THE HEART HACKATHON: NURTURING THE NEXT GENERATION IN CARDIOVASCULAR INNOVATION.

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Introduction

Heart Failure (HF) is a leading cause of death globally [1]. With its increasing prevalence and a lack of donor hearts [2], device-based alternatives are required. Total artificial hearts (TAH) can bridge a HF patient until a donor's heart is available. The only commercially available TAH to date was FDA-approved 10 years ago [3], which emphasises a lack of innovation for device-based solutions. To promote new ideas in the field of mechanical circulatory support for HF patients, a student competition, the Heart Hackathon, was developed. This global biomedical engineering design competition aimed to generate a platform for novel ideas and contribute to the development of novel approaches to train the next generation of cardiovascular engineers.

Methods

The ideation process was shaped by interviews with university team leads for established engineering student competitions e.g. Formula Student (motorsport) and University Rover Challenge (Mars rover), focusing on determining an appropriate competition structure, timeline and requirements for competing teams as well as submissions. Based on these discussions, the competition development was broken into four core steps: an online event where teams pitch their concepts, two report submissions, and the grand final. The organising committee was built from the existing structure of the Monash Young Medtech Innovators (MYMI) to lay the groundwork, while the final organising committee is an independent group divided into the lead, engagement, marketing, operations and partnerships divisions. The implementation of the competition included the definition of rules and regulations, IP and NDA arrangements, marketing (HeartHackathon.com), a press release, and global outreach to academic institutions as well as online webinars and workshops. The Heart Hackathon was then merged with the International Society for Mechanical Circulatory Support (ISMCS).

Results

The Heart Hackathon has grown to 9 teams across five continents, constituting over 300 students. Through memberships of the competing teams, ISMCS membership was increased by 22% in 2023, and 50 competing students attended the annual meeting of ISMCS 2023 (Dallas) in person, representing 20% of the conference attendees. Competing teams have received substantial recognition via channels including the Duke of Edinburgh (UK), the Excellence Prize for Scientific Research and the Romanian Healthcare Awards - Medical Innovation of the Year (Romania), and the 2023 UNSW Engineering Education Festival - Winner of the VIP impact competition (Australia). The Heart Hackathon was subsequently integrated into the curriculum of five Universities and directly led to five job interviews for student members to date.

Discussion

Currently, the Heart Hackathon is at a pivotal point of retaining current teams and sponsors while growing and adapting to accommodate teams with varying levels of experience and resources. This competition has created greater public and university awareness of the need for TAH innovation and provided a framework for biomedical engineering students to develop novel approaches for mechanical HF support. The implementation of this competition in university curricula solidifies the longevity and engagement to this need, and enhances biomedical engineering degree courses by providing hands-on experience to students and connecting them to international experts in the field.

References

1. G. Savarese et al, Cardiovascular Research, vol. 119, no. 6, pp. 1453–1453, 2023.
2. M. Cameli, E. et al, Front. Cardiovasc. Med., vol. 10, p. 1290011, 2023.
3. T. Lee and G. Torregrossa, Elsevier, pp. 545–557, 2018.