



Center Core Faculty Member, Dr. Carissa Low, is an Assistant Professor of Medicine and Psychology at the University of Pittsburgh, where she directs the [Biobehavioral Oncology and Technology \(BOT\) Lab](#). Her research focuses on the interactions between behavior, biology, and patient-centered outcomes in the context of cancer, and she is investigating the use of mobile technology to detect and target risk states during cancer treatment.

The [Center's](#) Julia Holber had the opportunity to talk with Dr. Low to learn more about her work.



Julia: Can you tell us a little about the BOT Lab? I love that acronym!

Carissa: Sure! In the BOT Lab, our research bridges behavioral science, mobile technology, and cancer care to understand and improve patient well-being during and after cancer treatment. We're conducting a number of studies with patients and their families aimed at using technology to detect and reduce physical and psychological symptoms and unhealthy behaviors.

Julia: Can you give us a few examples of some of these unhealthy behaviors?

Carissa: Physical inactivity is a good example. We have a [paper](#) that just came out today in the Annals of Behavioral Medicine where we used Fitbit devices to monitor patients' activity after cancer surgery, and we found that patients who took more steps while they were recovering in the hospital were at lower risk for readmission.

Julia: Wow, congratulations! I look forward to reading the paper. At our 3rd Integrative Conference last month, you presented DASH (Detecting Activity to Support Healing) at our Demo Session. What is DASH? What does it aim to do?

Carissa: DASH is a study where we're developing an intervention to target sedentary behavior before and after cancer surgery. It's funded by the NCI, the Center for Behavioral Health and Smart Technology, and the Aging Institute, and it's a follow-up to our Fitbit finding. DASH uses a wearable device to detect in real-time when patients have been sitting or lying down for a long period of time, and then it suggests brief walking breaks to reduce prolonged sedentary bouts, with more frequent breaks at times when patients are feeling relatively well and asymptomatic. So, DASH will start before surgery, which research on prehabilitation has shown is a really important time point when increasing activity can set people up for a better recovery, and then it continues through the post-operative recovery period. We're still refining DASH and conducting usability and iterative design sessions with patients right now so we can build an intervention that meets their evolving needs while they're waiting for and then recovering from this major surgery. We're learning a lot so far, and we're looking forward to finalizing the intervention and testing its effects on post-operative outcomes in a randomized trial next year.

Julia: So, you are clearly working on a lot of projects, publishing papers, working on DASH, but is there another project or research you are working on now that you are specifically excited about?

Lately, we've been doing a lot of work with passive sensing to detect risk during cancer treatment. We're using sensors embedded in smartphones, like the accelerometer, the light and noise sensors, and data about app use- pretty much anything you can collect with a smartphone that provides some continuous information about behavior patterns. And

we're continuing to use wearable devices like Fitbits to check activity and sleep. In a paper coming out within a month or so we report that these passive sensor data can be used to remotely monitor patient symptom burden during chemotherapy. We developed an algorithm that can identify worsening symptoms with a high level of accuracy using just these objective behavioral data. We're also just finishing a study to see whether the same passive sensing approach can be used to identify risk for readmission after cancer surgery. I'm excited about passive sensing, I think it has a lot of potential for detecting which patients might be at risk and when. And, even better, it can be done with minimal demand on patients' time because we can collect the data as they go about their daily lives from their smartphones that they probably already own and carry around.

Julia: It seems like passive sensing holds a lot of promise in the medical field! What would you say has been the most rewarding part of your work?

Carissa: I can't choose, so I'm going to tell you three things I really love about my job. The first is talking with people living with cancer about their experiences and struggles. It's so humbling and keeps our day-to-day hassles in perspective. I'm so grateful to our patients who take the time to share their thoughts with us and participate in our studies. I also love collaborating with researchers, clinicians, and students from wildly different disciplines. Right now I'm working on teams that include computer scientists, surgeons, immunologists, exercise physiologists, and engineers. It's really a fun and challenging puzzle trying to integrate all these diverse perspectives and expertises into a single research protocol that everybody likes, but it's really led my research down some exciting paths that I never would have found on my own. That's been really rewarding. And then, I'm a big data nerd, so I love sitting down to finally run analyses after spending years thinking about and designing a study and collecting the data. Even when my hypotheses aren't supported, it's really exciting to have the information at hand to learn new things about the world

Julia: Well, you clearly have a lot of rewarding parts of your work, which is great. What would you say are some of the challenges?

Carissa: Working with technology can be extremely frustrating. Our apps crash, our devices break all the time. We've had a very hard time finding a commercial device that can provide real-time step count data for DASH and that can communicate well with our smartphone app. Things like that can just take way longer than you expect them to. And, of course, when we're running a research protocol, we want everything to be standardized and run smoothly with no missing data but with no frustrations for our participants, and we're finding that just doesn't happen when you're relying on a technological system.

Julia: Finally, what do you see as some of the promises and future obstacles in mHealth?

Carissa: Figuring out how to integrate passive sensing and other patient-generated data into clinical care is something I see as a huge challenge and an opportunity. We know from our research that these data are valuable and that they predict important outcomes, like readmission and treatment toxicities. But we, and I don't think others, have solved the problem yet of how or when to share these data with healthcare providers or even patients without overwhelming everyone with data. It's easy to get the data but it's harder figuring out exactly what to do with it.

Want to read more about Carissa's work? See the [press release](#) and read the [full text](#) of Dr. Low's recently published paper!