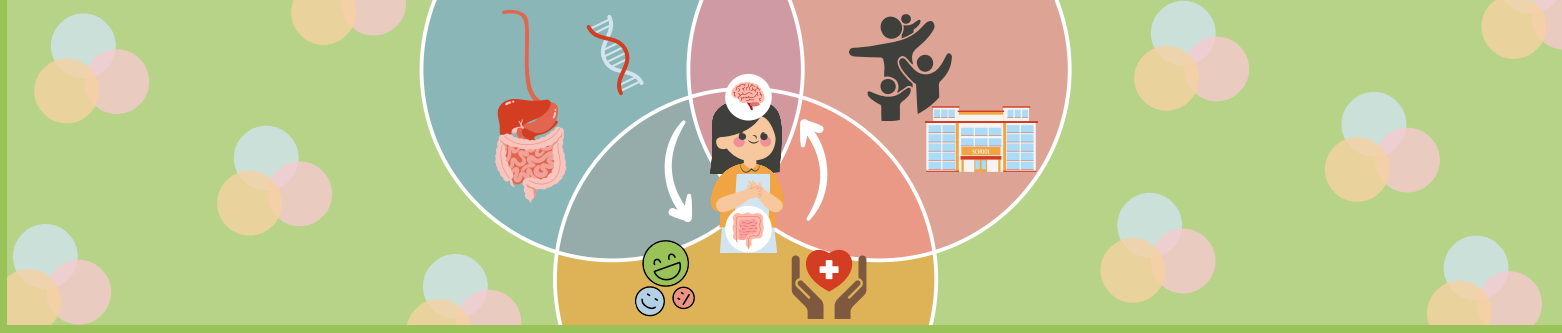

APPLYING THE BIOPSYCHOSOCIAL MODEL IN DGBI DIAGNOSIS

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ABSTRACT

Disorders of Gut-Brain Interaction (DGBI) are characterized by chronic gastrointestinal symptoms without structural abnormalities. There are several challenges in the diagnostic process due to difficulty identifying biomarkers for accurate diagnosis, the variability of symptom presentation, and the influence of culture on disorders. While the Rome IV criteria acknowledge cultural variations, existing cultural barriers complicate the diagnostic process. Discrepancies in diagnostic approaches across countries underscore the need to validate criteria like Rome IV in diverse cultural settings. Cultural differences also manifest in symptom expression and perceptions of pain, impacting diagnosis and treatment. Understanding these multifaceted influences is crucial for healthcare professionals to provide culturally sensitive care and improve diagnostic accuracy across diverse cultural contexts. The research suggests incorporating the biopsychosocial model can lead to more personalized and effective diagnoses. This paper advocates for incorporating the biopsychosocial model in diagnosis instead of solely using diagnostic criteria to offer a more comprehensive understanding of the illness.

INTRODUCTION

Formerly known as Functional Gastrointestinal Disorders (FGID), DGBI are a group of gastrointestinal (GI) disorders characterized by chronic GI symptoms with relation to intestinal motility disturbance, increased pain sensitivity in internal organs, altered mucosal and immune function, altered gut microbiota, and altered central nervous system processing [1]. The pathophysiology of DGBI is not yet fully understood, but it can be best identified as dysregulation of the gut-brain axis and presentation of any combination of motility disturbance, visceral hypersensitivity, altered mucosal and immune function, altered gut microbiota, or altered central nervous system processing [2,3].

DGBI heavily impacts the livelihood of children through the complex process of diagnosis and treatment. DGBI are associated with psychological disorders, emotional problems, school absenteeism, and poor school performance [4]. As such, timely and accurate diagnoses of DGBI can improve patient health.

Diagnosis of pediatric DGBI involves a medical history, physical examination, laboratory examination, and often a symptom-based assessment [5]. DGBI are diagnosed following the Rome Criteria, a diagnostic tool that classifies DGBI into 33 adult and 20 pediatric disorders based on symptom presentation [3]. These criteria assess the combination of physical symptoms present as well as their frequency and duration, and emphasize identifying symptom patterns without an identifiable organic cause [6]. Diagnostic criteria typically require that symptoms are present for at least three months, with onset occurring six months before diagnosis. Diagnostic tests such as endoscopy may be used to rule out structural causes. Additional tests such as balloon expulsion tests, anal surface EMG, or manometry may be employed according to the specific disorder presentation [5]. Some diagnostic consultations may consider psychological and social factors; however, these practices may be less formalized in the biomedical model, which assumes illness to be the consequence of exclusively measurable biological factors [7]. As the Rome Foundation acknowledges, minimizing this disorder to the symptoms presented in the Rome criteria can neglect the role that psychology and sociology can play. Applying the biopsychosocial model to children with DGBI provides a more comprehensive understanding of illness, enabling the examination of the combined roles of genetic, physiological, psychological and environmental factors that affect children with DGBI [8]. The biopsychosocial model has been widely used in healthcare since the 1970s to recognize the interplay of

biology, psychology and sociology in medicine [9]. Since then, this model has provided a way to understand the discrepancies between biomedical thought and clinical observation [1]. Considering the biopsychosocial model in relation to DGBI allows for holistic assessment of the complexities in diagnosing DGBI as topics surrounding anxiety, social life, and culture can be considered in addition to factors such as genetics and cellular biology.

The absence of reliable biomarkers, variability of symptom presentation, and relevance of cultural context can lead to difficulties in diagnosing DGBI [5]. As such, looking at timely diagnosis based on individual circumstances guided by a patient, family and caregivers, and clinician beliefs may be beneficial.

BIOMARKERS AND DIAGNOSIS

A biomarker is a measurable characteristic that can be used to evaluate biological processes in an accurate and reproducible manner. Past efforts to identify biomarkers for DGBI diagnosis have been unsuccessful as they have not proven consistent enough to diagnose patients. Without a perfect reference standard to compare biomarker candidates to, many avenues for research end up with invalid results [10]. Early investigations have identified fecal volatile organic molecules and colonic mucosal immune cells as potential biomarkers. However, these findings are yet to be validated and tested in larger and more diverse sample sizes or in a diagnostic setting [11]. As such, there are currently no biomarkers that can be used to diagnose DGBI, posing a challenge to their timely and accurate diagnosis in people that are affected and seeking care [12,13].

A lack of reliable biomarkers increases the dependence on the symptom-based Rome IV criteria, the current gold standard for diagnosing DGBI. Diagnoses often rely on the process of elimination, which can be costly and tedious for patients and the healthcare system [7,14]. Additionally, the Rome IV criteria is limited in that it is based on its own previous versions, potentially introducing risk of bias. This has led researchers to look for biomarkers in many areas to try to deliver a more impartial and effective diagnosis to people afflicted by DGBI. However, a limited understanding of the pathophysiology of DGBI has slowed down investigations [15]. A potential option that takes this into account is the establishment of "surrogate endpoints," which are defined as biomarkers that may be substitutes for clinical endpoints to predict clinical benefit. Establishing surrogate endpoints may be able to guide researchers in biomarker investigations. An example of this would be establishing small intestinal microbiota as a surrogate endpoint and hydrogen breath tests as a biomarker candidate [11].

Another challenge in the search for DGBI biomarkers is the difference in presentation across several cultures and environments, making important prevalence and severity data difficult to gather. DGBI already presents differently from person to person, but the contrast may be more stark when compared across countries due to differences in symptom perception across cultures [10,16].

The Rome IV criteria is currently available in 33 different languages to allow for global consistency in diagnosis. However, there may be a need to implement further cultural and regional considerations for diagnosis. This is shown by instances such as inconsistent Irritable Bowel Syndrome (IBS), a common DGBI, epidemiology across different countries [17]. Establishing reliable biomarkers could help attain a clearer picture of global DGBI prevalence. However, it is largely unrealistic to try to target a single biomarker considering the variability of presentation [16]. Research into a broader scope of biomarkers is a current focus of DGBI research, as they are necessary for improved care and individualized patient treatment [11].

Considering these obstacles, DGBI research is moving towards innovative techniques that could provide a chance for a better diagnosis of DGBI. One of the potential avenues is the use of neuroimaging techniques. Current research has shown evidence of neural structural alterations in individuals with IBS. However, this finding alone is not robust to form new diagnostic criteria due to a 70% predictive accuracy. The primary hope for using neuroimaging in DGBI research and diagnosis is the reframing and recontextualization of the disorders falling into that category [18]. Another option, considering the high comorbidities experienced by people with DGBI, may be to identify psychomarkers to utilize in conjunction with future biomarkers and the symptom-based criteria already in use [12]. As such, searching for supplemental diagnostic criteria will likely have to consider the biopsychosocial model due to DGBI-specific diagnosis difficulties, such as a lack of biomarkers. The multifaceted nature of DGBI encourages innovative approaches in this sector.

VARIABILITY IN SYMPTOMS

DGBI, heterogeneous disorders, which are characterized by a wide range of symptoms, pose diagnostic challenges for clinicians showcasing the need for diagnosis through the biopsychosocial model [19].

Genetic predispositions demonstrate the biological aspect of symptom variability, as children with a family history of conditions like maternal anxiety or depression are at a heightened risk for developing DGBI [20,21]. Moreover, physiological factors, including the diversity of enteric neurons, have been associated with symptoms of DGBI, showcasing the role of biology in symptom expression [22]. Furthermore, research highlights the need to consider a child's unique genetic and physiological makeup, including the connections between genetic predispositions and environmental factors like diet, microbiota, and stress [14,21,23]. For example, the Children's hospital of Philadelphia incorporated the

biopsychosocial model through an integrated pediatric gastroenterology psychology program. Physicians are trained in providing DGBI diagnoses, cognitive behavioural therapy for abdominal pain disorders, treatment adherence, and feeding and eating difficulties. Additionally, there is training surrounding culturally competent care and considerations for people from marginalized groups. The program has experienced a larger increase in visit volume compared to the hospital's general GI division in the same decade. Outpatient visits have increased from 722 in 2011 to 6,348 in 2021 [24]. This approach showcases the need for an approach to diagnosis and treatment that accounts for the child's genetics and physiological state. Psychological aspects further complicate symptom variability. Mental health comorbidities like anxiety and depression, which are prevalent amongst children with DGBI, contribute to the variability of symptoms. These conditions worsen physical symptoms and complicate their management [25,26]. The high prevalence of anxiety and depression in children with DGBI highlights the importance of incorporating mental health support into the care plan for children with DGBI, addressing both the psychological factors directly influencing symptom severity and the co-morbid mental health conditions [25-27]. Other psychological factors, like catastrophizing, can exacerbate symptoms and reduce quality of life, demonstrating the need for psychological interventions as part of the diagnostic and treatment processes [26].

The social aspect of the biopsychosocial model also plays an essential role in the expression and severity of DGBI symptoms [25]. Family dynamics, peer interactions, cultural influences, and environmental stressors can significantly impact symptoms [25]. For instance, a family history of gastrointestinal symptoms can predispose children to DGBI, while negative peer interactions such as bullying can worsen symptoms through increased stress [25]. Furthermore, experiences of childhood abuse can lead to chronic stress, which in turn can aggravate symptoms, highlighting how social factors influence DGBI [21].

The complexity of DGBI in children highlights the need for a biopsychosocial approach to diagnosis and treatment [25]. Biologically, children's genetic and physiological makeup predisposes them to DGBI, psychological components can exacerbate symptoms, and social factors influence the severity of symptoms [23,25,26]. Given these factors, integrating the biopsychosocial model into healthcare settings can significantly advance understanding, management, and diagnosis of DGBI in children. By acknowledging and addressing the complex nature of these disorders, clinicians can diagnose more effectively [21]. This approach encourages a more nuanced view of symptom variability, moving beyond a solely biomedical perspective and including psychological and social considerations [22]. Clinicians can use assessments that account for the biological, psychological, and social aspects of a patient's health. This can involve collecting medical histories, and understanding the patient's mental health, lifestyle, and environmental factors. Clinicians can use this to create personalized treatment plans that can include therapies, social support, and medical interventions [28,29]. In summary, the biopsychosocial model creates a more comprehensive understanding of DGBI, increasing the potential for timely and accurate diagnosis and improving health outcomes [6-8,20].

CULTURE & ENVIRONMENT

Culture is characterized by values, beliefs, norms, and practices acquired by a group through learning and shared experiences. It serves as a guiding force influencing thought processes, decisions, and actions in predictable patterns [30]. Cultural influences can impact various aspects of the patient-physician dynamic, including the diagnostic process, treatment selection, and overall health outcomes [31]. It is notable how culture influences DGBIs through these aspects, a connection recognized in the collaborative development of Rome IV, which engages 117 experts from 23 countries and acknowledges the profound impact of cultural factors on disease manifestation and management [32]. However, despite this global effort, cultural barriers persist, complicating the diagnostic journey, particularly among pediatric populations.

From a biomedical perspective, there are some discrepancies in diagnostic approaches across different countries. As DGBI diagnoses depend on symptom description, it is necessary to establish the validity of the Rome IV criteria in different cultural settings. In particular, Hreinsson et al. conducted a study in 33 countries to assess whether or not the disorders in Rome IV aligned with their assigned symptoms in their particular populations. Findings indicate that North Americans are incompatible with the Rome IV symptoms for functional dyspepsia. This is potentially attributed to evolving clinical and diagnostic trends in the United States, where reflux disease is overemphasized, and dyspepsia's significance is underestimated [33]. Additionally, it was found that meal-related pain and abdominal pain limiting daily activities were additional symptoms correlated to IBS that are not currently included in the Rome IV criteria [32,34].Functional dyspepsia is another example of cultural differences that impact the biomedical perspective of DGBI. This condition is broken down into two subgroups: epigastric pain syndrome and postprandial distress syndrome [1,35]. Studies indicate that the prevalence of each sub-group varies between East Asian and Western populations and can potentially be attributed to factors such as Helicobacter pylori infection, which is more prevalent in Asia and may influence gastrointestinal motility and hormone production [36,37].

In childhood, cultural influences can shape one's psychological relationship with health. In particular, the stigma surrounding a functional disorder such as DGBI may manifest as shame or embarrassment to a child or

their family, resulting in them minimizing their symptoms or downplaying its severity [38,39]. Moreover, cultural norms dictate the expression of pain, influencing a child's perception of symptoms [1]. For instance, in China, pain and bloating might be viewed as interconnected, with bloating seen as a less severe form of pain along a continuum [40]. Within a social context, familial experiences with chronic pain have been linked to more frequent episodes of pain in children. Children with mothers who have IBS exhibit increased occurrence of both GI and non-GI symptoms, along with more school absences and clinical visits [41]. While children with both parents experiencing chronic pain exhibited significantly worse health outcomes compared to those with only one or neither parent having chronic pain [42]. This may be explained through the social learning theory and the social communication model of pain, which suggests that children mirror their expression of pain based on how their parents demonstrate pain behaviour [43].

By simultaneously considering the biological, psychological, and social dimensions by applying the biopsychosocial model, healthcare professionals can attain a more comprehensive understanding of the factors influencing DGBI across diverse cultural contexts [43]. Particularly when utilizing internationally applicable criteria like the Rome IV, this approach ensures sensitivity to patients' cultural backgrounds in diagnosis. In a healthcare setting, assessing the emotional dynamics within a patient's family provides crucial insights into how relationships may affect the patient's health, including their contribution to health-promoting behaviors or disease progression through stress-related pathways or emotional dysregulation [44]. Enhancing clinicians' capacity to observe these relational dynamics and linking them to health outcomes via the biopsychosocial model facilitates broader systemic thinking and ultimately a clearer picture of DGBIs in children [44]. Consequently, future areas of study may benefit by looking into diagnostic patterns within immigrated/emigrated groups (e.g. a group in their native country compared to in a "melting pot" country like Canada or the United States) and associations between prevalence rates, perceptions of health, familial dynamics and culturally sensitive diagnostic processes.

CONCLUSION

It is essential to consider the biopsychosocial model when dealing with DGBI as the complex nature of this disease provides significant difficulty for children living with DGBI. Within an exclusively biomedical model, children living with DGBI could be classified or stereotyped as someone with a psychological disorder; this may invalidate the symptoms this child is feeling, and possibly even misdiagnose a child due to a misunderstanding of the effects of the DGBI.

The exploration of DGBI in children describes the complicated interplay of biological, psychological and social factors in their diagnosis and management. With an understanding of the limitations provided by a more traditional diagnosis, it is critical to advocate for the integration of the biopsychosocial model to develop a more holistic understanding of DGBI. By integrating genetic predispositions, physiological factors, psychological comorbidities and social influences into the diagnosis and treatment of DGBI, clinicians can develop better strategies that focus on the unique presentation of DGBI.

The limitations of diagnosis are apparent through the lack of diagnostic biomedical investigations, variability of symptoms, and cultural challenges which underscore the need for the biopsychosocial approach. Additionally, factors like genetic predispositions, physiological conditions, mental health comorbidities, family dynamics, and peer interactions, highlight the need for a nuanced approach to diagnosis [22].

With a variety of information to consider, clinicians may find it challenging to incorporate the biopsychosocial perspective, instead diagnosing children using the biomedical model. This may lead to increased risk of a misdiagnosis or stereotyping of physiological pain. The biomedical model is commonly used, but it is essential to consider all aspects of the biopsychosocial model when interacting with children to provide the patient with a diagnosis that accounts for their personal needs. By acknowledging the diverse nature of these disorders, clinicians can better address the complex needs of affected children, hopefully leading to improved health outcomes and overall better quality of life.

LIMITATIONS

It is important to note that the biopsychosocial model may present challenges in diagnosis or identifying symptom contributions in DGBI in children. For example, the subjective nature of social and psychological assessments may lead to variation in the interpretation of symptoms, which can complicate diagnosis [45,46]. Additionally, a multidisciplinary team comprising gastroenterologists, psychologists, social workers, and other professionals may be used to apply the biopsychosocial model [47]. This strategy may need resources that are not available and bring logistical difficulties. Furthermore, the evidence for the biopsychosocial model's use in children's DGBI diagnosis is still developing [22]. This gap in the literature suggests the need for more targeted research that can offer evidence-based recommendations for using the biopsychosocial model to diagnose and treat DGBI in children.

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