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From the clinic to algorithmic prediction: Critical reflections on artificial intelligence, neurotechnology and subjectivity in contemporary psychiatry

De la clínica a la predicción algorítmica: reflexiones críticas sobre la inteligencia artificial, las neurotecnologías y la subjetividad en la psiquiatría contemporánea

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SUMMARY

The progressive incorporation of artificial intelligence (AI), neurotechnologies, and biomarkers into psychiatric practice has opened a field of profound clinical, diagnostic, and epistemological transformations. From the use of machine learning algorithms to predict hospitalizations for schizophrenia to the identification of functional biomarkers through neuroimaging, digital sensors, and explainable artificial intelligence, contemporary psychiatry is moving toward more precise and objectified models of psychological suffering. However, this technological shift raises substantial questions about the limits of neurobiological reductionism, the clinical interpretation of data, the ethics of algorithmic diagnosis, and the role of subjectivity in mental health care. This reflective article critically analyzes the integration of AI and neurotechnologies in psychiatry, articulating recent scientific evidence from clinical and ethical perspectives. The contributions, risks, and challenges of these tools in disorders such as schizophrenia, obsessive-compulsive disorder, and depression are discussed, highlighting the need for hybrid models that combine technological innovation with clinical judgment, the patient's subjective experience, and the principles of person-centered psychiatry.

Keywords: *Artificial intelligence, psychiatry, neurotechnologies, biomarkers, subjectivity.*

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RESUMEN

La incorporación progresiva de la inteligencia artificial (IA), las neurotecnologías y los biomarcadores en la práctica psiquiátrica ha abierto un campo de profundas transformaciones clínicas, diagnósticas y epistemológicas. Desde el uso de algoritmos de aprendizaje automático para la predicción de hospitalizaciones por esquizofrenia hasta la identificación de biomarcadores funcionales mediante neuroimagen, sensores digitales e inteligencia artificial explicable, la psiquiatría contemporánea avanza hacia modelos de mayor precisión y objetivación del sufrimiento psíquico. No obstante, este giro tecnológico plantea interrogantes sustantivos sobre los límites del reduccionismo neurobiológico, la interpretación clínica de los datos, la ética del diagnóstico algorítmico y el lugar de la subjetividad en la atención de la salud mental. El presente artículo de reflexión analiza críticamente la integración de la IA y las neurotecnologías en psiquiatría, articulando evidencia científica reciente con una mirada clínica y ética. Se discuten los aportes, riesgos y desafíos de estas herramientas en trastornos como la esquizofrenia, el trastorno obsesivo-compulsivo y la depresión, destacando la necesidad de modelos híbridos que conjuguen la innovación tecnológica con el juicio clínico, la experiencia subjetiva del paciente y los principios de una psiquiatría centrada en la persona.

Palabras clave*: Inteligencia artificial, psiquiatría, neurotecnologías, biomarcadores, subjetividad.*

INTRODUCTION

Contemporary psychiatry is undergoing an accelerated transformation driven by the development of digital technologies, the expansion of artificial intelligence (AI), and the consolidation of precision psychiatry approaches. In recent decades, the analysis of large volumes of clinical, administrative, and neurobiological data has enabled the development of predictive models that estimate risks, anticipate relapses, and optimize therapeutic decisions in mental health (1-3). This shift toward algorithmic prediction is presented as a promise of greater efficiency, diagnostic standardization, and personalized treatment.

However, psychiatry is not merely a biomedical discipline focused on symptom control, but also a clinical field permeated by subjectivity, the therapeutic relationship, and the contextual interpretation of human suffering. The increasing delegation of diagnostic and therapeutic decisions to algorithmic systems creates tensions between traditional clinical knowledge and new forms of objectifying the psyche (4,5). In this context, it is necessary to critically reflect on the scope, limitations, and ethical consequences of integrating AI and neurotechnologies into psychiatric practice.

This reflective article analyzes, from clinical and ethical perspectives, the impact of artificial intelligence, neurotechnologies, and biomarkers on contemporary psychiatry, problematizing the risk of neurobiological reductionism and highlighting the need for hybrid models that preserve the centrality of subjectivity and clinical judgment.

Psychiatry and artificial intelligence: from diagnosis to prediction

The use of machine learning algorithms in psychiatry has experienced exponential growth over the last decade, particularly in hospital settings where large volumes of clinical and administrative data are available. Studies employing machine learning techniques have demonstrated their usefulness in predicting hospitalizations, readmissions, and length of stay among patients with schizophrenia, achieving clinically relevant levels of accuracy and discriminative capacity (1,6-8,30). These models enable identification of risk profiles based on sociodemographic variables, clinical history, service utilization patterns, and comorbidities, thereby supporting more efficient planning of mental health resources.

However, predictive logic introduces a substantial epistemological shift in psychiatric practice: the move from clinical diagnosis based on interviews and longitudinal observation toward probabilistic models grounded in statistical correlations (29,31). While this transition can strengthen preventive decision-making, it also poses the risk of overestimating the explanatory power of algorithms and underestimating the complexity of individual psychopathology (9,37).

The incorporation of explainable artificial intelligence (XAI) has emerged in response to the opacity of predictive models, enabling

the identification of variables that influence algorithmic decisions and facilitating their critical evaluation by clinicians (10,11). However, even explainable systems require expert interpretation and do not replace clinical judgment; rather, they challenge and transform it. In this sense, AI should be conceived as a tool to support clinical decision-making rather than as an autonomous agent for diagnosis or treatment (23,25).

Neurotechnologies and biomarkers in psychiatry

The development of neurotechnologies has strengthened interest in identifying objective biomarkers in psychiatry, particularly through functional and structural neuroimaging techniques. Resting-state functional magnetic resonance imaging (rs-fMRI), combined with machine learning algorithms, has shown promising results in identifying brain patterns associated with disorders such as obsessive-compulsive disorder and schizophrenia (7,8,12-14). Metrics such as amplitude of low-frequency fluctuations (ALFF), regional homogeneity (ReHo), and degree centrality (DC) have been proposed as relevant functional indicators (12,26,27). These advances support the aspiration for biomarker-based precision psychiatry, which is aligned with biomedical models in other specialties. However, the available evidence shows considerable interindividual variability and overlap between diagnoses, which limits their direct clinical applicability (15,16,37). Furthermore, most of the identified biomarkers lack sufficient specificity to be used in isolation for individual diagnosis.

From a critical perspective, several authors warn that the centrality given to biomarkers can lead to a reduction of psychological suffering to quantifiable neurobiological processes, thus obscuring subjective, relational, and cultural dimensions of psychopathological experience (5,17). This trend reinforces the need to integrate neurotechnological findings into broader clinical frameworks, while avoiding their use as substitutes for comprehensive clinical reasoning.

Digital devices, sensors, and the Internet of Things

The expansion of digital devices and Internet of Things (IoT) technologies has introduced new forms of continuous monitoring in mental health. Wearable sensors, actigraphy devices, and mobile applications allow for the collection of longitudinal data on motor activity, sleep patterns, and circadian rhythms, which can be analyzed using artificial intelligence algorithms to estimate affective and psychotic states (6,18-20,24).

These approaches have shown potential for differentiating between depression and schizophrenia, as well as for detecting subtle changes in daily functioning that precede clinical relapses (38,39). However, the clinical interpretation of these data remains a challenge, given that behavioral indicators do not always correlate directly with the patient's subjective experience or with psychopathological severity.

Additionally, the widespread use of sensors raises ethical dilemmas related to privacy, informed consent, and the management of large volumes of sensitive data (20-22,35). The ongoing objectification of behavior can lead to new forms of clinical surveillance and social control, particularly in vulnerable populations, necessitating clear regulatory frameworks and ongoing ethical reflection.

Subjectivity, ethics, and clinical decision-making

The increasing integration of algorithmic systems into psychiatric practice is reshaping the relationship between the professional, the patient, and the clinical decision-making process. While AI can provide valuable information for risk stratification and treatment planning, its use raises fundamental ethical questions related to professional responsibility, equity, and patient autonomy (22,31-34).

Several studies have indicated that machine learning algorithms can reproduce biases present in training data, amplifying social and structural inequalities in access to and quality of mental health care (32-34). In this context, the uncritical delegation of clinical decisions to automated systems is particularly problematic.

From a clinical perspective, the patient's subjectivity, narrative, life context, and experience of suffering constitute an irreplaceable component of the therapeutic process. The ethics of care in psychiatry demand that technology be used as

a complement to clinical judgment and not as a substitute for the therapeutic relationship or professional deliberation (23,25,40).

Likewise, contemporary authors warn that the expansion of predictive technologies can contribute to an anticipatory medicalization of risk, redefining normality and expanding the boundaries of clinical control over daily life (35,36). In this scenario, it is essential to maintain critical reflection that preserves the centrality of the person and the humanistic character of Psychiatry.

Reflections for a technologically responsible psychiatry

The responsible integration of AI and neurotechnologies in psychiatry requires the development of hybrid models that articulate quantitative evidence with a qualitative understanding of human suffering. These models must incorporate clear ethical principles, mechanisms for transparency, and professional training strategies that enable the critical use of technology. Furthermore, it is necessary to promote epistemological reflection that avoids the naturalization of neurobiological reductionism and preserves the complexity of the field of psychiatry. Technology, far from being neutral, reflects values, interests, and assumptions that must be explicitly analyzed.

CONCLUSIONS

The integration of artificial intelligence, neurotechnologies, and digital devices into contemporary psychiatry represents one of the most significant changes in the discipline's recent history. The ability to analyze large volumes of data, identify complex patterns, and anticipate clinical risks has opened significant opportunities to improve treatment planning, continuity of care, and resource allocation in mental health. In disorders such as schizophrenia, obsessive-compulsive disorder, and depression, these tools have demonstrated increasing potential to support diagnosis, prognosis, and clinical follow-up.

However, this technological advance is not without epistemological, clinical, and ethical tensions. The increasing centrality of predictive models and functional biomarkers introduces the risk of reducing psychological suffering to quantifiable indicators, displacing fundamental dimensions of subjective experience, life context, and the therapeutic relationship. Psychiatry, as a clinical discipline, cannot be entirely replaced by algorithmic systems without compromising its humanistic and relational character.

From this perspective, this reflective article argues that artificial intelligence and neurotechnologies should be conceived as complementary tools for clinical judgment, rather than as autonomous decision-making systems. Their responsible integration requires hybrid models that articulate quantitative evidence with a qualitative understanding of human suffering, as well as robust ethical frameworks that guarantee transparency, equity, and the protection of patients' rights.

Ultimately, the challenge for contemporary psychiatry lies not only in adopting new technologies, but in doing so critically, reflectively, and within a specific context. Preserving the centrality of subjectivity, strengthening ethical training, and promoting person-centered clinical practice are essential conditions for genuinely improving mental health care through technological innovation.

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