BIOETHICS EDUCATION EXPOSURE AND ETHICAL PREPAREDNESS TOWARD HUMAN GENE EDITING AMONG SCIENCE UNDERGRADUATES IN COLOMBO DISTRICT, SRI LANKA

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Abstract

The development of human gene-editing technologies, including CRISPR-Cas9, has brought ethical questions surrounding safety, enhancement, consent, equity, and governance into greater focus. Ethical preparedness is essential for science undergraduates who may contribute to biotechnology and biomedical research, yet evidence from Sri Lanka remains limited. This study examined bioethics education exposure, attitudes toward human gene editing, and perceived ethical preparedness among science undergraduates in Colombo District, Sri Lanka. Science undergraduates were selected as prospective professionals who may engage with applications involving human gene editing. A cross-sectional mixed-methods study used a bilingual Sinhala-English questionnaire developed by adapting items from previously published questionnaires and relevant literature, followed by expert review and pilot testing with 50 participants. Convenience sampling yielded 390 responses, analyzed using descriptive statistics, independent- and paired-samples t-tests, and Pearson correlations; open-ended responses were analyzed thematically. Support for therapeutic gene editing was high, with 95.9% (n = 374) agreeing that human gene editing should be used to prevent serious genetic diseases. Formal bioethics exposure was linked to more favorable views of therapeutic applications, regulation, and professional responsibility, while informal exposure showed its strongest association with germline/somatic ethical attitudes ($r = 0.413$, $p < 0.001$). Perceived preparedness was higher among students who reported formal bioethics exposure than among those without such exposure ($M = 3.77$ vs. 2.38; $p < 0.001$). However, perceived current preparedness ($M = 3.51$) was significantly lower than the perceived value of strengthened bioethics education for professional development ($M = 4.56$; $p < 0.001$), with 93.8% supporting stronger education. Thematic findings emphasized compulsory or integrated bioethics education, practical learning, and responsible regulation. These findings provide empirical data from the Colombo District that formal bioethics exposure is associated with greater ethical preparedness toward human gene editing, while students' perceived current preparedness remains lower than the perceived value of strengthened education.

Keywords: bioethics education, human gene editing, ethical preparedness, responsible innovation, CRISPR