damage and impaired repair mechanisms. Our research evaluates the role of innate immune recognition proteins to provide insights into age-related neurodegeneration and cognitive decline. METHODS/STUDY POPULATION: We will utilize transcriptomic data from the Long-Life Family Study (LLFS), a cohort rich in genetic and phenotypic data related to aging and longevity. Our approach includes assessing a set of innate immune recognition proteins, also known as pattern recognition receptors (PRRs) expression across various age groups, focusing on potential correlations with cognitive performance. By analyzing serum transcriptomic profiles, we aim to map changes in expression and DNA repair genes over time, evaluating their connection to cognitive health and neurodegeneration in aging populations. RESULTS/ANTICIPATED RESULTS: We anticipate that the expression of some PRRs will increase with age and correlate with cognitive decline, suggesting a role in age-related neurodegeneration. We also expect a decrease in DNA repair pathway gene expression in older age groups, contrasting with an increase in genes involved in endogenous DNA detection. These results will reveal how PRRs may function as neuroprotective factors and how their expression changes may relate to the decline in DNA repair processes with age, providing a better understanding of innate immune recognition in cognitive health. DISCUSSION/SIGNIFICANCE OF IMPACT: This study will reveal the role of PRRs in aging and neurodegeneration, potentially establishing them as a key player in neuronal protection. Findings may guide future research into therapeutic strategies targeting them for Alzheimer's and other age-related neurodegenerative diseases.

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Precision education and generative AI in surgery utilization study: A framework for global surgical education

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OBJECTIVES/GOALS: Global surgical education is largely driven by high-income countries (HICs), with curricula not tailored to the needs of low- and middle-income countries (LMICs). This study assessed country-specific needs for global surgical curricula and used generative AI to develop tailored curricula. METHODS/STUDY POPULATION: A curriculum framework was developed using expert opinion. Using a focused needs assessment survey, we evaluated international medical students' and trainees' needs for structured global surgery curricula, covering research, education, data and develop tailored curriculum templates for each country, ensuring alignment with the distinct needs of respective LMIC and HIC respondents. The AI-generated curricula were then compared across countries to identify variations in content and focus areas. RESULTS/ANTICIPATED RESULTS: A total of 145 respondents from 18 countries and 6 continents participated, with 94 from LMICs and 51 from HICs. Four countries [Uganda (n = 31), Nigeria (n = 34), the USA (n = 23), and the UK (n = 23)] had more than 10 respondents, with the creation of a country specific global surgery curriculum. Curricula developed by HIC trainees focused on access to resources and infrastructure, future directions of global surgical research, and the role of medical students and early career development with a decreased focus on the history of global surgery. LMIC country-based curriculum focused on introducing the concepts of global surgery, quantifying the burden and epidemiology of surgical disease and had a greater emphasis on case studies and use cases, with decreased focus on resources and collaboration. DISCUSSION/SIGNIFICANCE OF IMPACT: The research introduces a "precision education" approach that could help close the surgical education access gap globally. Further pilot and qualitative studies are necessary to validate the feasibility of AI-generated needs-based curricula.

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Improving risk stratification in kidney transplant outcomes by modeling antigen processing to inform prediction of T-cell epitopes derived from mismatched HLA proteins

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OBJECTIVES/GOALS: We aim to enhance risk prediction in kidney transplantation outcomes by improving models of peptide antigen presentation of mismatched HLA molecules. HLA-derived peptides presented by HLA Class II to T-cells can activate an immune response, ultimately leading to graft failure. We aim to improve peptide prediction by modeling antigen processing. METHODS/STUDY POPULATION: T-cell epitope models for HLA mismatching struggle to predict which peptides are presented because antigen processing by proteases is not well modeled. We model antigen processing of HLA Class II proteins using 3D HLA structures (crystallography data) to create an HLA-specific antigen processing likelihood (APL) model. APL uses conformational stability measurements such as b-factor, COREX, solvent accessible surface area, and sequence entropy to predict cleavage sites from proteolysis. We will

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