

Lay attitudes towards risk and moral responsibility in gain-of-function research

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Background

Advances in technology and science have led to an increase in capacity for gain-of-function research (GOFR). This is defined as scientific experimentation that increases the virulence and/or transmissibility of infectious agents. Whilst potentially contributing to knowledge of infectious diseases, this research also poses significant biosafety risks (accidental release through a laboratory accident) and biosecurity risks (intentional release by a terrorist or other malevolent actor) to public health.

Two highly controversial gain-of-function experiments involving avian influenza (H5N1) in 2011-2012 sparked debate and contention, and eventually led to the United States (US) government implementing a pause on new funding for GOFR involving influenza, MERS and SARS (effective October 2014). To date, the GOFR discourse has been largely concentrated in the scientific community and national governments/regulatory bodies. Despite wide recognition that there is a need for greater consultation with civil society in the GOFR debate, there has been minimal engagement of the general public to date.

Aims

The empirical component of this research aimed to gauge the general public's attitudes towards GOFR. The overarching aim of the project is to inform the ethical literature around GOFR and contribute to the policy debate in the US (and globally) around the regulation of GOFR.

The main aims of the empirical research were to:

1. Assess the general public's risk attitudes towards GOFR.
2. Assess lay attitudes towards prospective moral responsibility amongst various stakeholders who have authority in GOFR scenarios.
3. Assess lay attitudes towards the involvement of the general public in GOFR decision-making.

Methodology

- Cross-sectional study performed through an online survey platform
- Survey participants were taken only from the US
- Questions relating to attribution of prospective responsibility for decision-making in GOFR scenarios amongst three stakeholders
- Question on beliefs on the role of general public in the GOFR problematic
- Risk benefit decision-making questions involving GOFR scenarios, assessing preference of values (Table 1) employed in GOFR decision-making:
 - 'limited science budget' questions - participants asked to choose only one (if any) of three GOFR experiments to perform, where all have differing risks and benefits
 - 'perform or not perform' - presented individual experiments one by one and asked the participant to decide if the experiment 'morally ought' to be performed or not performed

Table 1. Five identified values to inform decision-making in a GOFR scenario

Value	Description
Value 1	Maximising the magnitude of the possible benefits (classic maximax approach)
Value 2	Maximising the probability of the possible benefits
Value 3	Minimising the magnitude of the possible harms (classic maximin approach)
Value 4	Minimising the probability of the possible harms
Value 5	Choosing the option with the most favourable expected utility

Significance

To our knowledge, this research project was the first to assess lay attitudes on GOFR. It contributes new insights into the GOFR problem that will inform bioethical debate, and contribute to policy-making that is representative of the people. This study offers a strong foundation for further research into the broader issue of the inexorable advance of technology and science and its intersection with the moral foundations of modern society.

Results: Overall

- Total of 204 valid responses with diverse demographics
- Over 50% of participants were tertiary educated + high proportion of survey participants studied science at tertiary level (82 people out of a total of 107 tertiary educated people)

Results: Risk attitudes in GOFR

1. Participants displayed a high degree of risk tolerance and willingness to perform GOFR
2. Participants were pluralistic in their decision-making values (respondents did not make decisions based on one value consistently)
3. Expected utility was a compelling decision-making value
 - a. significant correlation between the expected utility of the experiment and the participants' preparedness to perform the experiment ($p < 0.001$)
4. Desire to maximise the possible benefits of the scenario was compelling, as compared to a desire to minimise risk
 - a. contrary to hypothesis on favouring of risk-averse decision values

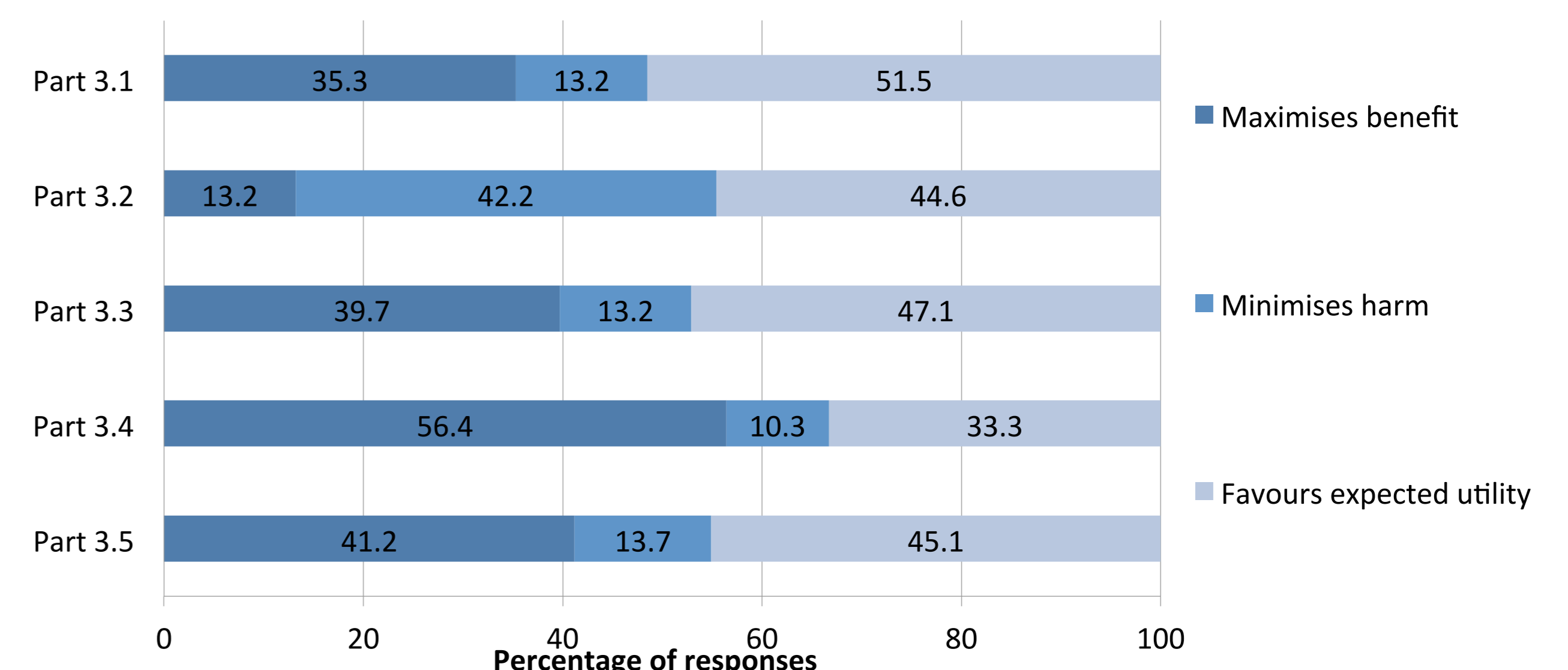


Figure 1. Comparison of preference for acting to maximise benefit (value 1+2), acting to minimise harm (value 3+4), and acting to maximise expected utility (value 5).

Results: Moral responsibility in GOFR

1. Participants indicated that prospective responsibility should be shared between three key stakeholders
2. Participants were less inclined to agree that they (the general public) should have a say in permissions and restrictions applying to potentially dangerous scientific research
 - a. Departure from bioethical and scientific literature that highlights importance of engaging general public

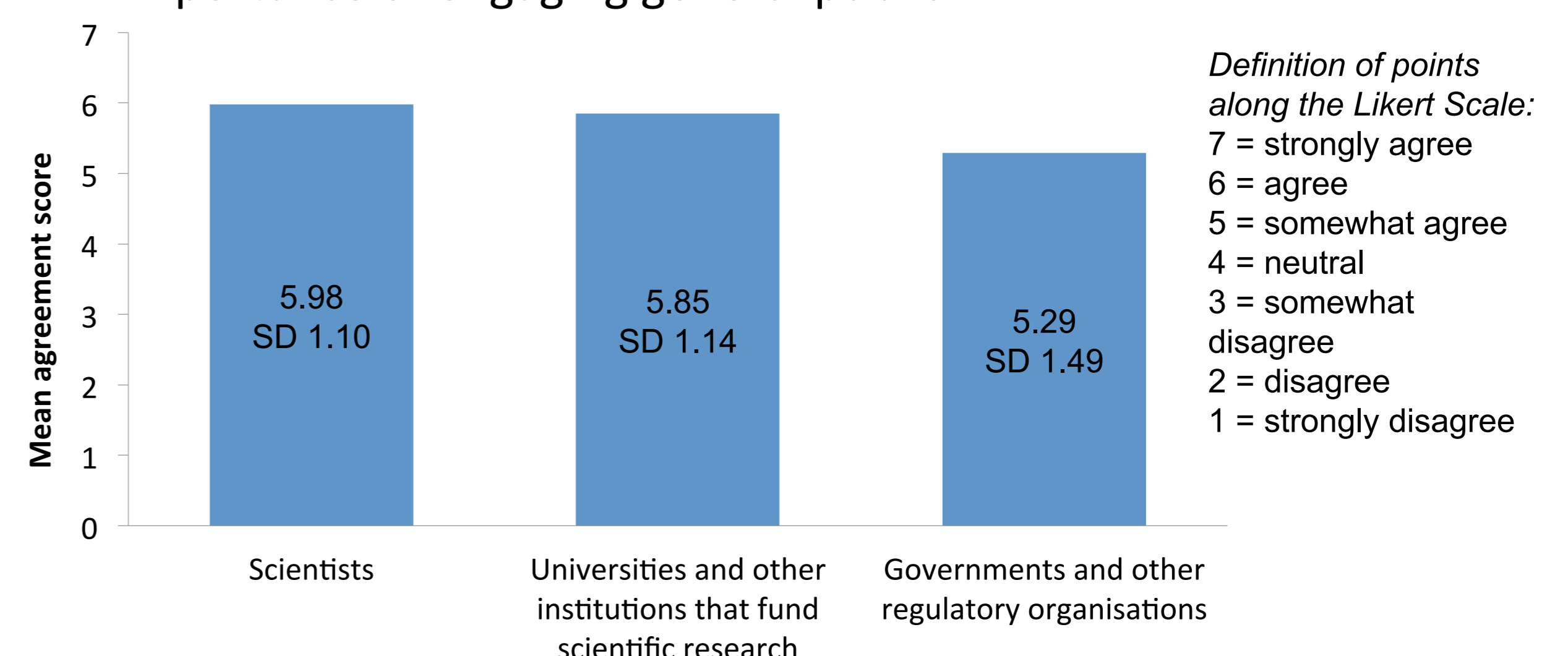


Figure 2. Mean agreement score (and standard deviation) that three key stakeholders in GOFR have responsibility for 'considering the risks and benefits of scientific research and deciding on which experiments should or should not be performed'.

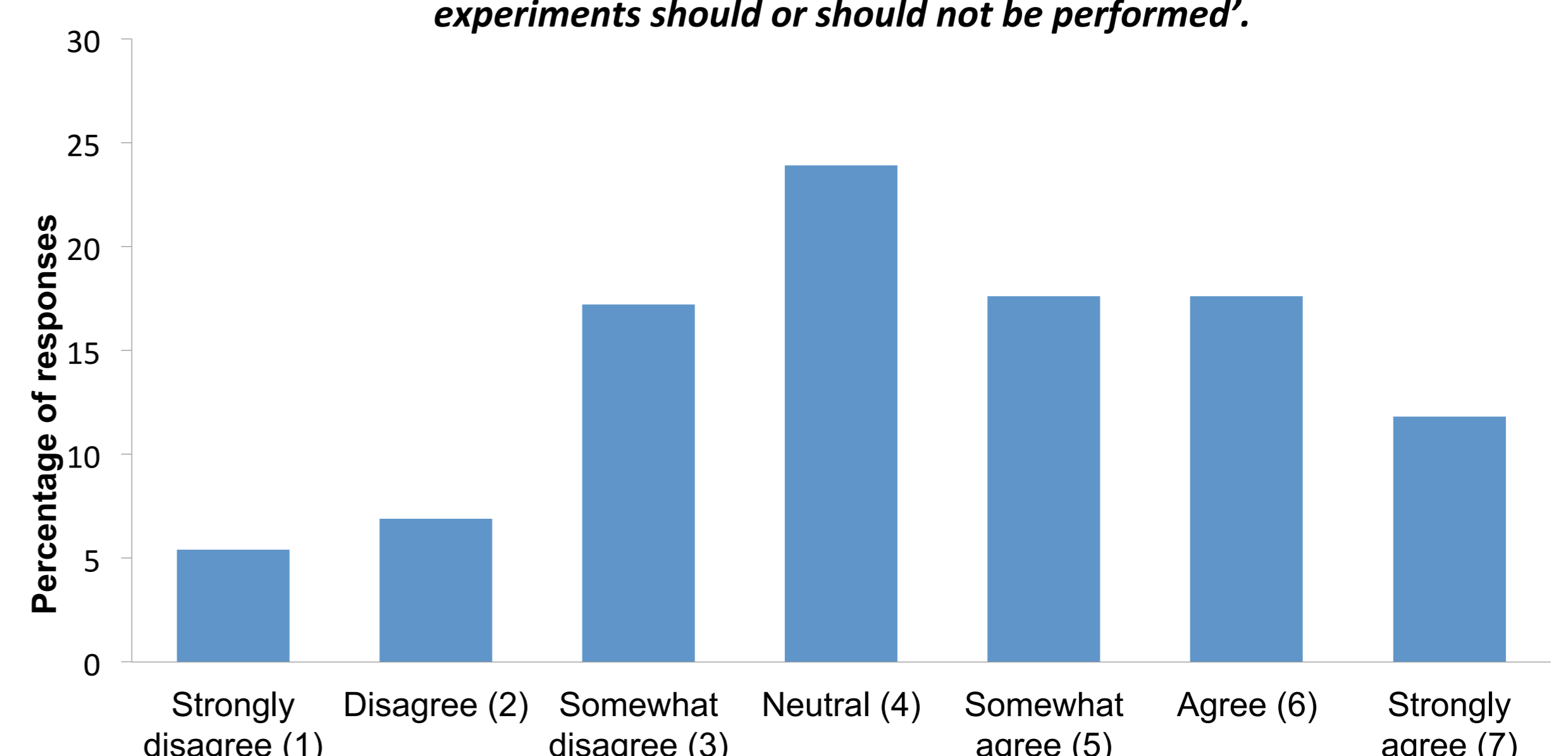


Figure 3. Level of agreement that 'the general public should have a say in the permissions or restrictions applying to potentially dangerous scientific experiments' (mean agreement score 4.41).