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**Important clarifications about our recent brain imaging vs. body composition study**

We were excited when we first learned that a journalist wanted to cover our latest research findings. Most of us never imagined that one of our studies would generate interest from international media outlets. However, at least some of this interest appears to have resulted from mistaken interpretations about what our study actually explored.

Contrary to many of the newspaper headlines, our research paper is not about intelligence or intelligence quotient (IQ), and it is certainly not about shaming or stereotyping individuals based on their weight. Therefore, we would like to take this opportunity to briefly discuss and hopefully clarify some of the apparent misconceptions about our study.

There is emerging evidence that body composition may be related to brain structure, blood flow, and metabolism. Therefore, in order to investigate these potential relationships, we conducted a neuroimaging study using state-of-the-art magnetic resonance imaging (MRI) acquisition and analysis methods. To be perfectly clear, we did not assess the cognitive performance or intelligence of our participants, so our paper does not, and cannot, establish any relationships between obesity and intellect.

So how did our modest research paper (innocuously entitled "Effects of Body Mass Index and Body Fat Percent on Default Mode, Executive Control, and Salience Network Structure and Function") get spun into headlines like "Are Fat People Less Intelligent Than Thin?" and "Obese People Less Intelligent Compared To Their Thinner Counterparts"?

In short, it seems to have played out a bit like the (broken) telephone game. To date, we have only been interviewed by two reporters (Sharon Kirkey from the National Post, and Malgosia Pakulska from Research2Reality). Therefore, the rest of the articles are based on second- or third-hand information and second- or third-hand quotes, with little evidence that the writers read the study itself (which is open-access and freely available here). In fact, our research paper has an entire section entitled "Limitations of the Current Study," in which we discuss our relatively small sample size of 32 subjects and point out that we did not "assess subject-specific measures of executive function, impulsivity, etc."

What concerns us, however, and why we feel the need to respond, is that certain erroneous claims and misinterpretations about our study (particularly some of the more sensationalist "clickbait" headlines) have potentially harmful consequences.

They are damaging to our personal and professional reputations as credible scientists and, by extension, to the reputations of our academic institutions, funding agencies, and science in general. They are detrimental to society, because they mistakenly reinforce negative stigmas and stereotypes. And, in this case, they are harmful to individuals who may already be suffering from depression or dealing with self-esteem issues related to their body image.

So what did we actually do in this study, and what did we find?

Our original peer-reviewed manuscript is fairly long (23 pages, plus additional supplementary material posted with the online version) and is admittedly quite technical in certain sections, so we will try to briefly distil it here.

Let's start with some facts. Obesity is a major global health issue and has several deleterious effects on physical health, including type 2 diabetes, cardiovascular disease, and even certain types of cancer. These outcomes of obesity are well established within the scientific and medical communities. However, there is a growing body of research that also suggests that there may be correlations between body composition and the brain.

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Based on previous scientific literature, the main objective of our study was to use several advanced neuroimaging methods in order to determine whether brain structure or resting-state brain activations were related to individual differences in body composition. Moreover, because the validity of body mass index (BMI) has been questioned as a sole measure of body composition, we also assessed body fat percent (BFP) using a bioelectric impedance scale as a second (and independent) method for evaluating body composition. In this regard, our findings suggested that BMI and BFP were both associated, on average, with individual differences in brain structure and functional connectivity (i.e., coordinated brain activity) – particularly in brain regions and networks that are thought to mediate cognitive function, reward processing, and impulsivity. It is perhaps important to point out, however, that none of these findings were perfectly correlated, meaning that there are "outliers" that do not fit the general trends (and because we showed all of the data points, these anomalies can be seen clearly in any of the correlation figures in our paper).

It may also be worth noting that our study included fairly stringent exclusion criteria, and did not include any subjects with neurologic (e.g., traumatic brain injury, neurodegenerative disease, etc.), psychiatric (e.g., depression, anxiety, etc.), or metabolic disorders (e.g., diabetes, hypothyroidism, etc.). Furthermore, we also controlled for a number of other factors beyond BMI and BFP in our analyses, including age, sex, and multiple comparisons.

Another unique feature of our study is that we looked for linear relationships, as opposed to performing group-wise comparisons (e.g., underweight vs. normal vs. obese), which almost all previous studies relating body composition to brain imaging findings have done. In other words, at no point in our experiment or analyses did we group the overweight or obese participants together and compare their neuroimaging outcomes to those of normal-weight participants. In fact, within our modestly-sized sample of 32 subjects, 2 were underweight (BMI < 18.5), 17 were normal weight (BMI = 18.5-25), 6 were overweight (BMI = 25-30), and only 7 were obese (BMI > 30). Therefore, our findings show linear relationships with body composition along the entire spectrum (even among normal-weight individuals), which is quite different from how most of the news stories have framed things. We understand that details and nuances are often excluded when distilling complex topics down to a half-page article or blog post, but we feel that this is a particularly important distinction to make because it alters the nature of the conclusions.

And, finally, although our study does not speak to the directionality between body composition and brain structure/function (which was clearly stated in our study and both of the interviews that we have done), it does lead to some interesting hypotheses that should be explored in future work. For example, now that we have identified correlations with particular brain structures and networks, future investigations can try to replicate/confirm the results using larger sample sizes and longitudinal study designs (following the same participants over time) in order to address "changes" (and potentially "causation"), as opposed to "correlations".

To conclude, although we are pleased that our research has drawn interest from both grassroots and mainstream media across the world (and there have been some excellent write-ups about our work), we are simultaneously disheartened that certain media outlets have misrepresented the nature and implications of our findings. As a result, we hope that the above explanation offers some clarity and a much-needed measure of balance regarding our study and its interpretations.

Respectfully,

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