Thesis Project Portfolio

Predicting The Severity of Anxiety in Adolescents Through Passively Sensed Behaviors

(Technical Report)

Navigating Women's Health in a Post-Roe Era: The Sociotechnical Evolution of Wearable Technologies

(STS Research Paper)

An Undergraduate Thesis

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Technical Project Abstract

In this work, we investigate whether the severity of adolescents' anxiety can be predicted using passively sensed behaviors. We recruited 55 adolescent participants with diagnosed anxiety to participate in a 24-week-long study. Participants completed a weekly questionnaire recording their anxiety level. Using Fitbits and participants' mobile phones, we passively collected their physiology and behaviors. We find that adolescent anxiety can be predicted with a relatively low mean absolute error of 2.45 on a 22-point scale. Using SHAP values and feature importance, we determine that certain behaviors, particularly those related to phone usage, mobility, and activities, are particularly useful for predicting anxiety. Coincidentally, our study overlaps with the early stages of the COVID-19 pandemic. As such, we also explore how our participants' anxiety and behaviors varied throughout government-mandated lockdowns and during spikes of COVID cases after the lockdowns ended. We find evidence that participants were least anxious during partial lockdowns and when the cases of COVID-19 were low. We also find that participants' physiology and behaviors altered based on lockdown severity and prevalence of the disease. Despite these differences, the accuracy of our predictions remained consistent, regardless of lockdowns and the number of new COVID cases. These findings may provide insight into adolescents' anxiety and behaviors during prolonged traumatic events.

STS Project Abstract

In this paper, I examine how gender biases embedded in clinical research and technological design have hindered the development and effectiveness of wearable health technologies for women. Despite the explosive growth of the wearable technology market, which was valued at $33 billion in 2019 and projected to grow significantly, these advancements have largely relied on male-centric data from clinical trials, marginalizing women's unique health

needs. Furthermore, I discuss the sociopolitical consequences of recent policy rollbacks such as the overturn of *Roe v. Wade* and the lack of protection for menstrual data. I use the feminist critique framework to trace the historical exclusion of women from clinical trials and to analyze the biases in the wearable tech industry, drawing upon Sandra Harding's standpoint theory and Donna Haraway's theory of situated knowledge. This paper also highlights the consequences women face due to the eroding trust in data privacy, such as the reduced adoption of wearable technologies by menstruating women, the smaller datasets women provide for innovation, and the potential for the overall stunted growth of the femtech industry. To address these challenges, I outline concrete future steps in this paper, including implementing robust data privacy laws like the proposed American Privacy Rights Act, mandatory transparency, user control over data, third-party audits, and increased public awareness. The key takeaway is that inclusive, effective health technologies for women can only be realized when privacy, equity, and targeted investment become top priorities.

How They Relate

My technical project and STS project are closely connected through their shared focus on the use of personal sensing data to address health challenges and the sociotechnical implications of doing so. Both projects center around wearable and mobile sensing technologies and how they interact with individual health. In my technical project, I analyze the accuracy of machine learning models in predicting anxiety and depression among adolescents using mobile sensing data. This research aims to evaluate how personal data can be responsibly and effectively used to aid in mental health interventions, particularly for vulnerable populations like adolescents. My technical project also explores how mobile sensing data can reveal behavioral patterns in

response to major world events, such as COVID-19, offering insight into how external stressors influence adolescent mental health. Similarly, my STS project explores how the development and usage of wearable technologies for women's health is shaped by historical gender bias and recent political shifts, such as the overturn of Roe v. Wade. It highlights growing concerns around privacy, particularly regarding the misuse of sensitive health data like menstrual tracking. This fear is similar to the care needed when working with sensitive mental health data from adolescents in my technical project. Both projects raise important questions about consent, trust, and the responsible design of wearable health technologies.

Ultimately, my technical project looks into the limitations and capabilities of using sensing data to improve mental health diagnoses, while my STS project analyzes how societal shifts, such as changes in reproductive health laws, impact the development of wearable technology for women. Both projects explore the growing impact of wearable devices on health and society, highlighting how their advancement shapes personal well-being, privacy, and technology design.