

Applied Healthcare Data Science at UCSF

Alvin Rajkomar, MD

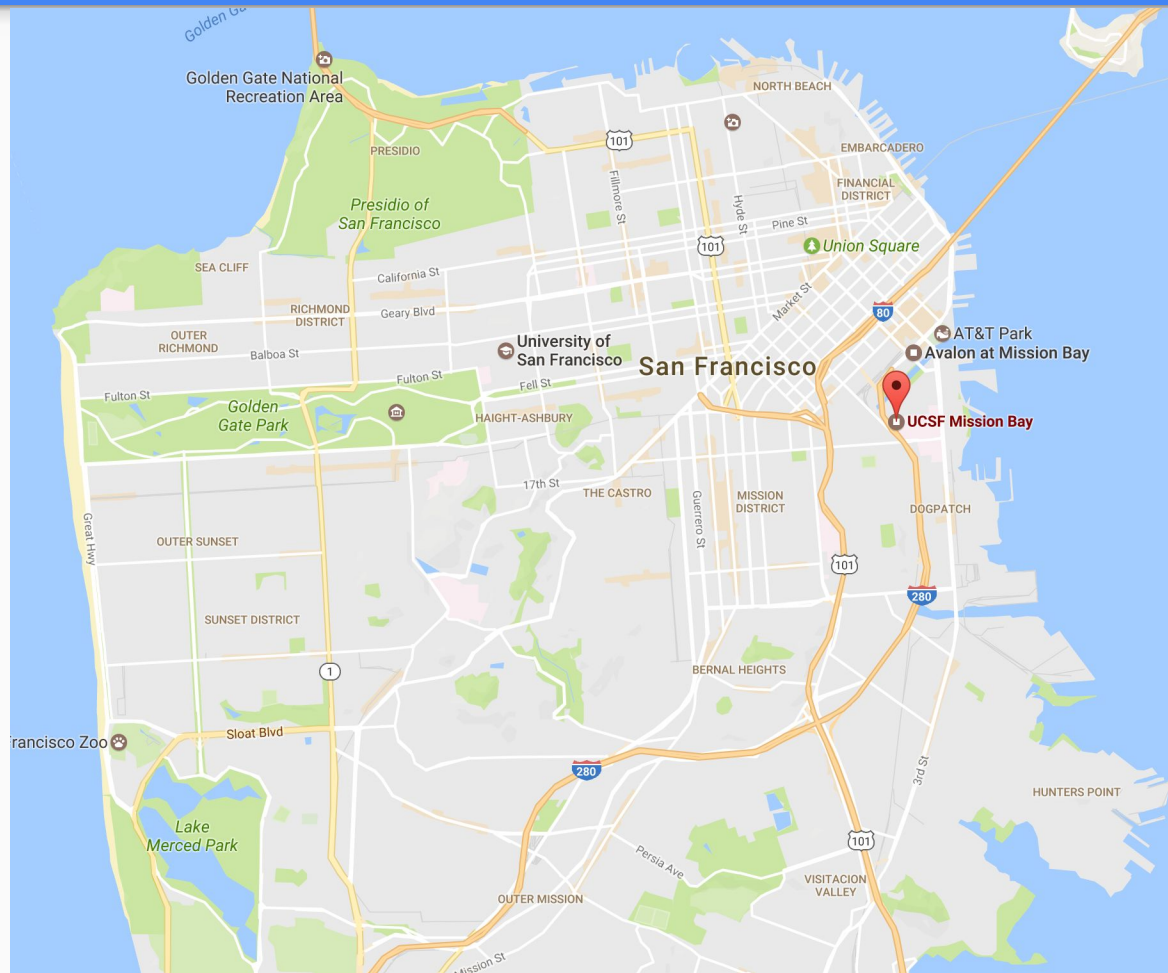


Roadmap

How I got started

Early projects

Lessons from later projects



How I got started



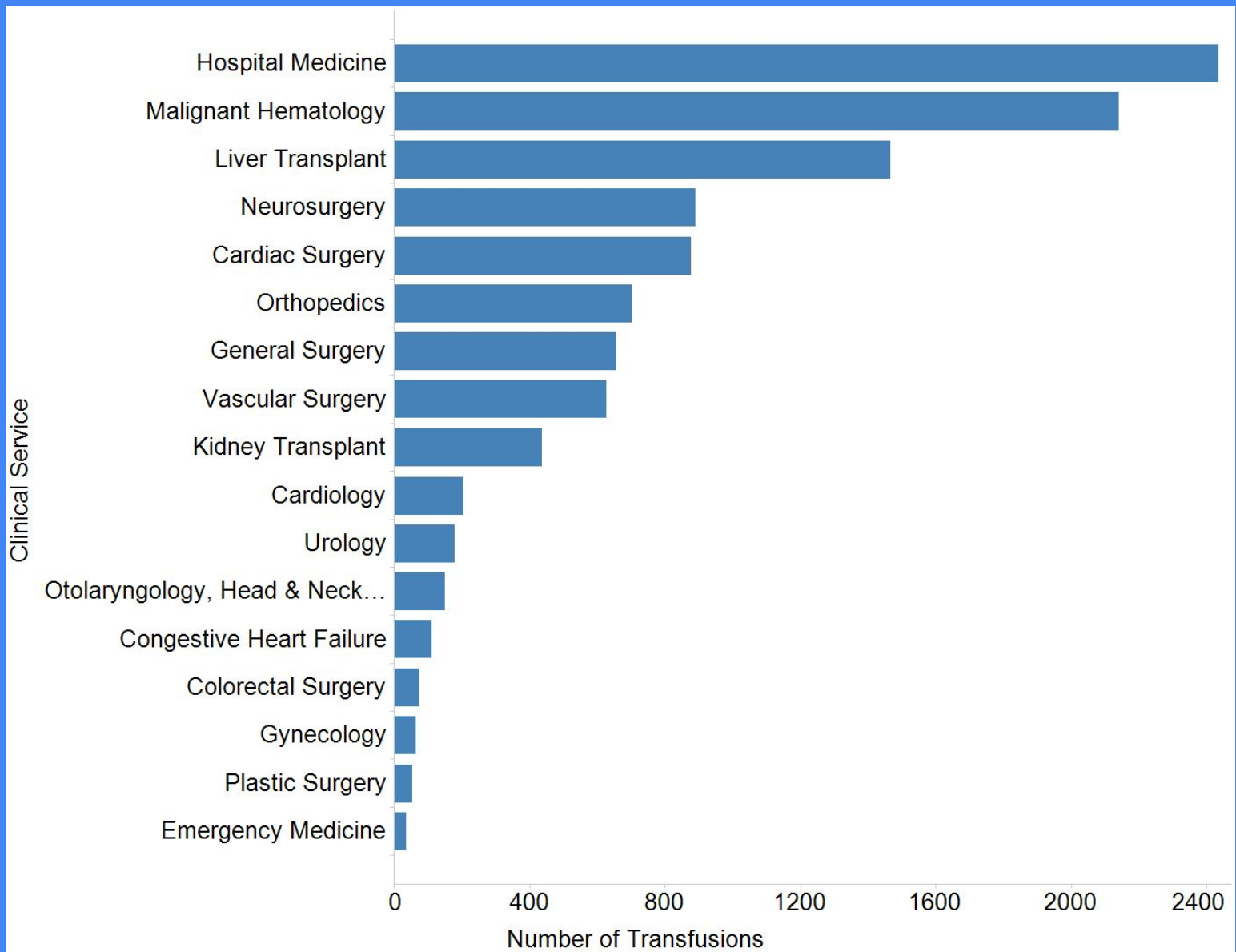
Early Projects

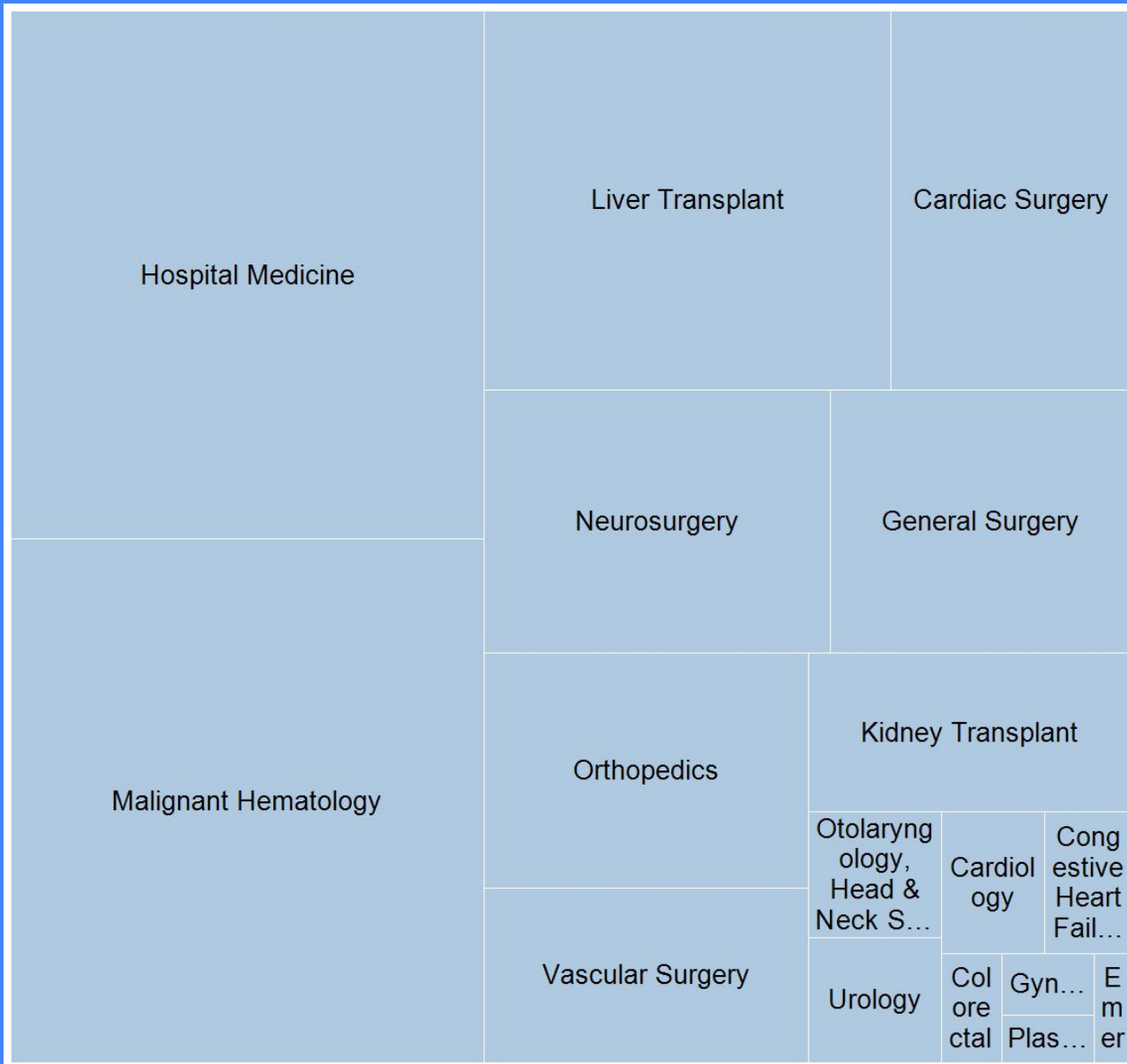
Blood Transfusion Overuse



Date of Transfusion	Clinical Service	Attending Physician	Hemoglobin Prior to Transfusion	...23 other variables
7/1/2013	Hospital Medicine	Alvin Rajkomar	7	...
7/2/2013	Hospital Medicine	Alvin Rajkomar	6.5	...
7/5/2013	Hospital Medicine	Alvin Rajkomar	6.1	...
7/10/2013	Hospital Medicine	Alvin Rajkomar	8	...
7/11/2013	Hospital Medicine	Alvin Rajkomar	12	...
7/16/2013	Hospital Medicine	Alvin Rajkomar	6.7	...
7/20/2013	Hospital Medicine	Alvin Rajkomar	7.2	...

Clinical Service	Number of Transfusions	Mean Threshold	SD of Threshold	SE of threshold	Proportion of Transfusions Above 8
Hospital Medicine	2311	7.39	1.19	0.02	0.77
Malignant Hematology	2096	8.49	0.81	0.02	0.31
Liver Transplant	1261	7.98	0.91	0.03	0.58
Neurosurgery	781	8.85	1.39	0.05	0.28
Cardiac Surgery	711	8.61	1.45	0.05	0.35
Orthopedics	585	7.85	1.37	0.06	0.68
General Surgery	572	8.35	1.09	0.05	0.40
Vascular Surgery	544	8.78	0.89	0.04	0.18
Neonatology	479	11.45	2.45	0.11	0.08
Kidney Transplant	402	7.82	0.97	0.05	0.66
Cardiology	197	8.09	1.20	0.09	0.54
Gynecologic Oncology	195	7.91	1.17	0.08	0.60
Obstetrics	126	8.44	2.22	0.20	0.54
Urology	124	7.93	1.25	0.11	0.60
Otolaryngology, Head & Neck Surgery	121	8.82	1.46	0.13	0.28
Congestive Heart Failure	104	7.80	0.98	0.10	0.66
From July 2012-Dec 2013					

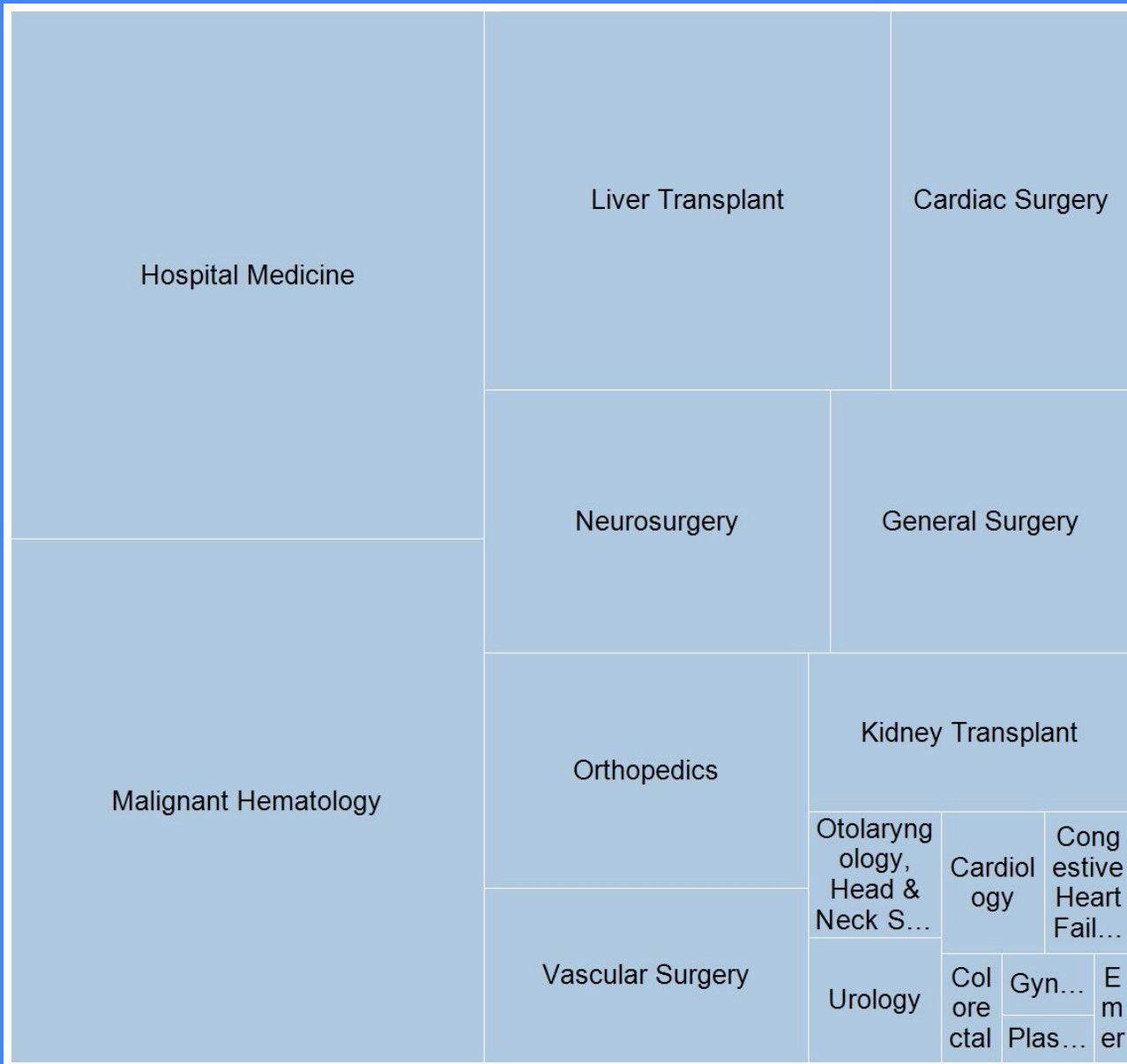


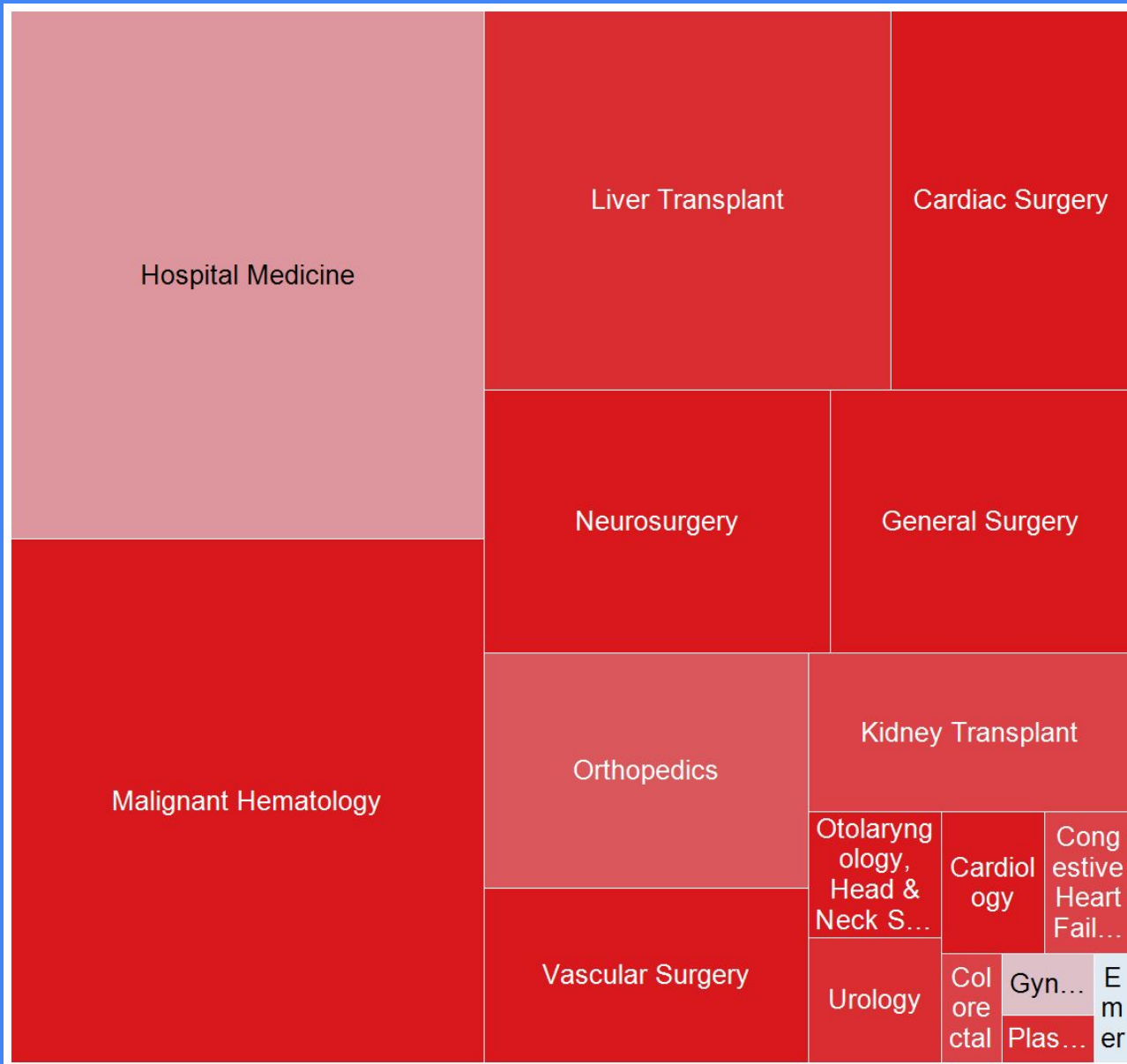


Date of Transfusion	Clinical Service	Attending Physician	Hemoglobin Prior to Transfusion	...23 other variables
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7/2/2013	Hospital Medicine	Alvin Rajkomar	7.1	...
7/3/2013	Hospital Medicine	Alvin Rajkomar	12	...
7/4/2013	Hospital Medicine	Alvin Rajkomar	6.5	...
7/5/2013	Hospital Medicine	Alvin Rajkomar	4.3	...
7/6/2013	Hospital Medicine	Alvin Rajkomar	7.2	...
7/7/2013	Hospital Medicine	Alvin Rajkomar	6.9	...
7/8/2013	Hospital Medicine	Alvin Rajkomar	6.5	...
7/9/2013	Hospital Medicine	Alvin Rajkomar	7.8	...
7/10/2013	Hospital Medicine	Alvin Rajkomar	5.9	...

Clinical
Service

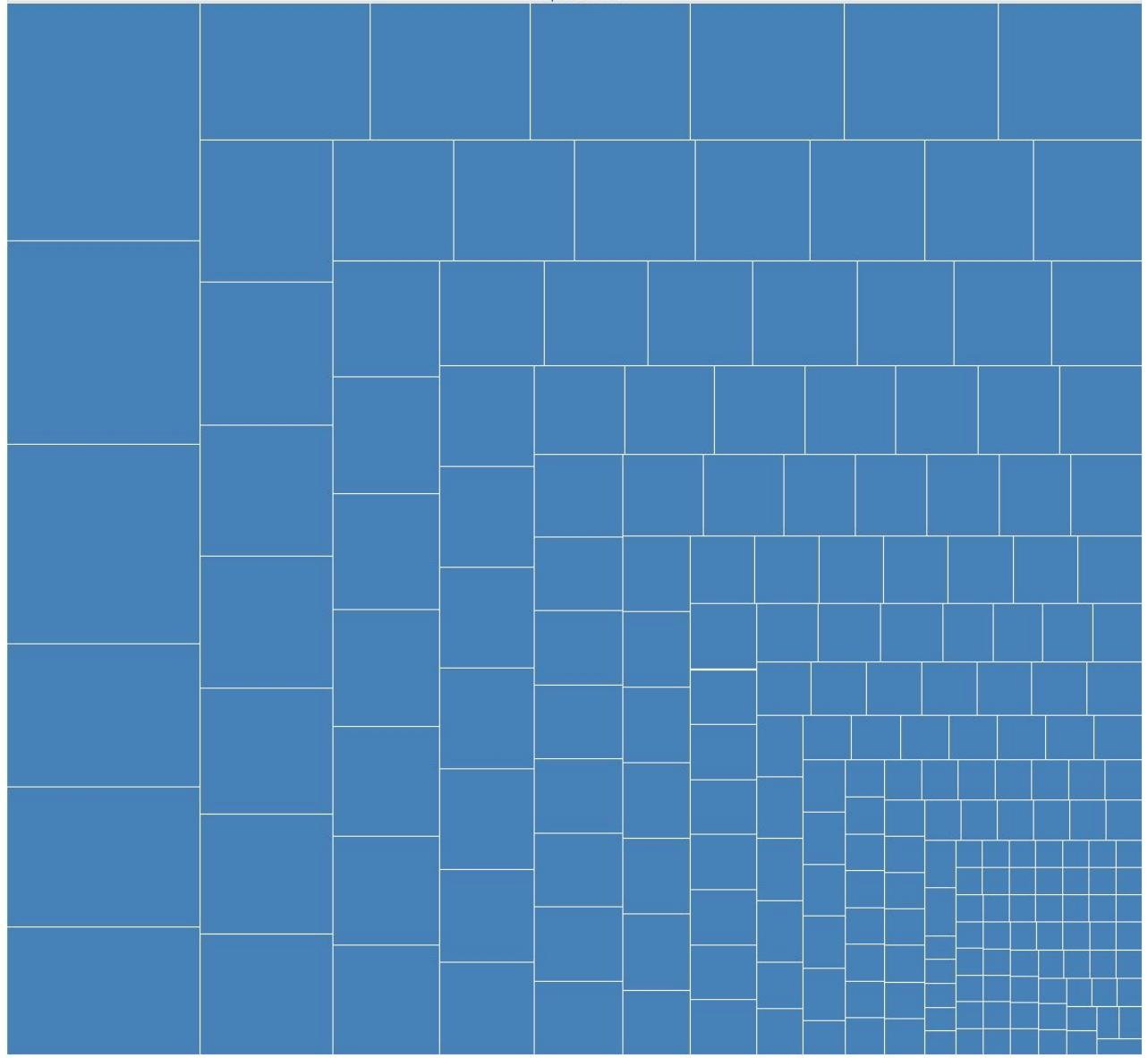
Hemoglobin
Threshold





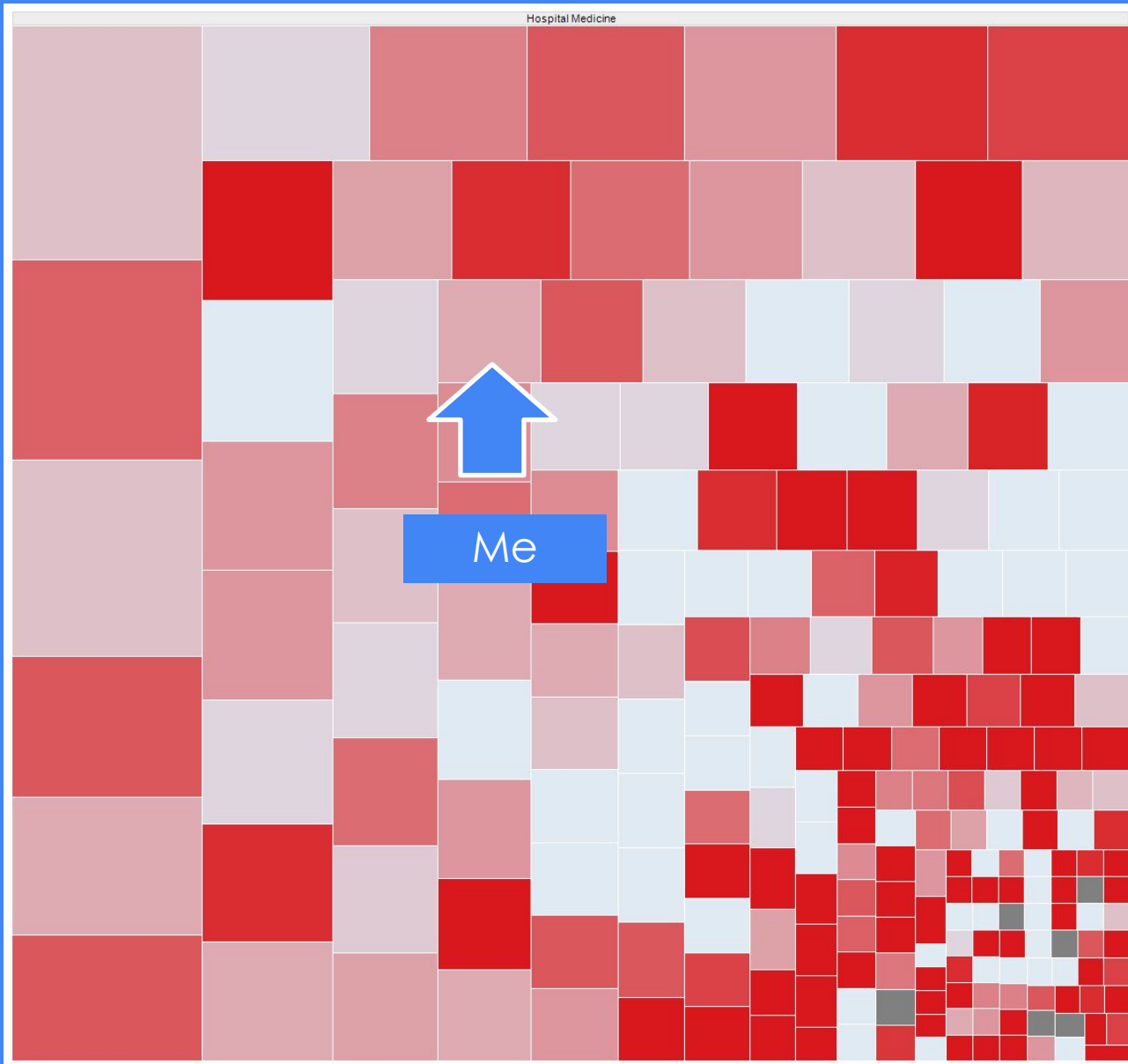
Hospital Medicine

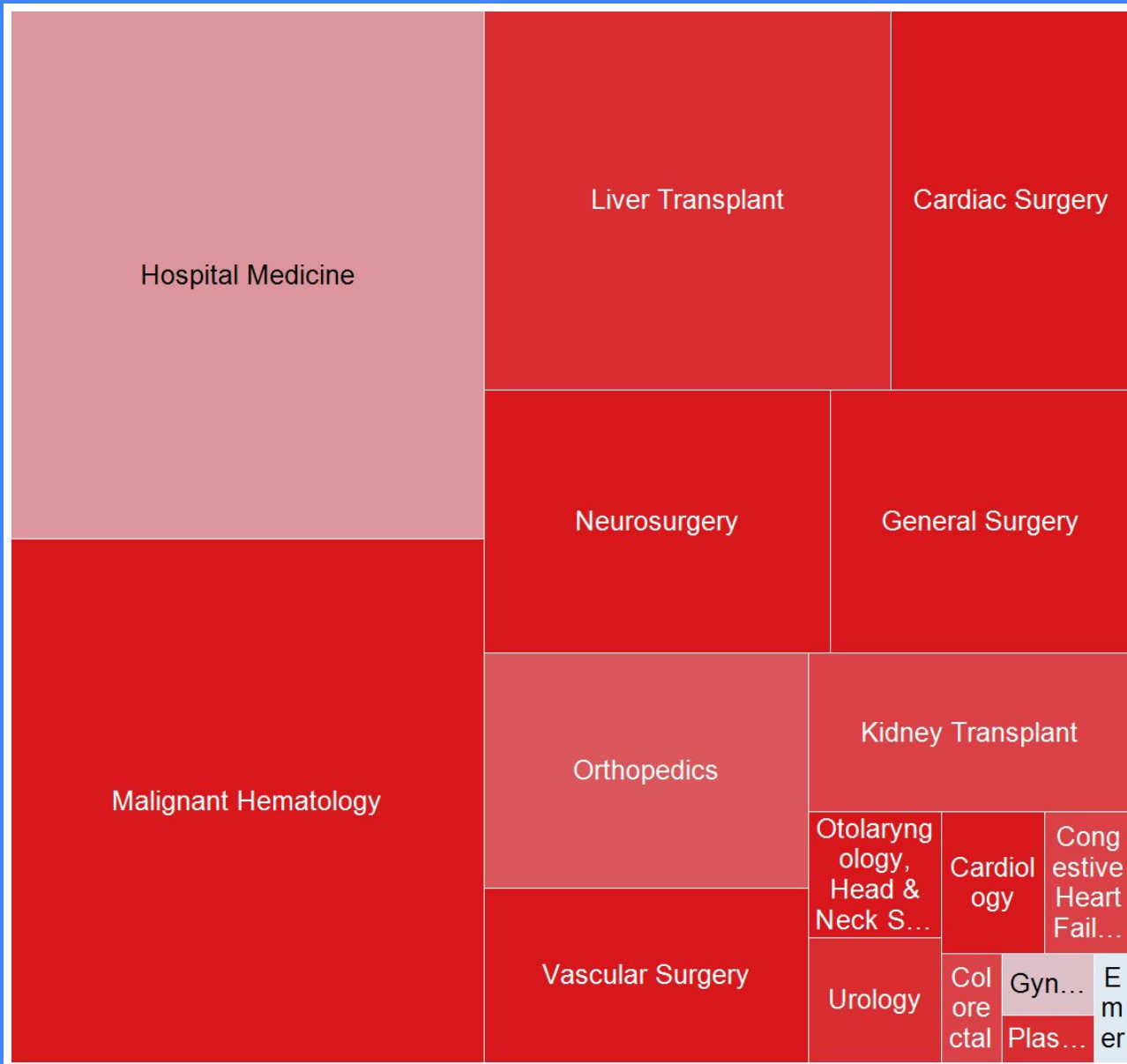
Hospital Medicine

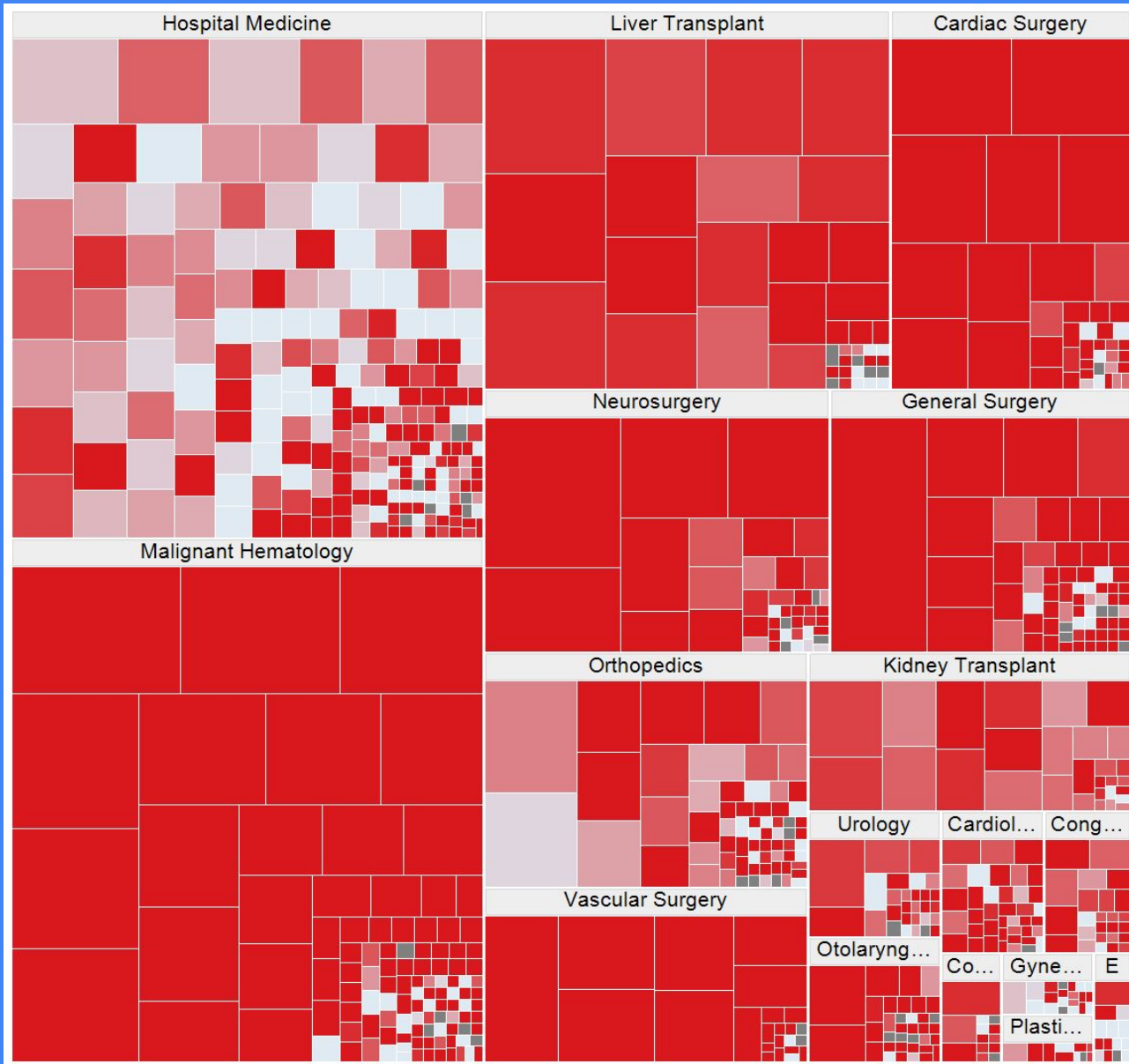


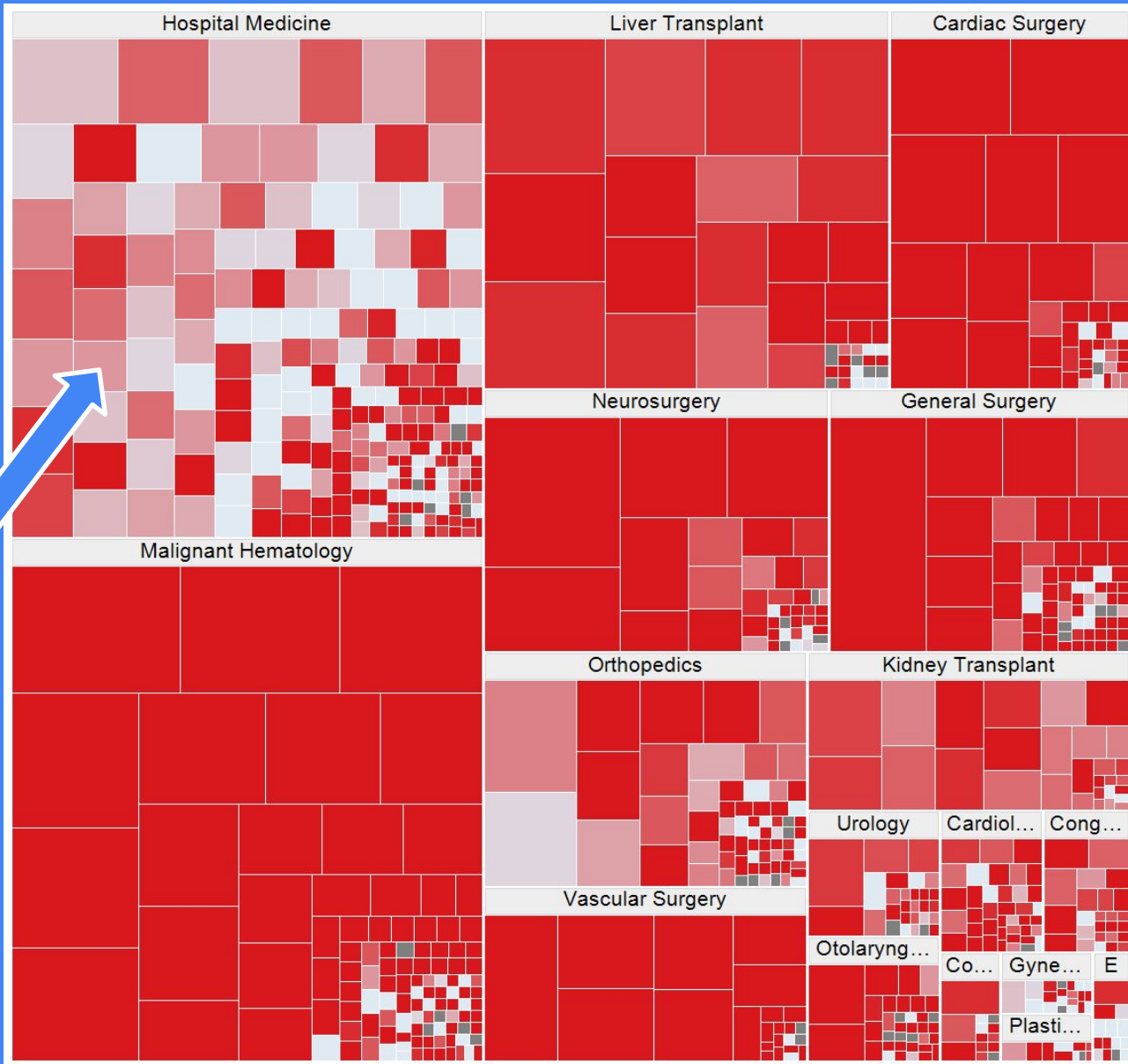


Me

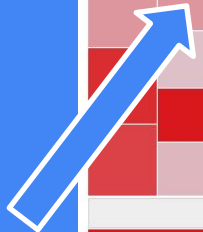


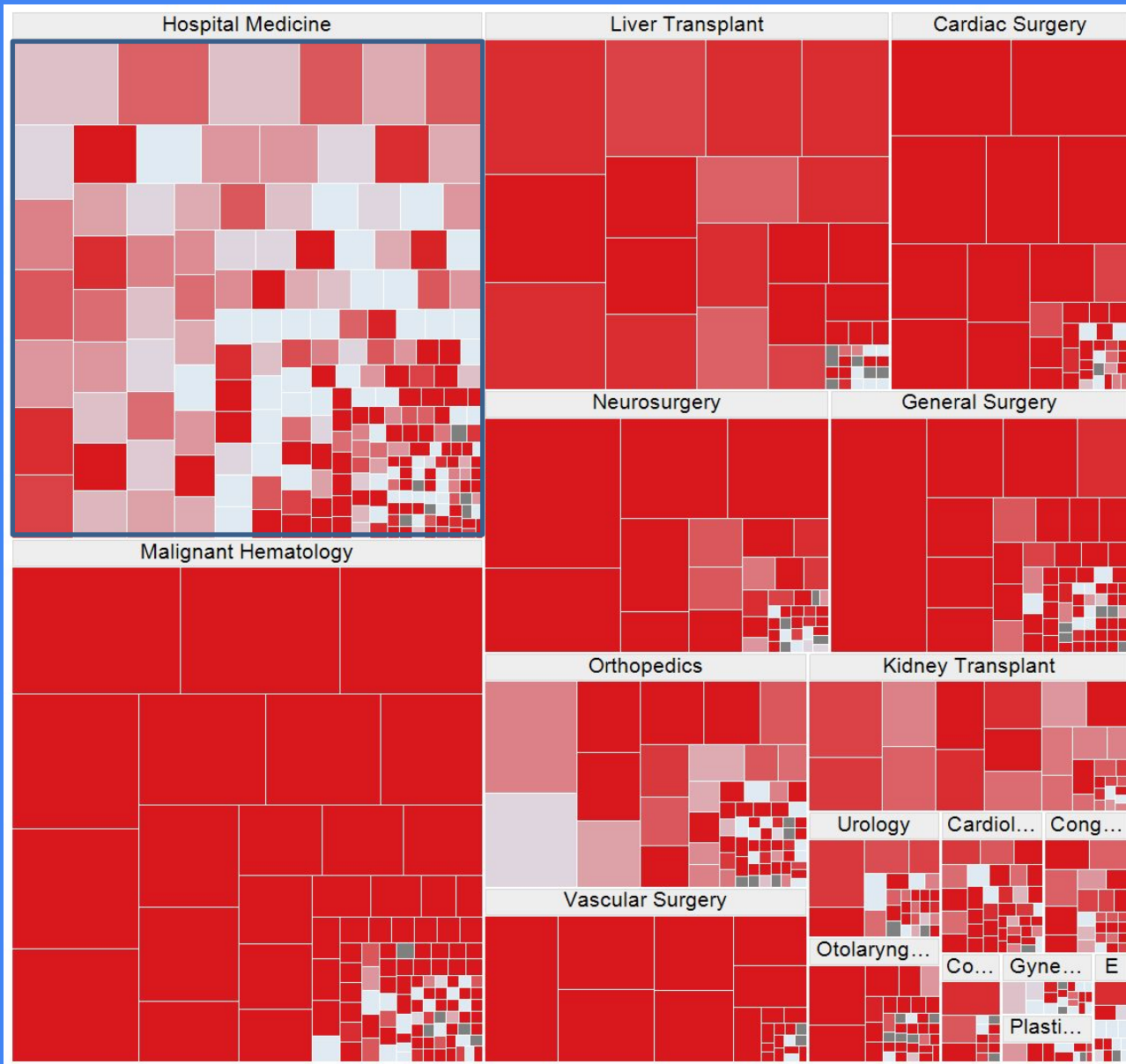


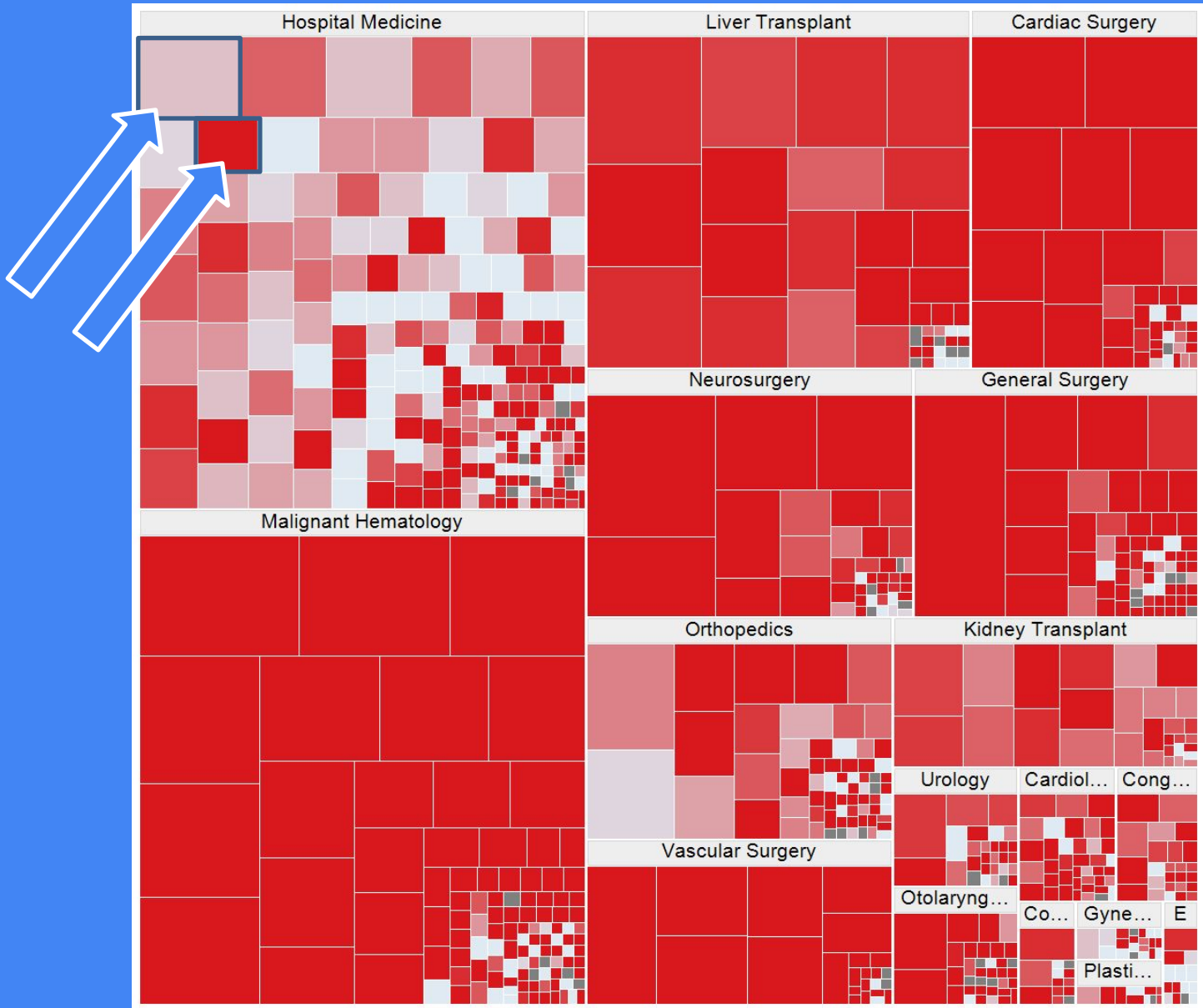


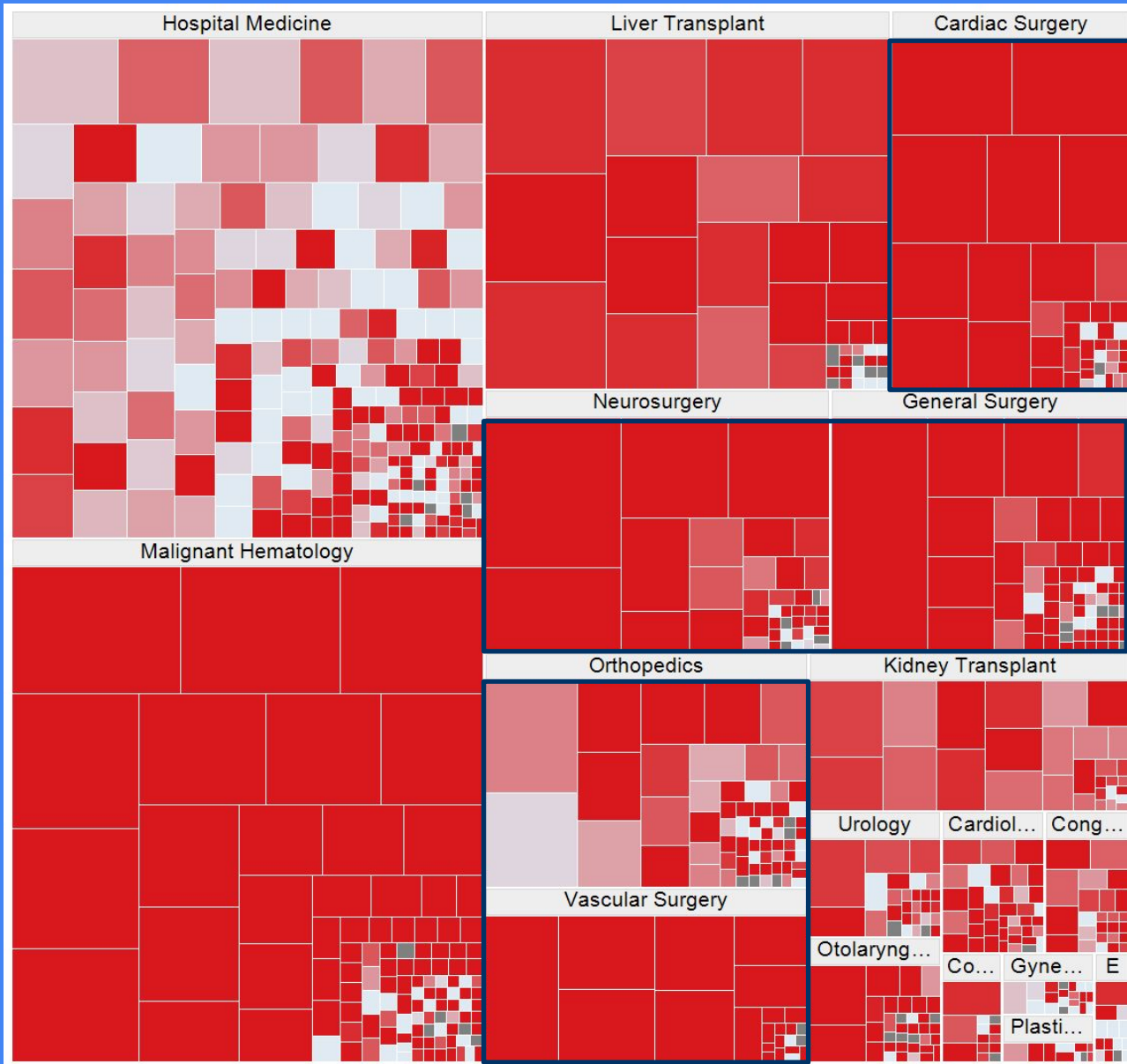


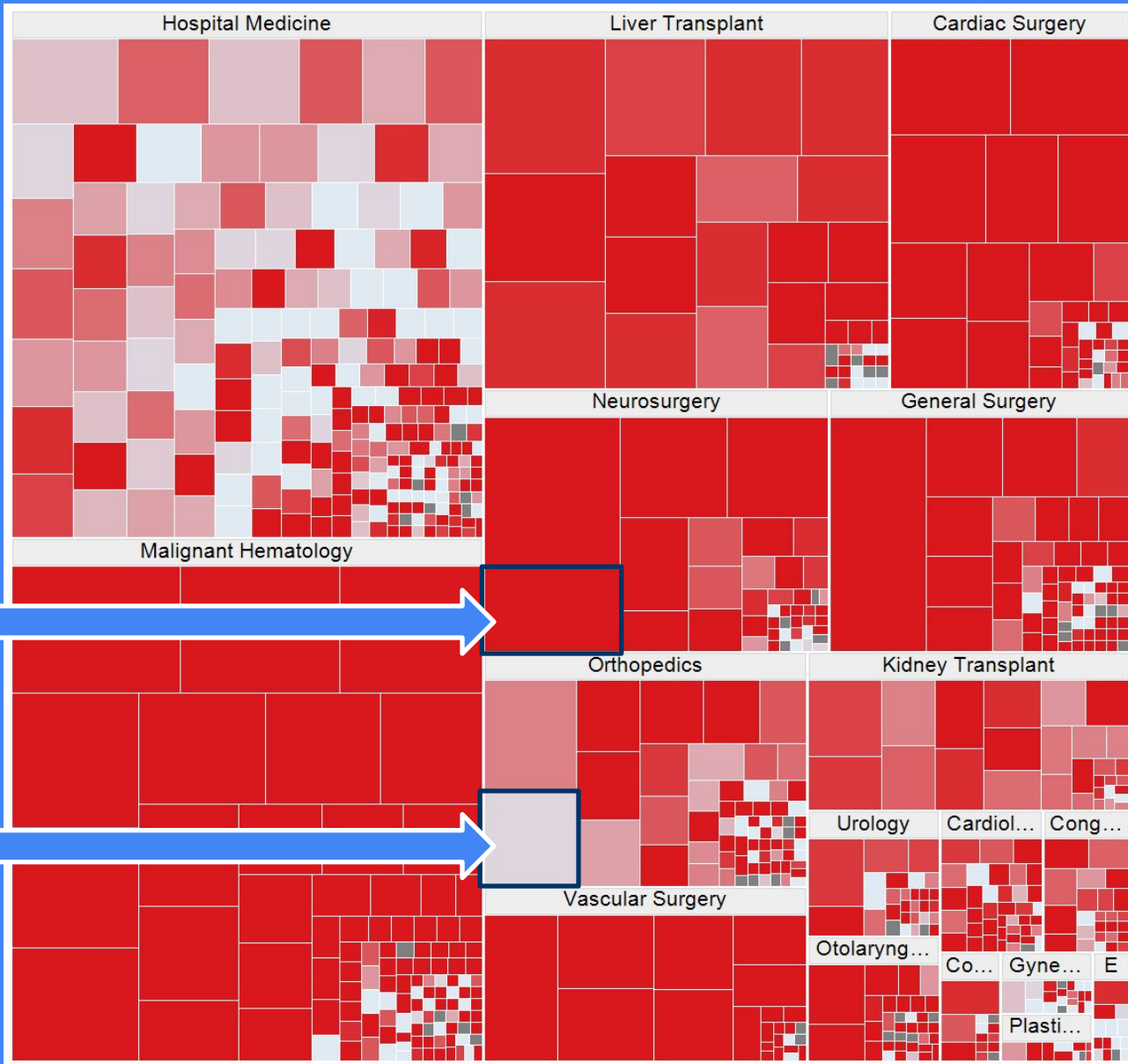
Me











Lessons from later projects

1. Find meaningful questions that can be answered with data
#domainexpertise

Am J Med. 2016 Nov;129(11):1194-1197. doi: 10.1016/j.amjmed.2016.07.004. Epub 2016 Jul 22.

Low Diagnostic Utility of Rechecking Hemoglobins Within 24 Hours in Hospitalized Patients.

Rajkomar A¹, McCulloch CE², Fang MC³.

J Hosp Med. 2016 Dec;11(12):859-861. doi: 10.1002/jhm.2529. Epub 2015 Dec 30.

The association between discharge before noon and length of stay in medical and surgical patients.

Rajkomar A¹, Valencia V¹, Novelero M¹, Mourad M¹, Auerbach A¹.

J Grad Med Educ. 2017 Feb;9(1):109-112. doi: 10.4300/JGME-D-16-00272.1.

Using the Electronic Health Record to Identify Educational Gaps for Internal Medicine Interns.

Rajkomar A, Ranji SR, Sharpe B.

2. Embrace `#rawdata`
and master your
`#datapipeline`

Beware of upstream
pre-processing of
data

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ORIGINAL RESEARCH | 2 MAY 2017

Association Between a Virtual Glucose Management Service and Glycemic Control in Hospitalized Adult Patients: An Observational Study

Robert J. Rushakoff, MD; Mary M. Sullivan, DNP; Heidemarie Windham MacMaster, PharmD; Arti D. Shah, MD; Alvin Rajkomar, MD; David V. Glidden, PhD; Michael A. Kohn, MD, MPP

JAMA Surgery | **Original Investigation**

Association Between Surgeon Scorecard Use and Operating Room Costs

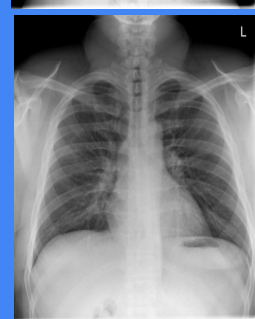
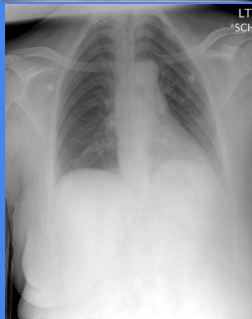
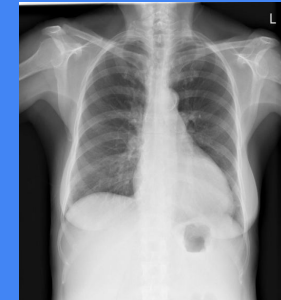
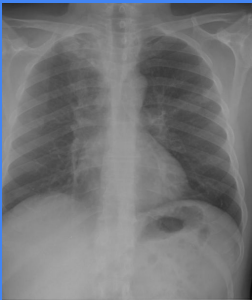
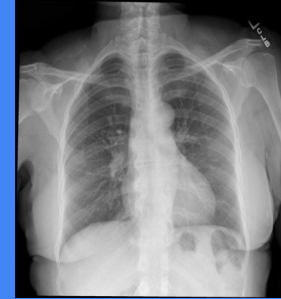
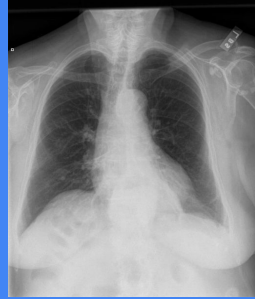
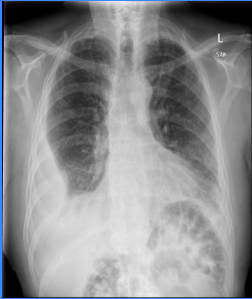
Corinna C. Zygourakis, MD; Victoria Valencia, MPH; Christopher Moriates, MD; Christy K. Boscardin, PhD; Sereina Catschegn, MD; Alvin Rajkomar, MD; Kevin J. Bozic, MD, MBA; Kent Soo Hoo, PhD; Andrew N. Goldberg, MD, MSCE; Lawrence Pitts, MD; Michael T. Lawton, MD; R. Adams Dudley, MD, MBA; Ralph Gonzales, MD, MSPH

3. Use #opensource
tools #r #python
#tensorflow

Don't be dogmatic

4. Sometimes hard questions require new techniques

Which of these patients will become critically ill without intervention?



High-Throughput Classification of Radiographs Using Deep Convolutional Neural Networks

Alvin Rajkomar^{1,2} • Sneha Lingam² • Andrew G. Taylor³ • Michael Blum² •
John Mongan³

5. Disseminate and Deploy

Alvin Rajkomar, MD
Joanne Yim, PhD



*Primary
care
panel
sizes*

Original Paper

Weighting Primary Care Patient Panel Size: A Novel Electronic Health Record-Derived Measure Using Machine Learning

Alvin Rajkomar^{1*}, MD  ; Joanne Wing Lan Yim^{2*}, PhD  ;

Kevin Grumbach^{3,4}, MD  ; Ami Parekh^{1,3}, MD, JD 

Algorithm currently
deployed and used by
all adult primary care
at UCSF

Challenges I faced

Data is contextual and requires clinical insight to understand. *Work with the people who created the data you are analyzing (e.g. physicians, nurses, pharmacists, surgeons, administrators)*

Expertise in machine learning limited. *Don't underestimate power of "simple" algorithms with lots of data. Collaborate when they don't work.*

Using data with protected health information requires significant investment in security infrastructure. *Engage excellent UCSF IT security teams*

Deploying algorithms is hard (data pipeline/serving infrastructure, monitoring data drift, retraining).

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