

The leaky pipeline: a statistical analysis of self-reported barriers to participation of women and non-binary physicists at undergraduate level

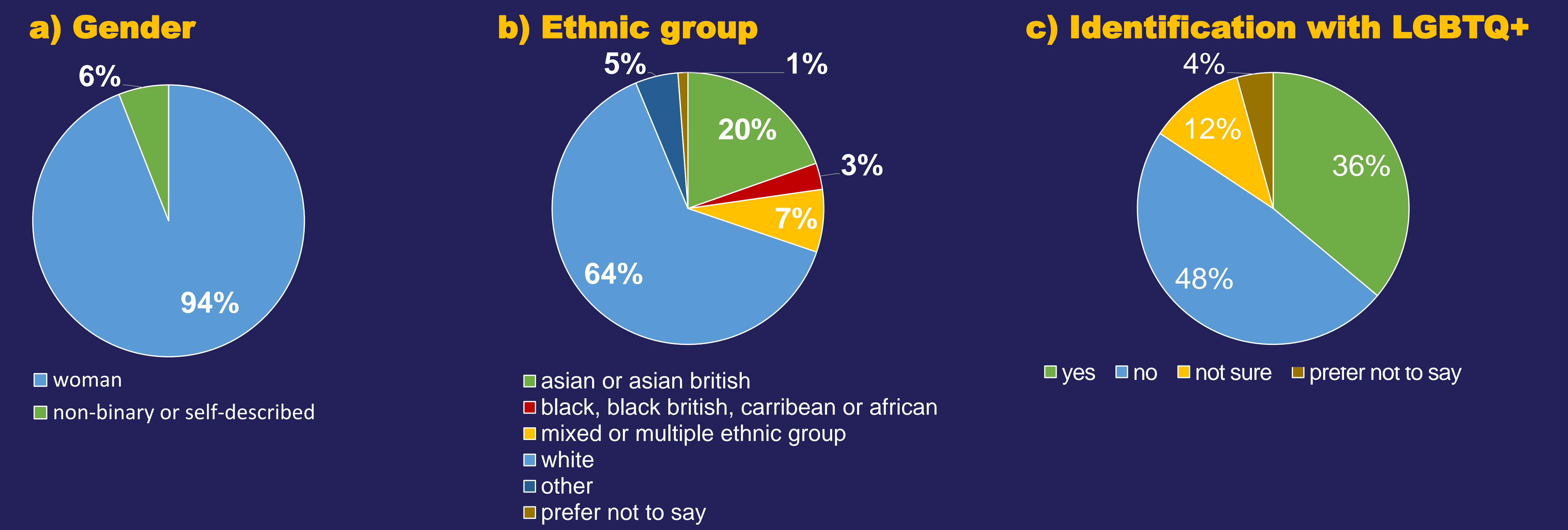
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ABSTRACT

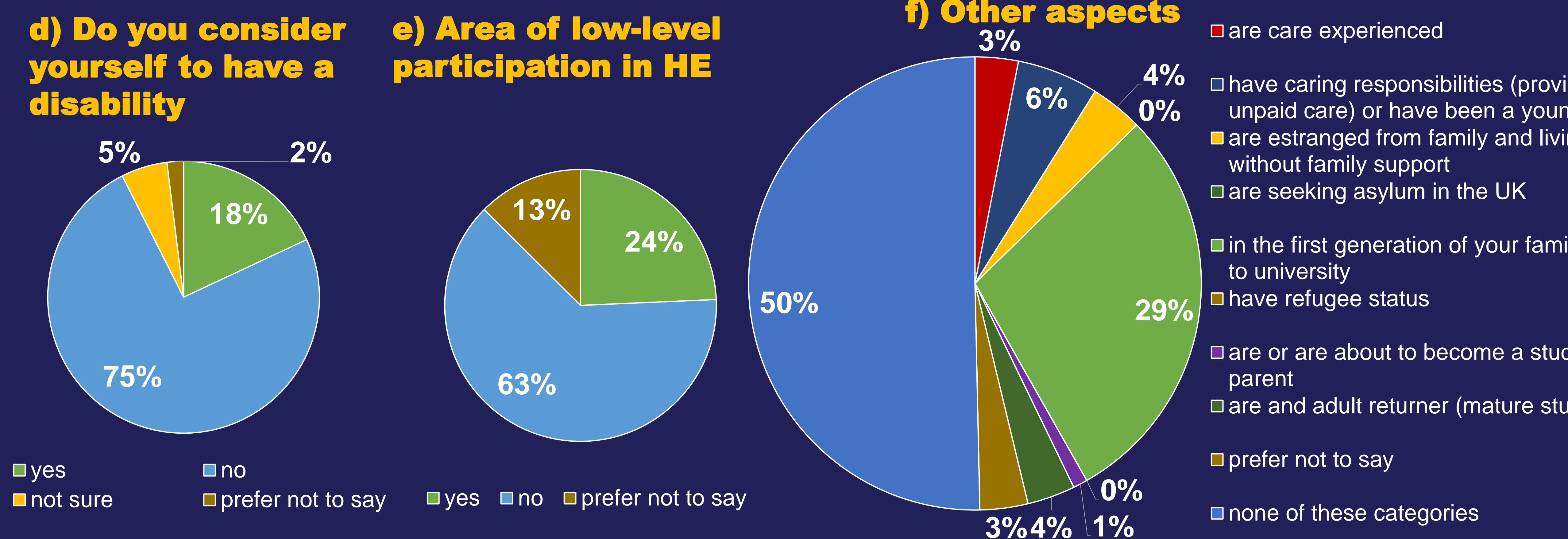
Across STEM subjects, at all stages of their education and professional careers, women are consistently underrepresented [1]. Referred to as the "leaky pipeline", the issue of representation grows worse further along the educational or career path [2-4]. In physics, the reasons and proposed solutions for the leaky pipeline have been discussed for decades, yet any achieved successes exist only within a limited scope, as evidenced by recent statistical reports [5,6]. Further, barriers to participation can be exacerbated for those belonging to more than one minoritized or marginalised group, and gender equality initiatives are increasingly considering intersectional inequalities to provide a more nuanced picture [7].

CUWIP, the Conference for Undergraduate Women and nonbinary Physicists, aims to encourage and support women and non-binary physicists to persist with studies and careers in physics related fields. The conference has run annually in the UK since 2015 and in 2022 it was hosted jointly by the Universities of Glasgow and Strathclyde. Here we present a statistical analysis of the reasons given by applicants for wanting to attend the conference, identifying common themes and self-reported barriers to participation. For many students they are still one of only a handful of women or non-binary students on their course and this is their only opportunity to build shared characteristic peer networks. We present statistical demographic data for the cohort and apply an intersectional lens to themes identified. We hope that this data can provide insight into the barriers faced by minoritised genders studying physics, allowing physics educators to support and reinforce current efforts to improve diversity and inclusion in physics.

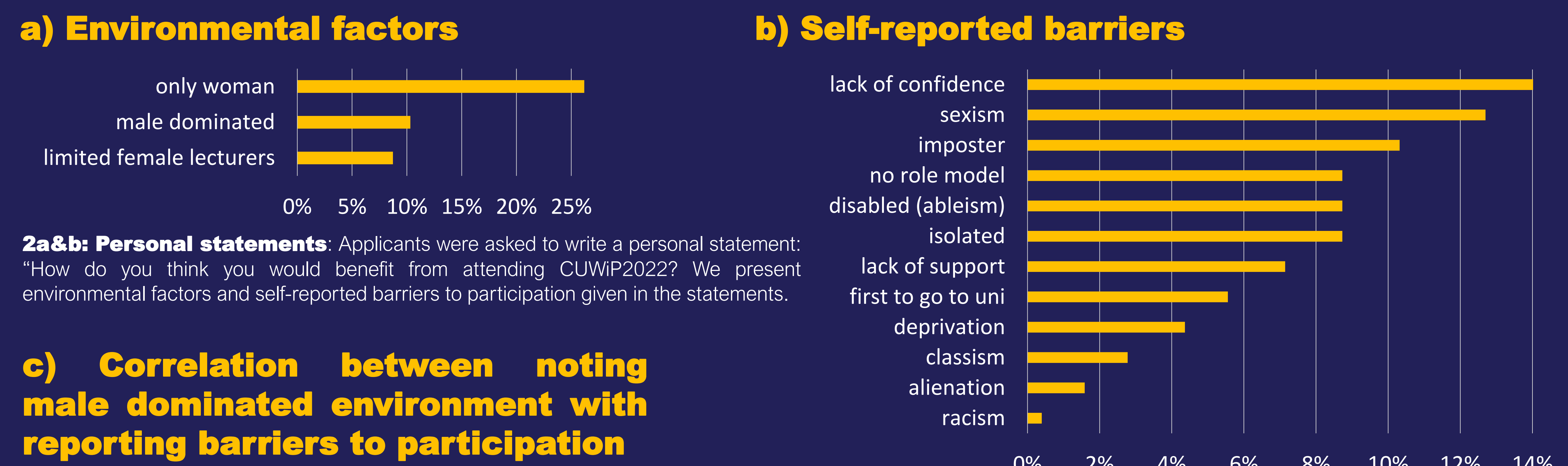
1 - DEMOGRAPHIC DATA: APPLICATIONS BY



1a-f: Demographic data: We have had 252 (=100%) applications to attend CUWIP Glasgow. The demographics of the applicant pool are reported. Where UK-wide data is available we have found that marginalised groups are over-represented in the sample compared to the UK undergraduate physics student population as a whole. The dataset gives a unique snapshot into the experiences of physics students belonging to marginalised groups, and barriers to participation identified by these students.

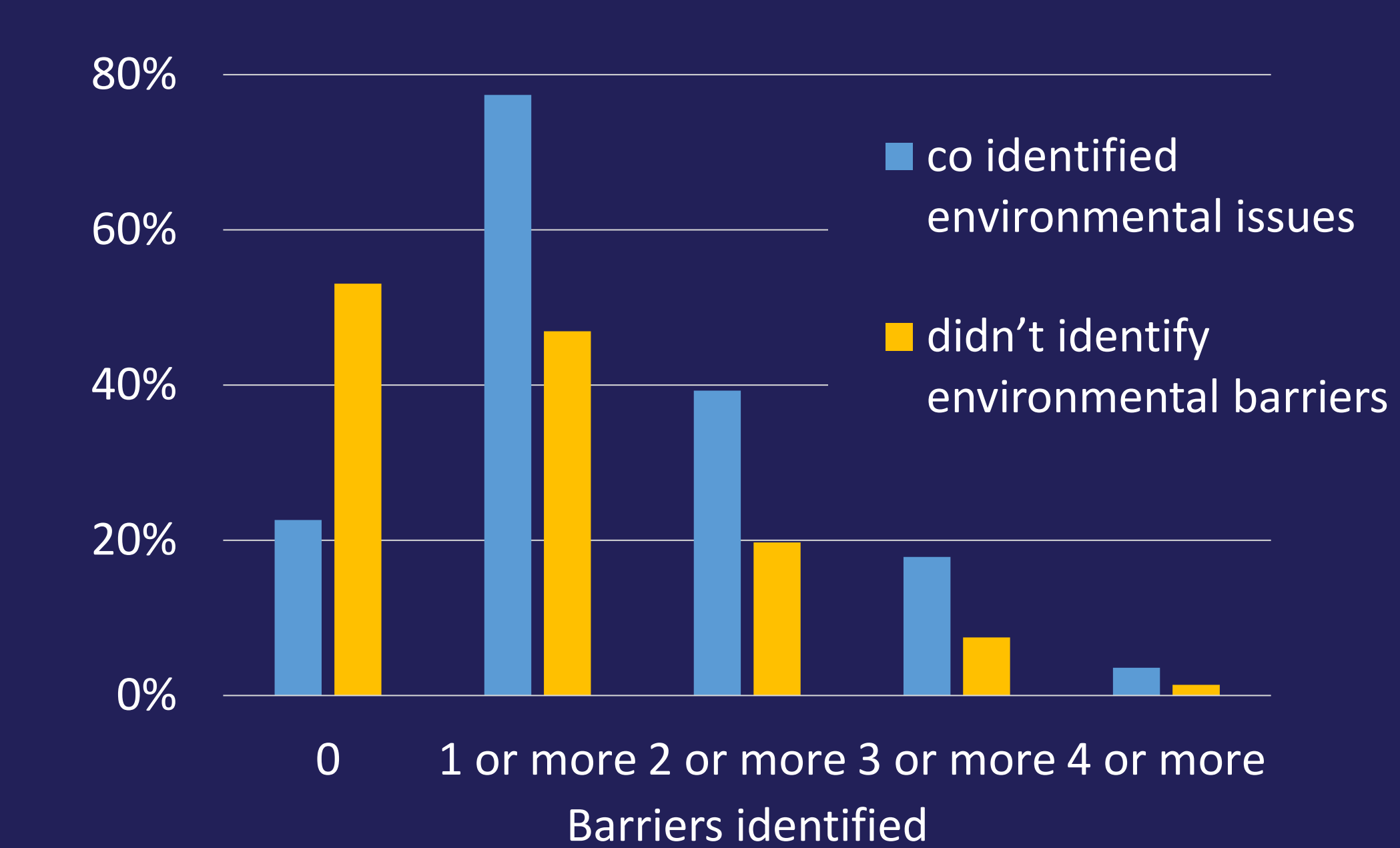


2- PERSONAL STATEMENT ANALYSIS



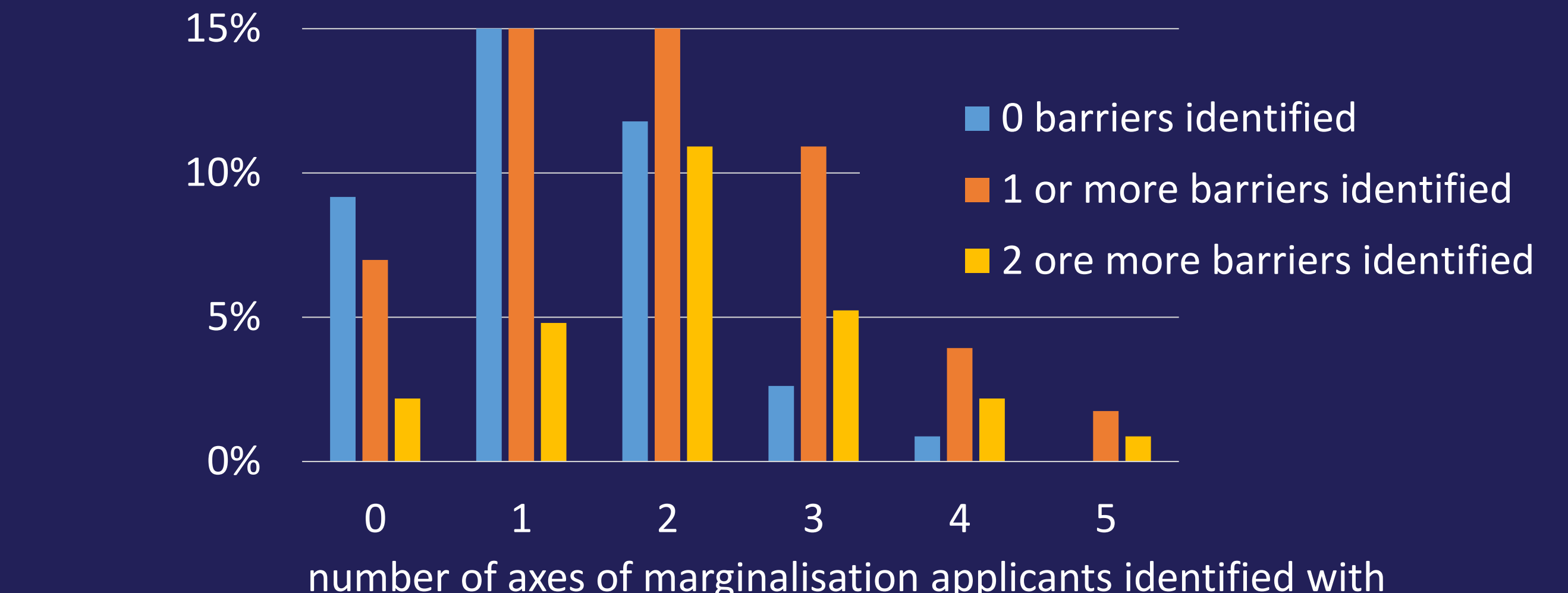
2a&b: Personal statements: Applicants were asked to write a personal statement: "How do you think you would benefit from attending CUWIP2022? We present environmental factors and self-reported barriers to participation given in the statements.

c) Correlation between noting male dominated environment with reporting barriers to participation



2c: We observe different distributions of self-report barriers based on whether applicants identified environmental issues or not. Of those who identified an environmental factor, nearly 80% list one barrier or more and furthermore they are nearly twice as likely to list 2 or more barriers compared to those who did not identify environmental issues.

d) Correlation of intersectionality with reporting barriers to participation



2d: We report on the number of barriers identified by applicants belonging to varying axes of marginalisation (eg gender, race, disability). We observe a shifted distribution (the higher the intersectionality of applicants the more barriers are reported). This demonstrates that applicants who experience marginalisation on multiple axes are more aware of the impact of barriers.

3- CONCLUSION

We have presented a statistical analysis of demographic data and of personal statements of applicants to CUWIP Glasgow 2022. Demographic data shows that marginalised groups were over-represented in applications compared to the UK physics undergraduate population as a whole, demonstrating the perceived need for both the event as a whole, and for a focus on inclusivity and intersectionality. We note in particular the relatively high proportion of applicants identifying as LGBTQ+.

Analysis of the personal statements showed a correlation between applicants reporting that they had experienced a male-dominated environment, and also in the statement identifying barriers to participation. We cannot conclude from the data whether students in male dominated environments experience more barriers, or that students who identify barriers are more likely to perceive the environment as being male-dominated. It is clear however from the data, that despite the increased number of women physics students at Universities, a lot of women and gender minorities report being the only one in their class. We don't know if this is at school or University level, but is worth noting that this is still a relatively common experience, highlighting the continued need for interventions at school level, such as the IoP's Improving Gender Balance and Limit Less programmes, as well as gender equality initiatives at University level.

We have also found a correlation between the number of barriers reported by applicants with the number of axes of marginalisation identified with, indicating the need for an intersectional approach in diversity and inclusion initiatives.

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