

Neuroimaging innovations and public health: advancing brain structure, function and clinical translation

Abstract

Neuroimaging has transformed neuroscience and public health by enabling non-invasive insights into brain structure, function, and connectivity. This review covers major advances from 2020 to 2025 in MRI, fMRI, PET, MEG, DTI, fNIRS, and CT, focusing on their roles in mapping brain anatomy and neural activity. Clinical applications include early detection of Alzheimer's disease, stroke treatment, and psychiatric diagnostics. Key challenges—such as resolution limits and motion artifacts—are addressed through innovations like ultra-high-field MRI, AI-driven analysis, and hybrid PET/MRI systems. Portable, low-cost tools like fNIRS offer promise for underserved regions. Future priorities include standardizing protocols, integrating computational tools, and fostering global collaboration to ensure equitable access and reproducibility. Neuroimaging is set to become central to precision public health worldwide.