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COMMENT **Open Access**

Considerations for informing precision psychiatry in eating disorders: Foundations for future practice

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Abstract
Eating disorders (EDs) are multisystemic, debilitating, and complex illnesses that affect many young Canadians. These disorders are associated with high rates of medical complications, psychiatric and physical comorbidities, functional impairment, family distress, and financial burden. Despite the severity and increasing prevalence of EDs in youth, advancements in understandings of the pathophysiology and treatment of EDs have remained limited over the past three decades. This trend may be shaped by the chronic underfunding of the field, reliance on small sampled cross-sectional studies, and the notable lack of research focused on youth with EDs from historically underrepresented communities. Current treatment practices demonstrate modest efficacy and often omit the complex, heterogeneous presentations, development, and maintenance of pediatric EDs. Large-scale, multiaxial datasets are necessary to elucidate ED etiology and enable phenotyping. This is a critical step towards implementing future precision psychiatry and personalized treatment advances. In this commentary, we share our experience of conceptualizing a precision ED data and bio-registry, EDBioMAP: Eating Disorder Bio-Registry and Multiaxial Precision Health Platform, and suggest necessary pillars to inform, implement, and drive the successful use of precision psychiatry in pediatric ED care. Effective data utilization requires actionable steps and includes: (1) establishing strategic partnerships; (2) incorporating measurement-based care into clinical practice; (3) collecting novel biological markers; (4) developing minimum datasets; and (5) leveraging predictive modelling techniques. Strategic and standardized data integration is imperative to informing the future use of precision psychiatry for EDs. It can lend well to igniting multi-site collaboration to enhance large datasets necessary for this type of work and offers avenues for future development of personalized treatment interventions and clinical decision-making tools for youth with EDs.

Keywords Eating disorders, Phenotyping, Personalized treatment, Bio-registry, Precision medicine

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Background

Decades of research continue to identify eating disorders (EDs) as among the most debilitating mental health conditions [1–5]. EDs are multisystemic and associated with high rates of medical complications [6], psychiatric and physical comorbidities [7], functional impairment [7], family distress [8], financial burden [9], and high mortality rates [10]. Global lifetime prevalence of any ED is estimated at 0.74–2.2% for males and 2.58–8.4% for females [11], with adolescents being disproportionately affected. In recent years, the incidence of EDs has risen exponentially, particularly among adolescent males (416%) and youth aged 12–14 (196%) [12]. Trends during the first 2 years of the COVID-19 global pandemic likely accelerated this crisis, with a 126% rise in ED-related emergency department visits and a 60% increase in hospitalizations, largely among youth [13]. These post-pandemic spikes mark a critical tipping point—demanding urgent, coordinated, and sustained action [9, 14].

The onset of EDs typically occurs during adolescence [15, 16], and, for some, develop into chronic conditions [17] that often persist into adulthood [18], with approximately only half of individuals experiencing improvements despite receiving first-line evidence-based treatment [19]. While early, targeted intervention is associated with improved outcomes [20, 21], there is a lack of clarity concerning which treatments work best for whom [22]. This is partially due to EDs being widely recognized as multifactorial, shaped by genetic, biological, psychological, social, and environmental factors [23]. Accordingly, many treatment programs reflect this complexity by delivering multidisciplinary care that incorporates, at minimum, medical, psychological, and nutritional interventions [7]. However, despite these shared care models, existing research and treatment models often rely on one-size-fits-all approaches, typically based on limited evidence generated from small, homogenous samples that yield only modest remission rates (35–40%) [24]. For example, Family-Based Therapy (FBT) remains the standard of care for treating EDs in children and adolescents [21], yet it is often applied broadly despite limited remission rates and knowledge of its efficacy in marginalized youth [21]. This approach may not adequately reflect the diversity and the complexity of ED presentations, particularly among underrepresented groups (e.g., males, gender-diverse youth, and individuals with atypical or subthreshold symptoms) [25], making phenotyping research and precision medicine difficult for the field. Precision medicine and personalized care has long been established in oncology [26] and, more recently, introduced in brain-based diseases such as Alzheimer's [27, 28] showing promise for improving outcomes [29]. Research in mental health fields such as depression have already shown advances in identifying hundreds of distinct phenotypes of depression [30–33], with opportunities to generate more personalized treatment approaches based on one's phenology. This underscores the urgent need to shift how we conceptualize and treat EDs through more nuanced, individualized models of care.

Precision psychiatry—a branch of precision medicine applied to psychiatric conditions—leverages data ranging from a person's postal code to their genetic code to better understand the unique components that shape individuals well-being [34]. It offers a future where treatment is not only evidence-based, but tailored to each person's biology, environment, and lived experience [22, 26, 35]. In the context of EDs, a field long marked by diagnostic ambiguity [22], high comorbidity [7], and variable treatment response [24], this personalized approach is especially compelling. Yet despite growing interest and promising theoretical models, precision psychiatry remains in its infancy in ED research and clinical care, partly due to lack of routine clinical measurement and data to advance this work [22, 26, 36, 37]. In this commentary, we share our process of developing EDBioMAP: Eating Disorder Bio-Registry and Multiaxial Precision Health Platform, and suggest necessary pillars to inform, implement, and drive the successful use of precision psychiatry in pediatric ED care.

The creation of EDBioMAP was to establish a comprehensive clinical registry and biobank that will synthesize, analyze, augment, and report on data from the genetic code to the postal code for youth with EDs. EDBioMAP will lean on a 6-year retrospective database from youth who accessed treatment at the Children's Hospital of Eastern Ontario (CHEO) Eating Disorders Program (EDP) between 2018 and 2024 to inform its development. Data in this platform will contain clinical (e.g., sociodemographic, diagnostic, anthropometric), psychosocial (e.g., ED symptoms and behaviours, mood and anxiety, functional impairment), and biological (e.g., bloodwork, electrocardiogram [ECG], bone mineral density [BMD]) data collected via routine clinical measurement and electronic medical records (EMR). These data sources will be integrated with biological marker (i.e., biomarkers) data available for a subset of youth with EDs who participated and provided data for several ongoing clinical research studies (e.g., microbiome, dietary intake and composition, advanced metabolic, endocrine and immunologic blood analytes, sensory, pharmacogenetic, brain imaging, genomic sequencing data). We aim to analyze the retrospective database to identify early phenotypic patterns, which will serve to inform the minimum dataset recommended for the prospective EDBioMAP platform. Predictive modelling techniques, such as the use of artificial intelligence (AI), will be used to enhance predictive utility and to augment under-represented data in the retrospective database, thereby expanding the generalizability of findings.

Building the foundation for precision eating disorder care

In psychiatry, a personalized approach can be driven by key strategies including precise classification, precise treatment planning, and precise prevention [26]. Before precision psychiatry can be meaningfully implemented in ED care, we must first deepen our understanding of the mechanisms and factors that contribute to ED onset and shape individual treatment trajectories—including who is likely to respond to standard care and who may experience a more complex, treatment-resistant course [38]. Identifying early phenotypic patterns and risk profiles is essential to defining a minimum dataset that can guide effective screening, prevention, and personalized interventions [22, 38]. Emerging evidence highlights several promising biomarkers—including the gut microbiome [39], inflammatory and hormonal markers [40, 41], genetic profiles [42], and neuroimaging findings [43]—that may inform individualized care [44]. Diagnostic indicators such as illness chronicity, severity at onset, and previous treatment history and response [44], along with clinical and socio-environmental factors [37], are also critical to understanding diverse treatment needs. Yet significant barriers remain, particularly the lack of large, multidimensional datasets and the underrepresentation of diverse populations [45], limiting progress toward a more nuanced, phenotypic understanding of EDs. Accordingly, we propose that advancing precision psychiatry for EDs requires several key pillars for its success: (1) fostering strategic partnerships, (2) incorporating measurement-based care (MBC) into clinical practice, (3) collecting biomarkers, (4) developing minimum datasets, and (5) leveraging predictive modelling techniques.

While the successful implementation of these pillars depends on the availability of management support, infrastructure, expertise, and funding, we recognize that such resources may be limited or not accessible for some. As an academic tertiary care facility, our team has prioritized embedding research and quality improvement efforts into care via embedded researchers or clinician-scientists, fostering collaboration to bring innovations to the bedside. This long-standing collaboration allows for ease in partnering across clinical and research teams to build precision medicine study opportunities. This includes successfully finding funding to support the different aspects of this work, as well as leaning on in-house expertise to contribute to these studies. The combination of these organizational assets makes this type of precision psychiatry platform possible. Acknowledging that not all programs will have access to these types of assets, design of such platforms should foster an inclusive and contribute-what-you-can approach, to expand the reach of this work and potentially provide programs with less resources and buy-in opportunity to participate.

Fostering interdisciplinary partnerships

Advancing precision psychiatry for EDs requires an integrative, interdisciplinary approach [46]. The complexity and heterogeneity of ED presentations and treatment responses highlights the importance for diverse disciplines and experts to collaborate to drive innovation including healthcare teams (e.g., physicians, psychologists, social workers, dietitians, nurses, etc.), researchers, individuals with lived/living expertise, statisticians, nutrition, neuroimaging, data science, AI and genomic scientists [22, 47]. This collaborative approach enhances the design and interpretation of research findings and is essential for the successful implementation of precision psychiatry within clinical care [48, 49]. The ultimate yield for precision medicine projects, like EDBioMAP, are to integrate research and clinical teams to transform multiaxial data, in real time, into supportive clinical decision-making information that can better classify and create treatment plans tailored to an individual.

Precision psychiatry relies on measurement

Measurement-based care (MBC) is central to precision psychiatry [26], as offers a structured framework to improve diagnostic accuracy and treatment outcomes, monitor symptom progression, and identify patients who may not be responding to treatment [50–52]. Implementing MBC within clinical settings represents a critical step in shifting care toward a precision psychiatry approach, establishing a foundation for more tailored and effective treatment for youth with EDs [52]. MBC involves the regular, systematic collection of self-reported patient symptoms throughout treatment to monitor progress and guide clinical decision making [52, 53], a practice well embedded into existing ED programs that include the use of a battery of psychological questionnaires as part of assessment and monitoring practices. While implementation involves successive stages and may present challenges with adoption—such as perceived patient burden, stakeholder engagement and buy-in, and organizational resource limitations [52]—its benefits are significant and well-documented. These include improved patient outcomes, enhanced accuracy of clinical judgement, strengthened collaboration between clinicians and patients, and the ability to support quality improvement and research initiatives using routinely collected clinical data [51, 52, 54]. By capturing variability in patient symptoms over time, MBC can uncover differential treatment responses and point to underlying contributing causes [50]. Expanding this capture to include biological, brain-based and genetic signals can greatly improve existing precision medicine approaches.

Collection and feasibility of biomarker data

The successful integration of precision medicine in ED clinical care also requires data derived from biomarkers, given the multi-dimensional etiology of EDs [23]. Within the field, there is interest in the utility of genetic, neurobiological, and physiological markers to explore and measure the effects of targeted interventions [22]. Examples include the gut microbiome [39, 55], serum immune and endocrine biomarkers (e.g., interleukin 6 [IL-6] and leptin) [41, 56], sensory (e.g., olfaction and taste perception) and sleep profiles [57, 58], genetics and genomics [42, 59], brain structures and function [43, 60, 61], inflammatory markers [40, 62], cardiac health [63], bone health [64], and metabolomics [65, 66]. However, mainstream clinical applications remain largely unexplored, and research to date has predominantly focused on patients with anorexia nervosa (AN) [36, 67]. Recent findings from our research program suggest the integration of microbiome, blood, pharmacogenetic, sensory and sleep data collection alongside treatment is feasible and acceptable among youth with severe restrictive EDs [68]. As research in this area progresses, it will be critical to not solely focus on exploring new and innovative biomarkers, but also examine how biomarkers can be integrated into routine care to help guide personalized decision making and bolster treatment outcomes [22, 23]. An example of this real-time use of biomarker data, our program of research includes pharmacogenetic testing. Results from the saliva sample are typically reported to the clinician within two weeks of the laboratory receiving it, providing important genetic information about which psychotropic medication might be most effective for a specific individual. This was deemed a highly valued use of biomarker testing by patients and families, that contributed to important treatment planning around medication usage. While the science on personalized treatment options based on biomarkers in still in its infancy, there is much promise for the field given recent advances [61, 69]. With more advanced biomarker assessments (e.g., MRI) in EDs currently only available via research studies, implementation studies that prioritize understanding how to embed feasible and high value biomarker assessments into clinical practice is an important avenue for the field to explore to advance precision psychiatry and personalized treatment options in ED care.

Bringing the data together: the role of minimum datasets

The practice of standardizing data collection is increasingly recognized as important for improving illness detection and informing strategies to enhance treatment outcomes [38]. Establishing standardized data collection mechanisms can encourage usage of these definitions across sites, better populating much needed datasets for the field and increasing generalizability of findings. It involves operationalizing definitions of clinically relevant data sources, ensuring consistent data entry, and harmonization of data abstraction across sites [38]. Central to this process is the development of a minimum dataset—a standardized collection of core data elements that ensures consistent and systematic capture of various levels of data, supporting both clinical decision-making and research efforts [70]. To date, there has been difficult in identifying harmonized datasets in EDs. Given the multi-systemic involvement of EDs [21], lack of standardized operational definitions of remission, relapse, and good outcomes [71], and abundance of data parameters involved in ED care, there is a need for experts to collaborate together to derive minimum datasets across sociocultural, psychological, biological, nutritional, social and environmental factors that help to inform precision medicine for the field. Accordingly, an aim of EDBioMAP is to use the three-legged stool of evidence approach [72] to inform the creation of these minimum datasets. Namely, we will consult published treatment standards and clinical guidelines to learn of the important parameters to measure across the different domains of data. This will contribute to a first list of minimum data set parameters. We will then consult with clinicians on the parameters most used to guide treatment decisions and add them to the list. Similarly, consulting with our Youth and Family Advisory panel on important data elements for them will also be explored and added to the list. Together, these pieces will help curate a list of parameters to consider as part of a minimum dataset that can then be further validated by other ED programs. While creation of minimum ED datasets can be quite helpful to advancing precision psychiatry for EDs, previous difficulties in standardizing these pieces highlights the ambitiousness and complexity of this work.

Leveraging predictive modelling to enhance classification and treatment planning

Utilizing technology, research informatics, and predictive modelling techniques such as AI, has significant potential to enhance precision psychiatry efforts for EDs. Novel research informatics methodologies (e.g., large language processing algorithms) using advanced electronic medical records platforms (e.g. Electronic Patient Information Chart [EPIC]) can guide optimal approaches for extracting, storing, and merging routine clinical data from medical charts with other relevant data sources for ED research [73]. The ability to enable these mechanisms allows for the accurate extraction of the necessary data fields to advance multi-axial datasets without requiring lengthy chart reviews. Predictive modelling and augmenting approaches using AI can then be used to plan and evaluate the usability of extracted data to predict a clinically relevant outcome [74, 75].

This is particularly important given that community and hospital-based ED research is often constrained by small homogeneous samples [76–78], which can restrict model flexibility, obscure interaction effects, and increase the risk for overestimating predictive power [79]. Such model restrictions inhibit our ability to capture the complexity and specificity needed to identify distinct ED phenotypes and to develop effective clinical decision-making tools that are generalizable to all young people with EDs. Within EDBioMAP, data augmentation techniques (e.g., generative adversarial networks [GANs], variational autoencoders [VAEs]) [80] can be applied to the retrospective database to enhance the data capacities for under-represented groups and data structures within the dataset (e.g., males, those with non-restrictive type EDs, those with limited biomarker data [45, 81]. These techniques can be applied to critically assess cumulative and multiplicative effects of intersecting identities that may exist among ED outcomes and studied cohorts [82]. Other AI techniques, such as (ML), can enhance the predictive ability of these datasets. Insights from predictive modelling approaches can assist with identifying meaningful ED subtypes extending beyond the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) categories [83], marking significant advancement in the development of tailored treatment approaches [84], early identification of refractory likelihood [85], and the creation of future clinical decision-making tools [86].

Conclusion and steps toward precision psychiatry

The implementation of precision psychiatry and personalized treatment advances within the field of EDs requires effective data utilization alongside establishing strategic partnerships, incorporating MBC into clinical practice, collecting novel biomarkers, developing minimum datasets, and leveraging predictive modelling techniques. In order accomplish this work, substantial financial investments and change management plans are required. While initial costs are expected to be high, the downstream benefits will offer widespread and meaningful impacts to millions of Canadians and their families who are impacted by EDs [87, 88]. The research proposed is complex, ambitious, and presents significant challenges, but the steps we outlined can serve to inform the development of a comprehensive clinical registry and biobank that attempts to integrate clinical, psychosocial, and biological data from pediatric ED patients to support the shift toward precision psychiatry. Through this necessary work, diverse data streams can be synthesized and analyzed to uncover clinically meaningful phenotypes, early biomarkers of severe illness, and eventual prospects of personalized ED care treatment options.

Insights from this work are far-reaching and supports the development of a multiaxial, minimum dataset to facilitate collaborative, multi-site research and clinical innovation across pediatric ED programs. Without a shift toward precision psychiatry in EDs, the cost of inaction is high: many young people will continue to cycle through ineffective 'one-size-fits-all' treatment approaches, and the multi-systemic interactions of EDs will remain poorly understood. By implementing precision psychiatry via a multiaxial biobank and clinical registry, routinely collected data can be utilized to better inform assessment and treatment, and integration of research, measurement and clinical practice become more of a reality. Leveraging technology, electronic medical records and predictive modelling techniques greatly enhance and diversify available data, creating a platform that has the potential to drive meaningful change in how we understand and care for youth with EDs.

Abbreviations

AI	Artificial intelligence
AN	Anorexia nervosa
BMD	Bone mineral density
CHEO	Children's Hospital of Eastern Ontario
DSM-5	Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition
ECG	Electrocardiogram
EDs	Eating disorders
EDBioMAP	Eating Disorder Bio-Registry and Multiaxial Precision Health Platform
EDP	Eating Disorder Program
EMR	Electronic medical records
EPIC	Electronic Patient Information Chart
FBT	Family-Based Therapy
GANs	Generative adversarial networks
IL-6	Interleukin
MBC	Measurement-based care
ML	Machine Learning
VAEs	Variational autoencoders

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NO conceptualized, reviewed, and edited the manuscript; NL and AHMB wrote the original draft, reviewed, and edited the manuscript; MLN reviewed and edited.

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Declarations

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Competing interests

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