TGH's unique positioning on Davis Island raises the issue that during any major storm, access becomes very limited. This issue drives a continually imperative question that is needing to be answered here: can we predict the duration of closure for the bridges in order to predict necessary staffing in the hospital? This two part question (bridge closure, then staffing prediction) will be explored in this paper as I describe my methodologies and solution.

Via various web scraping and manual methods, as with any legitimate project, collecting data was certainly the most important process. In doing so I used NOAA for storm data as well as a variety of news articles in order to collect the bridge closure information as I could not find a solid reservoir of data describing that. I decided to log it all in a JSON format just because it is something I am familiar with and it would be easy to draft any sort of data fetching script to process information from a JSON format. Also, I went ahead and stored extraneous data for these bridges like a description of the storm, descriptions of the bridges, etc. Afterwards I used a python script to load the data from the JSON file and convert it into pandas DataFrames to use in modeling. This filters the storms by the closure data, quality, and year range, then goes ahead and computes summary stats, all of which is exported to CSV for the model's training.

I had a myriad of options for what sort of model to use for the closure duration prediction model, but because of the small dataset, interpretability, and overfitting avoidance, I landed on linear regression. Using this with a validation method of Leave-One-Out Cross-Validation (LOOCV), I reached a MAE of around 4 hours. An interesting tidbit about this part of the project is that at one point with only 8 storms, I had extremely tight fit statistics, with near-perfect R^2 values and minimal residuals. It was certainly the result of such a small sample, which was corroborated by a big deterioration in both R^2 and residuals as the sample size hit 18 storms. This makes much more sense logically as these metrics perfectly generating coefficients to represent the relationship is insanely improbable. Importantly, despite the looser fit statistics, the expanded model still revealed strong interpretable relationships—forward speed emerged as the strongest predictor ($r = -0.623$), with storm surge and track distance also significant, while maximum wind speed proved surprisingly weak as an independent predictor.

With closure duration predictions in hand, the next challenge was translating these into actionable staffing recommendations. This utilized a "Team A/Team B" strategy that is encompassed by: Team A physicians are pre-positioned on Davis Island before bridges close and

remain isolated there during the closure. For closures over 12 hours, Team B provides additional physicians who cross before closure to rotate with Team A in 12-hour shifts, ensuring continuous coverage while allowing rest periods. I want to introduce a more thorough estimation process with monthly or possibly daily statistics in order to be more accurate. From there I generate a risk score, and a predicted number of staff with a detailed breakdown to make more sense of who is needed in the hospital. Another future step for this portion is to have a call list/tree to gather the staff needed after the prediction is generated.

I am excited to keep expanding on this project with better data, and the ideas I detailed. I really enjoyed the project and hope that this can actually be used to help TGH in years to come. The model isn't perfect, the dataset is still relatively small, and I'm missing some features that could be useful like storm approach angle and more. Down the road, I'd love to expand the historical data further, hook it up to real-time weather feeds for live predictions, and maybe even extend it to help coordinate closures across multiple Tampa Bay healthcare facilities. Thank you for this opportunity and I would love to be in touch about more potential work whether it's in the form of full time work or additional projects.