Collaboration:
A Mathematical and Medical Partnership

Kate Causey

with thanks to Greenville Health System and Drs. Liz Bouzarth, Kevin Hutson, and Tom Lewis of the Furman Mathematics Department

FURMAN

GREENVILLE HEALTH SYSTEM

My research partners for the summer

Kate Causey, Danny Rivers, and Jordan Brown's first surgical observation at Greenville Health System (GHS)

Goals

Learn

Communicate

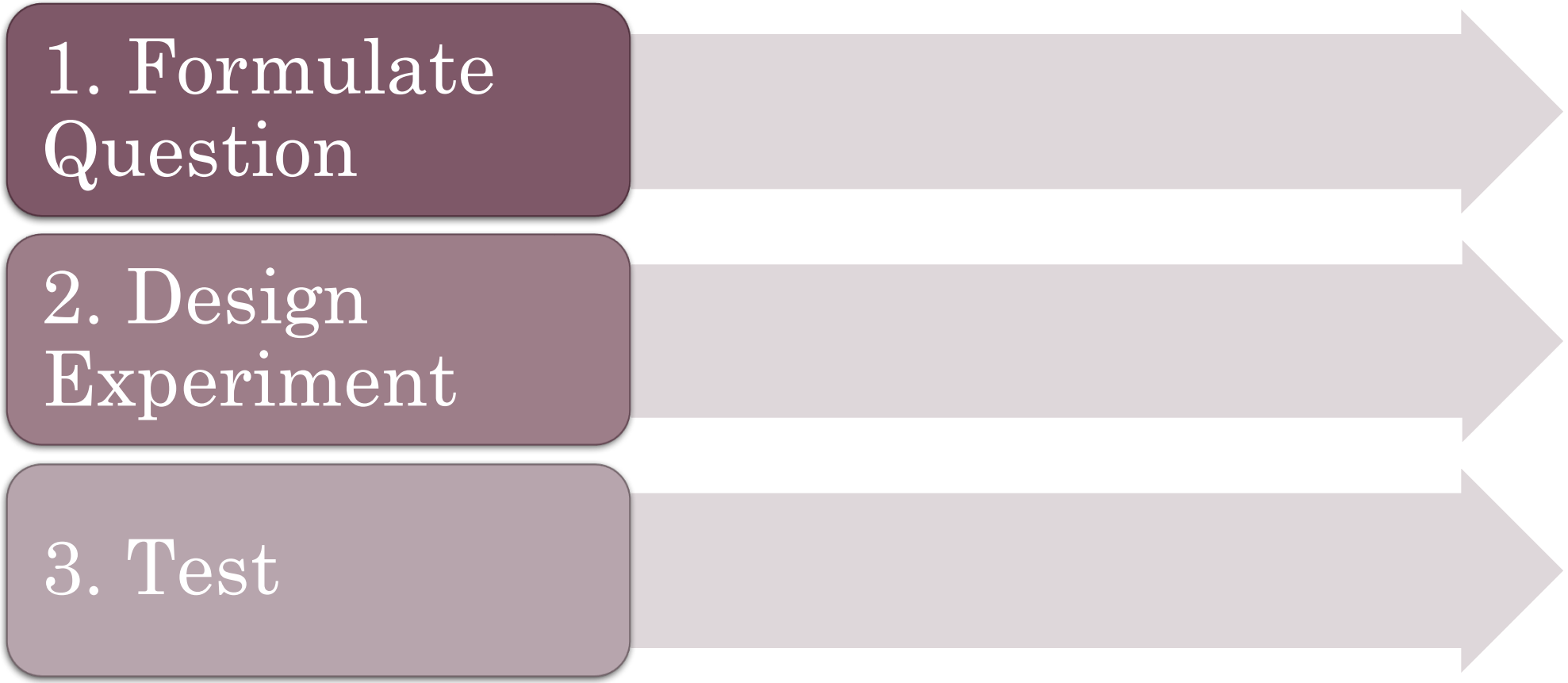
Analyze

Discern

Hospital Overview

- Regional Hospital
- University of South Carolina Medical School Greenville
- Upsides:
  - Particular type of patient
  - Opportunities for students like me
- Downsides:
  - Little data sharing
  - Few overworked statisticians
  - Pre-existing datasets

Steps in a Study

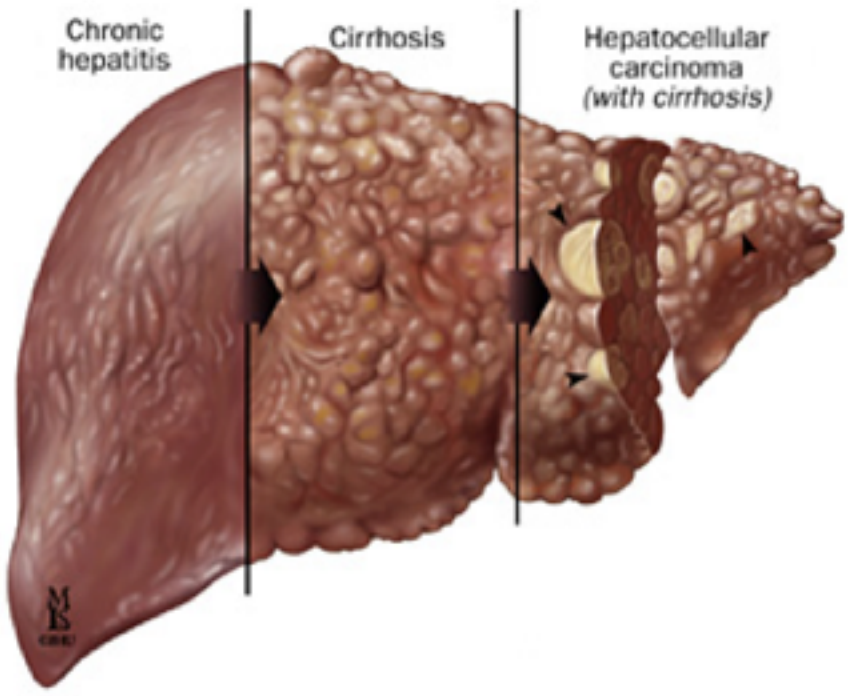


1. Formulate Question

- What question are we trying to answer?

1. Formulate Question

- **Hepatocellular Carcinoma (HCC)**
- Cure: liver transplant or surgery
- Ineligible?
  - Four Treatments
- Question: Of four treatments, which has the best outcome?



1. Formulate Question

- Question: Of four treatments, which has the best outcome?
- BUT!
- How do we define "best outcome?"
  - Survival
  - Days of survival
  - Days of survival past median survival
- OR Tumor Size Change
  - Shrink (positive)
  - None (positive)
  - Grow (negative)

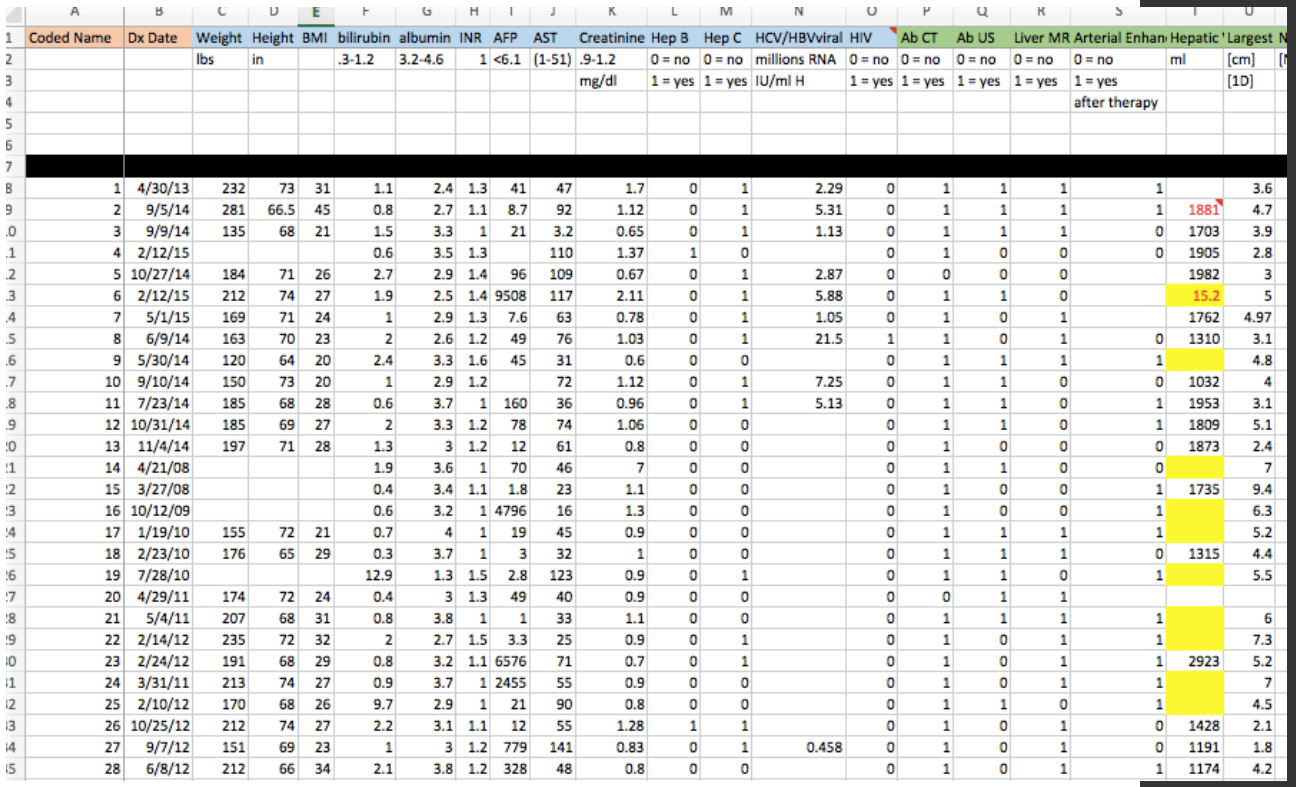
1. Formulate Question

- When we don’t get to ask the question, we make do with what we have.

1. Formulate Question
   - Hepatocellular Carcinoma
2. Design Experiment
3. Test

2. Design Experiment

- Pre-Existing data
- **Database Design**
- Binary Data
- Unknown data
- White, white, or Caucasian



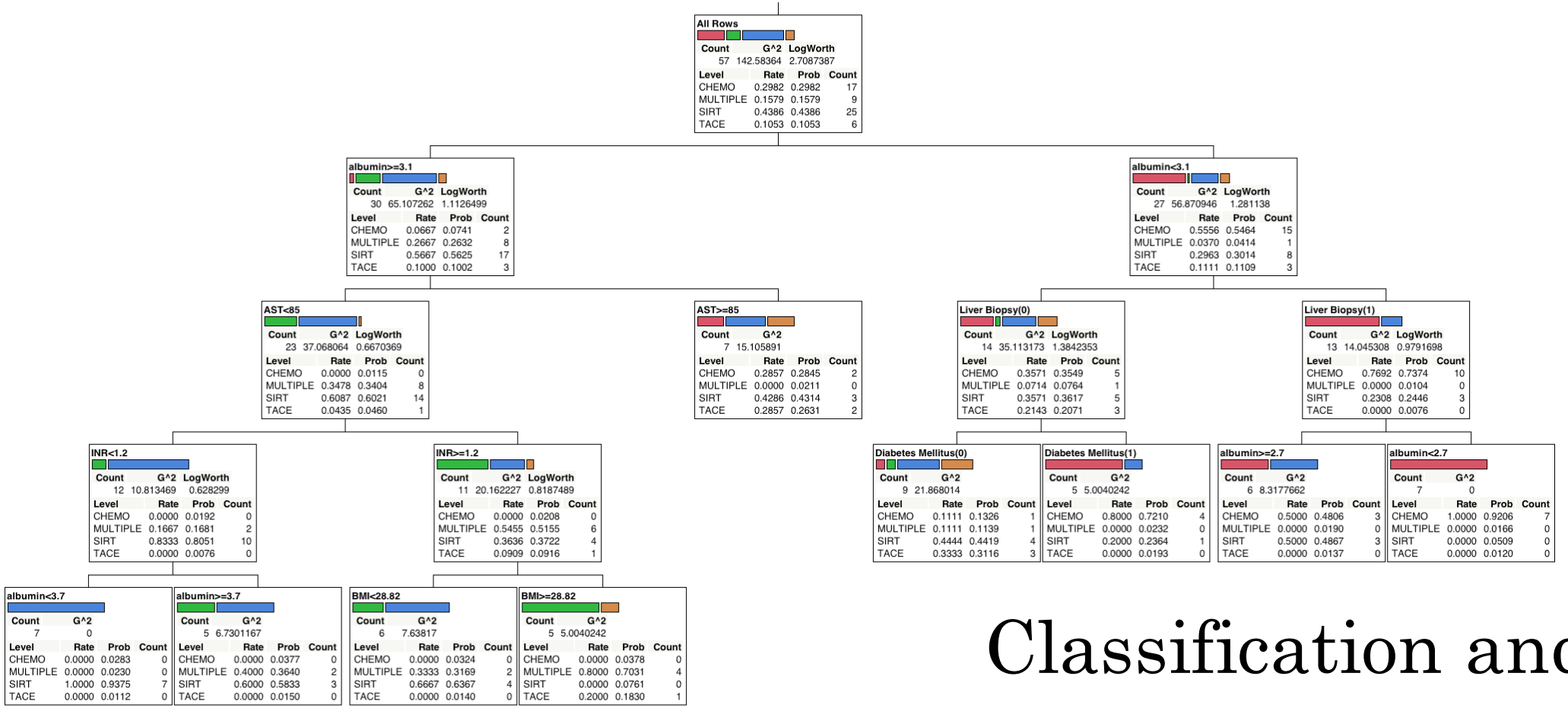
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Coded Name	Dx Date	Weight	Height	BMI	bilirubin	albumin	INR	AFP	AST	Creatinine	Hep B	Hep C	HCV/HBVviral	HIV	Ab CT	Ab US	Liver MR	Arterial Enhan	Hepatic '	Largest N
2			lbs	in		.3-1.2	3.2-4.6	1	<6.1	(1-51)	.9-1.2	0 = no	0 = no	millions RNA	0 = no	0 = no	0 = no	0 = no	0 = no	ml	[cm]
3											mg/dl	1 = yes	1 = yes	IU/ml H	1 = yes	1 = yes	1 = yes	1 = yes	1 = yes		[1D]
4																			after therapy		
5																					
6																					
7																					
8	1	4/30/13	232	73	31	1.1	2.4	1.3	41	47	1.7	0	1	2.29	0	1	1	1	1		3.6
9	2	9/5/14	281	66.5	45	0.8	2.7	1.1	8.7	92	1.12	0	1	5.31	0	1	1	1	1	1881	4.7
10	3	9/9/14	135	68	21	1.5	3.3	1	21	3.2	0.65	0	1	1.13	0	1	1	1	0	1703	3.9
11	4	2/12/15				0.6	3.5	1.3		110	1.37	1	0		0	1	0	0	0	1905	2.8
12	5	10/27/14	184	71	26	2.7	2.9	1.4	96	109	0.67	0	1	2.87	0	0	0	0		1982	3
13	6	2/12/15	212	74	27	1.9	2.5	1.4	9508	117	2.11	0	1	5.88	0	1	1	0		15.2	5
14	7	5/1/15	169	71	24	1	2.9	1.3	7.6	63	0.78	0	1	1.05	0	1	0	1		1762	4.97
15	8	6/9/14	163	70	23	2	2.6	1.2	49	76	1.03	0	1	21.5	1	1	0	1	0	1310	3.1
16	9	5/30/14	120	64	20	2.4	3.3	1.6	45	31	0.6	0	0		0	1	1	1	1		4.8
17	10	9/10/14	150	73	20	1	2.9	1.2		72	1.12	0	1	7.25	0	1	1	0	0	1032	4
18	11	7/23/14	185	68	28	0.6	3.7	1	160	36	0.96	0	1	5.13	0	1	1	0	1	1953	3.1
19	12	10/31/14	185	69	27	2	3.3	1.2	78	74	1.06	0	0		0	1	1	0	1	1809	5.1
20	13	11/4/14	197	71	28	1.3	3	1.2	12	61	0.8	0	0		0	1	0	0	0	1873	2.4
21	14	4/21/08				1.9	3.6	1	70	46	7	0	0		0	1	1	0	0		7
22	15	3/27/08				0.4	3.4	1.1	1.8	23	1.1	0	0		0	1	0	0	1	1735	9.4
23	16	10/12/09				0.6	3.2	1	4796	16	1.3	0	0		0	1	0	0	1		6.3
24	17	1/19/10	155	72	21	0.7	4	1	19	45	0.9	0	0		0	1	1	1	1		5.2
25	18	2/23/10	176	65	29	0.3	3.7	1	3	32	1	0	0		0	1	1	1	0	1315	4.4
26	19	7/28/10				12.9	1.3	1.5	2.8	123	0.9	0	1		0	1	1	0	1		5.5
27	20	4/29/11	174	72	24	0.4	3	1.3	49	40	0.9	0	0		0	0	1	1			
28	21	5/4/11	207	68	31	0.8	3.8	1	1	33	1.1	0	0		0	1	1	1	1		6
29	22	2/14/12	235	72	32	2	2.7	1.5	3.3	25	0.9	0	1		0	1	0	1	1		7.3
30	23	2/24/12	191	68	29	0.8	3.2	1.1	6576	71	0.7	0	1		0	1	0	1	1	2923	5.2
31	24	3/31/11	213	74	27	0.9	3.7	1	2455	55	0.9	0	0		0	1	0	1	1		7
32	25	2/10/12	170	68	26	9.7	2.9	1	21	90	0.8	0	0		0	1	1	0	1		4.5
33	26	10/25/12	212	74	27	2.2	3.1	1.1	12	55	1.28	1	1		0	1	0	1	0	1428	2.1
34	27	9/7/12	151	69	23	1	3	1.2	779	141	0.83	0	1	0.458	0	1	0	1	0	1191	1.8
35	28	6/8/12	212	66	34	2.1	3.8	1.2	328	48	0.8	0	0		0	1	0	1	1	1174	4.2

1. Formulate Question
   - Hepatocellular Carcinoma
2. Design Experiment
   - Database design
3. Test

3. Test

- Neonatal Intensive Care Unit
- Research Question:
  - Which babies are at risk?
- 210 babies, 1035 days

3. Test



Classification and Regression Tree

3. Test

50%

200 college students

(100 prefer salty snacks and 100 prefer sweet)

50%

70.8% salty

120 students

GPA > 2.8

(85 salty and 35 sweet)

80 students

GPA ≤ 2.8

(15 salty and 65 sweet)

81.2% sweet

3. Test

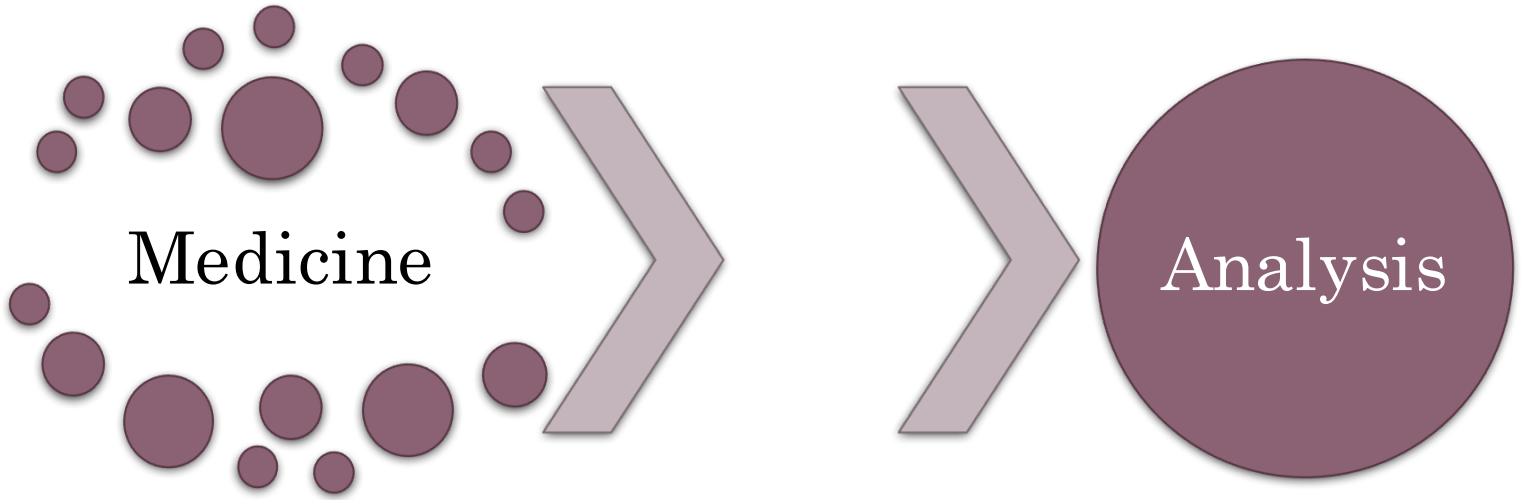
- Data Points:
  - Birth Weight
  - Size for Gestational Age (Small, Medium, Large)
  - Gestational Age
  - Glucose Infusion Rate (GIR)
- To determine outcome:
  - Glucose tolerant or intolerant
- Goal: iPhone app to aid clinicians

Summary

1. Formulate Question
   - Hepatocellular Carcinoma
2. Design Experiment
   - Database design
3. Test
   - NICU

What did I learn?

- Communication is KEY
  - I often served as the bridge between the math and the medicine.



Thank You

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Thank you for coming! Questions?