Appendix Table 1: Individual contributions of the top 15 contributors to laboratory test expenditure on medical units from the period of 2015-2018 in four adult tertiary care hospitals in Calgary, Canada

Laboratory Test	**% contribution to total expenditure on laboratory testing**
Complete Blood Count and differential	15.7
Electrolytes (Sodium/Potassium/Chloride/Bicarbonate)	9.2
Creatinine and Urea	8.5
Extended electrolytes (Calcium/Magnesium/Phosphate)	6.2
Coagulation studies (PT INR/PTT)	5.7
Liver Studies (ALT/Total and direct bilirubin/AST/ALP/GGT)	4.9
Blood Gas Arterial	3.2
Respiratory Infection Panel (Viral)	3.2
MRSA swab	2.9
Blood culture	2.8
Anti-GBM (GBM, ANCA, MPO, PR3, ANA)	2.1
Vancomycin LEVEL	1.3
Troponin	1.3
CK	1.2
Alpha-1 Antitrypsin	1.1

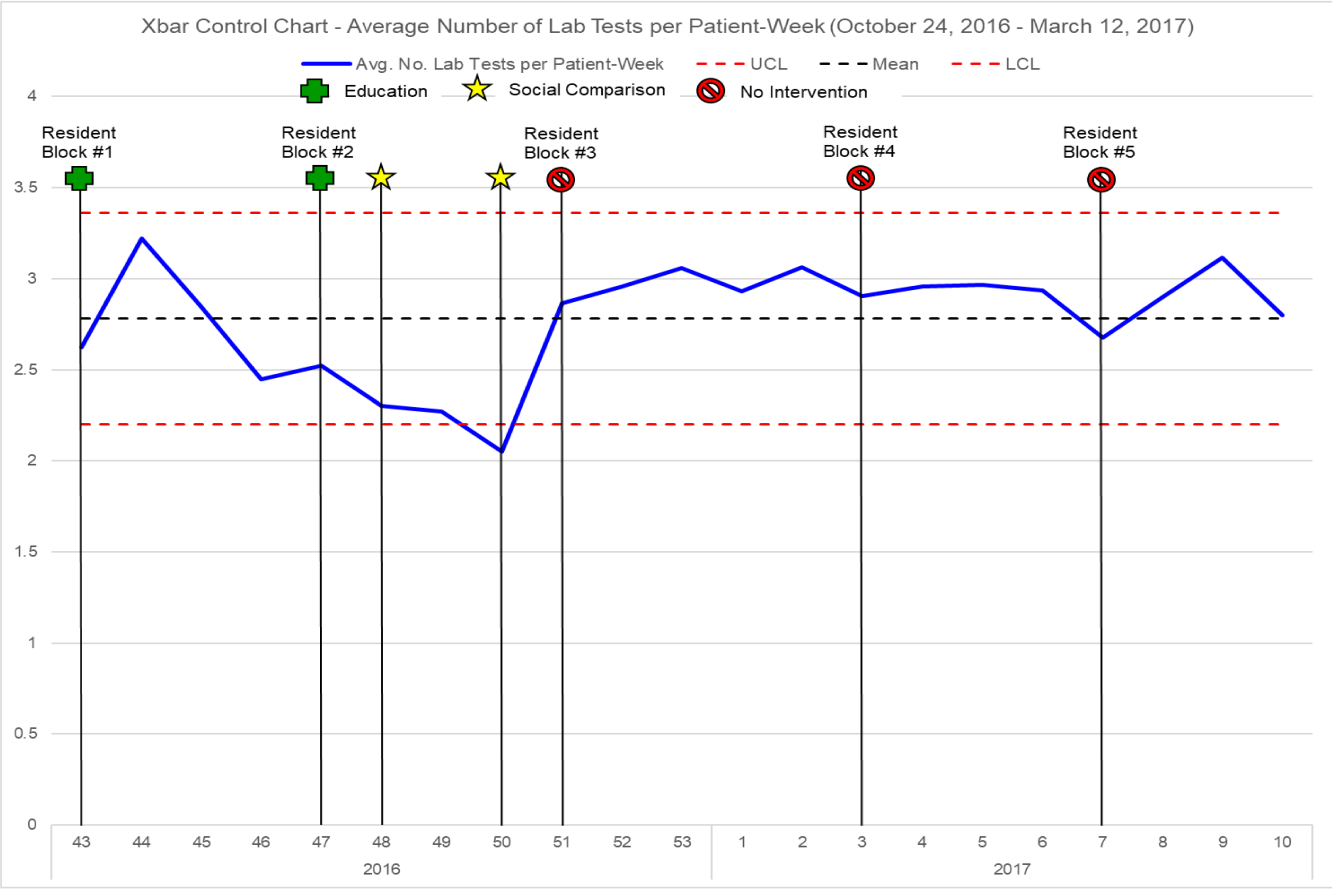
PT INR=:Prothrombin Time International Normalized Ratio; PTT: Partial Thromboplastin Time; ALT: Alanine Aminotransferase; AST: Aspartate Aminotransferase; ALP: Alkaline Phosphatase; GGT: Gamma-glutamyltransferase; MRSA: Methicillin Resistant Staphylococcus aureus; GBM: Glomerular Basement Membrane; ANCA: antineutrophil cytoplasmic antibodies; MPO: Myeloperoxidase; PR3: Proteinase 3; ANA: Antinuclear antibody; CK: Creatine kinase

Appendix Table 2: Appropriate use criteria developed by local consensus

Laboratory Test	General Indications	Frequency Recommendations	Costs (in CAD)
Complete Blood Count	Active Bleeding Acute infection/inflammation Abnormal cell lines Post transfusion HITT monitoring	Active Bleeding: q4-6h Acute infection/inflammation: Daily Stable patient: None	$7.00
Electrolytes (Na, K, Cl, CO_2)	DKA Hypo/Hyperkalemia Hypo/Hypernatremia Metabolic acidosis/Alkalosis Tumor Lysis Arrhythmias Prolonged QT_c Refeeding syndrome Electrolyte replacement AKI Diuretic use	DKA with gap: q2h Severe Na or K derangement: q4h General indications: Daily No indications: None Stable patient: None	$5.00 (Total or Each)
Creatinine	AKI Nephrotoxic agents Post contrast Sepsis Systemic Vasculitis Large volume paracentesis	General indications: Daily No indications: None Stable patients: None Note: Do not order daily on people on chronic dialysis	$5.00
Urea	Osmolar Gap GI bleed Uremic encephalopathy for consideration of dialysis	Most indications: Once Uremic encephalopathy prior to dialysis: Daily No indications: None Stable patient: None	$5.00

Coagulation (PT/INR)	**Bleeding diathesis Anticoagulants Sepsis/DIC Tylenol OD/EtOH hepatitis Liver dysfunction/failure Prior to invasive procedures**	**Tylenol OD/Liver failure: q6-8h Most indications: Daily No indications: None Stable patient: None Note: No daily INRs for stable INR on stable warfarin dose**	**$7.50**
Coagulation (PTT)	**IV Heparin Bleeding diathesis Anti-Phospholipid Antibody**	**IV heparin: Per Protocol Most indications: Once No indications: None Stable patients: None**	**$7.50**
Extended Electrolytes (Ca, Mg, P)	**DKA: all Drug Overdose: all Arrhythmias: Ca/Mg Prolonged QT_c: Ca/Mg Re-feeding Syndrome: all Refractory Hypokalemia: Mg Active replacement of any**	**Re-feeding syndrome: q6-12h Most indications: Daily No indications: None Stable patients: None Note: most patients do not require daily extended lytes**	**$5.00 For Each**
CK	**Rhabdomyolysis Severely low phoshate Suspicion for myopathy**	**Daily if rhabdo until normalizes Once Once**	**$15.00**

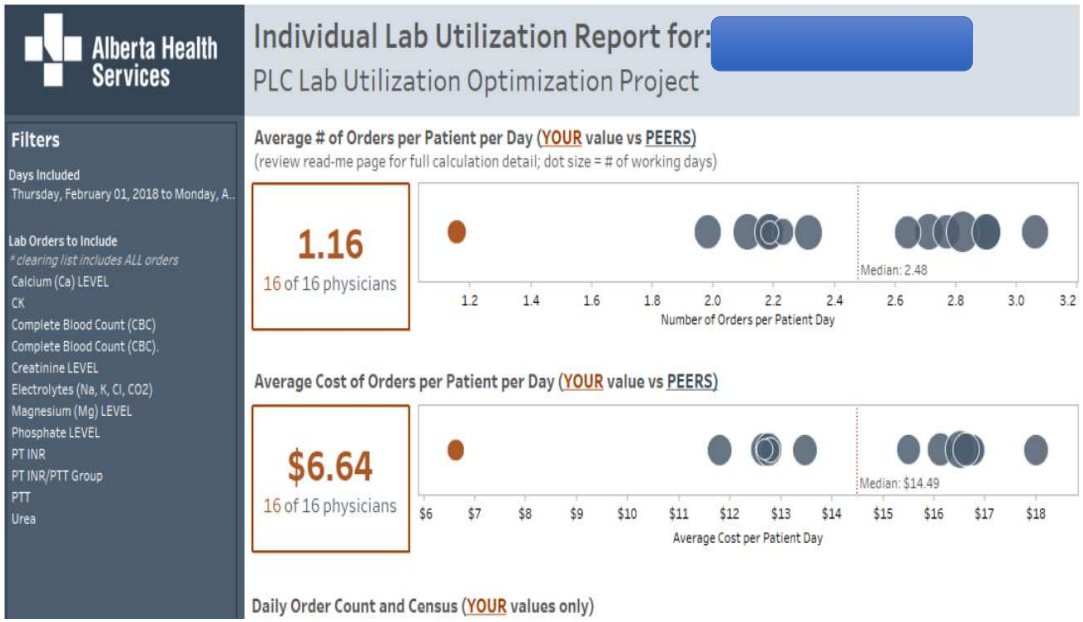
Appendix Fig 1: Development and Implementation of the Intervention bundle



The multicomponent intervention bundle was developed over five 4-week resident rotation blocks. The first trial block saw the implementation of the education arm of the intervention. Education occurred during learner orientation on the first day of the block, which consisted of five minutes of orientation to the initiative and to the locations of the educational posters on the unit. In addition, each learner received pocket cards outlining laboratory utilization appropriate criteria, frequency recommendations and costs. During the second block, we added social comparison between the three medical teams in the intervention hospital. Social comparison was provided via written information on the whiteboard of the team meeting rooms and occurred twice during the block (week 2 and week 4). No

intervention was delivered on the third block, which occurred over the holiday season. During blocks 4 and 5, no active intervention was delivered. During this time, the QI committee convened to review the interim results from our intervention trials and seek input from all stakeholders to refine the interventions.

Appendix Figure 2: Individual physician laboratory test utilization feedback

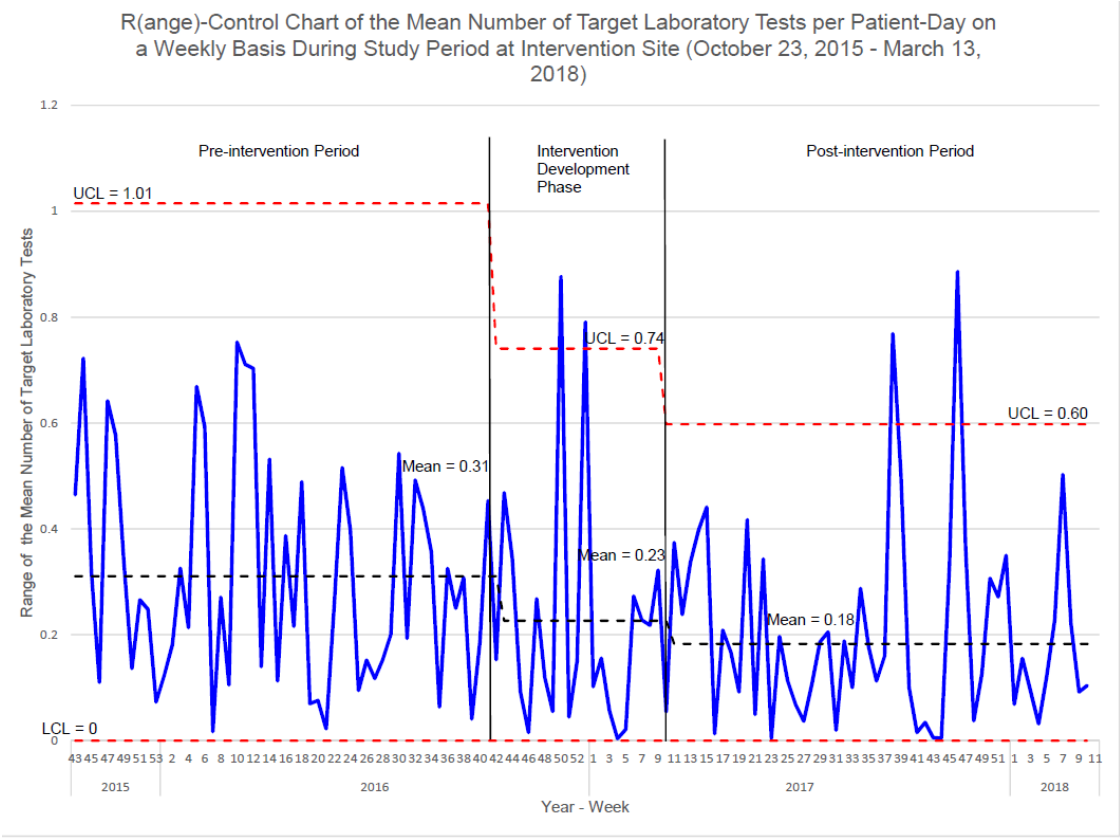


Appendix Table 3: Complete list of all critical laboratory test results as defined by our laboratory services

Laboratory Test	Critical lab values
Total calcium	Less than 1.65 mmol/L Greater than 3.25 mmol/L
Potassium	Less than 2.60 mmol/L Greater than 6.20 mmol/L
Phosphate	Less than 0.4 mmol/L
Sodium	Less than 120 mmol/L Greater than 155 mmol/L

Hemoglobin	Equal to or less than 60 g/L
Platelet	Less than 20 X 10^9/L
Absolute neutrophil count	Less than 0.6 X 10^9/L
White blood cell count	Less than 0.6 X 10^9/L Greater than 99.9 X 10^9/L
International Normalized Ratio	Greater than 5
Partial thromboplastin time	Equal to or greater than 120s

Appendix Figure 3:



At the intervention site, we note a reduction n the range of the mean number of target laboratory tests ordered per patient-day on a weekly basis during the study period.