Abdominal Imaging and HCC Risk

Shelley "the bomb" Facente and Steph "the badass" Holm

February 12, 2020

We have restricted our dataset to adult UCSF patients diagnosed with HCV who, prior to the start of follow up (ie. as of 12/31/14) had no cirrhosis and no HCC. (n = 1905) For those who had been in the system prior to 2015, historical data back to 2011 was used to calculate their FIB-4 score at the beinning of follow up (ie. by the end of 2014), for those who did not yet have those data, the FIB-4 score in 2014 was imputed using the median value.

- **Sex**. This is a dichotomous variable, with two categories (male, female), as UCSF has not been capturing other gender categories within Epic.
- **Race**. This is a categorical variable, which we have recategorized into White, Black/African American, Latinx, and Other for ease of analysis.
- **SES**. We are using insurance type (Medi-Cal, or not Medi-Cal) as a marker of SES status, which is again a dichotomous variable.

The table below displays the demographic breakdown of the sample.

Demographic	Category	n	%
Sex	Male	1064	55.9%
	Female	841	44.1%
Race/ethnicity	Black/African American	297	15.6%
	Latinx	264	13.9%
	White	944	49.6%
	Other	378	19.8%
	Unknown	22	1.2%
SES (Payor type)	Medi-Cal	286	15%
	Not Medi-Cal	1570	82.4%
TOTAL		1905	100%

Here, $Y(t)$ is an indicator variable describing whether or not the patient has been diagnosed with HCC by time t; as such, it deterministically jumps to 1 and remains there once an individual has become ill.

Causal Question: How would the counterfactual probability of getting HCC differ by the end of the 5 year follow up under an intervention to get abdominal imaging at least once a year every year for four years?

The target causal parameter is $\psi^F(\mathcal{P}_{U,X}) = E_{U,X}(Y_{\bar{a}=1(5)} - Y_{\bar{a}=0(5)})$

the average treatment effect on HCC diagnosis in year 5 assuming that all patients had abdominal imaging every year for the 4 prior years ($Y_{\bar{a}=1}$), compared to HCC outcomes in year 5 if all patients did NOT have abdominal imaging at any time point during the preceding four years ($Y_{\bar{a}=0}$).

When testing our estimators against a simulation of 100,000 patients roughly matching the variable distribution of our observed dataset, here is how they performed:

	G-Comp	IPTW	TMLE
Bias	0.00396	0.249134	0.00729

	G-Comp	IPTW	TMLE
Variance	0.00001	0.02397	0.00077
MSE	0.00003	0.086037	0.00082

Ultimately, implementing *ltmle* with *Super Learner* on our observed data produced the following estimates for the risk difference of developing HCC in year 5 when receiving abdominal imaging at least once per year for the 4 preceding years, compared to not receiving abdominal imaging during that time, when controlling for the number of hepatology or primary care visits, FIB-4 score, sex, race, and SES was:

G-Comp (95% CI)	IPTW (95% CI)	TMLE (95% CI)
1.179 (1.148, 1.274)	1.226 (1.171, 1.318)	1.234 (1.183, 1.313)

If we use the G-computation estimate, this means that over the five years under study, patients with no cirrhosis at baseline were 1.2% less likely to develop HCC by year 5 when they had abdominal imaging each year for the 4 previous years, compared to patients who had no abdominal imaging, when controlling for liver cirrhosis, number of primary care or hepatology visits, sex, race, and SES. **This represents a number needed to treat (NNT) of 83** : for every 83 people who receive annual abdominal imaging despite no evidence of cirrhosis at baseline, 1 case of HHC could be prevented over 5 years.