

MAGIC guidelines for responsible communication of research into sex/gender and the brain

MAGIC: Five factors that need to be considered to prevent misleading and damaging claims reaching the public domain



Why this matters

- There is a long history of outdated, flawed and exaggerated claims about brain-based sex/gender differences informing teaching materials, training courses, diversity and inclusion initiatives, and marketing campaigns.
- Problems of misrepresentation and misunderstanding can arise at all points along the chain of communication, but too often start with a disconnect in the original research paper between the strength of the findings and the impression created by the narrative.
- The cumulative effect of these misleading claims can reinforce stereotypical expectations which can limit people's potential.
- Authors need to take care to avoid some common pitfalls that can create a false impression about how meaningful any observed sex/gender differences really are.

Good practice principles

PRINCIPLE	MORE DETAIL
<p>MAGNITUDE: describe the extent of any 'differences' clearly and accurately</p>	<p>Authors should state the ratio of statistically significant to non-significant comparisons, in order to draw attention to, for example, the percentage of areas where differences were not found as well as where they were.</p> <p>Authors should clearly indicate the extent of overlap between female and male data, for example by use of effect size, to avoid giving the impression that a sex/gender 'difference' refers to something that distinguishes most of the female cohort from all or most of the male cohort (unless that is what is found).</p>
<p>ACCURACY: be careful about how variables are used in the interpretation of results</p>	<p>Authors should make clear how they account for the biological, social and cultural factors associated with sex/gender in interpreting their results.</p> <p>Authors should apply appropriate caution when interpreting their data in terms of measures that did not form part of the study. For example, when describing the possible causes or behavioural consequences of any average differences in brain imaging data, they should be careful only to refer to brain-behaviour links with a well-established evidence base, beyond stereotypical beliefs.</p>
<p>GENERALISABILITY: be cautious about how widely the results might be applied</p>	<p>Authors should be cautious about the use of phrases such as "women are.." or "men are..." even where moderated by the term "on average".</p> <p>Authors should include appropriate caveats about whether or not their results are likely to apply beyond the study's demographics, in terms of factors such as age, level of education, occupation, socio-economic status, ethnicity, gender variance and/or neurodiversity.</p>
<p>INFLATION: avoid language that overstates the importance of the results</p>	<p>Authors should ensure they match the strength of their language to the strength of their evidence, avoiding, for example, the unjustified use of terms such as "fundamental" or "profound".</p> <p>Authors should ensure any discussion of their results accurately reflects the true extent of any differences found.</p>
<p>CREDIBILITY: be careful to acknowledge how the findings do or do not fit with existing research</p>	<p>Authors should acknowledge whether their analytical intent is exploratory or confirmatory, clearly identifying the lower levels of credibility in exploratory studies.</p> <p>Authors should report the potential limitations of their methodology and analyses, and ensure this has sufficient prominence, including, where appropriate, in the abstract.</p>

Notes:

1. We use the term 'Sex' to refer to a set of biological attributes associated with physical and physiological features including chromosomes, gene expression, hormone function, and reproductive/sexual anatomy; 'Gender' to refer to socially constructed roles, behaviours and identities of female, male and gender-diverse people; and 'Sex/Gender' to indicate the entanglement of an individual's biological sex with psychological and social attributes of their environment.
2. The guidelines are adapted from Robert P. Abelson's MAGIC framework for organising a principled argument from quantitative evidence (Abelson, R. P. *Statistics as principled argument*, 1995, Hillsdale). They are not intended to prevent fraud or disinformation, nor to set blanket restrictions on how research is communicated.
4. The brains in the image below are all the same colour. The only change is to overlay different coloured horizontal lines. In an effect known as the Munker-White illusion, these lines distort our perception. Overstated and misleading language about research findings on sex/gender and the brain can have a similarly distorting effect on how people interpret the underlying evidence.



Image based on an original by Professor David Novick, University of Texas, El Paso.

Feedback on these guidelines and suggestions for improvements are very welcome.

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Endnotes