

I looked at the email I had just received, “Congratulations, you have been selected to take part in ECNP’s Got Talent at the 33<sup>rd</sup> ENCP Congress”. I felt the usual thoughts run through my mind, “Great what an awesome opportunity”, and “Oh no what have I done”. The Congress was to be held online this year, which meant that my presentation was to be pre-recorded, this made the process feel less daunting.

My research uses magnetic resonance imaging (MRI) to look at structural and functional changes in the brain that are associated with non-dependent alcohol use. My motivation to pursue biological research on the brain-based impacts of non-dependent alcohol use lies in my previous experience as a substance use counsellor. Clients were referred to me for counselling services as a result of committing violent crimes and engaging in illicit substance use. All of my clients consumed alcohol non-dependently, which contributed to difficulties in attending school, maintaining employment, continuing friendships, and completing court-ordered activities. However, this use was not viewed as problematic by their peers and communities as they were not addicted to this substance.

I think this topic is very interesting, but my friends have a long running joke whereby they fall asleep at the mention of my work. How was I going to make sure that people found my topic interesting and informative, and did not feel that they were being preached to? I realised that I needed a key theme to my presentation, I decided I was going to talk about how I ruin every party I go to with discussion of my research. It’s not hard to bring down the mood when you tell people that frontal areas of the brain are found to be thinner in association with non-dependent alcohol use, or that alcohol use was a risk factor in almost 11 million deaths in 2017, or that the act of drinking alcohol will change how the reward centre of our brains typically functions<sup>1;2;3</sup>.

While it is difficult to talk about, these conversations are important. Within Irish society, alcohol consumers tend to drink alcohol less frequently than their European counterparts, yet at higher amounts when they do, however, our knowledge of the impacts of non-dependent alcohol on the structure and function of the brain is limited<sup>4</sup>. This is particularly salient at the moment, when rates of alcohol use are reported to have increased in many countries during lockdown as a result of the global pandemic<sup>5</sup>.

My presentation to ECNP’s Got Talent was an eight-minute talk, I acknowledged that my friends do not enjoy listening to me, but that there is limited research in my field of interest. However, we do know that we drink alcohol because it activates reward circuitry in the brain and provides us with a pleasurable experience<sup>6</sup>. Functional MRI has demonstrated that when we drink alcohol, activation in the reward centre of the brain, the basal ganglia, is associated with how pleasurable we find the experience of intoxication<sup>6</sup>. In other words, the more active this area, the more we enjoy the experience of being drunk. Structural MRI is also used to look at differences in the thickness of cortical areas, studies have shown that prefrontal and medial frontal areas of the brain are thinner in association with non-dependent alcohol use<sup>7</sup>. And these are areas that are involved in processes like: how we allocate importance to internal and external stimuli: how salient we find pictures of alcohol, or our perception of alcohol use. How we regulate our emotions: can we respond appropriately to happy or angry faces? How effective we are at inhibiting impulses: can we stop ourselves talking about one topic ad nauseum, as well as evaluating reward: is this glass of alcohol making me feel great right now?

In my work I think of the brain as a complex network which has a balance between strong local and global connectedness<sup>8</sup>. Recent advances in network neuroscience have allowed us to look at patterns of connectivity within the network of our brains. Changes in the patterning of these networks can be used to identify disruptions to connectivity in association with environmental impacts such as alcohol use. Using diffusion weighted MRI and structural MRI scans, I can reconstruct the brain’s white matter, and look at which areas are connected to each other to form a network. I can then use a branch of

mathematics, called graph theory to describe the connectivity of the network. Think of it this way, the white matter of our brains are like roads that information travels along to get from one region to another. I am recreating the white matter highways, and looking at where road works may be present, if there are diversions in place, or if some networks are using alternative routes.

Using this approach, I identified a subnetwork of the brain that is differently connected in people who consume alcohol, and who are not dependent or addicted to alcohol. When I looked at the strength of connectivity of this network, I found that increased alcohol use was associated with an increase in connectivity strength within this network. And there was also a difference in connectivity strength between people who reported a likelihood of harmful use, in comparison to those who did not, in other words they were more likely to engage in higher levels of use or binge drinking. Areas in this subnetwork included the insula, which is involved in allocating salience to internal and external stimuli, the middle frontal cortex and hippocampus which are involved in the processing of emotions<sup>9;10</sup>. The orbitofrontal and superior frontal cortex, which we rely on for inhibiting impulses, and the caudate, thalamus and putamen which are involved in reward processing<sup>11</sup>. This subnetwork is interesting as it suggests that alcohol contributes to processes that increase our likelihood to consume alcohol and find it pleasurable, despite negative consequences.

At this point I am confident that you think my friends are wrong and this is the perfect conversation to have over a glass of wine or a cocktail. Or I continue to delude myself and my friends are correct. Ultimately, the judges of ECNP's Got Talent thought that the truth lay within the scientific evidence and that the attitudes of my friends and my ability to ruin parties was funny. I won, the excitement and relief!

The movement of so many conferences and congresses online opens up more opportunities for us students and early career researchers to take part, in a manner that is not as daunting as standing in front of a packed conference room. I would of course prefer to travel and meet fellow researchers, but every cloud must have a silver lining, and this lining meant that I was able to plan, record, and present at the conference from my home. It was still nerve wracking, but it was doable. I would encourage every early career researcher to take these opportunities when you can and make the most of working from home.

As for myself I remain very willing and available to talk about alcohol and the brain to your lab meeting, to your research group, to any and all conferences you may be organising, or at your family dinner via zoom.

## References

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