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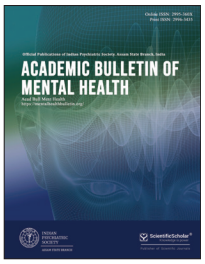

Editorial

The Future of Psychiatric Research

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Psychiatry has come a long way as a medical speciality. It started with the emergence of the asylums in the 18th and 19th centuries, where some physicians started treating the mentally ill patients and began publishing case histories, which initially also served as advertisements for their clinical knowledge. Philippe Pinel's *Medical Philosophical Treatise on Mental Illness* published in 1801 became the first book on nosology of psychiatry, which is still evolving centuries later. By 1918, psychiatry had a definitive book on psychiatric nosology called *Statistical Manual for the Use of Institutions for the Insane* published by the American Medico-Psychological Association. "Psychological work experiments" was the first article to be published in the field of psychiatry by Emil Kraepelin in 1921.[1] It gave birth to "descriptive psychiatry," which eventually laid the basis for psychiatry. Research in the field of psychiatry then revolved around two areas of interest—the diagnosis of mental disorders and psychopathology and abnormal morphology of the brain.[2]

Psychiatry now stands at the threshold of transformative research focused on genetics, neuroimaging, decoding critical networks in the brain responsible for the complexities of human behavior, and newer molecules of target for therapy, and with Artificial Intelligence (AI) around the corner, research can only become more innovative every day. Precision medicine in psychiatry, genetics, AI, and neuropsychiatry are some of the themes of psychiatric research that the future promises.

It was observed that psychiatrists were typically more invested in understanding the phenomenology of disease, whereas for the neurologist, the spotlight was on the neuroanatomical basis of a disorder. The 1980s saw the assimilation of these two schools of science when a symposium on Gilles-de-la-Tourette Syndrome in Paris in 1985 put forward the evidence of an organic basis for the disorder.[3] Today, neuropsychiatry encompasses "that aspect of psychiatry which, like neurology, seeks to advance understanding of clinical problems through increased knowledge of brain structure and function."[4] More recently, neuropsychiatry is what explains the neurobiological basis of psychiatric conditions.[5] The International Neuropsychiatric Association's definition best elucidates the milieu of this speciality—"a field of scientific medicine that concerns itself with the complex relationship between human behavior and brain function, and endeavors to understand abnormal behavior and behavioral disorders on the basis of an interaction of neurobiological and psychological–social factors."[6] Research in this sphere has led to the understanding of the processes of neurogenesis, synaptic pruning, dendritic outgrowth and axonal sprouting, and neuroplasticity, thereby giving way to therapeutic procedures like electro-convulsive therapy (ECT), transcranial magnetic stimulation (TMS), transcranial direct current stimulation (tDCS), and deep brain stimulation (DBS). In addition, fast development of neuroimaging techniques and complex computer algorithms can unravel many more mysteries of neuropsychiatry.

At the same time, we ought not to forget the burgeoning role that genetics play in psychiatry. Genome Wide Association Studies (GWAS) and studies on structural variations have helped expand our knowledge base on the biology of psychiatric disease. Both common and rare genetic variants have been found to be associated with psychiatric disorders, which regulate multiple complex biological pathways downstream. The bottom line from these studies is that psychiatric disorders are polygenic, which means that several small alterations in genes could result in an inefficient pathway that could lead to incompetent development in response to any environmental insult.[7] More recently, epigenetic studies of psychiatric disorders have taken the academia by storm. Epigenetics, coined by Conrad Waddington, (*epi* meaning over) refers to phenotypic modifications (i.e., appearance) or changes in the gene expression caused by mechanisms other than those affecting changes in the underlying deoxyribonucleic acid (DNA) sequence.[8,9] These studies are providing insights on the interaction between genetic vulnerabilities and an individual's exposure to stress, and toxins in the environment leading to the creation of changes at genetic loci and resultant aberrant gene expression. Even as some epigenetic modifications like DNA methylation and their role in schizophrenia and major depressive disorder are being increasingly recognized, epigenetics still remains a conundrum that is now arousing the curiosity of scientists. Epigenetic research sustains the biopsychosocial model in psychiatry; integrating psychotherapy with pharmacotherapy could mean a favorable epigenetic alteration that translates into symptomatic improvement and recovery as well.[10]

With an expanding awareness of psychiatric illnesses up to the molecular level, precision medicine is gaining momentum. Precision medicine may be defined as targeted, individualized care that is tailored according to the patient's specific genetic profile and medical history. Unlike traditional medicine which can be analogous to a one size fits all approach, precision medicine employs genomic sequencing tools to examine a patient's entire genome and locate the specific genetic alterations.[11] Emerging neuroimaging technologies and multiomics, like genomics and transcriptomics, supplemented by advanced computer algorithms have helped to characterize individuals based on their biological makeup; thus, tailoring healthcare to an individual based on their genetic makeup, epigenetic modifications and biomarkers could be a reality, which is what precision medicine is aiming for. Arguably, it totally ignores the well-known fact that psychological and social processes have a complex interplay with biological processes in any psychiatric disorder, which is why heterogeneity in psychiatric disorders is universal.[12] Notwithstanding this, precision psychiatry with its focus on pharmacogenomics holds great promise on understanding the prognosis and treatment course of psychiatric disorders.[13]

All of these advances in psychiatric research were made possible by the promising presence of AI. AI, termed by John McCarthy, is defined as "the science and engineering of making intelligent machines."[14] Though initially argued that AI and psychiatry cannot overlap as psychiatric data are subjective perceptions of patients and qualitative mostly in the form of patient's statements, it is now developing a strong foothold in mental health. AI in psychiatry includes natural language processing for analyzing patient data, such as speech and text, machine learning for identifying patterns in large datasets, and computer vision for analyzing brain imaging.[15] It has found application in children with attention deficit hyperactivity disorder (ADHD) and autism where technologies like machine learning and data mining analyze children's performance in tasks related to attention, decision-making, and emotional regulation.[16].AI's potential role in detecting emotional distress or suicidality in individuals by analysis of social media messages, text messages, and speech patterns, thereby enabling identification of individuals needing intervention, has been much appreciated.[17,18] Big data (which refers to large, diverse, complex, longitudinal, and/or distributed datasets generated from instruments, sensors, Internet transactions, email, video, click streams, and/or all other digital sources available today and in the future)[19] from various sources like Electronic Health Records, user-generated social media content, and wearable mobile technologies are now being analyzed with the help of AI to understand mental illnesses beyond clinical evaluation and modify treatment algorithms altogether.

However, one needs to be mindful of the ethical implications that these rapid advancements could have. Specifically, AI brings with it the challenges of data safety and privacy, effectiveness, user experience and adherence, and accountability in decision-making. Huge records of personal information are at risk of misuse, while at the same time, the question arises as to who could be responsible for decision-making using AI. If data sets available for machine learning and AI algorithms are not representative of every race and community, it could lead to bias that could impede the benefits of AI. Another blatant issue is the loss of the therapeutic relationship between patients and mental health specialists should AI be integrated into psychiatric practice, as psychiatrist's care and empathy goes a long way in patient management.[20]

The future looks forward to revolutionizing advances in psychiatry. Decoding the genetics of psychiatric disorders and appreciating the role of epigenetics coupled with excellent neuroimaging technologies, precision medicine,

computational algorithms, and digital tools could bring about radical changes at how we understand mental illnesses. Enforcement of appropriate guidelines should be an area of concern as research begins to utilize big data analytics. Advancement in research should not remain confined to the developed nations but should focus on global equity and the elimination of any disparities between nations in advanced psychiatric research. At this pace of advancement, the day is not far when research in psychiatry could truly help meet the United Nations Sustainable Development Goal on mental health.

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