

# MAGIC guidelines for responsible communication on 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- There is a long history of outdated, flawed and exaggerated claims about brain-based sex/gender differences informing teaching materials, training courses, diversity and inclusion initiatives,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 and nature of the findings and the impression created by the narrative.
- The risks are growing as a result of mandates to use sex as a biological variable in relevant research and an emphasis on ‘impact’ as a measure of research(er) success.

## Good practice principles

PRINCIPLE	WHY IT MATTERS FOR SEX / GENDER <sup>1</sup> RESEARCH	GOOD PRACTICE	POOR PRACTICE
<b>MAGNITUDE:</b> the strength and nature of statistical results should be clear to non-expert readers	The prevalence of gender stereotypes means there is a high risk of:  ...lay-readers getting the impression that any reported ‘difference’ means distinct, non-overlapping meaningful differences between two groups (M/F)	To communicate responsibly, authors <b>should:</b>  describe the size and nature of statistical findings in a way that is accessible to non-experts (see note 2)	Authors <b>should not:</b>  focus on a limited subset of findings without good reason
<b>ACCURACY:</b> interpretation should only be in terms of clearly defined variables	...authors drawing on assumptions about ‘typical’ female and male behaviours, not measured in the study	clearly define study variables such as ‘sex’ and ‘gender’	refer to differences or effects that were not measured and which merely reflect stereotypical assumptions
<b>GENERALISATION:</b> authors should avoid unwarranted generalisations	...lack of recognition of the limitations of a study’s demographics, leading to a false assumptions that the results are likely to apply in any groups of women or men	be explicit about the potential influence of social and cultural factors as well as the potential for physiological causation	imply that the results are likely to apply to any groups of women or men without justification
<b>INFLATION:</b> language should match the strength of the findings, without ‘spin’ or hyperbole	...inappropriate use of terms such as ‘profound’ ‘fundamental’, giving a misleading, essentialist or deterministic impression	draw attention to the implications of any limitations in the methodology	use hyperbole to describe the difference without correspondingly strong evidence
<b>CONTEXT:</b> authors should frame a finding appropriately	...authors drawing on a narrow or outdated literature	draw on a broad, robust, and up to date literature to put any difference in appropriate context	draw on overly focussed or outdated material, material from failed replication studies, or studies with small or overly narrow samples

# 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. In describing the size and nature of statistical findings authors should:
  - describe the effect size in a way that allows readers who are unfamiliar with normal distributions to get a sense of the extent of similarity as well as difference. Without this, non expert readers are likely to imagine two non-overlapping groups, or a generalisable difference as big as that seen in height ( $d=1.7$ ) where men are usually, albeit not always, taller than women. Particular caution is needed where a sex/gender 'difference' is closer in scale to that seen in the incidence of left-handedness ( $d=0.1$ ) to ensure readers understand that this means no broad sex/gender generalisations can be drawn.
  - explain how serious the risk of 'false positives' is, given the proportion of the sex/gender comparisons made that passed a test of statistical significance
3. The guidelines are drawn 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.



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

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