Chloe Terestchenko

Heart Rate Variability as a Biomarker of Mental Well-Being: The Role of Resilience in Medical Students

QSS Honors Thesis 2024-25

What I Did:

My senior thesis in Quantitative Social Science began with an internship I pursued during junior winter with Professor Thesen and Dr. Blackmon at Aga Khan University in Kenya. (Special thanks to Dawn Carey at the Dickey Center for connecting me to this opportunity!) While working on research involving wearable devices, mental well-being, and resilience in medical students and patients, I became increasingly interested in how physiological and psychological factors intersect.

For my thesis, I focused on the relationship between heart rate variability (HRV), psychosocial resilience, and mental well-being. I designed and implemented a survey assessing resilience in medical students, then analyzed how these factors, together with HRV data from Fitbit devices, could help explain mental health outcomes.

What I Learned:

My research revealed a quadratic relationship: students with both high HRV and high resilience scores reported the most positive mental health indicators. This pattern was particularly compelling because prior studies had not examined this specific intersection—nor the role of these four psychosocial resilience factors together.

Beyond the findings themselves, the experience taught me a great deal about the research process: I became fluent in the literature and techniques surrounding HRV, I developed advanced coding skills and learned to evaluate the accuracy and reliability of my statistical models, and I gained confidence in leading an interdisciplinary, independent research project from beginning to end.

Working on a thesis that could inform how we measure and support mental health has been an extremely rewarding experience.

Why I Did It:

I chose to pursue a thesis because the topic truly inspired me. After my work in Kenya, I was eager to continue exploring the many dimensions of resilience and physiological well-being. The project also felt like a perfect bridge between my majors in neuroscience and QSS. I was able to look at mental health and physiological symptoms of well-being through data analysis. Equally important was my relationship with my thesis advisor. Having worked together before, I knew his mentorship style and expertise would be a great fit. His support, analytical rigor, and excitement for the topic pushed me to do my best work.

Advice:

1. **Start with a research question thar genuinely excites you.**

I began with a broad interest in heart rate variability and ended up deeply immersed in psychosocial resilience and the nuances of survey-based mental health data. Allowing myself to shift and refine my focus throughout the thesis allowed me to find something that was exciting and inspiring. Start with a bigger topic and get narrower; this is something I spent all of junior summer really thinking about. However, I also picked this topic because I knew it was practical. I could use data and study designs previously developed, which reduced one obstacle that others had to face.

2. **Choose an advisor who both challenges and supports you.**

My advisor is someone I had done research with both in Kenya and at Dartmouth. He was one of the biggest motivators for my thesis. He met with me often, pushed me to do more complex an analysis, and most of all, was so passionate/knowledgeable about the material that he could immediately tell me which direction to pivot to (if needed). A strong advisor will push you to think deeper and act as a sounding board when you're stuck. They are CRUCIAL to your thesis!

3. **Develop a detailed plan early and revisit it often.**

If you decide to write a thesis, it is crucial to sit down at the beginning of your senior year and write a plan out for yourself. I did this loosely but wished I had been a lot more robust with it. Map out deadlines for the fall thesis seminar, brainstorm your study design, and identify time blocks for writing and coding. Use winterim and spring break as thesis sprints. This will help you feel confident about your project throughout the process with hopefully less “crunch time” at the end.

4. **Keep your data and results organized.**

If you’re working with real-world data, expect chaos: gaps, inconsistencies, outliers. Oftentimes, I would change one result and not realize how it would affect everything else. If I were to redo my thesis, I would take time to keep my results *extremely* organized and document every change and how it fixed my data. Document everything, version your files, and test code in chunks. By the end, I started making presentations of my results based on the date, which helped me organize and see any changes.

5. **Be realistic about time — and plan your terms accordingly.**

Your thesis will take far more time than you expect. With Dartmouth’s ten-week terms, balancing a thesis alongside multiple demanding classes can become overwhelming. I took four classes in the fall, which left little time for deep thesis engagement. To compensate, I used winterim to make substantial progress and avoid falling behind in the winter. But what helped most was designing a light senior spring — I took only one other class — which gave me the breathing room to fully invest in my writing, analysis, and revisions. Be intentional about when and how you’ll make space for your thesis (and adjust your class schedule accordingly).

Conclusion

Writing a thesis can be so exciting and fulfilling. I hope this was helpful and allowed you to consider if it may be the right path for you. Please feel free to reach out to me with any questions, especially if you are interested in any the topics I wrote about, at chloeterestchenko@gmail.com

Chloe