



The influence of minority stress on the neurobiological correlates of executive functioning

Herry Patel¹, Magdalena Siegel^{2,3}, Taylor Hatchard^{1,4}, Albina Veltman^{1,5}, Margaret C. McKinnon¹, Sabrina K. Syan¹, Colleen Merrifield⁶, Sophia L. Roth¹, Katholiki Georgiades^{1,7}, Suzanne Archie¹, Jakub Wolf⁸, Andrew A. Nicholson^{1,8}

¹Department of Psychiatry and Behavioural Neurosciences, McMaster University, Hamilton, Canada; ²Department of Developmental and Educational Psychology, Faculty of Psychology, University of Vienna, Vienna, Austria; ³Department of Public Health, Institute of Tropical Medicine Antwerp, Antwerp, Belgium; ⁴Youth Wellness Centre, St. Joseph's Healthcare Hamilton, Hamilton, Canada; ⁵Assertive Community Treatment Team, Dual Diagnosis Team & LGBTQ+ Mental Health Clinic, St. Joseph's Healthcare Hamilton, Hamilton, Canada; ⁶Ontario Structured Psychotherapy Program, West Region, St. Joseph's Healthcare Hamilton, Hamilton, Canada; ⁷Offord Centre for Child Studies, McMaster University, Hamilton, Canada; ⁸Faculty of Psychology, University of Vienna, Vienna, Austria

Correspondence to: Andrew A. Nicholson. Department of Psychiatry and Behavioural Neurosciences, McMaster University, Hamilton L8N 3K7, Canada. Email: nichoa25@mcmaster.ca.

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Marginalized groups, including 2SLGBTQIA+ populations (2-spirit, lesbian, gay, bisexual, transgender, queer, intersex, asexual, and other sexual and/or gender minorities), have not been well represented in medical, psychological, and neuroscientific research and are often further stigmatized within the research context (1). With their novel neuroimaging design, a recent investigation by Wang and colleagues (2) is noteworthy for their focus on sexual minority individuals from a non-Western society, especially when considering the overrepresentation of W.E.I.R.D. (Western, educated, industrialized, rich and democratic) samples in research (3). This study examined neuropsychological differences between sexual minority and heterosexual male-identifying Chinese residents. Critically, however, the overall narrative depicts an apparent deficit in executive functioning among sexual minority men without presenting substantial evidence to support the authors' claims. In response to this neuroimaging study, our central concern is that the authors have omitted measures of minority stress from their analyses and have made conclusions that may further perpetuate

stigma associated with these marginalized groups.

More specifically, the authors fail to acknowledge the pervasive emotional and cognitive toll of chronic oppression and marginalization associated with stigmatized sexual minority identities when discussing cognitive performance [i.e., on the Wisconsin Card Sort Task (WCST)]. Indeed, minority stress (1) refers to insidious stressors that sexual, gender, and racial/ethnic minority individuals experience because of their historically marginalized and stigmatized identities. Such stressors can include structural (e.g., laws and societal attitudes) and individual forms of discrimination and prejudice (1), in addition to proximal stressors such as internalized homonegativity, moral affect, sexual orientation concealment, and rejection sensitivity (4). Of critical importance, it has been proposed that exposure to minority stressors accounts for the disproportionately higher levels of adverse mental health outcomes among sexual minority groups (5) by disrupting transdiagnostic neurobiological stress pathways (6,7). As 2SLGBTQAI+ individuals may have heightened exposure to minority specific stressors

and insidious trauma related to chronic oppression (8), accounting for minority stress when conducting research with these communities is paramount. Unfortunately, in the study by Wang and colleagues, minority stress was neither acknowledged, assessed, nor controlled for in the analyses. A recent systematic review by Nicholson and colleagues examined the impact of minority stress on structural and functional brain connectivity, highlighting the importance of incorporating minority stress exposure levels associated with multidimensional minority identities within research designs. This narrative synthesis suggests that sexual minority stress exposure may be associated with aberrant functional connectivity within intrinsic brain networks. Critically, this review suggests minority stress may have several shared neuropsychological pathways with posttraumatic stress disorder (PTSD) and stress-related disorders, which may be an underlying mechanism associated with disproportionately higher adverse mental health outcomes among sexual minorities. With respect to the Wang *et al.* (2) study, failure to consider minority stress exposure as a potential explanation/mechanism for their reported findings is a significant oversight. Omission of these alternative explanations, regardless of assessment inclusion, creates a risk of misattribution and can lead to harmful inferences, as seen within this article.

Noteworthy is that the authors only report an association between WCST performance and sexual orientation scores, where cognitive measures did not correlate with connectivity alterations observed among sexual minority men. Critically, sexual orientation was assessed using the Kinsey Scale. Notably, the Kinsey Scale conflates or omits different aspects of sexual orientation, assumes sexual orientation is linear (rather than multidimensional), and polarizes heterosexual and homosexual desires as trade-offs (9,10). Further shortcomings of the Kinsey Scale include inadequately capturing sexual and gender minority participants' sexual orientation, particularly for plurisexual and/or gender minority participants (11). In the Wang *et al.* (2) study, the authors grouped participants with differing degrees of same-gender attraction (i.e., from 4 to 6 on the Kinsey Scale) into a "homosexual" group. This ignores important within-group differences in sexual minority populations, such as differences between bisexually and monosexually (i.e., gay) identified people. The authors' inferences are based on the notion that all sexual minority men identify as gay, which might not necessarily be the case (e.g., participants scoring four on the Kinsey Scale might identify as bisexual and experience different minority

stressors). The assumed linearity of sexuality (heterosexual to homosexual) would effectively render bi- or other plurisexual people (located on the midpoints of the scale) analytically invisible. The current conclusions drawn by the authors go beyond the evidence presented in the study given that the authors did not control for minority stress exposure and non-linear presentations of sexuality and gender, among other variables identified in the limitations section such as intelligence quotients, social extraversion, and differing Kinsey Scale scores. The current interpretation of results represents a problematic approach concerning conducting and presenting research with marginalized populations and may potentially harm this community. Not acknowledging and accounting for other potential factors that could explain deficits in cognitive functioning, the possible misattribution of deficits to identity rather than psychological stress may serve to perpetuate stigma.

In conclusion, the numerous points presented within this response raise questions about the validity of the presented results and their interpretation. Specifically, the authors concluded that deficits in executive functioning are associated with sexual orientation without considering alternative factors. As stated at the outset, there is an astounding lack of minority representation in neuroscientific literature, and the authors' intentions to expand this literature are commendable. However, it cannot be overlooked that when conducting research with historically oppressed groups, the ethical duty of the researcher to run sensitive and responsible research is paramount. From what Wang and colleagues reported, we feel that the considerations regarding the impact of minority-related stressors were not adequately weighed in the study design and believe that the published work without highlighting these crucial limitations may add further harm and stigma to the 2SLGBTQIA+ community.

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