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DATASCI 241: Experiments and Causal Inference

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<div align="center">Does Chinese Medicine Actually Decrease long-COVID Symptoms?</div>

Might Chinese Medicine (CM) be an effective means of alleviating symptoms associated with lingering issues that arise during recovery from COVID-19, or "long-COVID"? Zhong et al.'s 2022 study "Effects of Chinese medicine for COVID-19 rehabilitation: a multicenter observational study" asserts that CM may provide a promising solution to long-COVID. The authors deployed a longitudinal observational study, recruiting 150 patients for participation in the treatment, which involved 3 to 6 months of individualized CM interventions. Among these recruited patients, all had recently been discharged from Hong Kong public hospitals after being treated for COVID-19. Furthermore, all of them subsequently sought CM consultations at public research CM clinics – government-subsidized establishments called "Chinese Medicine Clinic cum Training and Research Centres (CMCTRs)." Over the course of these CMCTR interventions, the researchers collected monthly data from questionnaires and lung function tests. The main variables of interest were changes in the "CM diagnostic pattern" and the scores of "Qi and Yin Deficiency" – specifically deficiency of the lungs and the spleen (Zhong et al.). Overall, by utilizing longitudinal data on CM diagnoses and symptoms, the authors arrived at the conclusion that CM may cause a decrease of long-COVID symptoms.

The supposed effect of CM causing a decrease in long-COVID symptomatology could be inaccurately estimated due to unobserved heterogeneities. These unmeasured features might include, but are not limited to, one's reaction to the mRNA vaccine, one's pre-existing disorder –

referred to in the study as a "CM Syndrome" –, one's trust in holistic medicine, and one's value of health. Firstly, consider an individual who had a negative vaccine reaction and sequentially contracted COVID. In this case, it would be difficult to distinguish long-COVID symptoms from vaccine symptoms. Furthermore, it would be difficult to figure out whether or not someone has an underlying disorder that has been triggered by having COVID or the vaccine, or whether their underlying disorder has coincidentally shown up after COVID or the vaccine. The possible effects of the vaccine and the potential for underlying disease both create difficulty in the measurement and definition of long-COVID specific symptoms. Therefore, individual by individual, depending on the true origins of one's symptoms, there is potential for both overestimation and underestimation of the effect of CM on long-COVID. Moreover, in the context of the pandemic world, an individual may develop a distrust of current conventional medical treatments. This might increase one's odds of wanting to participate in this holistic CM intervention, creating a self-selection bias. This self-selection bias contributes to a potential overestimation of CM's effects on long-COVID; we know from the placebo effect that if someone believes in a treatment, it will probably do something good for them. Finally, one's value of their own health and well-being may also increase one's odds of participating in this study, again creating self-selection bias. Such a health-valuing participant may end up with better results, due to potential additional self-care practices on top of the CM treatment, hence contributing to an overestimation of CM's effects.

Through this observational study, in order to make a causal claim out of correlation, the authors implicitly assumed that they properly controlled for variables that may account for the decrease in long-COVID symptoms over the course of CM treatment. However, the aforementioned effects of vaccine reaction, underlying disorder, trust in holistic medicine, and

value of health all seem to contribute to various forms of bias. In other words, the results of this study are likely biased due to spurious correlation.

The ideal experiment to truly answer the question of whether or not CM treatment causes decreased long-COVID symptoms would involve, first, randomly sampling patients discharged from hospitals once they test negative for COVID-19. Among this random sample of post-COVID-19 patients, we would filter our sample to only include those with some degree of long-COVID. We would do this through a comprehensive questionnaire about their new symptoms, meaning symptoms that have only come up after their COVID-19 recovery. Next, and very importantly, we would randomly assign our filtered sample of long-COVID patients to treatment and control groups. The treatment group would receive a personalized 6 month course of CM interventions, while the control group would receive a placebo intervention. Data would be collected longitudinally among both groups through 7 monthly questionnaires filled out directly by doctors (MDs) who would be continually monitoring participants' reported symptoms, vitals, and test results – monthly blood work, chest exams, and relevant scans if needed – throughout the 6 month period. These questionnaire responses would be cleaned and converted into a dataframe, where our unit of observation would be a unique patient, and some of our columns might be the following: blood_health_month0 through blood_health_month6, lung_health_month0 through lung_health month6, heart_health_month0 through heart_health_month6, exercise_hours_month0 through exercise_hours_month6, weight, age, is_smoker (T/F), trusts_hollistic_treatment (T/F), values_health (T/F), and of course is_treatment_group (T/F). All of our x_health_monthx columns will be standardized on a scale from 0 to 1, 0 being the most unhealthy, 1 being the most healthy. Once all data is collected and cleaned, we will perform exploratory data analysis to visualize average changes in blood, lung,

and heart health among treatment and control groups. Furthermore, we will perform feature engineering to determine an appropriate measure for the degree of improvement of long-COVID symptoms on a scale of -1 to 1, where -1 indicates extreme worsening of symptoms, 0 indicates no change, and 1 indicates extreme improvement of symptoms. Finally, we will calculate the average treatment effect as a measure of the effect of CM interventions on the improvement of long-COVID symptoms.

In terms of feasibility of our study, we may run into some issues when randomly sampling patients. The bureaucracy involved in hospitals may lead the process of sampling patients to be logistically complex. Furthermore, there may be concerns such as finding a medical doctor willing to participate in the objective symptom assessment of patients, as some medical doctors may be wary of CM practices. Nonetheless, this experiment is still possible, and would certainly yield more faithful results than an observational study.

Works Cited

Zhong, L.LD., Wong, YP., Leung, CY. et al. "Effects of Chinese medicine for COVID-19

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