UNIVERSITY OF CAMBRIDGE

Bennett Institute for Public Policy Cambridge

# Improving Inclusivity in Grant Funding: Initial Gender Analysis

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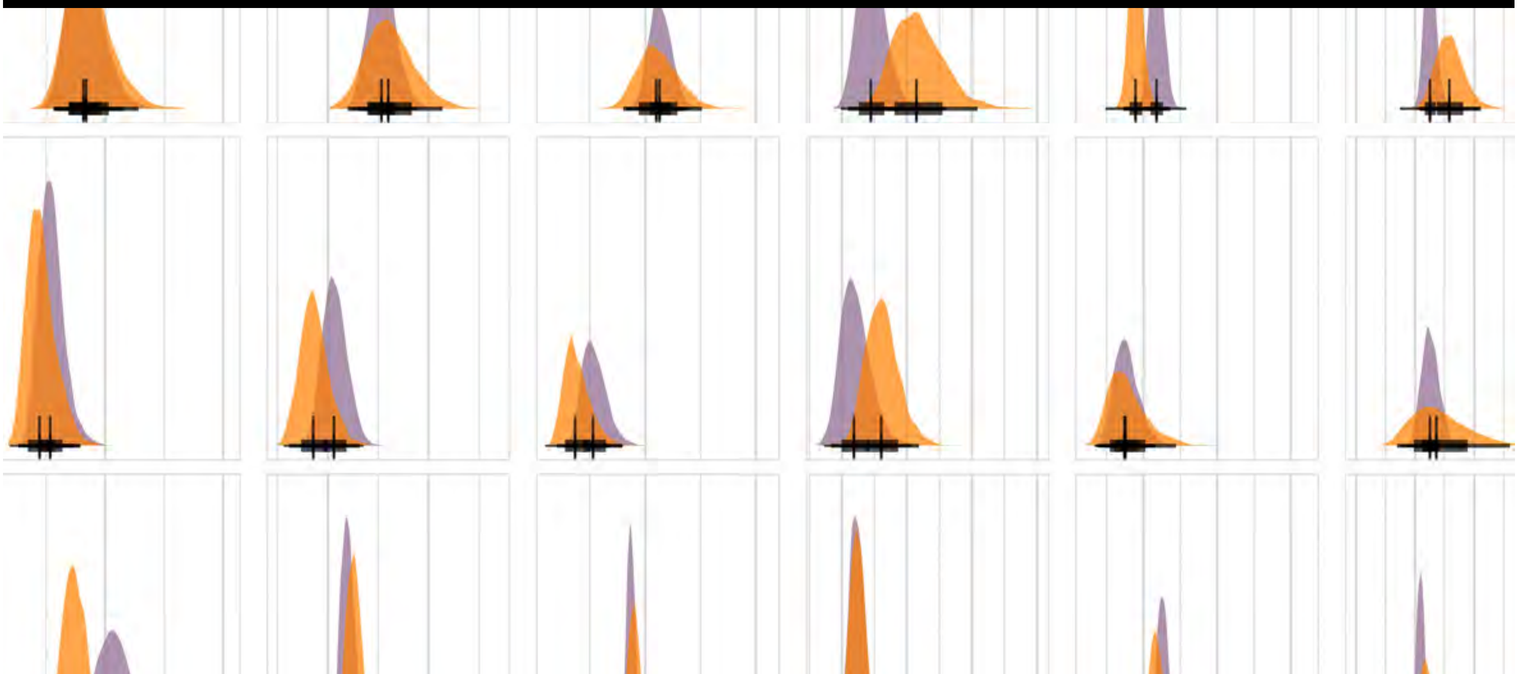

April 2025

# Contents

# Executive summary

This report presents an analysis of grant funding disparities related to gender between 2015 and 2023 at the University of Cambridge. It is part of a project examining grant funding disparities between researchers with different demographic characteristics.

We look at three stages of the grant application process. We ask: who applies? How large are the applications? And who is successful? We examine these stages because reasonably comprehensive data is available and we believe they are important markers in the process (although not the only important stages). We are looking at gender first as a test of our approach and because the data is most complete. Analysing other characteristics may require additional data collection.

Our analysis makes it clear that seniority and school have substantial effects. Application rates, size of application and success rates all increase with seniority. All aspects vary by school. Variation by school is unsurprising given the different role that grant funding plays in supporting research in different disciplines and the funding landscape in those disciplines. Cross-school comparisons of application rate, grant size or success rate are therefore likely to be influenced mainly by disciplinary differences.

Women are underrepresented in the senior academic population of the university, and the gender split across schools is uneven. This means the professional structure of the university heavily influences overall application rate, application size and success rate. Our analysis attempts to separate these structural imbalances from the question of current grant seeking behaviour. By separating the two, we aim to highlight where interventions can be most effective. Controlling for seniority and school we see a much more varied pattern of disparities in grant seeking behaviour, with different career stages in different schools more or less imbalanced.

### Who applies?

The two schools with the most consistent pattern of disparities are the School of Clinical Medicine, in which we estimate that men of most grades applied for more grants than women (difference in rates of 15-40%); and the School of Physical Sciences, in which women professors apply for more grants than men (differences around 50%). The School of Arts and Humanities, the School of Humanities and Social Sciences, the School of Technology and the School of Biological Sciences have some grades at which application rates are similar, and others where men or women appear to apply more frequently.

Our estimates suggest the disparities we see in the School of Clinical Medicine have probably decreased since 2015; our best estimate is that they have almost disappeared. The application rate of women in the School of Physical Sciences has remained above that of men since 2015. In the School of Arts and Humanities it is likely that women's application rate has overtaken that of men.

### How large are the applications?

Differences in the sizes of grants applied for are less clear – in most schools at most grades, the sizes are similar. There are five grade/school combinations where men's grants were probably larger than women's and only one grade/school combination where women's grants might be larger. There has not been a clear pattern of change between 2015 and 2023 – there are suggestions of both reducing and increasing disparities. The clearest changes are for professors in the School of Arts and Humanities and the School of Humanities and Social Sciences, where women's relative grant size has overtaken men's, and for assistant professors in the School of Technology where it seems to have fallen behind.

# Executive summary

## Who is successful?

There are indications that overall women's success rates may have been slightly higher than men, but these are only seen in some grade/school combinations and may be partially accounted for by the differing sizes of grants applied for. There is one probable exception to this: professors in the School of Humanities and Social Sciences, where women appear to have had higher success rates. There are eight other grade/school combinations where there are indications of a difference: four where women were more successful and four where men were. There are no strong indications of changes in the relative success rate of men and women between 2015 and 2023, although there has been a clear overall decrease in success rates across all groups.

Our initial results highlight the potential for interventions for researchers in specific schools and/or career stages and identify where qualitative research and contextual knowledge could be most valuably used to address disparities. Our results also make clear that to remove university-wide disparities in grant seeking behaviour, structural disparities in seniority (and discipline) would have to be reduced.

## Limitations

We map all positions to standardise grades. We consider externally applied for research grants. We only consider the gender of the lead principal investigator (PI). We do not distinguish between full time and part time or grant types (fellowship/project etc.) due to data quality concerns. We consider the grant size recorded in the university costing system.

# Acknowledgements

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We consulted with leadership at each of the six schools. The feedback they provided about how to improve this report and how we should prioritise our next steps was very helpful. We would also like to especially thank champions on these issues in the University: Mette Eilstrup- Sangiovanni, Ndunge Kivuitu, and Rachel Oliver. Additionally, John Aston, PVC Research, and Kamal Munir, PVC Community and Engagement, provided valuable feedback and encouragement for this project.

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# Introduction

There is considerable evidence suggesting that academics from minoritised backgrounds often face disadvantages in securing research grants.[1,2,3] The Improving Inclusivity in Grant Funding (I3GF) project is working to identify disparities in grant funding between groups of researchers with different demographic characteristics (gender, ethnicity etc.) and identify interventions that could reduce these disparities.

Our initial analysis is quantitative and examines three important points in the funding process:


We hope this will provide insights into the disparities present at these stages and provide a foundation for the contextual knowledge of those in the university, alongside qualitative investigations, of why these disparities exist and how they can be addressed. This might include exploration of earlier stages in the application process, such as the decision to apply, which take place before the application is officially submitted.

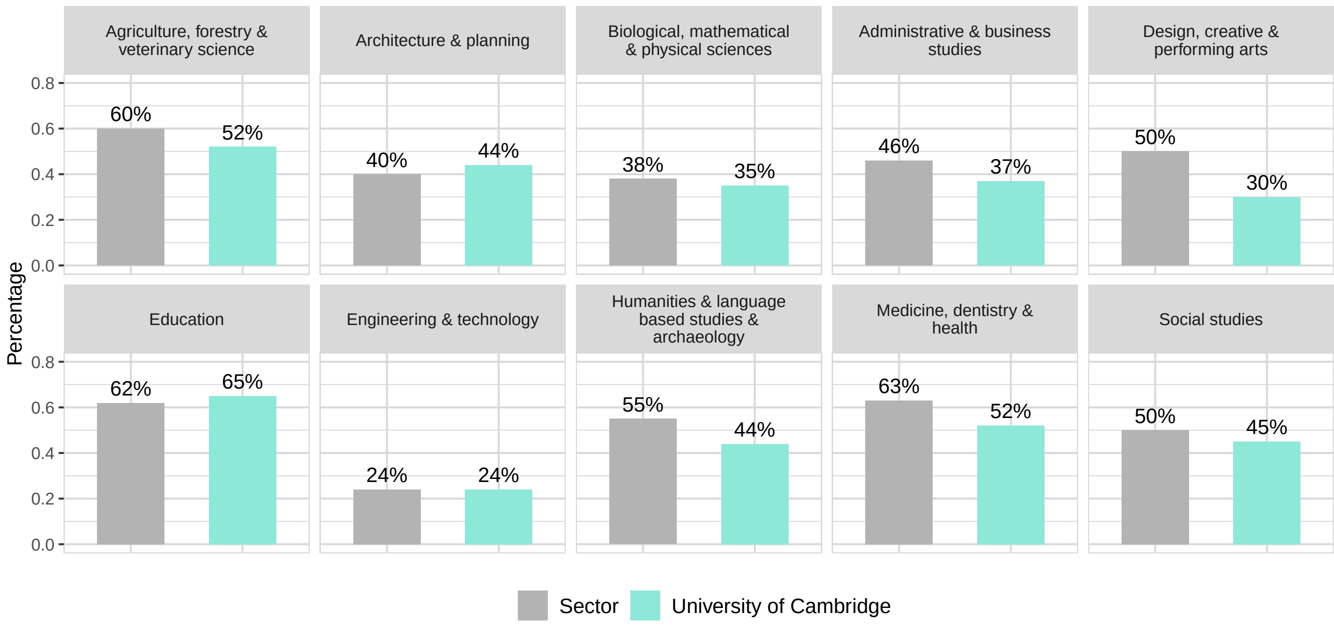
Different disciplines have different approaches to grant[4]-supported research, use grant funding in different ways and have a different range of funding sources available to them. These differences mean that cross-school comparisons of application rate, application size and success rates are more likely to tell a story of disciplinary differences than school characteristics. While acknowledging that it does not always align with disciplinary divisions, we choose to analyse by school because it is the administrative division of the university and likely to be instrumental in the delivery of interventions.

1. Bornmann, L., Mutz, R., Daniel, H.-D., 2007. Gender differences in grant peer review: A meta-analysis. J. Informetr., 1(3), 226–238.
2. Bedi, G., Dam, N.T.V., Munafo, M. (2012). Gender inequality in awarded research grants. Lancet 380, 474.
3. Ginther, D.K., Kahn, S., Schaffer, W.T., (2016). Gender, Race/Ethnicity, and National Institutes of Health R01 Research Awards: Is There Evidence of a Double Bind for Women of Color? Acad Med 91, 1098.
4. By 'grant' funding we mean research grants provided by funders outside the University of Cambridge. We do not include internal funding or donations.

# Introduction

**Figure 1** shows that at the University of Cambridge, and in the whole sector, women are under-represented in some disciplines that have higher success rates and larger grants, and in senior career stages. We use grade as our measure of seniority and experience because it is, relatively, unambiguous and we wish to map the experience of clearly identifiable cohorts – similarly to our reason for classifying according to school.

**Figure 1: Share of women in disciplines at the University of Cambridge and in the sector**




Comparison of the fraction of women in different disciplinary areas from HESA data, and at the University of Cambridge, mapped to HESA categories.

Our analysis shows that career stage and discipline have large effects on grant funding, so this under-representation produces disparities in grant funding based on the professional structure of the sector and the university. This report concentrates on disparities in current grant seeking behaviour (or disparities 'at the point of application'). We separate the effects of professional structure and current situation (i.e., we measure and control for the differences in grade and discipline) because we believe that addressing disparities caused by each of them will require different interventions.

Our analysis uses three datasets covering 2015–2023:

1. data on the contracts of research and academic staff;
2. data on the protected characteristics of research and academic staff;
3. data on applications submitted and awards granted.

We tidy this data before use: first, we simplify the seniority scale into five steps (in instances where an individual has overlapping concurrent contracts, we take the grade of the most senior position)[5]. Secondly, we break each contract into stints by year. Finally, we match applications and grants to these stints, linking applications to contracts and allowing us to measure yearly application rate. Our dataset includes over 23,000 applications, out of which 8,000 were successful, and 17,029 researchers and academics, out of which 3,800 applied at least once.

5. We simplify seniority into 5 levels: grade 7 or research associate; grade 9 or assistant professor, formerly lecturer; grade 10 or associate professor, formerly senior lecturer; grade 11 or professor (grade 11), formerly reader; grade 12 or professor (grade 12) formerly professor.

# Introduction

We include 84%[6] of applications from our original dataset (which covers 80% of successful grants, from 3,400 applicants), we exclude institutional grants and doctoral training centres, external applicants and serving pro-vice chancellors (PVCs). Additionally, when calculating the success rate, we exclude applications for which outcomes were not available at the time the data was collected (only 7 applications).

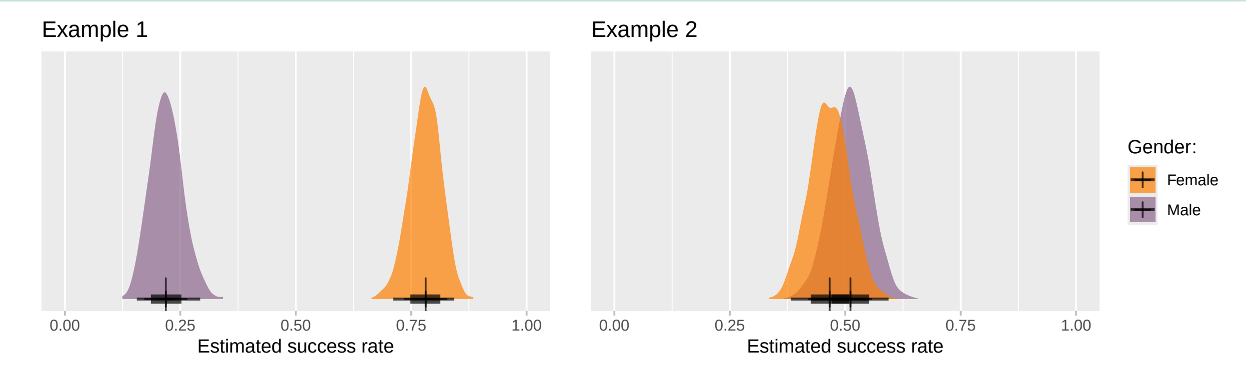
We take a Bayesian approach to our statistical analysis to present both the size and likelihood of disparities (Box 1 has details of how to interpret our results). There is more detail on our assumptions[7] and methodology in the section Modelling, methods and supplementary analysis, with more forthcoming in a subsequent paper (Czech et al., in prep).

**Box 1. Bayesian Guide**

Bayesian modelling is a statistical approach that estimates the likelihood of a situation based on a prior assumption and the data available. We make an initial weak assumption that there are no disparities, and that exceptionally large disparities are unlikely. We then estimate the application rates/size of grants/success rates for each group starting from this assumption and based on the data available[8]. To make our results easier to interpret, we present them in 'real world' terms – e.g., for application rate we present our estimates of average yearly application rate for men and women rather than presenting the coefficients from the model. We hope this approach makes it easy to visualise both the size and direction of the effect as well as the associated uncertainty. Below we show two synthetic results to illustrate how to read our graphs.

The *x*-axis represents the probability of success in real terms, and the *y*-axis the likelihood of each estimated value. The narrower the distribution, the more precise our estimate (the tighter the spread of probable values). Each estimate includes a black bar on the axis which represents the likelihood of a given section containing the true value. There is a 66% chance that the true value is contained in the thicker line and a 95% chance it is contained in the thinner one; the dot represents the most likely of the estimated values.

This is illustrated in Example 1, where the difference between genders is clear and the distributions of each estimate are narrow.




6. 3,859 observations were removed for meeting the following criteria, some observations met more than one criteria: (1) 3,001 (13% of the sample) – external applicants on whom we do not have complete demographic information; (2) 106 (0.5%) – grants awarded to non-school institutions; (3) 61 (0.2%) – grants to PVCs after having been appointed, because they are assigned some very large grants that are awarded to the institution and do not relate to their personal research portfolio; (4) 225 (1%) – grants to doctoral training centres because they do not relate to the personal research portfolio of the PI; (5) 601 (2.5%) – donations and scholarships.
7. Because our initial assumptions are weak, they should not heavily influence our conclusions. Where there are particularly small sample sizes, we are testing to confirm this is the case.
8. As our initial assumptions are weak, they should not heavily influence our conclusions. Where there are particularly small sample sizes, we are testing to confirm this is the case.

In contrast, in Example 2 the two distributions are also wider, showing we have less certainty about the true values and those distributions overlap. The extent of this overlap illustrates that there is probably no substantial difference between genders.

Our model aims to isolate the impact of different characteristics (gender, school, grade) and show its effect. Examples 3 and 4 show our estimates of the success rate difference for gender for Examples 1 and 2, rather than the success rates themselves. In Example 3, our best estimate for the difference is that women have twelve times higher odds of success whereas in Example 4 our best estimate is that women have 20% lower odds of success, but it quite likely that there is no difference as much of the distribution is to the right of the indicator line at parity (i.e., 1.0).

### Who applies?

**Figure 2** provides a snapshot of the researchers and academics who were employed at the University of Cambridge on 1st Dec 2023 as an illustration of the academic population covered in the analysis. This shows the predominance of men in the higher grades across the university and their distribution by school.

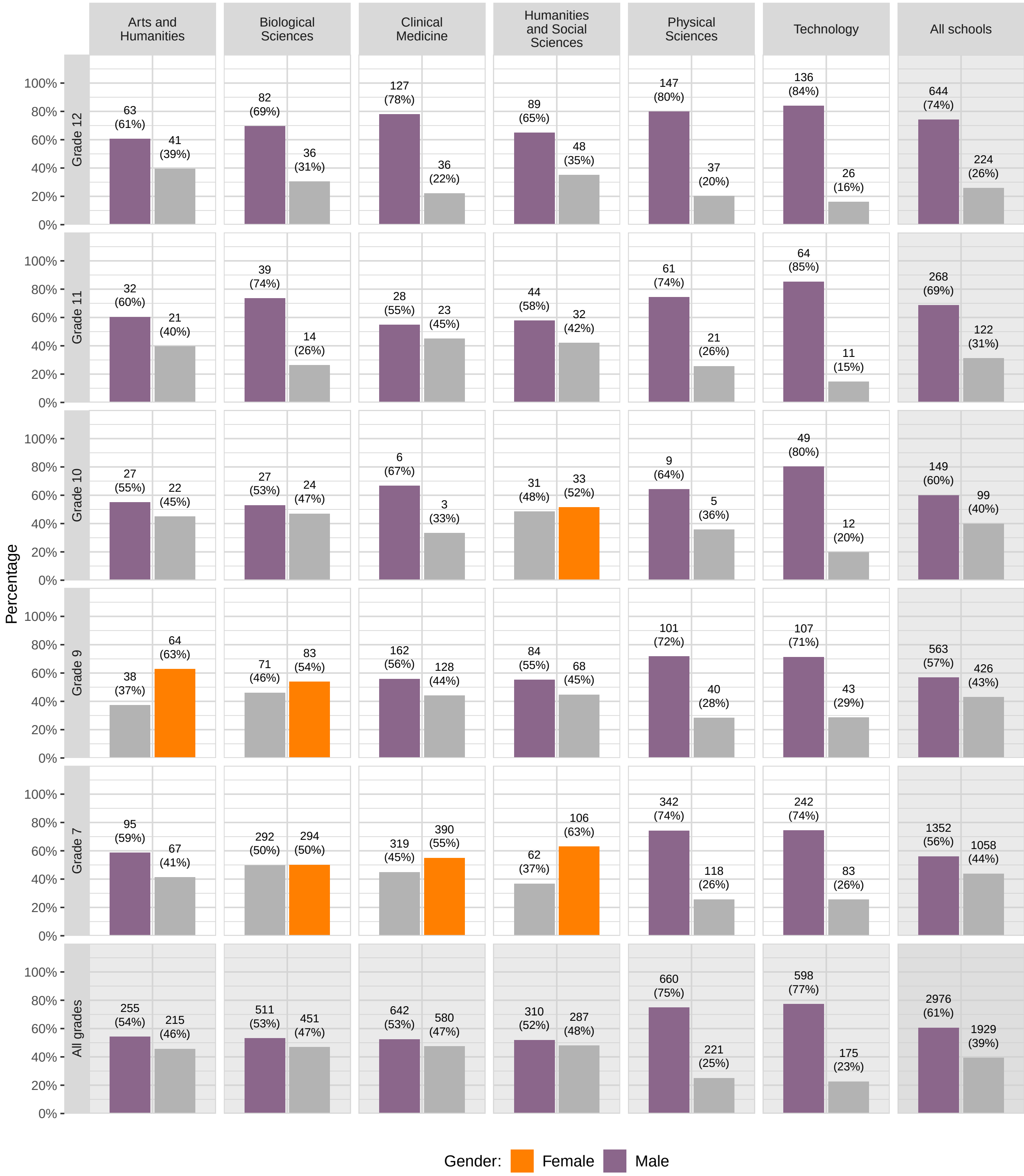
**Figure 3** shows the average number of grant applications per year for each gender, school and grade of PI to give an impression of the overall distribution of applications.

**Figure 4** combines the previous two perspectives and normalises the number of applications by the number of research and academic staff in each category, so it presents the number of applications per year by each type of academic. This analysis reveals categories where women have a higher application rate than men, while making up the minority of researchers. These graphs do not tell us how confident we can be that these differences represent a true difference, and only provide a snapshot in time, taking no account of the skewed distribution of application rates (a few people with high rates, many with no applications or a low rate).

**Figure 5** shows our Bayesian analysis[9] estimating the most likely application rates for each combination of gender, school and grade. The centre of each distribution shows our best estimate of the annual application rate for a category. For example, at grade 12 in the School of Biological Sciences we estimate that both women and men submit around 1.3 applications per year. In contrast, in the School of Clinical Medicine we estimate that women submit around 1.8 applications a year, while men submit 2, with a possibility that the rates are similar. The situation is reversed in the School of Physical Sciences where we estimate women in grade 12 submit 1.7 applications per year whereas men submit 1.2, and very little chance the rates are the same. In the School of Arts and Humanities, we have less certainty in our estimates (because there are less applications, or the variety of application rates is higher) and there is no indication of a difference in application rates, which are around 0.4 applications per year for both genders.

9. Our current models allow for a three-way interaction model incorporating grade, school and gender, and considers grant application a two stage process: first joining the group of researchers who might apply for grants and secondly choosing to apply for a specific grant. In other words, our model tries to take account of the extra 'zeroes' introduced by a cohort of researchers who never apply for grants. More detail on the Bayesian model can be found in the section 'Modelling, methods and supplementary analysis'.

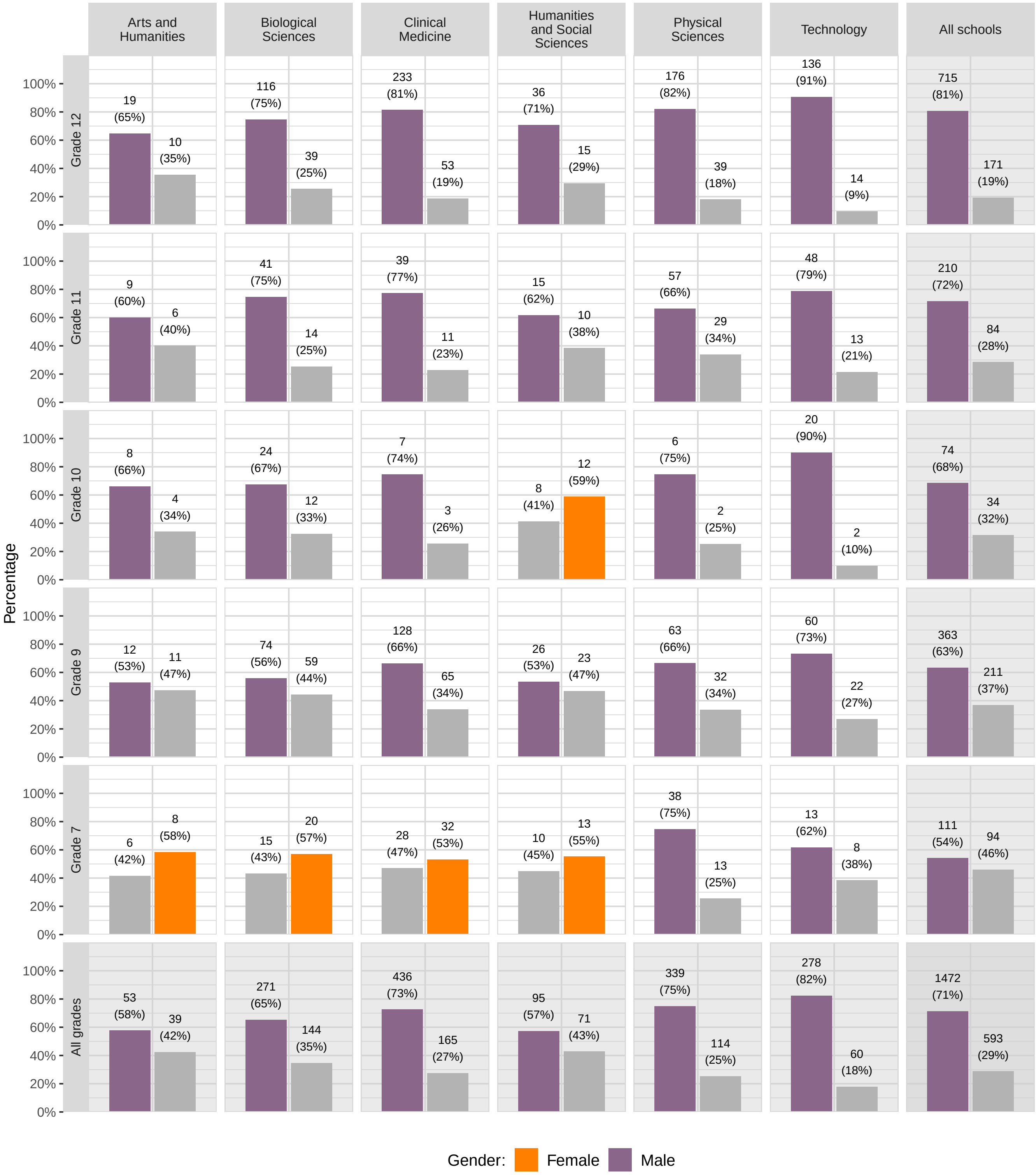
**Figure 2: The number of academics and researchers by gender, school and grade on 1st Dec 2023**




Bars on the left show the number of men, bars on the right show the number of women. The bar with the higher value is highlighted..

# Findings

**Figure 3: Average number of applications in a year by gender, school and grade of the lead PI**

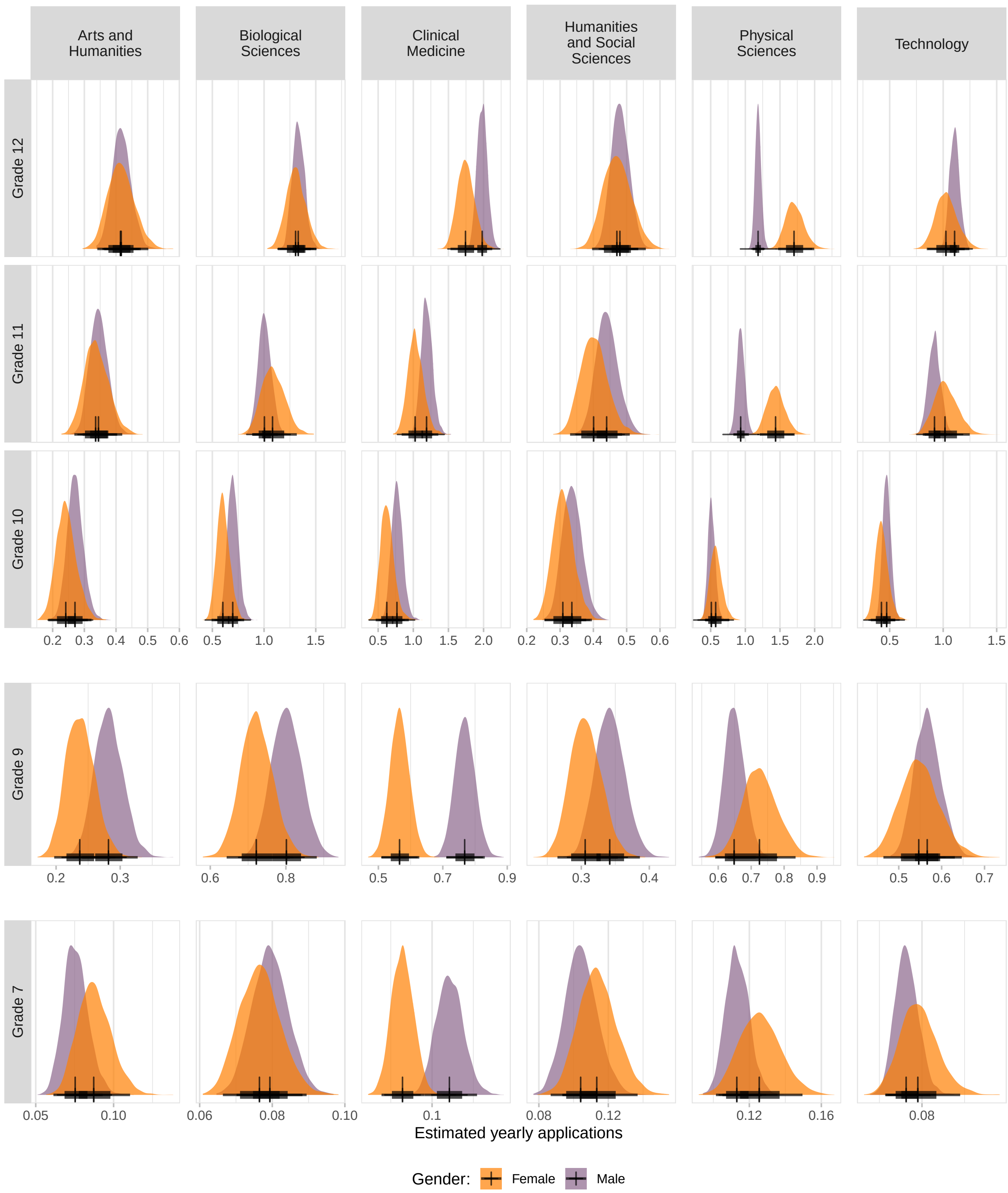



The number of applications is the average number of recorded grant applications in our dataset per year. Bars on the left show the number of applications made by men, bars on the right show the number of applications made by women. The bar with the higher value is highlighted.

### Figure 4: The average number of applications per year by gender, school and grade of the PI


The average is calculated based on each member of staff's count of applications in a given year. In cases where the observation is shorter than a year, the count is adjusted appropriately. The average includes individuals with no applications recorded. Bars on the left show the average number of applications made by men, bars on the right show the average number of applications made by women. The bar with the higher value is highlighted.

**Figure 5: Estimated yearly application rate for PIs by gender, school and grade**

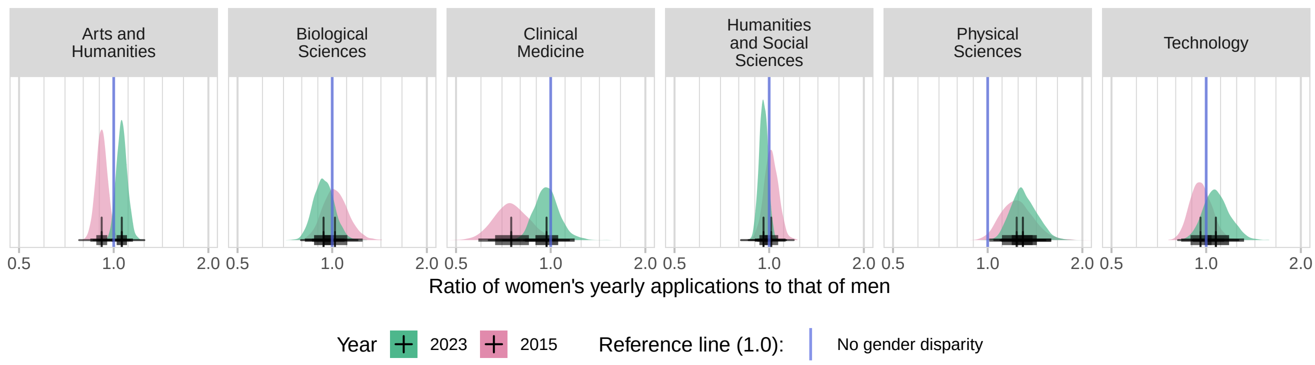



The estimates are based on a model that incorporates all main effects and interactions between gender, grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval.

Figure 6 includes the effect of time – showing our estimates of the 2015 situation and how it had changed by 2023. The downside of producing estimates for particular years is that breaking the data up over time makes our estimates less certain. In these graphs, we no longer present women's and men's application rates, instead we show our estimate of the difference[10] between the rates. A ratio of less than 1.0 indicates women are applying less than men, a ratio above 1.0 indicates men are applying less.

Our estimates suggest the disparities we see in the School of Clinical Medicine have probably decreased since 2015; our best estimate is they have more or less disappeared. There is a slight indication that the higher application rate of women in the School of Physical Sciences has increased since 2015. In the School of Biological Sciences there is a slight indication that men's application rate has moved above women's, in the School of Technology there is a slight indication of the reverse. In the School of Arts and Humanities it is likely that women's application rate has overtaken that of men. In the School of Humanities and Social Sciences the application rates appear to have remained very similar.

**Figure 6: Average ratio of women's application rate to that of men by school**

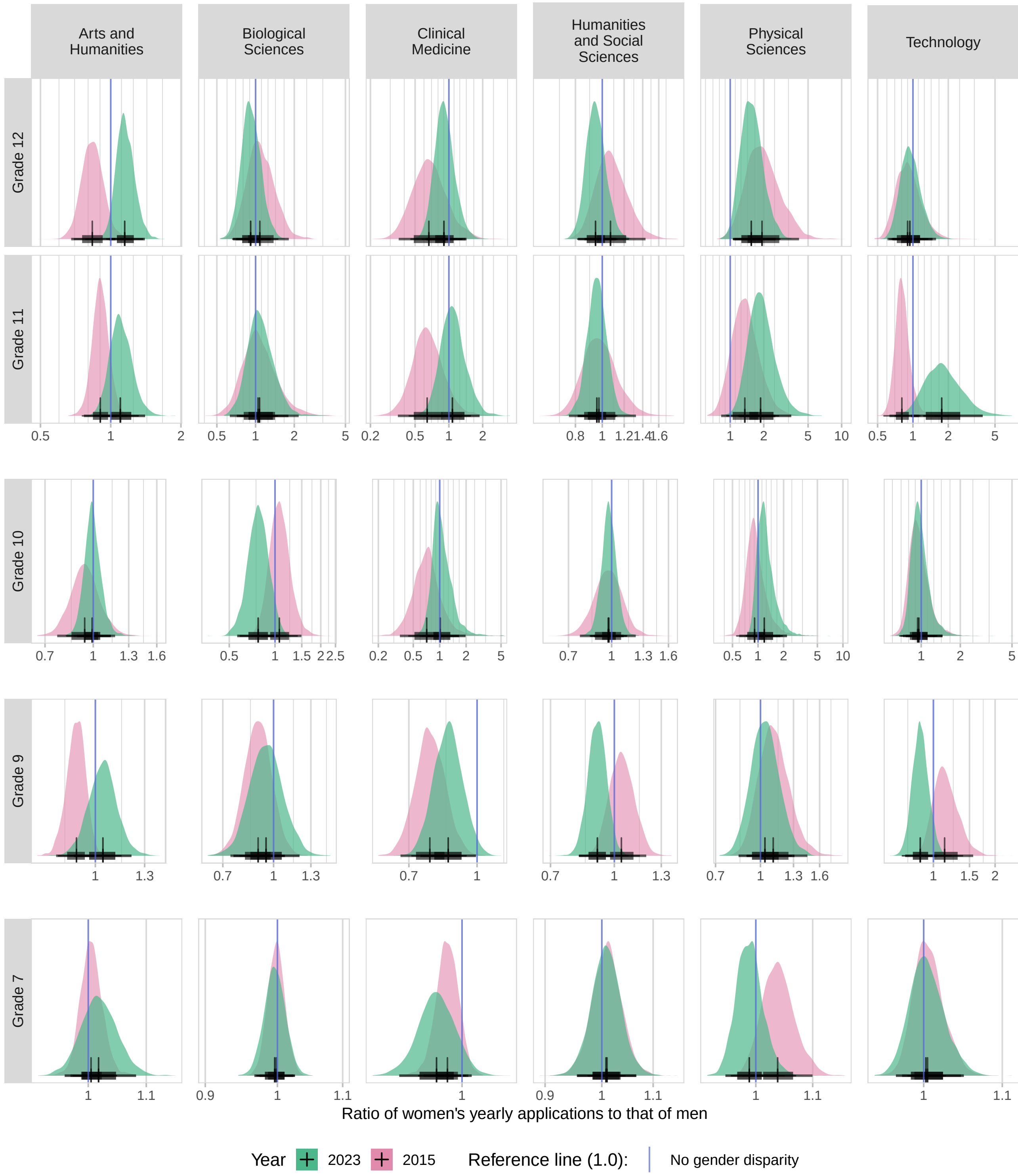



The estimates are based on a model that incorporates all main effects and interactions between gender, grade, school and year. The estimates are averaged over values of grade. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

Figure 7 presents similar estimates for each grade/school combination. These uncertainties are larger, as the data is being used to estimate more variables but give an indication where the school-level changes originate from.[11] The places where we are most confident that we see changes are in the School of Arts and Humanities and the School of Technology. In the School of Arts and Humanities there are indications that women's application rates have been closing on those of men at grades 9 and 11 and have overtaken those of men at grade 12. In the School of Technology there are indications that women's application rates have overtaken men at grade 11 but have slipped back at grade 9.

10. Marginal effects do not account for grade 'Other grade'. The average effect is computed over the remaining values of grade.
11. Because we present model estimates of ratios that draw on trends in the entire dataset and not directly summarised data from a particular grade/school combination, it is not possible to deduce the performance of individuals in the dataset from our results. This is true even in grade/school combinations with a small number of individuals.

**Figure 7: Average ratio of women's application rate to that of men in 2015 and 2023**

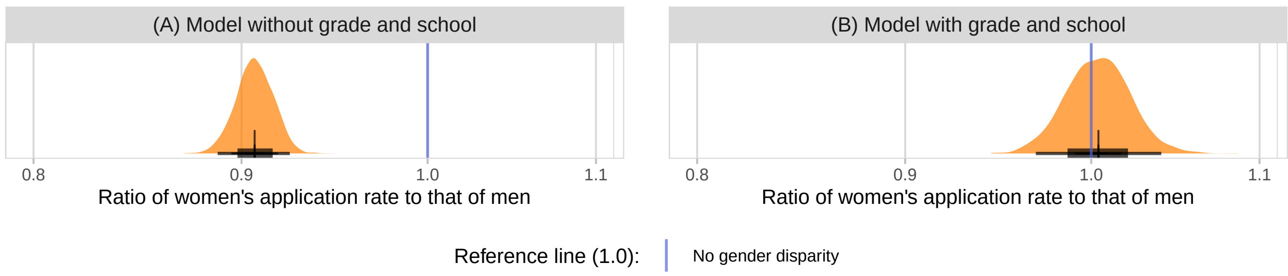



The estimates are based on a model that incorporates all main effects and interactions between gender, grade, school and year. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

So far, we have mainly shown our estimates of application rates in each grade/school category. We can also estimate the difference in application rate across the entire sample, controlling for grade and school, i.e. estimate the marginal effect of gender.

Figure 8 shows our estimate of the effect of gender comparing with and without controlling for the effects of grade and school. This highlights the impact of structural disparities – without controlling for grade and school we estimate a clear effect of gender, with women applying for around 10% less grants. When we control for grade and school this effect decreases, and we see very little indication that women are applying at a lower rate.

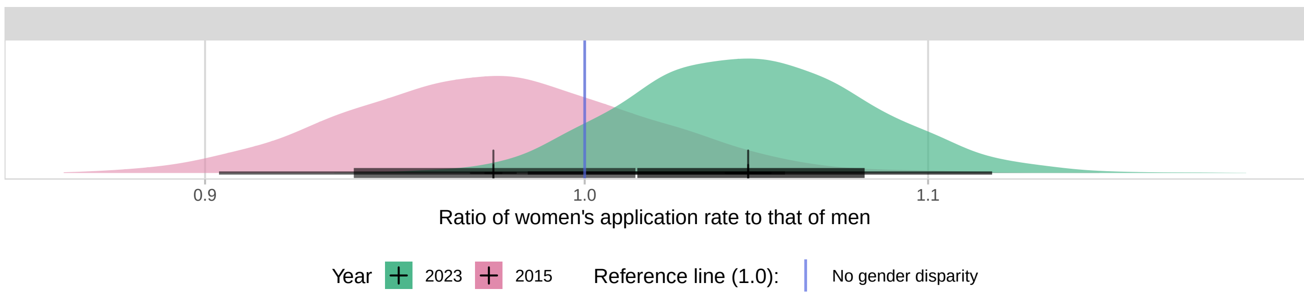
**Figure 8: Average ratio of women's application rate to that of men – model comparison**




The estimates in (A) are based on a model in which the only predictor is gender; the estimates in (B) are based on a model that incorporates all main effects and interactions between gender, grade and school. The estimates are averaged over values of grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

Figure 9 shows our estimate of how the application rate disparity has changed over time for the entire sample, controlling for grade and school. In 2015, there was some indication that women were applying at a lower rate, but by 2023 it is likely that women are applying at a higher rate. However, as illustrated by the detailed category graphs, this overall pattern can include areas where women apply more and others where they apply less.

**Figure 9: Average ratio of women's application rate to that of men in 2015 and 2023**




The estimates are based on a model that incorporates all main effects and interactions between gender, grade, school and year. The estimates are averaged over the values of grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

### How large are the applications?

**Figure 10** shows the average sizes of grants in each category for school and grade. Because grant sizes are heavily skewed (there are lots of smaller grants and a few much larger grants) using the median (Panel A) provides a slightly different story to using the mean (Panel B). The mean is more affected by very large grants, the median by the bulk of smaller grants. For example, the mean size of grants at grade 12 in the School of Clinical Medicine is around three times the median size, and in the School of Physical Sciences although women's median grant size is similar, the mean grant size for men is larger – suggesting a small number of very large grants held by men.

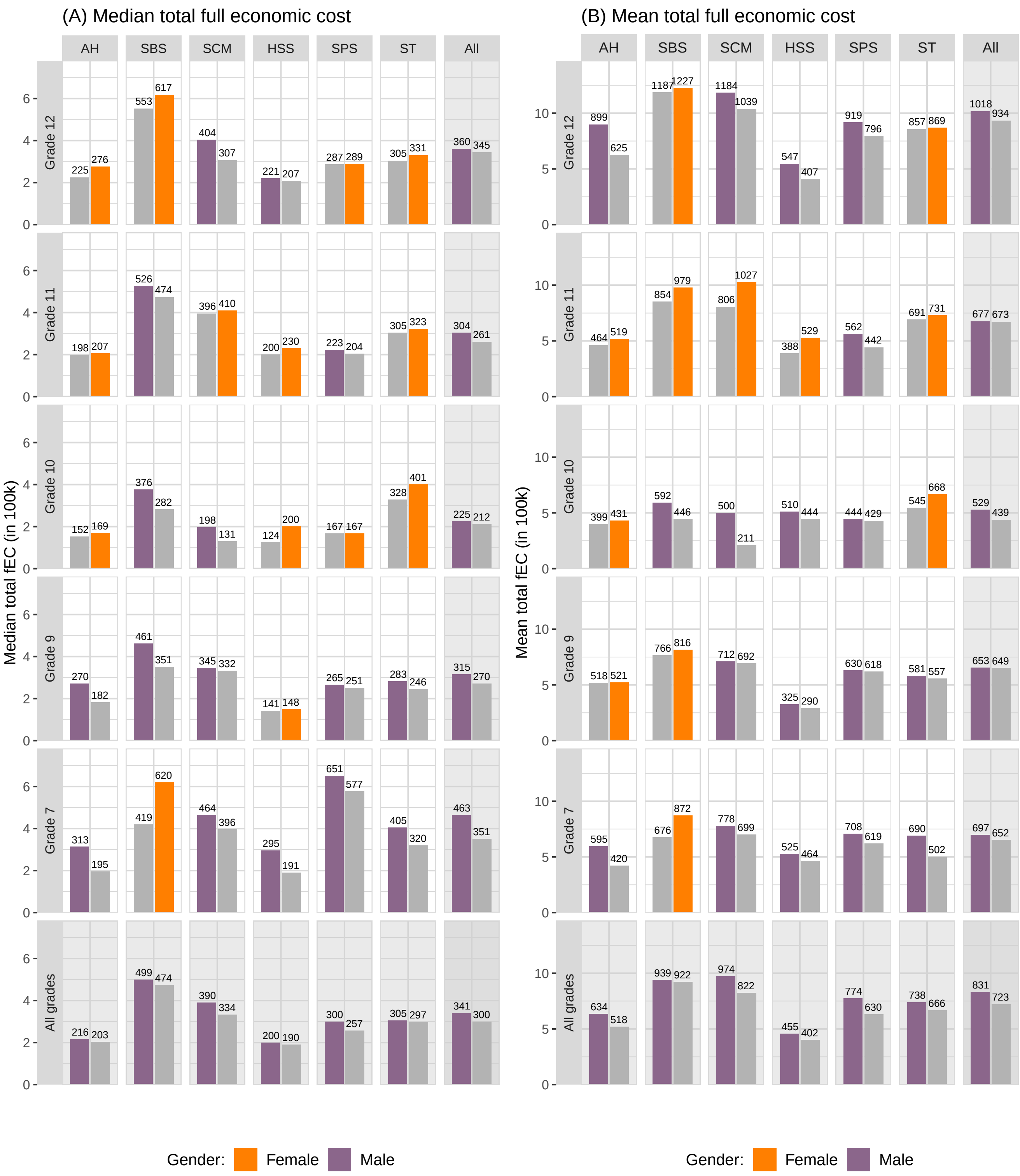
**Figure 11** shows the estimated mean application size for each of the gender, grade and school categories. In most schools and at most grades, the application sizes are similar. There are indications that women's grants might be smaller than men's in five grade/school combinations:

- School of Clinical Medicine - grade 7 and grade 12
- School of Physical Sciences - grade 11
- School of Arts and Humanities - grade 7 and grade 9

In contrast, there is only one grade/school combination where women's grants are likely to be larger:

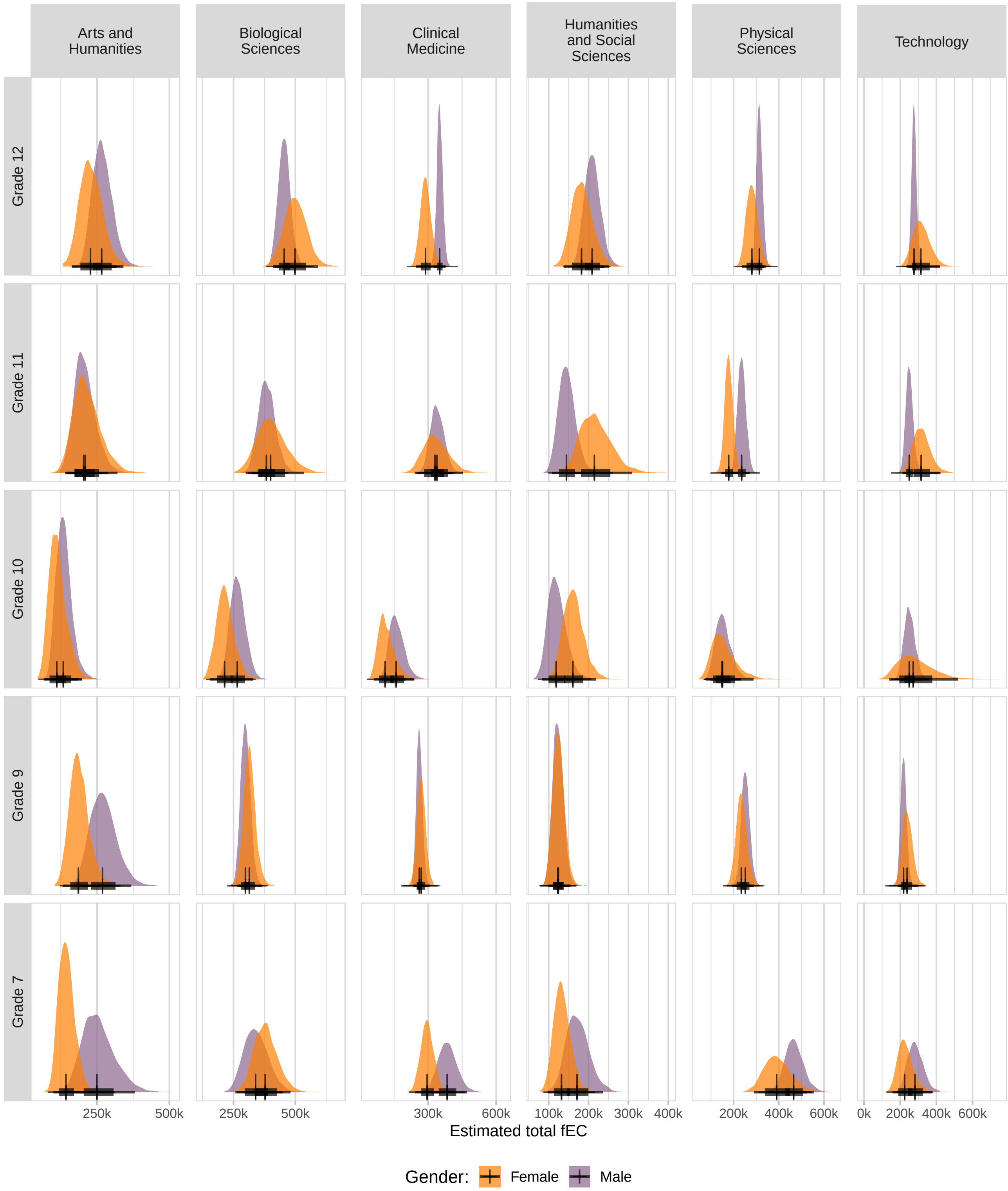
- School of Humanities and Social Sciences - grade 11.

**Figure 10: Median and mean total full economic cost by gender, school and grade of the lead PI (in £100,000)**




Bars on the left show the size of men's applications, bars on the right show the size of women's applications. The bar with the higher value is highlighted. School abbreviations: AH – Arts and humanities, SBS – Biological sciences, SCM – Clinical medicine, HSS – Humanities and Social Sciences, SPS – Physical sciences, ST – Technology, All – All schools.

**Figure 11: Estimated total full economic cost by gender, school and grade of the lead PI (in £)**

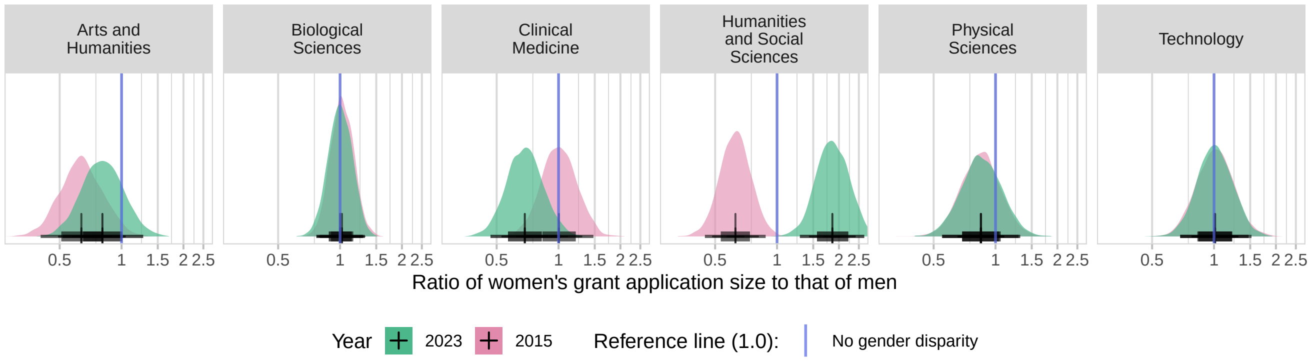



The estimates are based on a model that incorporates all main effects and interactions between gender, grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval.

[Figure 12](#) includes the effect of time – showing our estimates of the 2023 situation and the situation in 2015, taking account of changes over time. In these graphs, we no longer present the average size of women's and men's grants, instead we show our estimate of the difference between the sizes. A ratio of less than 1.0 indicates women are applying for smaller grants than men, a ratio above 1.0 indicates women are applying for bigger grants.

Our estimates suggest that in the School of Arts and Humanities there are indications that women's grants were smaller in 2015 and there is some indication that this disparity has decreased. In the School of Biological Sciences and the School of Technology it is likely that there are no large disparities and this situation is unchanged. Our model suggests disparities we see in the School of Clinical Medicine have increased since 2015, with women's grants now smaller. In the School of Humanities and Social Sciences women's average grant size appears to have overtaken that of men. In the School of Physical Sciences there are some indications of a persistent disparity with smaller women's grants.

**Figure 12: Average ratio of women's grant application size to that of men by school**




The estimates are based on a model that incorporates all main effects and interactions between gender, grade, school and year. The estimates are averaged over values of grade. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

Figure 13 presents similar estimates for each grade/school combination. Because the numbers of applications in each category are smaller, the estimates are less accurate (distributions are wider) and most overlap substantially. If there were no disparity the distributions would be centred on the blue line, indicating a ratio of 1.0. This is closest to being the case in both 2015 and 2023 in the School of Arts and Humanities grade 11.

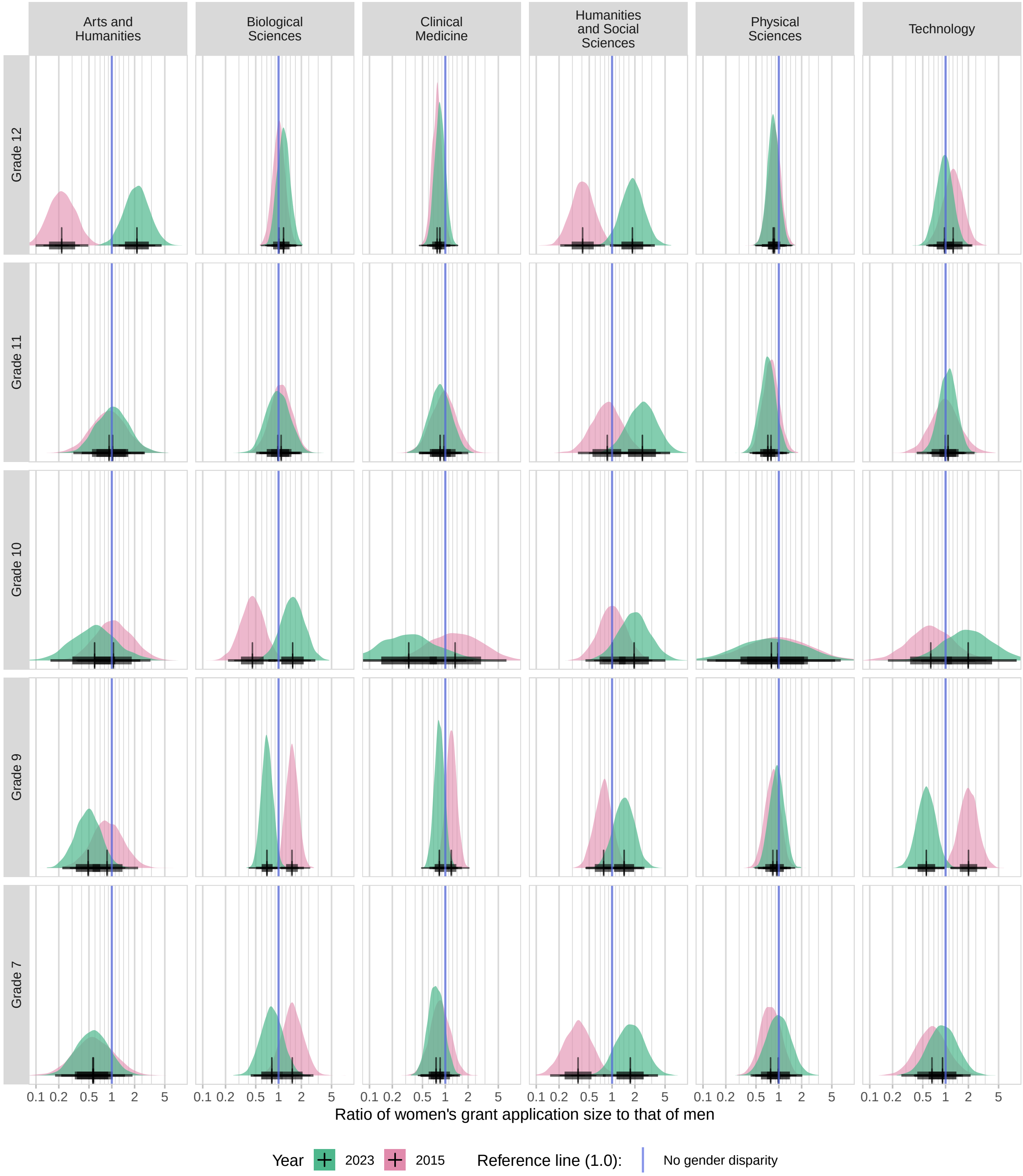
There are five categories where women's grant size has probably overtaken that of men's:

- School of Arts and Humanities - grade 12
- School of Humanities and Social Sciences - grade 12, grade 11 and grade 7
- School of Biological Sciences - grade 10

There are two places where men's grant size has probably overtaken that of women's:

- School of Biological Sciences - grade 9
- School of Technology - grade 9

**Figure 13: Average ratio of women's grant application size to that of men in 2015 and 2023**

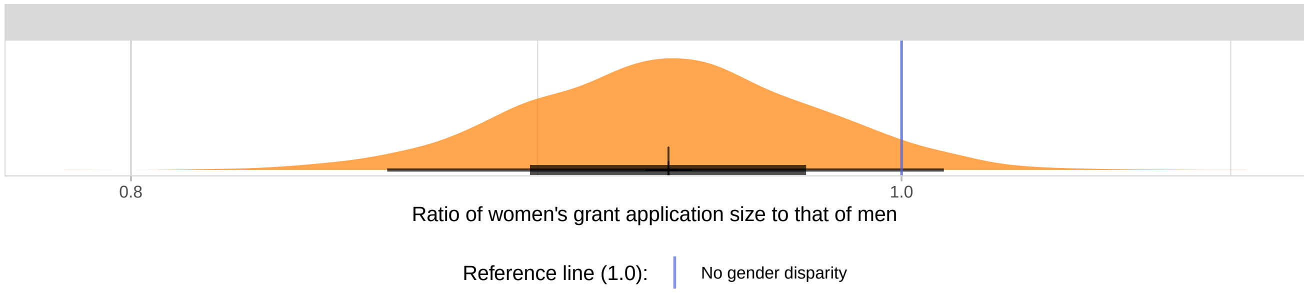



The estimates are based on a model that incorporates all main effects and interactions between gender, grade, school and year. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

Looking for differences at the level of each category reduces our statistical power because we have less observations contributing to each conclusion. We can also estimate the average difference between grants applied for by women and men across the whole sample while controlling for grade and school.

Figure 14 shows an estimate of the 'underlying' disparity between the sizes of women's and men's applications. It suggests women's grants are probably around 7% smaller (the best estimate of 0.93) – but it is possible, although unlikely, they are the same size (the 66% region of credibility does not overlap 1.0 but the region of 95% credibility does).

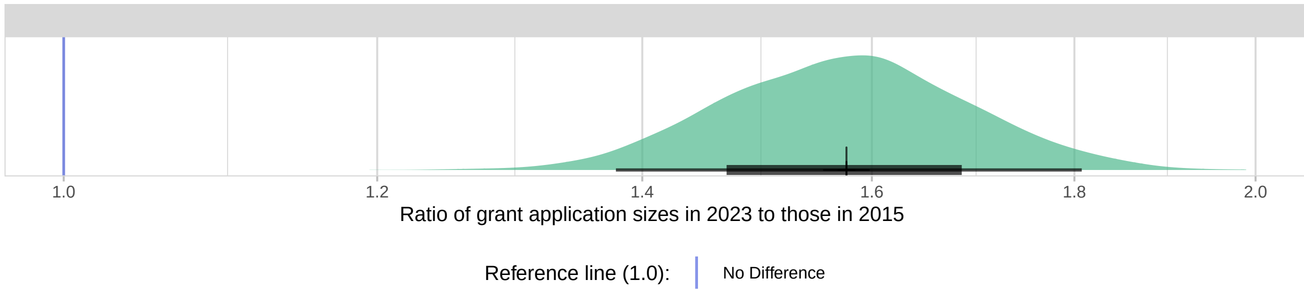
**Figure 14: Average ratio of women's grant application size to that of men**




The estimates are based on a model that incorporates all main effects and interactions between gender, grade and school. The estimates are averaged over the values of grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

Figure 15 shows that the average grant size applied for has increased by around 60% between 2015 and 2023.

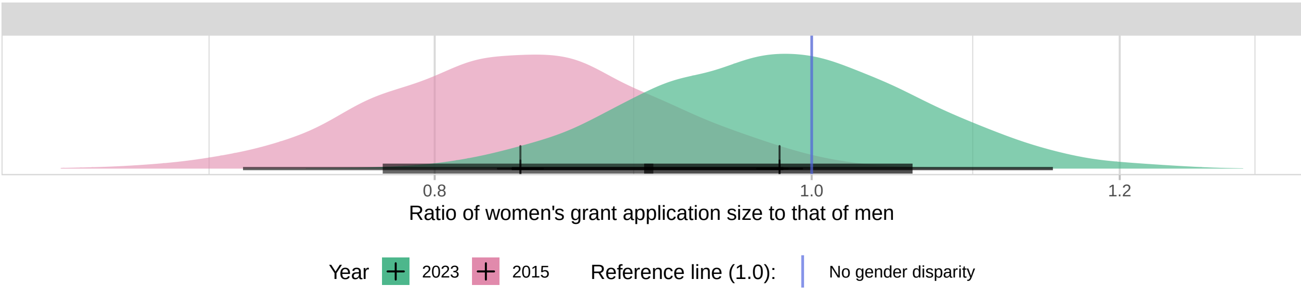
**Figure 15: Average change in grant size between 2015 and 2023**




The estimates are based on a model that incorporates all main effects and interactions between gender, grade, school and year. The estimates are averaged over values of gender, grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

**Figure 16**, which compares the marginal difference between female and male PIs in 2015 and 2023, shows an indication that women's grants have been catching up in size to men's grants, although there is a lot of uncertainty in the estimates. In 2015, we estimate that women's applications were smaller (pink distribution almost entirely to the left of 1.0), in 2023 that suggestion had almost vanished (green distribution is close to being centred on 1.0).

**Figure 16: Average ratio of women's grant application size to that of men in 2015 and 2023**




The estimates are based on a model that incorporates all main effects and interactions between gender, grade, school and year. The estimates are averaged over values of grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

## Who is successful?

**Figure 17** shows success rate by gender, grade and school. The success rates in the School of Arts and Humanities and the School of Humanities and Social Sciences are generally lower than those in the other four schools, except at grade 7 where the success rates are lowest in the School of Biological Sciences and the School of Physical Sciences. The 'All schools' column shows a general increase in success rate with grade.

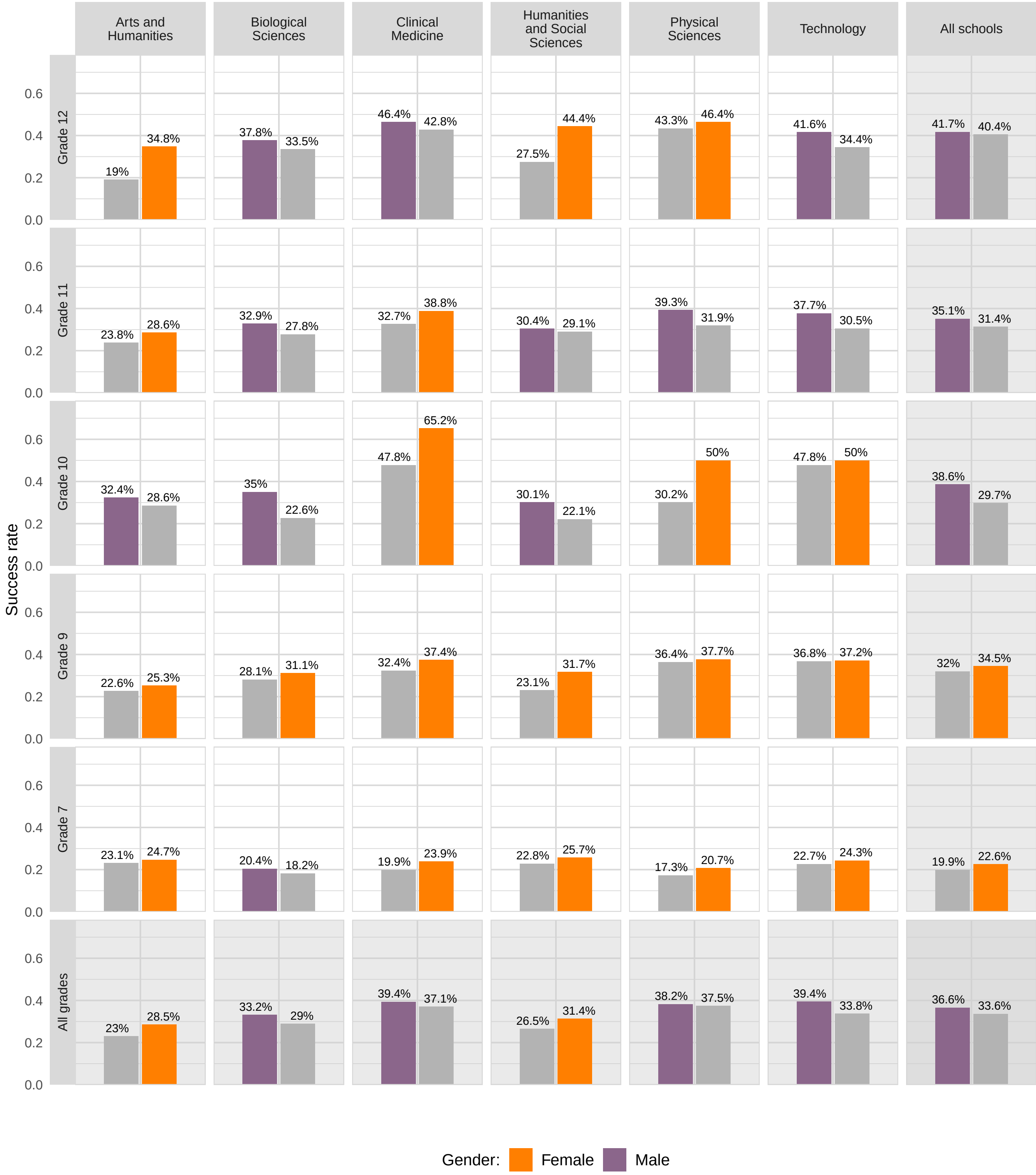
**Figure 18** shows the estimated success rate for each category (note that because of the variation in success rates, each school has a different x-axis). There are rarely strong indications that success rates vary by gender. There is one exception to this at grade 12 in the School of Humanities and Social Sciences, where we estimate women have higher success rates, by a little over 50%. There are eight other grade/school combinations where there are indications of a difference – four where women might be more successful:

- School of Arts and Humanities - grade 12,
- School of Clinical Medicine - grade 9 and grade 10,
- School of Humanities and Social Sciences- grade 9,

and two where men might be:

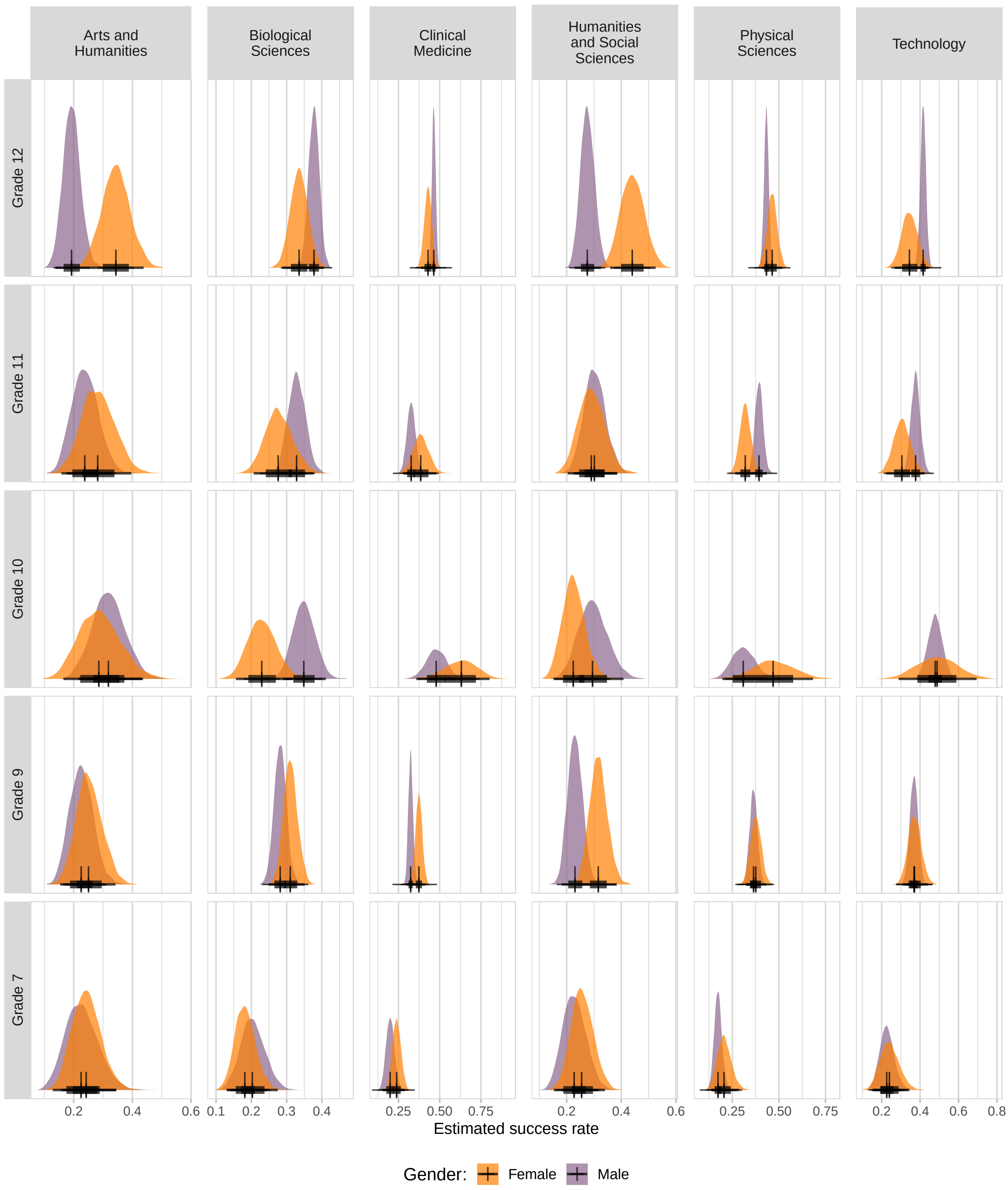
- School of Biological Sciences - grade 10 and grade 12,
- School of Physical Sciences - grade 11,
- School of Technology - grade 11 and grade 12.

### Figure 17: Success rate by gender, school and grade of the lead PI




Bars on the left show the success rate of men, bars on the right show the success rate of women. The bar with the higher value is highlighted.

**Figure 18: Estimated success rate by gender, school and grade of the lead PI**



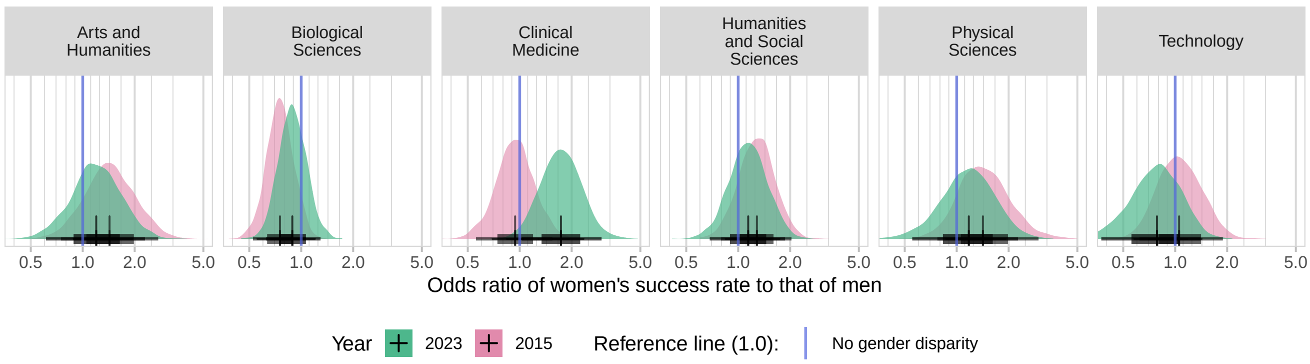

The estimates are based on a model that incorporates all main effects and interactions between gender, grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval.

# Findings

**Figure 19** incorporates the effect of time – showing our estimates of the situation in 2015 and in 2023 taking account of changes over time. In these graphs, we no longer present women's and men's success rates, instead we show our estimate of the difference between the rates. An odds ratio greater than 1.0 indicates women are applying more than men, a ratio below 1.0 indicates women are applying less.

Our estimates suggest that women's success rate in the School of Clinical Medicine has increased over time, relative to that of men, and probably exceeded it. Estimates for other schools do not suggest any large disparities or substantial changes over time.

**Figure 19: Average odds ratio of women's success rate to that of men**




The estimates are based on a model that incorporates all main effects and interactions between gender, grade, school and year. The estimates are averaged over values of grade. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

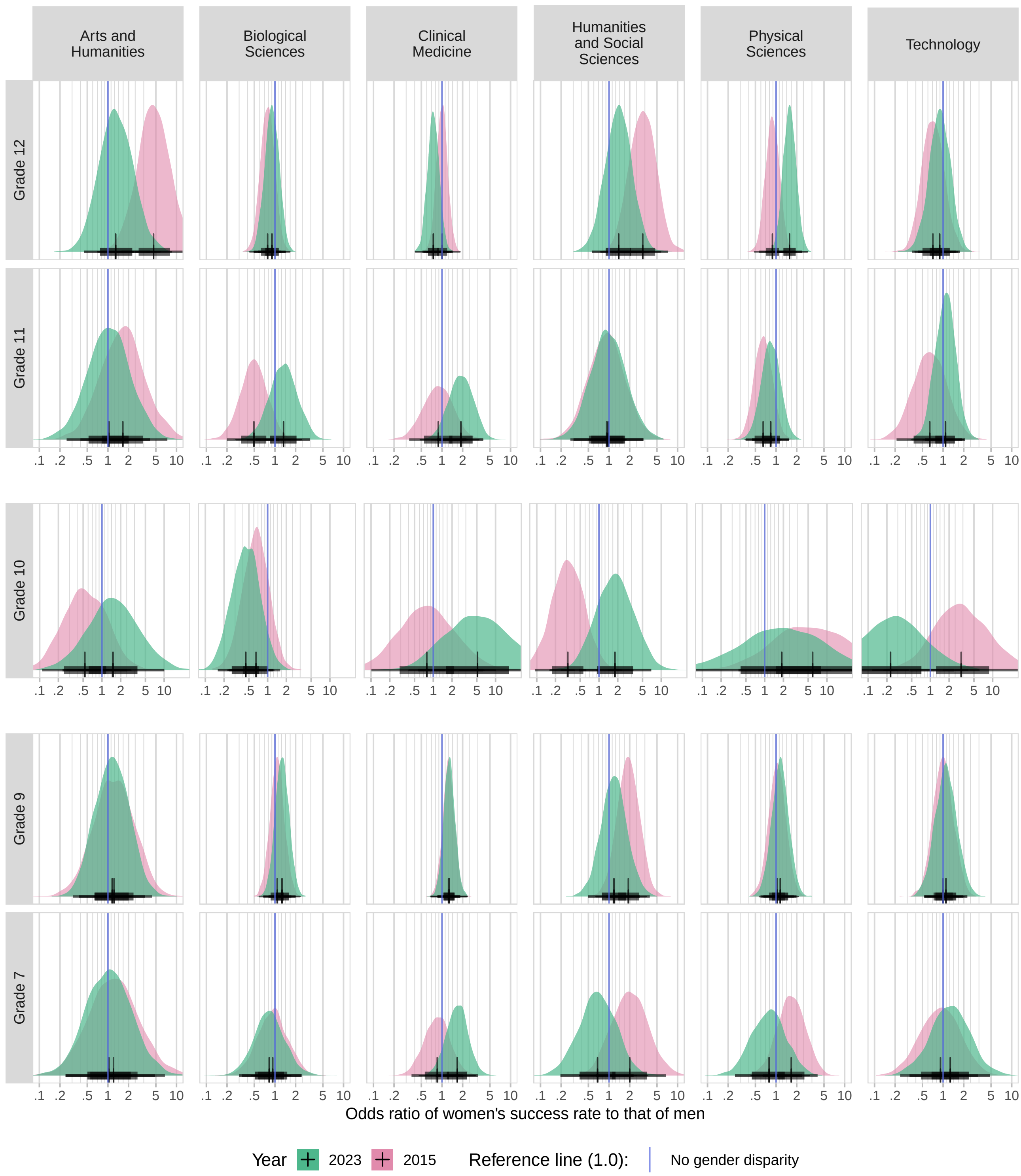
**Figure 20** attempts to break these changes down into grade/school categories; however, given the ambiguous effects seen at the level of the schools it is unsurprising that we see only a few indications of changes at grade school category levels. There are three grade school combinations where there are indications that women's success rate has increased relative to men's:

- School of Biological Sciences - grade 11,
- School of Humanities and Social Sciences - grade 10,
- School of Physical Sciences - grade 12,

and two combinations where there is an indication that men's success rate has increased relative to that of women:

- School of Arts and Humanities - grade 12,
- School of Technology - grade 10.

**Figure 20: Average odds ratio of women's success rate to that of men in 2015 and 2023**

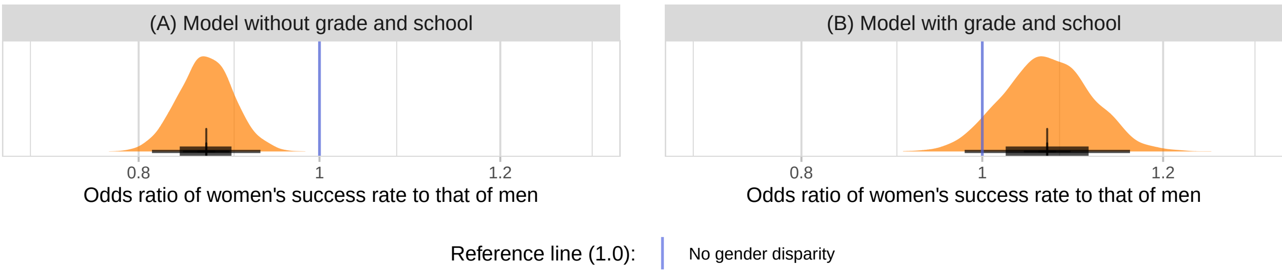



The estimates are based on a model that incorporates all main effects and interactions between gender, grade, school and year. The x−axis has been log−transformed. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

# Findings

**Figure 21** shows the effect of including grade and school in our estimates. Panel A shows the estimate of the marginal gender difference in success ignoring grade and school; this estimate is around 0.87 and does not overlap 1.0, clearly suggesting women are less successful when ignoring structural disparities. However, when we include grade and school (Panel B) the estimated odds ratio changes to around 1.1, suggesting women are more successful but leaving open the possibility that men and women's success rates are the same (as the 95% interval overlaps 1.0). In the previous section, our estimates indicated that women tended to apply for smaller grants, in the supplementary analysis we explore whether these factors are related (see Application size as predictor of success), as our analysis suggests that success rate decreases with grant size.

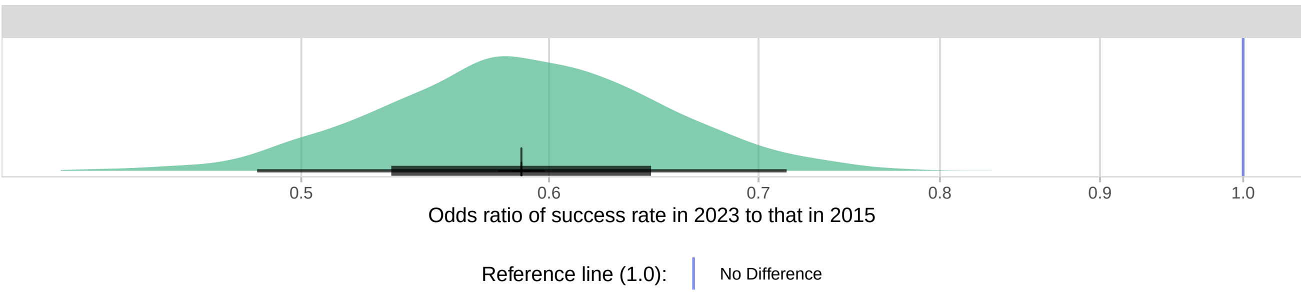
**Figure 21: Average odds ratio of women's success rate to that of men – model comparison**




The estimates in (A) are based on a model in which the only predictor is gender; the estimates in (B) are based on a model that incorporates all main effects and interactions between gender, grade and school. The estimates are averaged over values of grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

**Figure 22** shows the change in overall success rate for both genders over time. It shows a clear fall in the average success rate, with PIs in 2023 having an odds ratio of being successful of around 0.6 compared to 2015.

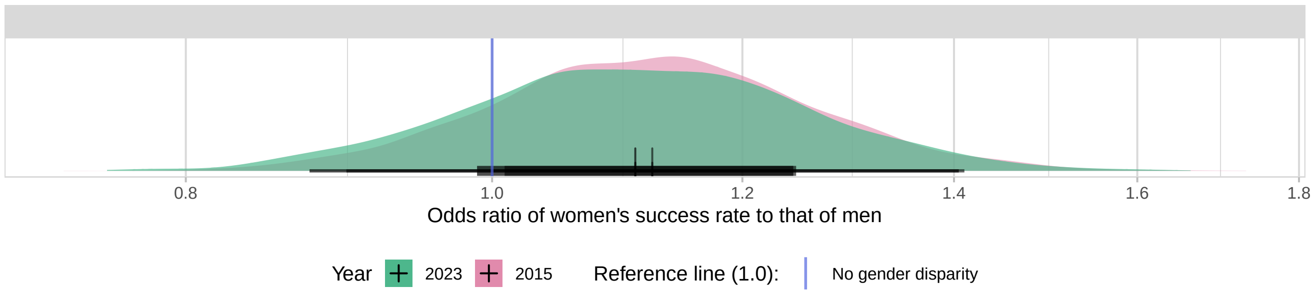
**Figure 22: Average change in success rate between 2015 and 2023**




The estimates are based on a model that incorporates all main effects and interactions between gender, grade, school and year. The estimates are averaged over the values of gender, grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

Figure 23 shows the difference between success rates for women and men in 2015 and 2023. In both cases there is an indication that women have higher success rates, with little indication of a change over the years.

**Figure 23: Average odds ratio of women's success rate to that of men in 2015 and 2023**




The estimates are based on a model that incorporates all main effects and interactions between gender, grade, school and year. The estimates are averaged over the values of grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

# Summary

Our findings suggest that many of the notable gender disparities in application rates, grant size and success probabilities arise from the current professional structure of the university. Our analysis, accounting for these structural disparities, reveals a complex and nuanced relationship between gender and grant seeking behaviour. Grade and school consistently emerge as critical factors in the patterns of disparity across all three stages.

This analysis highlights the importance of the large structural factors (grade and school) in influencing disparities in grant funding. It is also possible that smaller-scale structural factors could be important. For example, we consider all grants as part of a continuum of size, making no distinction between fellowships, project or programme grants, and we consider each school as homogeneous. In doing this, we attempt to find a balance between controlling for important structural factors, an awareness of the limitations of our data and getting tangled in the weeds of unnecessary detail.

This work attempts to provide a nuanced quantitative mapping of disparities and how they have changed over the previous nine years. It will be important to supplement this with a more qualitative exploration of the factors giving rise to these patterns at a school and grade level, supported by the contextual knowledge of those in schools and departments, to craft suitable interventions.

This work suggests two routes to reducing disparities in grant funding: identifying and addressing the specific causes of disparities at particular grades, in particular schools, and a wider challenge of addressing the structural disparities, the importance of which is underlined by this analysis.

## Assumptions

We obtained data from the Research Office on grant applications from the X5 database of grant applications, and data from HR on the contracts and demographic characteristics of applicants. Because we are working with real-world data we have to make assumptions to organise the data to enable our analysis.

- We include all individuals on research or academic contracts from grade 7 upwards – we are aiming to be inclusive of those who might apply for grants.
- The HR data contains detailed names for grades and position titles for each role. However, there is a huge variety in these grade names and position titles; for example, some staff are on NHS bands or other bespoke pay scales for affiliated institutions. To allow our analysis, we mapped all the grade names and position titles into five grade levels: grade 7, grade 9 (previously 'lecturer'), grade 10 (previously 'senior lecturer'), grade 11 (previously 'reader') and grade 12 (previously 'professor'). Because of the complexity of NHS grades, we reviewed our mapping for the School of Clinical Medicine with the HR team in the School of Clinical Medicine. For historical reasons unknown to us, grade 8 is not used in the research scale.
- Many of the individuals in our dataset were promoted between 2015 and 2023. For these individuals, for each application, we use their grade at the point of that application (so one person may have applications at more than one grade over time). In addition, some individuals have multiple concurrent contracts. In this case, we assign the highest grade contract they are employed on at the time of application. Occasionally, individuals' posts are regraded during their employment. In this case we cannot tell from the HR records when they were regraded so we take their final grade as their grade throughout the contract.
- We only analyse the gender of the lead PI. We have not included data on co-investigators (CoIs). We suspect data on CoIs is less reliable and less complete.
- We treat each application as independent – we do not group applications from the same individual or estimate individual/applicant effects.
- We ignore each individual's reported Full Time Equivalent (FTE) for two reasons: firstly, we know that academics and researchers have a different proportion of their time available for research regardless of their FTE, so we are concerned that FTE is not a good measure of 'time available for research'; secondly, the FTE data contains a cohort (1,121) who have 0 FTE contracts (and no other concurrent research or academic contracts), but who have applied for grants; this makes us cautious about how we should interpret the FTE data.
- As a starting point, we include all research grants that are applied for externally. We do not consider other sources of funding such as industrial contracts or 'start-up packages'.
- The grant size recorded is the size of the grant received by the University of Cambridge. For grants led by the University of Cambridge, this will be the total grant size including funding that is transferred to collaborators. For grants where the University of Cambridge PI is a collaborator on a larger grant, the size recorded will be the portion received by the University of Cambridge.
- Some grants are submitted by individuals who were not University of Cambridge staff members at the time of their application; this most commonly occurs for fellowship schemes. We can only see these individuals' demographic information if they are successful and become members of staff. To avoid a 'success bias' we exclude all these applications (2,982) from our dataset.

- The (vast) majority of research grants are awarded to academics in departments that are part of the six disciplinary schools in the university. However, some grants (106) were awarded to non-school institutions, which we exclude because our analysis is school-based.

- We exclude grants allocated to serving PVCs, as these grants include institutional grants or grants to support broader research initiatives, rather than relating to the personal research portfolio of the PVC. PVCs are not listed among the positions in this dataset, so we obtained a list of the terms and names of all PVCs and removed these individuals (61) from the sample between the appropriate dates, based on an identifier and name search. This issue will also arise with heads of department, although to a much smaller extent and the group of individuals is also much larger, so we did not exclude heads of department.

- We exclude doctoral training grants (225) as they do not normally relate to the personal research portfolio of the PI.

- We exclude donations and studentships (601) as we are focusing on externally applied for research grants.

- Different types of research funders are willing to support a different range of research costs. For example, research councils will pay 80% of the full economic costs whereas charities tend to pay 60% of full economic costs. Furthermore, some funders award a different amount to that which was requested. For this reason, we use the full economic cost of applications and awards in our analysis.

- Seven grants (7) in our dataset still have the status of 'submitted'. A final decision has not been recorded for these cases. These observations are included in the 'Who applies?' and 'How large are the applications?' datasets but are excluded from the 'Who is successful?' dataset.

## Methods

We run our Bayesian models using R packages *brms* and *rstanarm*. Using these models, we can plot expected predictive distributions through *epred_draws* from the *tidybayes* package. Finally, marginal effects are estimated using the *emmeans* package, in conjunction with *gather_emmeans_draws* from *tidybayes*. Across all models we use *contr.equalprior_pairs* for gender and *contr.equalprior_deviations* for grade and school. Variable year (where applicable) is centred on 2019 (the mid point of our sample). At this stage we do not account for individual/applicant effects.

### Who applies?

We know that grade and school are important predictors and gender distribution varies across both, so we use main effects alongside both two-way and three-way interactions. Our baseline analysis is based on the following linear model (using the negative binomial distribution):

$$\begin{aligned}\text{ApplicationRate}_i \;&= \beta_0 + \beta_1 \text{Ge}_i + \beta_2 \text{S}_i + \beta_3 \text{Gr}_i \\ &+\beta_4 \text{Ge}_i \text{S}_i + \beta_5 \text{Ge}_i \text{Gr}_i + \beta_6 \text{S}_i \text{Gr}_i \\ &+\beta_7 \text{Ge}_i \text{S}_i \text{Gr}_i + \log(\text{L}_i) + \epsilon\end{aligned}$$

where ApplicationRate is the number of applications individual *i* submitted in the observed period, *Ge* is the gender, *S* is the school and *Gr* is the grade of individual *i*. $\beta_j$ are the estimated coefficients and  is the offset accounting for variation in length of contracts. $\epsilon$ is the vector of the error terms. The model uses *N(log(0.93), 0.1)* prior for the intercept and *N(0, 0.1)* for the betas. We use *inv_gamma(0.4,0.3)* prior for the shape parameter.

As the data is zero inflated we use a zero-inflation model:

$$\log\left(\frac{1-\pi_i}{\pi_i}\right) = \alpha_0 + \alpha_1 \mathrm{Ge}_i + \alpha_2 \mathrm{S}_i + \alpha_3 \mathrm{Gr}_i$$

where $\pi_i$ is the probability of observation *i* being a structural zero. The zero-inflation part of the model uses *N(logit(0.64), 0.1)* prior for the intercept and *N(0,0.1)* for the betas.

To examine how the rate of applications has changed over time, we fitted a four-way interaction model with main effects:

$$\begin{aligned} \mathrm{ApplicationRate}_i \; = \; & \beta_0 + \beta_1 \mathrm{Ge}_i + \beta_2 \mathrm{S}_i + \beta_3 \mathrm{Gr}_i + \beta_4 \mathrm{Y}_i \\ & + \beta_5 \mathrm{Ge}_i \mathrm{S}_i + \beta_6 \mathrm{Ge}_i \mathrm{Gr}_i + \beta_7 \mathrm{Ge}_i \mathrm{Y}_i + \beta_8 \mathrm{S}_i \mathrm{Gr}_i + \beta_9 \mathrm{S}_i \mathrm{Y}_i + \beta_{10} \mathrm{Gr}_i \mathrm{Y}_i \\ & + \beta_{11} \mathrm{Ge}_i \mathrm{S}_i \mathrm{Gr}_i + \beta_{12} \mathrm{Ge}_i \mathrm{S}_i \mathrm{Y}_i + \beta_{13} \mathrm{Ge}_i \mathrm{Gr}_i \mathrm{Y}_i + \beta_{14} \mathrm{S}_i \mathrm{Gr}_i \mathrm{Y}_i \\ & + \beta_{15} \mathrm{Ge}_i \mathrm{S}_i \mathrm{Gr}_i \mathrm{Y}_i + \log(\mathrm{L}_i) + \epsilon \end{aligned}$$

where, as above, ApplicationRate is the number of applications individual *i* submitted in the observed period, *Ge* is the gender, *S* is the school, *Gr* is the grade of individual *i* and *Y* is the year in which individual *i* is observed. $\beta_j$ are the estimated coefficients and is the offset accounting for variation in length of contracts. $\epsilon$ is the vector of the error terms. The zero-inflation model is defined the same as above.

### How large are the applications?

Our baseline analysis relies on a linear model using a Gaussian distribution for the log of grant size. We have conducted a series of prior checks based on which a *N(12.5,0.5)* prior was selected for the intercept and a *N(0,0.5)* prior was selected for betas. The baseline analysis on 'How large are the applications' is grounded in the following three-way interaction model:

$$\begin{aligned} \log(\mathrm{Total\_fEC})_i \; = \; & \beta_0 + \beta_1 \mathrm{Ge}_i + \beta_2 \mathrm{S}_i + \beta_3 \mathrm{Gr}_i \\ & + \beta_4 \mathrm{Ge}_i \mathrm{S}_i + \beta_5 \mathrm{Ge}_i \mathrm{Gr}_i + \beta_6 \mathrm{S}_i \mathrm{Gr}_i \\ & + \beta_7 \mathrm{Ge}_i \mathrm{S}_i \mathrm{Gr}_i + \epsilon \end{aligned}$$

where *Ge* is the gender, *S* is the school and *Gr* is the grade of individual *i*. $\beta_j$ are the estimated coefficients and $\epsilon$ is the vector of the error terms.

To examine the size of grants over the years, a four-way interaction model with main effects is used (same priors as above):

$$\begin{aligned} \log(\mathrm{Total\_fEC})_i \; = \; & \beta_0 + \beta_1 \mathrm{Ge}_i + \beta_2 \mathrm{S}_i + \beta_3 \mathrm{Gr}_i + \beta_4 \mathrm{Y}_i \\ & + \beta_5 \mathrm{Ge}_i \mathrm{S}_i + \beta_6 \mathrm{Ge}_i \mathrm{Gr}_i + \beta_7 \mathrm{Ge}_i \mathrm{Y}_i + \beta_8 \mathrm{S}_i \mathrm{Gr}_i + \beta_9 \mathrm{S}_i \mathrm{Y}_i + \beta_{10} \mathrm{Gr}_i \mathrm{Y}_i \\ & + \beta_{11} \mathrm{Ge}_i \mathrm{S}_i \mathrm{Gr}_i + \beta_{12} \mathrm{Ge}_i \mathrm{S}_i \mathrm{Y}_i + \beta_{13} \mathrm{Ge}_i \mathrm{Gr}_i \mathrm{Y}_i + \beta_{14} \mathrm{S}_i \mathrm{Gr}_i \mathrm{Y}_i \\ & + \beta_{15} \mathrm{Ge}_i \mathrm{S}_i \mathrm{Gr}_i \mathrm{Y}_i + \epsilon \end{aligned}$$

where, as above, *Ge* is the gender, *S* is the school, *Gr* is the grade of individual *i* and *Y* is the year in which individual *i* is observed. $\beta_j$ are the estimated coefficients and $\epsilon$ is the vector of the error terms.

### Who is successful?

Our baseline analysis uses a logistic linear regression and weakly informative prior *N(0,1)* for both the intercept and betas. The baseline results on 'Who is successful?' are based on the following three-way interaction model:

$$\begin{aligned}\text{Outcome}_i &= \beta_0 + \beta_1 \text{Ge}_i + \beta_2 \text{S}_i + \beta_3 \text{Gr}_i \\ &+\beta_4 \text{Ge}_i \text{S}_i + \beta_5 \text{Ge}_i \text{Gr}_i + \beta_6 \text{S}_i \text{Gr}_i \\ &+\beta_7 \text{Ge}_i \text{S}_i \text{Gr}_i + \epsilon\end{aligned}$$

where *Ge* is the gender, *S* is the school and *Gr* is the grade of individual *i*. $\beta_j$ are the estimated coefficients and $\epsilon$ is the vector of the error terms. Outcome takes 1 if an application was successful.

Time analysis is based on the following four-way interaction model:

$$\begin{aligned}\text{Outcome}_i &= \beta_0 + \beta_1 \text{Ge}_i + \beta_2 \text{S}_i + \beta_3 \text{Gr}_i + \beta_4 \text{Y}_i \\ &+\beta_5 \text{Ge}_i \text{S}_i + \beta_6 \text{Ge}_i \text{Gr}_i + \beta_7 \text{Ge}_i \text{Y}_i + \beta_8 \text{S}_i \text{Gr}_i + \beta_9 \text{S}_i \text{Y}_i + \beta_{10} \text{Gr}_i \text{Y}_i \\ &+\beta_{11} \text{Ge}_i \text{S}_i \text{Gr}_i + \beta_{12} \text{Ge}_i \text{S}_i \text{Y}_i + \beta_{13} \text{Ge}_i \text{Gr}_i \text{Y}_i + \beta_{14} \text{S}_i \text{Gr}_i \text{Y}_i \\ &+\beta_{15} \text{Ge}_i \text{S}_i \text{Gr}_i \text{Y}_i + \epsilon\end{aligned}$$

where, as above, *Ge* is the gender, *S* is the school, *Gr* is the grade of individual *i* and *Y* is the year in which individual *i* is observed. $\beta_j$ are the estimated coefficients and $\epsilon$ is the vector of the error terms. Outcome takes 1 if an application was successful.

## Presentation of results

To avoid the danger of identifying individuals in the data we only show our model estimates of application rates, application sizes and success rate. That is to say, we build our model using the original data, and then show the outputs of the model. Because what we present is the output of the model, and not a summary of the data, even in grade/school combinations with small numbers of individuals it is not possible to identify the performance of individual researchers.

## Supplementary analysis

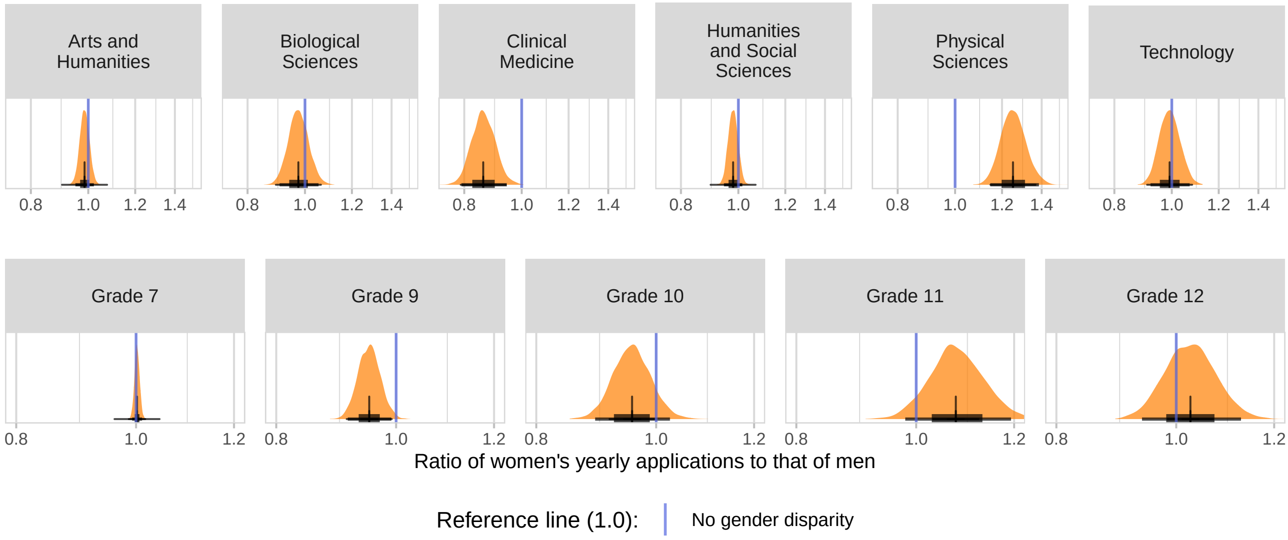
### Who applies? – marginal effects

In the body of the report we show the estimated application rate of women and men to allow comparison (Figure 5), but we do not show directly our estimate for the difference in application rates.

**Figure 24** shows our estimate of these average differences, or marginal effects[12], taking into account structural disparities for each grade and school. There are a few cases where the 95% credible interval (thinner line at the bottom of each distribution) falls fully beyond parity. The School of Clinical Medical appears to have a lower average rate of application by women. The opposite is true for the School of Physical Sciences, where women have around a 25% higher rate of applications than men. Looking at grades, there is a strong indication that rates of application by women fall from grade 7 to grade 9 and rise back again through to grade 11 and 12, where there is some indication that they exceed that of men.

12. Marginal effects do not account for grade 'Other grade'. The average effect is computed over the remaining values of grade.

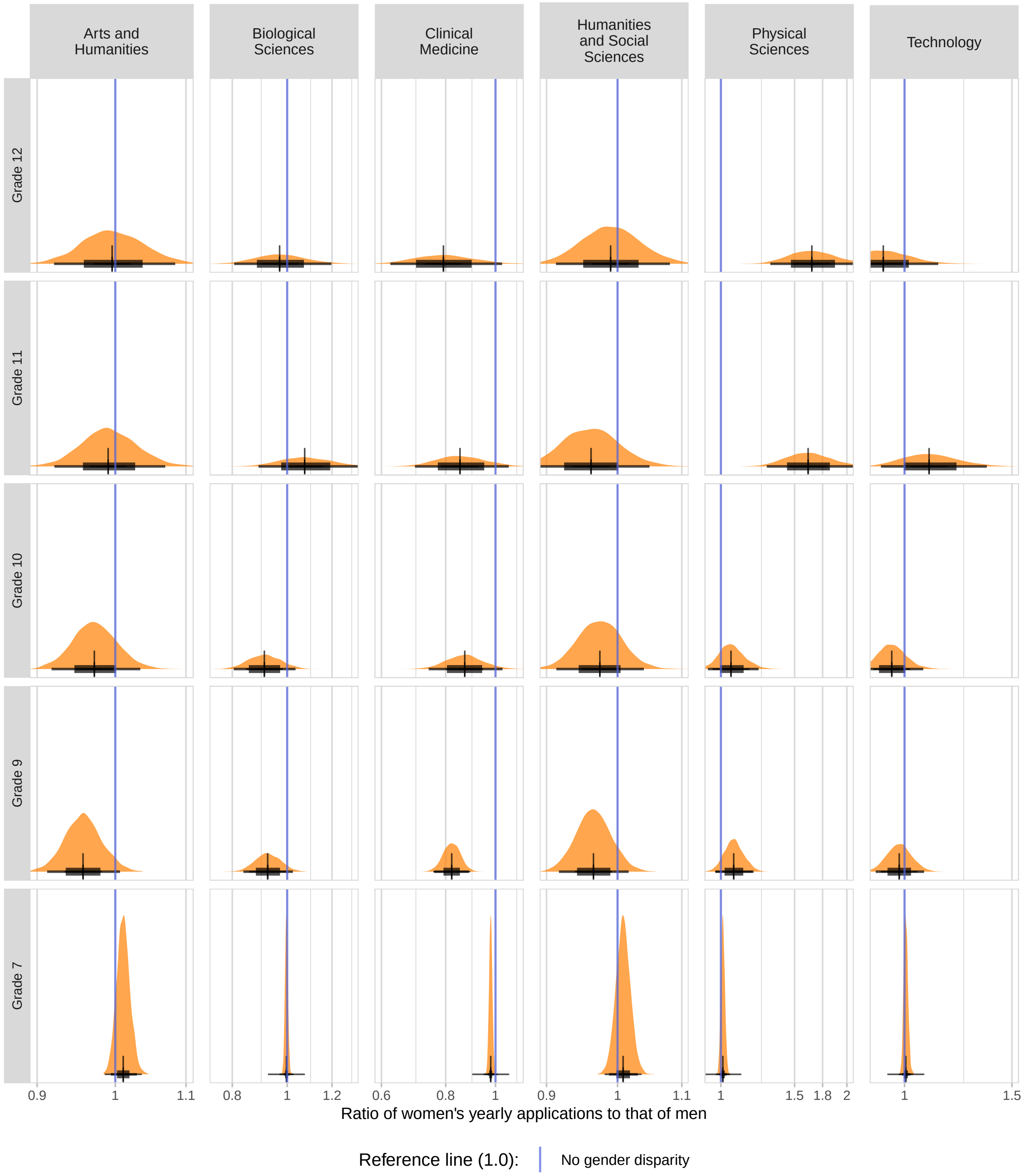
**Figure 24: Average ratio of women's application rate to that of men by school and by grade**




The estimates are based on a model that incorporates all main effects and interactions between gender, grade and school. The estimates are averaged respectively over values of grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

Figure 25 breaks these results down into the familiar grade/school categories. It shows indications that over the last 9 years, women have applied at a lower rate in grades 9 to 12 in the School of Clinical Medicine, and grades 9 and 10 in the School of Biological Sciences. In contrast, we clearly estimate that the rate of application by women has been higher over the last 9 years in grades 11 and 12 in the School of Physical Sciences and some indication this is the case in grade 11 in the School of Technology.

**Figure 25: Average ratio of women's application rate to that of men by school and grade**



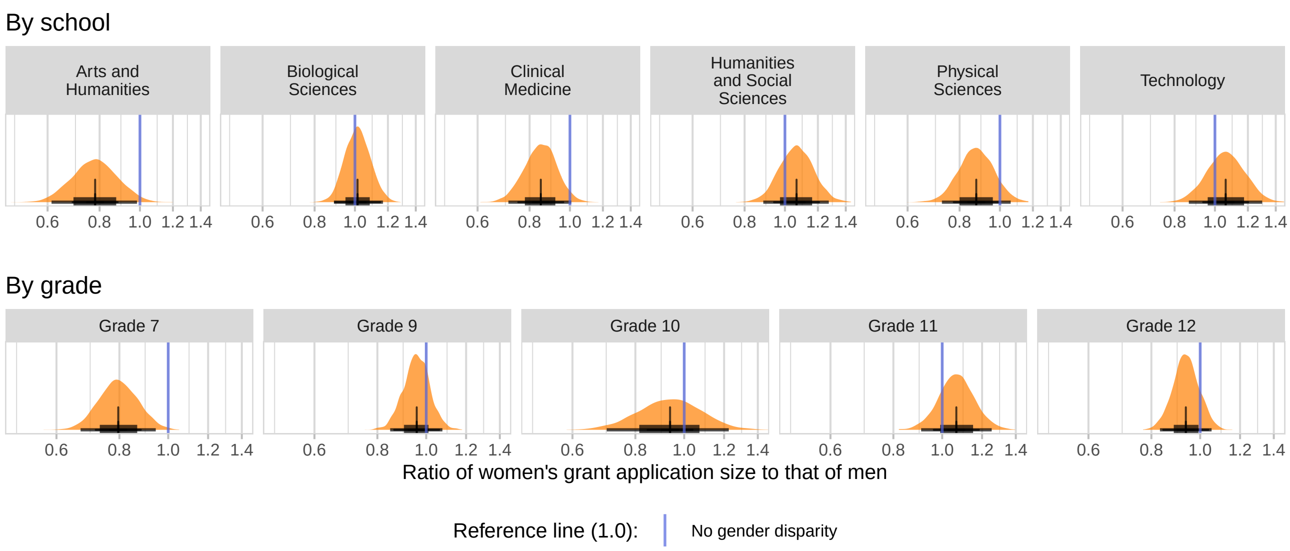

The estimates are based on a model that incorporates all main effects and interactions between gender, grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

### How large are the applications? – marginal effects

In the body of the report we show the estimated size of applications from women and men to allow comparison (Figure 11), but we do not show directly our estimate for the ratio of application sizes.

Figure 26 shows our estimate of these average differences, marginal effects, for gender taking account of structural disparities for each grade and school. There are two cases where parity falls outside the 95% credible interval (thinner line at the bottom of each distribution) – with indications that women's grants are smaller in the School of Arts and Humanities, and at grade 7.

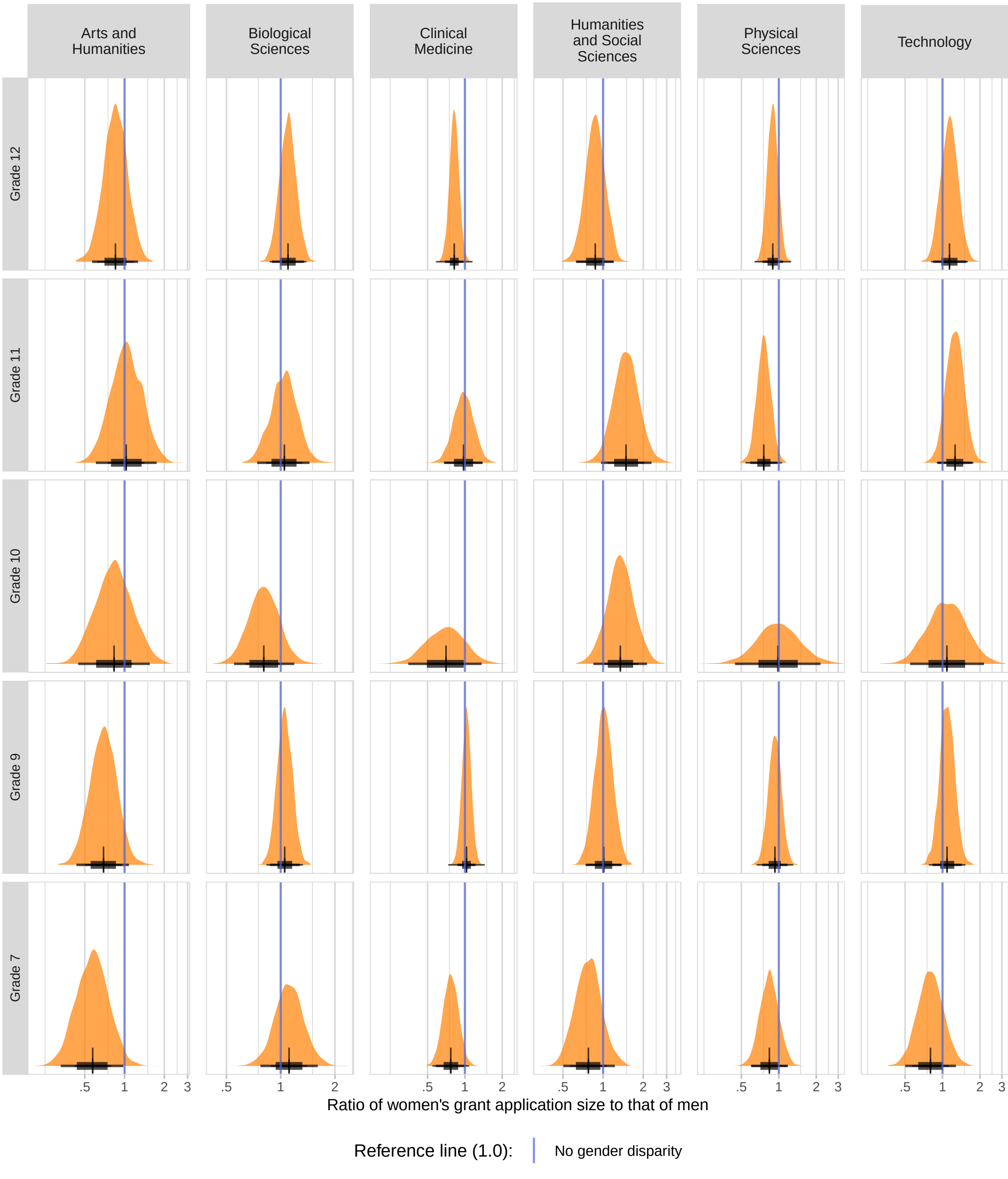
**Figure 26: Average ratio of women's grant application size to that of men by school and by grade**




The estimates are based on a model that incorporates all main effects and interactions between gender, grade and school. The estimates are averaged respectively over values of grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

Figure 27 breaks these results down into the familiar grade/school categories. There is only one combination where there are strong indications of a difference – in the School of Arts and Humanities at grade 7. Across the other combinations, there are indications of disparities in both directions.

**Figure 27: Average ratio of women's grant application size to that of men by school and grade**



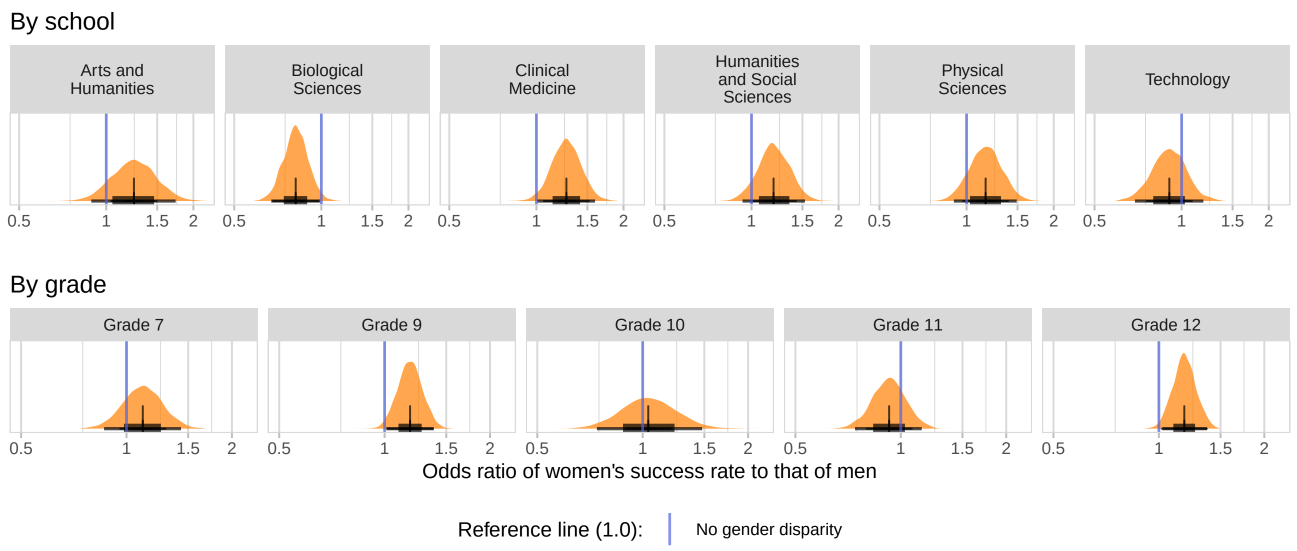

The estimates are based on a model that incorporates all main effects and interactions between gender, grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

### Who is successful? – marginal effects

In the body of the report we show the estimated rates of success for women and men to allow comparison (Figure 18), but we do not show directly our estimate for the odds-ratio for success.

Figure 28 shows our estimate of these odds-ratios, marginal effects, for gender taking account of structural disparities for each grade and school. This shows that in the School of Clinical Medicine, women appear to have a higher rate of success than men, with the reverse being the case in the School of Biological Sciences. However, this analysis tells us nothing about the reasons for these differences. It will be key to build on this to understand the drivers of these differences to support interventions to address them – it would be valuable to draw on both qualitative, expertise based and quantitative analyses to do this. We take a step in this direction in the final section of this report, where we look at the relationship between grant size, success and gender.

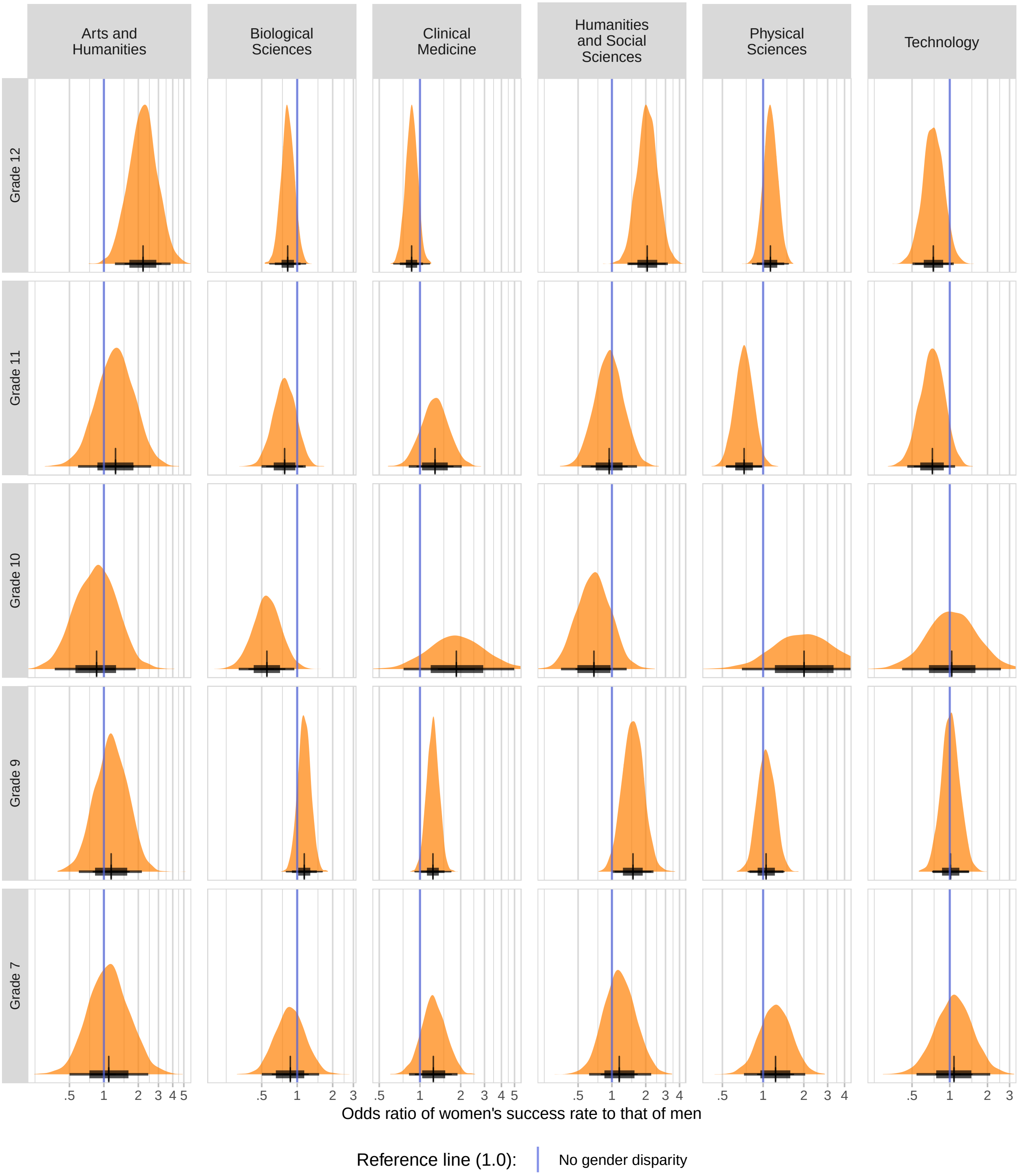
**Figure 28: Average odds ratio of women's success rate to that of men by school and by grade**




The estimates are based on a model that incorporates all main effects and interactions between gender, grade and school. The estimates are averaged respectively over values of grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

Figure 29 breaks down the estimates by grade and school. In the higher grades (10–12), there are examples of disparities in each direction and a range of strengths. At grades 7 and 9 the disparities are weighted towards a lower success rate for women.

**Figure 29: Average odds ratio of women's success rate to that of men by school and grade**



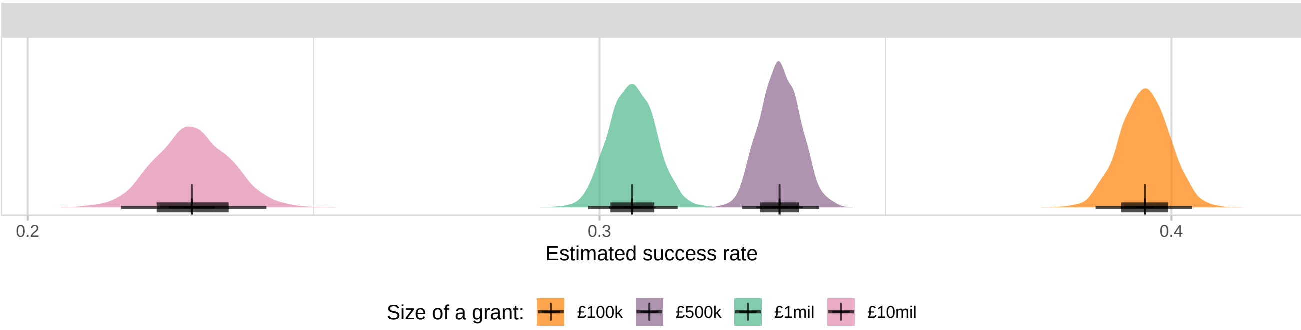

The estimates are based on a model that incorporates all main effects and interactions between gender, grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

### Who is successful? – grant size as a predictor of success

One critical factor in understanding differences in probabilities of success is the size of the grant applied for.

Figure 30 shows that PIs applying for larger grants have substantially lower success rates. We have also shown that women, on average, apply for smaller grants (Figure 14), so it is possible that these two findings are linked.

**Figure 30: Estimated success rate by size of grant application**

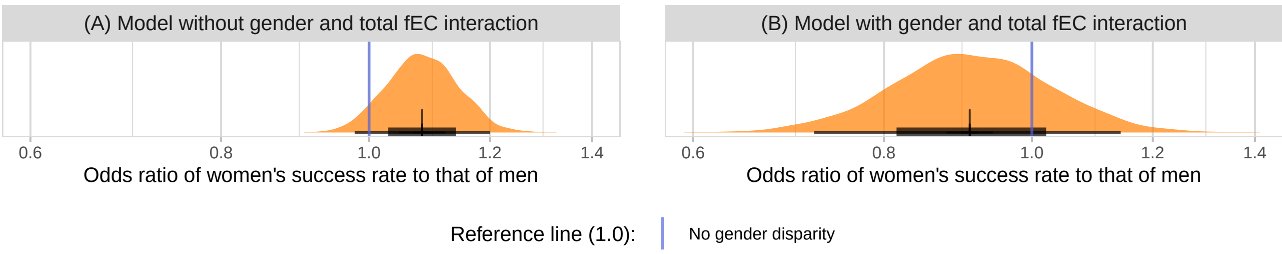



The estimates are based on a model that includes the size of the grant as the only predictor. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval.

To examine this, we ran a three-way interaction model incorporating an additional interaction term between gender and log(Total_fEC), (where Total_fEC is total full economic cost i.e. grant application size).

Figure 31 shows that in a model without the interaction with grant size (first shown in Figure 21), women's success rate appears higher than that of men. However, when the interaction with size is included there is a slight indication that women's success rate is below that of men.

**Figure 31: Average odds ratio of women's success rate to that of men – model comparison**




The estimates in (A) are based on a model that incorporates all main effects and interactions between gender, grade and school; the estimates in (B) are based on a model that incorporates all main effects and interactions between gender, grade and school, and an interaction term between gender and size of grant. The estimates are averaged over values of grade and school, and size of grant. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

Figure 32 presents two models investigating the influence of gender on success rates for different sizes of grant. The simple model only allows interaction of gender and grant size with no account taken of grade or school (A). This model estimates consistently lower success rates for women. However, when grade and school are taken into account (B), the situation is more nuanced with indications that women are more successful in winning smaller grants and little indication that men are substantially more successful in the largest grant category. Together, these figures emphasise the importance of considering career stage and discipline, as the inclusion of these controls explains much of the observed marginal gender differences in Figure 32 (A).

**Figure 32: Average odds ratio of women's success rate to that of men by size of grant application**


The estimates in (A) are based on a model in which the only predictor is gender; the estimates in (B) are based on a model that incorporates all main effects and interactions between gender, grade and school as well as an interaction term between gender and size of grant. The estimates are averaged over values of grade and school. The thicker line at the base of each curve indicates the 66% credible interval, the thinner line indicates the 95% credible interval. The x−axis has been log−transformed. Estimates to the right of the reference line indicate a higher outcome for women; estimates to the left of the reference line indicate a higher outcome for men.

In summary, Figure 14 shows that female PIs, on average, apply for smaller grants than male PIs. Figure 21 indicates a positive marginal effect of gender on success rate. This supplementary analysis suggests that the higher success rate of smaller applications may partly explain the higher odds of success observed for female PIs, and there are indications they preserve their higher rate of success for smaller grants.