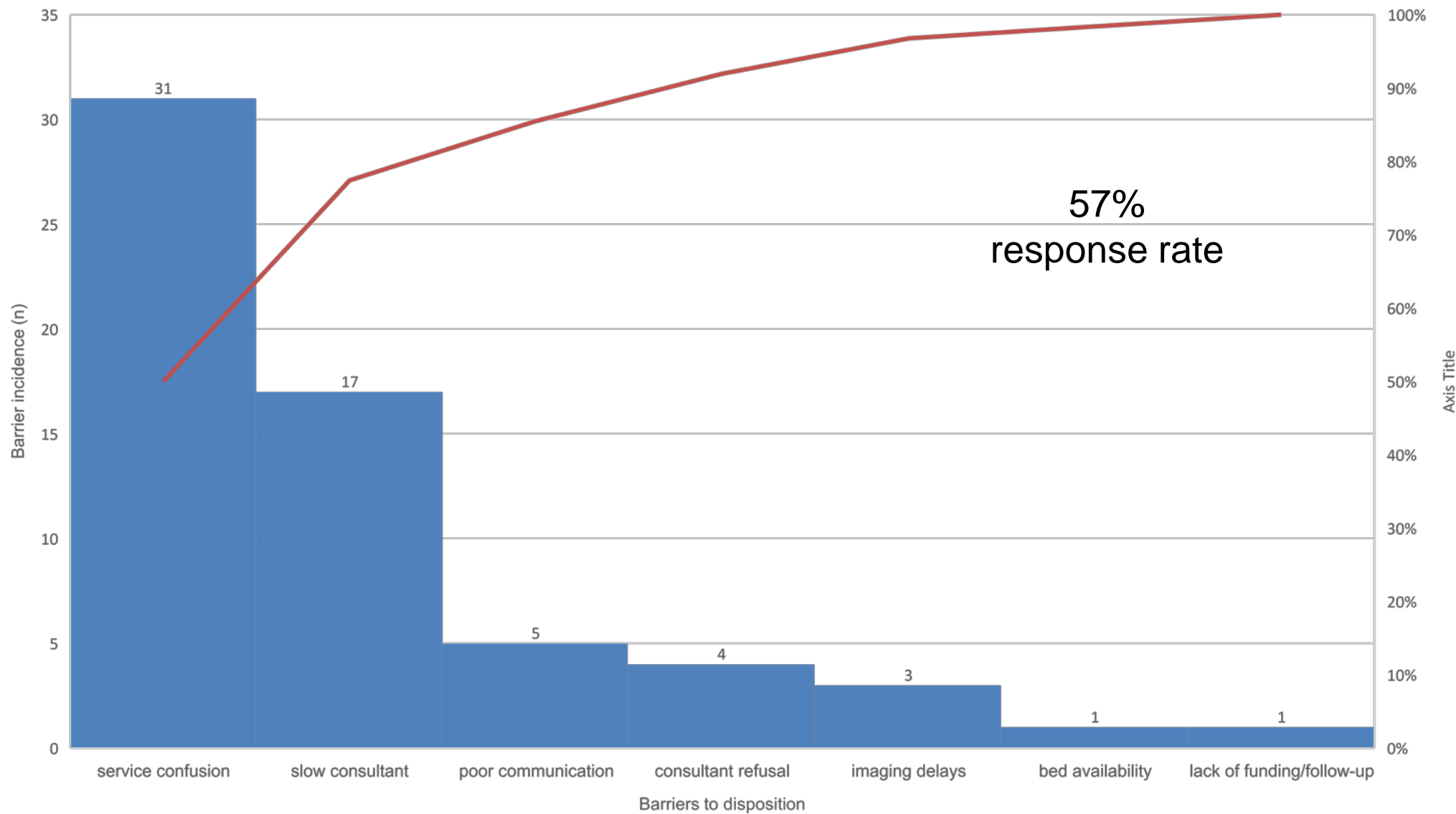
Few data exist regarding optimal management flow of inpatient diabetic foot ulcers, but outpatient trend is for multidisciplinary care models, such as our PALS (Preserving Ambulation and Limb Salvage) Clinic

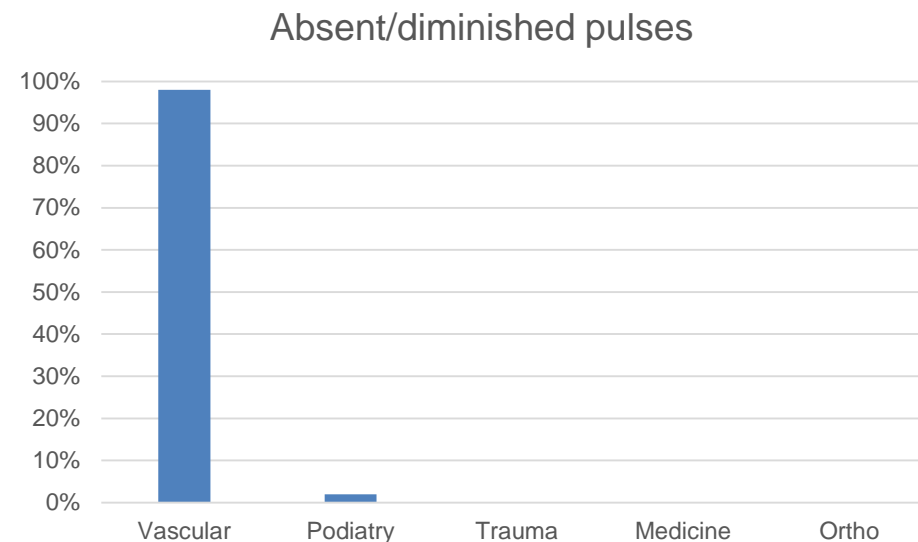
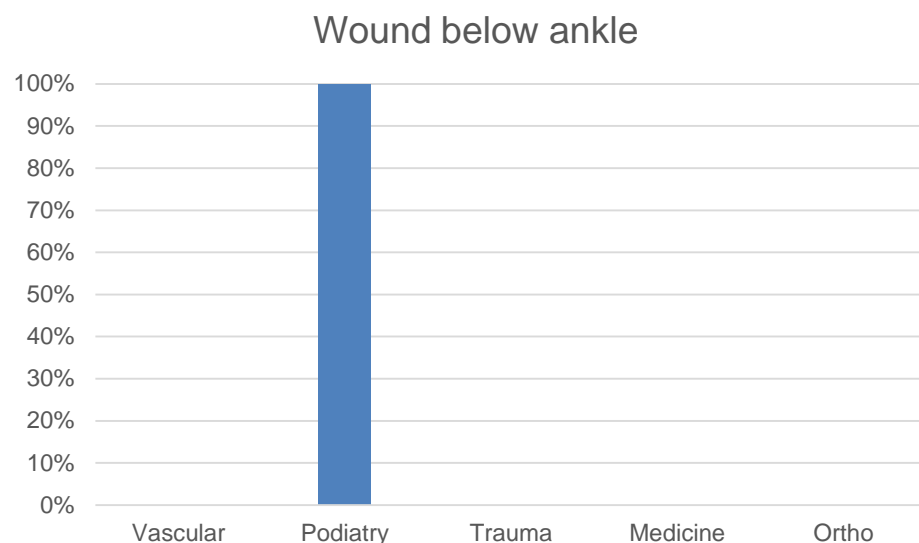
Multidisciplinary clinic involving vascular, podiatry, cardiology, wound care, and prosthetics to streamline care for foot ulcer and amputation patients

Process Flow for ER Encounter



Perceived barriers to timely disposition of diabetic foot ulcer patients in the ER

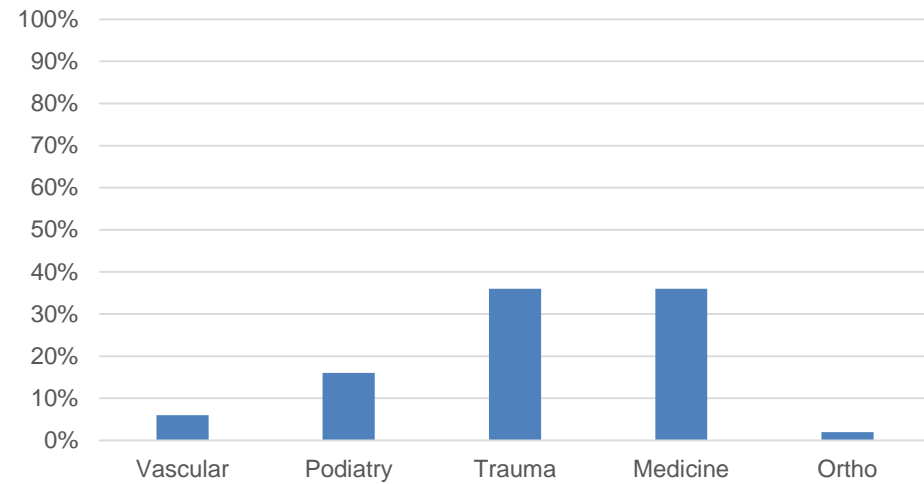




Near consensus on who to consult for wounds of the feet and in patients with diminished distal pulses

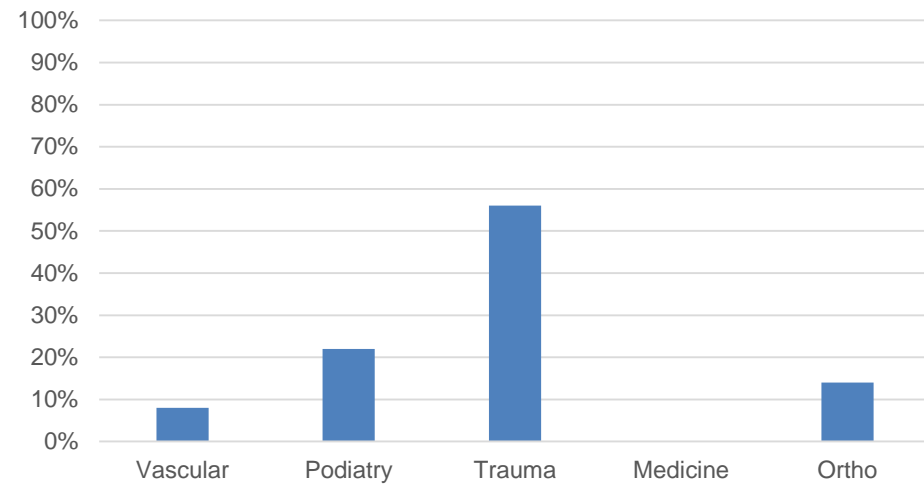
Important to note that very few patients present with one issue; most of the time, they have both

2+ SIRS criteria

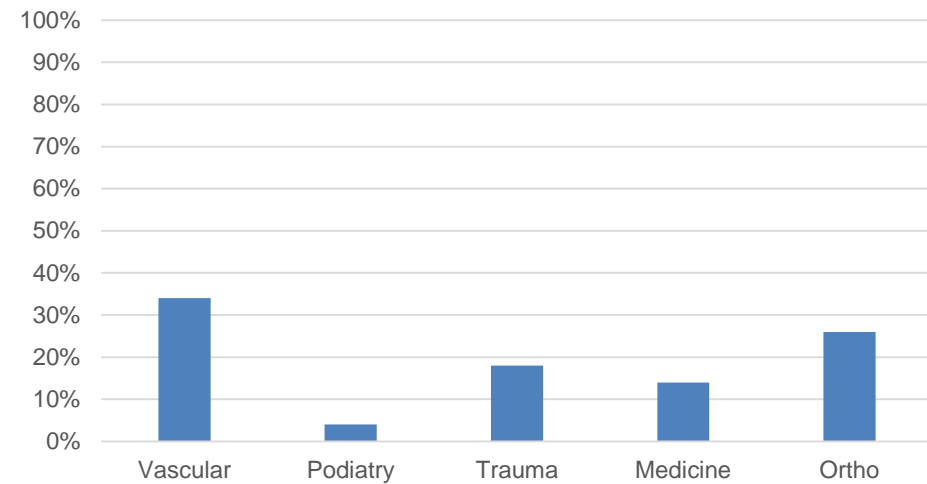


However much more variability in consultation practice patterns on those with gas, sepsis, and more proximally extending foot wounds

Gas in foot/ankle



Wound above ankle



Action Plan

Action Plan					
Action Strength	Action	Who	Where	Why	When
☑	Pre-intervention ER survey	T Cheun, C Bird	UHS ER	Gather baseline data, enhance communication	Oct 2018
☑	Post-intervention ER survey	T Cheun	UHS ER	Assess intervention effect	Dec 2019
☑	Educate ER on PALS clinic	T Cheun, L Jayakumar	UHS ER	Strengthen buy-in and more effective implementation	Nov 2018
☑	Implement vascular service activation criteria	T Cheun, L Jayakumar, C Bird	UHS ER	Streamline consultation patterns	Nov 2018
☑	Consultant agreement on admitting policy	T Cheun, L Jayakumar, C Ramanujam	UHS	Improve communication between consultant teams	Nov 2018
☑	Data collection and statistical analysis	T Cheun	UHS	Measure intervention effect and inform next steps	Jan 2019

Criteria for vascular surgery consult for disposition assistance

ER Chronic Foot Wound Algorithm

Meets **ALL** of the following:

- Foot ulcer or non-healing wound present for 4+ weeks
- Absence of other acute major medical issues** (Example: DKA, ACS, acute CHF exacerbation, etc.)
- Absent/diminished distal pulses

AND

Meets **1 or more** of the following:

- Evidence of gas on plain film below the ankle
- Meets 2 or more SIRS criteria without evidence of other infectious source
- Established patient with Vascular Surgery and/or PALS (Preserving Ambulation and Limb Salvage) Clinic

If patient meets above criteria, please contact **BOTH** Vascular Surgery and Podiatry services ASAP for disposition assistance

***Please note that if a patient does not meet all these criteria but is still believed to require Vascular Surgery/Podiatry involvement, do not hesitate to call. The above criteria function to identify those patients who would benefit from both Podiatry and Vascular Surgery involvement.*

Intervention

PLAN

- Obtain background data for baseline ER LOS for patients with diabetic foot ulcers.
- Multidisciplinary discussion with ER and podiatry regarding perceived barriers to timely foot ulcer patients disposition in ER.
 - Survey to ER providers distributed 10/26/18
 - Response rate 57%

Implementing the Change

Do

- Implement ER criteria sheet for consultation for patients presenting with diabetic foot ulcers (11/19/18)
 - Resulted in multiple issues and request from multiple services to redact and revise criteria sheet (11/27/18)
- Criteria sheet was revised and an algorithm for podiatry and vascular surgery services regarding criteria for inter-service activation of vascular surgery consultation was proposed

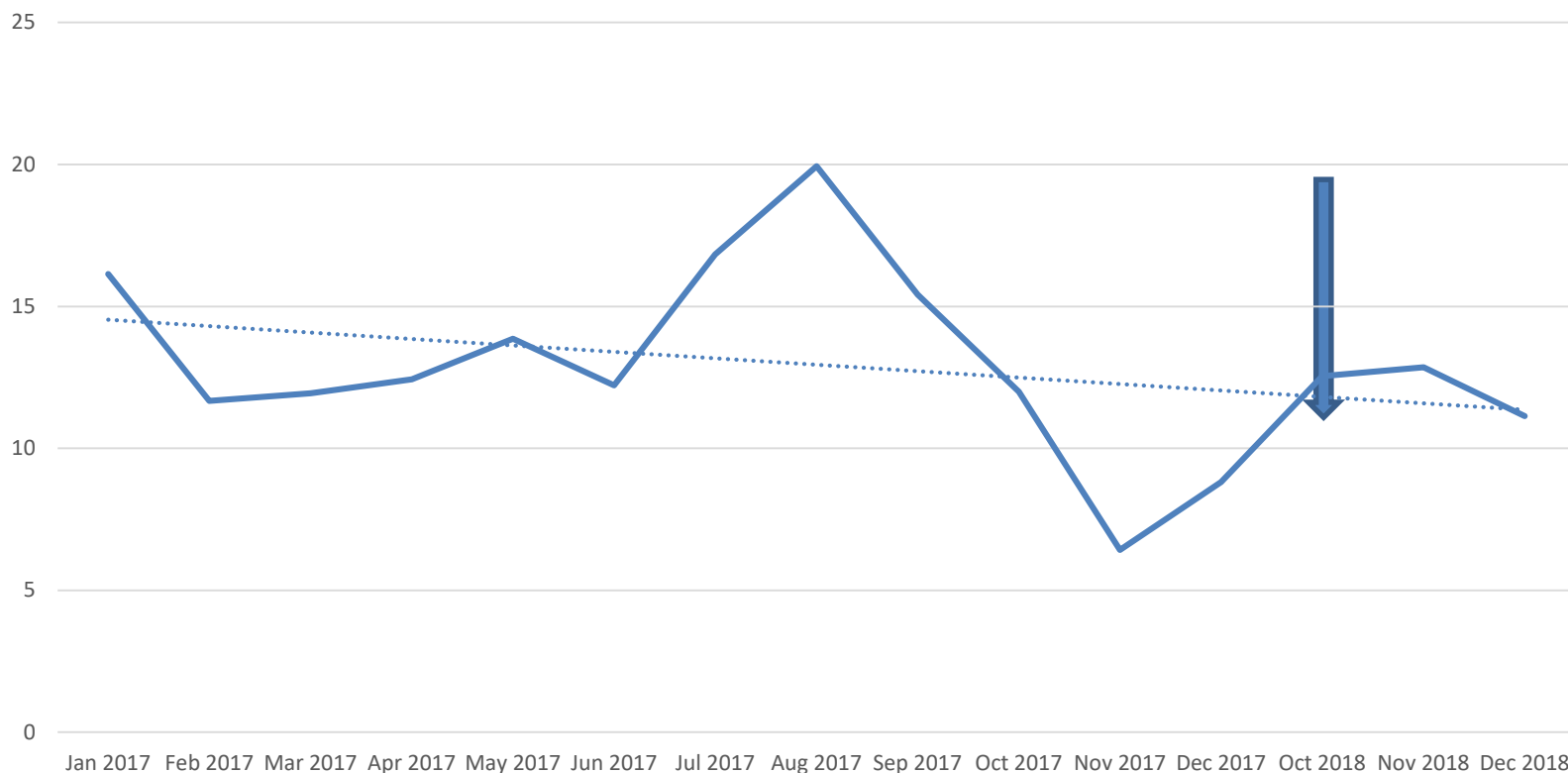
Results/Impact

Check

- Revisit ER LOS and average time-dependent cost per visit after pre-intervention phase (survey + increased awareness of appropriate consultation practice as well as truncated run of new foot ulcer protocol)

Results

Average ER LOS by Month (Jan 2017 - Dec 2018)



	Before intervention	After intervention
Mean ER LOS	13.0 hrs	12.1 hrs
Mean ER time-dependent cost	\$621.08	\$577.64

ER LOS	Prior to Intervention	After Intervention
mean	13.0	12.1
high	34.0	27.0
low	2.5	5.0
standard deviation	7.2	5.7

Expansion of Our Intervention

Act

- The consultation criteria document provides needed clarification for ER providers of patients who should have both a podiatry and vascular surgery consultation request in the ER.
 - We will continue to maintain the document with the ER as a part of their protocols in an effort to cut down on ER length of stay for these patients and reduce confusion.
- Inter-service criteria between vascular surgery and podiatry is under discussion currently.

Projected Return on Investment

- Reduction in time-dependent ER stay overhead
 - Mean \$47.64/patient-hour spent in ER (not inclusive of supplies, personnel, services)
- Cost in: none
- Savings:
 - 30% reduction of ER LOS: $(13\text{hrs}-9\text{hrs}) \times 47.64 = \190
 - Average of \$190/ER encounter cost reduction
 - @40 ER-sourced interventions/month for VS (variable month to month), **~\$7,600/mo**
savings in time-dependent ER overhead cost
- Reduction in unnecessary MRI
 - \$2108.75/foot MRI
 - Volume reduction TBD
- **Intangible value of more streamlined patient care and improved communication between services regarding patient care plans**

Conclusion/Future Direction

- Improving the multidisciplinary (ER, podiatry, and vascular surgery) team's awareness of the need for earlier vascular surgery involvement in patients with diabetic foot ulceration has resulted in a **7% reduction** in ER length of stay with a preliminary mean cost savings of **\$43/ER encounter** for the hospital
 - Significant decrease in variability of ER LOS since intervention
- Knowledge gained from the project:
 - Changing a multidisciplinary problem requires involvement and complete buy-in of the all levels and specialties affected by the change
 - Multiple revisions of the project are necessary
- Next steps
 - Analyze data after implementation of revised criteria

Thank you!



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