

Mathematical modeling of medical interventions - sepsis, electroconvulsive therapy, and psychotherapy

Eric Ross

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UMMS Capstone for Impact

Branch: Systems Based, Hospital Based

Advisor: Kara Zivin

Project Summary

I worked on several projects with an overarching goal of utilizing my background in data analysis and mathematical modeling to impact health outcomes at Michigan and nationally.

1. I worked as a data analyst with the Clinical Design sepsis quality improvement project. I used a data set derived from ED patients eventually diagnosed with sepsis to assess the sensitivity and timeliness of various possible sepsis screening strategies. My work on this project ran into a roadblock when attempting to gather additional ED data to better refine my analysis; I was never able to access the necessary data, and my work on this project came to a standstill before the start of interview season.
2. Along with Drs. Kara Zivin and Daniel Maixner, I developed a mathematical model to simulate the course of depression treatment in the United States. In my first project using this model, I simulated the costs and benefits of using ECT to treat depression, in order to determine: 1) the overall cost-effectiveness of ECT for treatment-resistant depression, and 2) when in the course of a depressive episode ECT should be offered in order to maximize its health-economic benefit. The manuscript based on this work is currently in revisions at a major psychiatry journal.
3. I am currently working on another project with Dr. Zivin assessing the costs and benefits of SSRIs vs CBT vs combined treatment for initial treatment of depression. I am currently in the process of preparing a manuscript based on this work, with a goal of submission in February.
4. Finally, the flexibility afforded by my impact project time enabled me to pursue several other projects that I think will prove valuable as my career progresses. With GHHS, I developed an automated system for students to gather feedback from patients they have worked with in the hospital or in the clinic; we have piloted this with one cohort of internal medicine students, and hope to continue rolling this out with leadership from the new class of GHHS students. I also was able to devote a lot of time to my PBSI project, which resulted in conducting a cost-effectiveness analysis of screening for autoimmune encephalitis in patients with first-episode psychosis; while there are substantial limitations to the available data, it appears that it would be cost-effective to test for this routinely. I plan to develop this work into a full manuscript in

the future, and would like to implement an actual screening system for first-episode psychosis patients during my residency.

Action Items/Outcome

Two manuscripts, with groundwork for a third
Gained experience in large-scale quality improvement project
Contributed to development of ED sepsis screening system
Developed online patient feedback system for GHHS"

Conclusion/Reflection

I feel very fortunate to have been a branch student - the time I was given enabled me to thoroughly pursue a number of projects I was interested in, and it really helped me refine my vision of where my career will go in the future. I would be more than happy to give a brief talk about my branch experience to incoming M4s!

If I had to offer specific advice to incoming branch students, I'd say my experience taught me the benefit of keeping several projects afloat during my branch time. Several of them did not turn out as I anticipated - I learned a lot from the sepsis project, but I personally wasn't able to contribute very much to it; and as of yet, the patient feedback project has received a lukewarm response from the medical students piloting it. Yet other projects progressed well in unexpected directions - I'll be publishing a few papers based on psychiatric modeling studies I've conducted, and my PBSI project has yielded a new area of clinical interest for me (and has captured the interest of at least one interviewer per interview day!). I was never bored during my impact months, as I always had at least two projects I could be actively pouring my time into.