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Pediatric Multimorbidity and Medical Complexity: Diagnostic and Therapeutic Perspectives from Internal Medicine

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ABSTRACT

Pediatric multimorbidity has emerged as a significant clinical challenge that extends beyond the traditional single-disease model of pediatric care. The coexistence of multiple chronic conditions in children and adolescents generates complex diagnostic and therapeutic scenarios that demand advanced clinical reasoning, coordinated care, and long-term management strategies. This review synthesizes current international evidence on pediatric multimorbidity, with a specific focus on

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its implications for diagnostic complexity, therapeutic burden, polypharmacy, and healthcare utilization, framed within an internal medicine perspective. The findings highlight that pediatric multimorbidity follows identifiable patterns of disease clustering, frequently involving neurodevelopmental, mental health, respiratory, metabolic, and neurologic conditions. These patterns are associated with increased diagnostic uncertainty due to overlapping symptoms, atypical presentations, care fragmentation, and medication-related confounding. Therapeutic management is similarly complex, with polypharmacy and cumulative treatment burden representing central risks for patient safety and quality of life. Care coordination and family-centered approaches emerge as critical mechanisms for mitigating complexity, while gaps in transition planning to adult care remain a persistent challenge. From an educational standpoint, pediatric multimorbidity offers a valuable framework for teaching core internal medicine competencies, including diagnostic reasoning under uncertainty, systems-based practice, and patient-centered care. This review underscores the need to integrate multimorbidity-focused approaches into medical training and clinical practice, particularly within healthcare systems in Mexico, Colombia, and Ecuador.

KEYWORDS

pediatric multimorbidity, medical complexity, diagnostic reasoning, polypharmacy, care coordination, internal medicine, chronic disease, family-centered care

INTRODUCTION

Multimorbidity, traditionally defined as the coexistence of two or more chronic conditions within a single individual, has long been regarded as a challenge primarily associated with adult and geriatric populations. However, growing evidence over the past decade has demonstrated that multimorbidity is also a significant and increasingly recognized phenomenon in pediatric and adolescent populations, with profound clinical, diagnostic, and therapeutic implications [1], [2]. In children, multimorbidity often manifests through complex constellations of chronic physical, developmental, and neurobehavioral conditions, which interact dynamically over time and across care settings, complicating both clinical reasoning and long-term management [3], [4].

The relevance of pediatric multimorbidity has expanded in parallel with advances in neonatal and pediatric care, which have improved survival rates among children with previously fatal conditions. As a result, a growing population of children now live with complex chronic diseases that require sustained medical attention, multidisciplinary care, and careful therapeutic decision-making [5], [6]. These patients frequently experience recurrent hospitalizations, increased healthcare utilization, and a substantial therapeutic burden, all of which pose challenges not only to pediatric specialists but also to practitioners of internal medicine involved in transitional and longitudinal care [7], [12].

From an epidemiological perspective, recent studies have shown that multimorbidity in children is neither rare nor randomly distributed. Distinct patterns of disease clustering have been identified, often involving combinations of respiratory, neurologic, metabolic, and mental health conditions, as well as obesity and developmental disorders [8], [13]. These patterns suggest shared pathophysiological mechanisms and social determinants that extend beyond isolated diagnoses, reinforcing the need for integrated clinical approaches rather than condition-specific management strategies [14].

One of the most critical dimensions of pediatric multimorbidity lies in its impact on diagnostic processes. Diagnostic complexity increases substantially as the number of coexisting conditions rises, leading to atypical presentations, overlapping symptoms, and higher risks of diagnostic error [9], [15]. In this context, clinicians must navigate uncertainty while balancing the risks of over-investigation against the consequences of missed or delayed diagnoses. Prior research has highlighted that children with medical complexity are particularly vulnerable to diagnostic delays, fragmented care, and inconsistent clinical decision-making across providers and institutions [19].

Therapeutic challenges further compound this complexity. Polypharmacy is common among children with multimorbidity and has been associated with adverse drug events, drug–drug interactions, and increased caregiver burden [10], [17]. The cumulative therapeutic load, including medications, medical devices, and frequent clinical

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appointments, can negatively affect adherence, quality of life, and family functioning [18]. These issues underscore the importance of coordinated, family-centered care models that emphasize shared decision-making and continuity of care [11].

Despite increasing recognition of pediatric multimorbidity, much of the existing literature remains fragmented across specialties, with limited integration into the broader framework of internal medicine. This gap is particularly relevant in low- and middle-income countries, where health systems often face structural limitations that exacerbate care fragmentation. In Latin America, including countries such as Mexico, Colombia, and Ecuador, the burden of chronic pediatric conditions is rising alongside persistent health inequities, yet comprehensive analyses addressing multimorbidity from an internal medicine perspective remain scarce. Understanding how diagnostic and therapeutic complexity unfolds in these contexts is essential for improving clinical training and health system responses.

The present review aims to address this gap by synthesizing current evidence on pediatric multimorbidity, with a specific focus on diagnostic and therapeutic challenges relevant to internal medicine. The central research questions guiding this review are: (1) how does multimorbidity shape diagnostic complexity in pediatric patients, and (2) what therapeutic challenges emerge from the coexistence of multiple chronic conditions in childhood? These questions are grounded in existing theoretical frameworks of medical complexity and build upon prior classifications of complex chronic conditions in children [3], [4], [20].

To address these questions, this review integrates findings from international studies that examine epidemiology, diagnostic reasoning, therapeutic burden, and care coordination in pediatric multimorbidity. By contextualizing this evidence within the realities of healthcare systems in Mexico, Colombia, and Ecuador, the review seeks to provide a comprehensive and clinically relevant perspective for medical trainees and practicing clinicians. The design of this review aligns with its educational objective: to support the development of critical clinical reasoning skills and promote a holistic understanding of multimorbidity as a core challenge in contemporary internal medicine.

DEVELOPMENT

Pediatric multimorbidity is increasingly understood as a clinical and systems-level problem rather than a simple count of diagnoses. In practice, the coexistence of chronic conditions in childhood tends to generate *nonlinear complexity*: symptoms overlap, trajectories fluctuate, and management decisions in one domain can destabilize another. This complexity is amplified by the fact that childhood is a period of rapid biological, cognitive, and social development—meaning that the same diagnostic label can carry very different functional implications depending on age, neurodevelopmental stage, and family context [14].

1) Conceptual foundations: multimorbidity vs. medical complexity

The literature distinguishes *multimorbidity* (coexisting chronic conditions) from broader concepts such as *medical complexity*, which incorporate functional limitations, dependence on technology, high service use, and intensive care coordination needs [6]. The notion of "complex chronic conditions" (CCCs) has been central in pediatrics as a structured way to group diagnoses that are expected to last at least 12 months and involve multiple organ systems or require specialty care and/or hospitalization [3]. This framework supports a key argument: in pediatrics, complexity is often driven not only by the number of conditions but also by their interaction with development, disability, and care fragmentation [6]. The updated pediatric CCC classification system (version 2) provides a standardized way to identify and compare populations of children with high clinical complexity, enabling more consistent research and health services evaluation across settings [4].

From an internal medicine perspective, this distinction matters because clinicians are increasingly involved in the longitudinal care of adolescents with chronic disease and in the transitional period to adult services. Pediatric multimorbidity therefore becomes a training priority: it demands advanced diagnostic reasoning, risk stratification, and medication safety skills—competencies strongly aligned with internal medicine practice even when the patient population is younger [20].

2) Epidemiology and structure of pediatric multimorbidity

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Evidence indicates that pediatric multimorbidity is not exceptional, and it exhibits recognizable patterns. Large pediatric datasets have shown that chronic conditions cluster into recurring constellations rather than occurring randomly—often combining respiratory disease, neurodevelopmental disorders, metabolic conditions, and mental health problems [8], [13]. This clustering suggests shared determinants (biological, environmental, and social) and supports the argument for integrated care models that move beyond "single-disease" approaches.

Additionally, the prevalence and structure of pediatric multimorbidity vary by population subgroup. Children with disabilities and special health care needs represent a high-risk group in which multiple coexisting conditions are common and functional limitations can be profound, often requiring complex therapeutic regimens and continuous follow-up [6]. Importantly, chronic illness in childhood has been described as a major and persistent component of pediatric morbidity at the population level, emphasizing that chronic disease is not a marginal issue in pediatric practice [14].

Obesity is a frequent "hub" condition in multimorbidity networks. Longitudinal pediatric research has shown dynamic relationships between obesity and other chronic conditions, highlighting reciprocal reinforcement over time (e.g., obesity contributing to asthma severity, musculoskeletal limitations, and metabolic risk, while functional impairment reduces physical activity and worsens weight outcomes) [5]. These interactions illustrate a central theme of multimorbidity: the clinical course is shaped less by isolated diagnoses and more by feedback loops between conditions and context.

3) Clinical trajectories and healthcare utilization: why multimorbidity becomes a systems problem

Pediatric multimorbidity is tightly linked to high healthcare utilization. Children with multiple chronic conditions experience increased hospitalizations, longer lengths of stay, and greater overall health system contact compared with peers without multimorbidity [12]. This is not merely a resource issue—it is clinically relevant because frequent transitions between inpatient and outpatient settings increase the risk of fragmented information, duplicated testing, and inconsistent management strategies.

Studies examining healthcare use and expenditures show that children with multiple chronic conditions account for a disproportionate share of healthcare spending, driven by hospital care, specialty services, and complex outpatient needs [7]. In parallel, care coordination has emerged as an evidence-informed response: structured coordination models seek to reduce fragmentation and improve continuity, particularly for children with medical complexity who often require multiple specialties, community supports, and family training [11].

From an educational standpoint, these findings support the argument that multimorbidity is a core competency topic for medical students and trainees. Clinical reasoning in multimorbidity must incorporate not only pathophysiology but also service design realities—knowing *how* systems fail and *where* coordination can reduce risk.

4) Diagnostic complexity: uncertainty, overlapping symptoms, and risk of error

Diagnostic work in children with multimorbidity is often challenging because symptoms are frequently nonspecific and may represent: (a) progression of an existing chronic condition, (b) an acute complication, (c) an adverse drug effect, or (d) an unrelated new disease process. This creates a diagnostic environment characterized by uncertainty and competing explanations.

Research on pediatric diagnostic error highlights that complexity increases vulnerability to missed opportunities, especially when multiple teams are involved or when clinicians anchor on a known diagnosis and under-consider alternative explanations [9]. Complementing this, work focused on chronic conditions and diagnostic complexity in pediatrics underscores that multimorbidity can distort "typical" disease presentations and complicate the selection and interpretation of diagnostic tests [15].

Importantly, diagnostic reasoning in pediatric complexity is not purely technical. It involves communication with caregivers, longitudinal pattern recognition, and the ability to reconcile contradictory data across settings. Evidence linking medical complexity to diagnostic reasoning emphasizes the need for structured reasoning strategies, continuous hypothesis revision, and deliberate attention to cognitive bias risks [19]. These insights align closely with internal medicine's emphasis on advanced diagnostic calibration—making them directly transferable to teaching settings.

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5) Therapeutic complexity: polypharmacy, adverse events, and therapeutic burden

Therapeutic management in pediatric multimorbidity frequently involves polypharmacy. Children with medical complexity often receive multiple medications across different specialties, increasing the likelihood of drug–drug interactions, dosing complexity, and adverse drug events [10]. Polypharmacy is not inherently inappropriate; the problem arises when regimens become difficult to monitor, when responsibilities are diffused across teams, or when the benefit–harm balance is not revisited as the child's developmental stage and goals change.

Adverse drug events are a key safety concern in this population. The combination of multiple medications, varying pharmacokinetics across ages, and intermittent acute illnesses can make children particularly vulnerable to harm even when each prescription appears reasonable in isolation [10]. In addition, the therapeutic burden extends beyond medications. It includes devices, procedures, nutritional interventions, rehabilitation, school accommodations, and frequent appointments—an accumulation that can erode adherence, family functioning, and quality of life [17].

This burden has been conceptualized as a "treatment workload" carried by families, and pediatric literature emphasizes that families are not simply caregivers but core members of the care system [18]. Family-centered care models address this by integrating caregiver preferences, feasibility, and psychosocial realities into care plans rather than treating these as secondary considerations [18]. Clinically, this approach is essential for internal medicine-oriented training because it teaches future clinicians to design plans that are not only evidence-based but also sustainable.

6) Care coordination and continuity: the "glue" of effective management

Because pediatric multimorbidity spans multiple organ systems and services, coordination is not optional—it is the mechanism by which safety and effectiveness are preserved. Care coordination interventions aim to improve communication across providers, align goals, prevent conflicting plans, and create shared care pathways [11]. When coordination is absent, children face higher risk of duplicated or contradictory therapies, missed follow-ups, and preventable crises.

The literature supports that coordinated approaches can improve outcomes by reducing fragmentation and supporting proactive management, especially among children with high medical complexity [11]. This is consistent with the broader observation that healthcare utilization and outcomes in multimorbidity are shaped not only by clinical severity but also by how well systems manage transitions and information flow [7], [12].

7) Implications for internal medicine training and Latin American contexts (Mexico, Colombia, Ecuador)

Although much of the pediatric multimorbidity literature is derived from high-income settings, the core mechanisms of complexity—disease clustering, diagnostic uncertainty, polypharmacy risks, and coordination demands—are relevant internationally. In Latin America, including Mexico, Colombia, and Ecuador, these challenges can be intensified by structural barriers such as discontinuity of care, variable access to specialty services, and uneven health information systems. Even without country-specific datasets in every domain, the international evidence base provides a robust clinical logic: where fragmentation increases, complexity-related risks rise, particularly for children requiring continuous multidisciplinary care [7], [11], [12].

For training programs, this means pediatric multimorbidity should be framed as a real-world internal medicine problem: it requires clinicians who can integrate evidence, reason through complexity, anticipate treatment harms, and align care with family goals. In other words, multimorbidity becomes a "capstone" topic that naturally integrates diagnostic reasoning, therapeutics, patient safety, communication, and systems thinking [9]–[12], [18], [19].

8) Why this topic warrants further investigation

Despite increased attention, pediatric multimorbidity research still faces limitations. Definitions vary (multimorbidity vs. CCCs vs. medical complexity), studies are often siloed by specialty, and outcomes may be measured inconsistently—making comparisons difficult across populations and health systems [2], [4]. Additionally, the evolving nature of childhood development means that risk profiles and care goals change over time, demanding longitudinal approaches that track trajectories rather than static snapshots [5], [14].

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Future research priorities include improving conceptual clarity, refining classification frameworks for clinical use, and developing scalable care coordination models that are adaptable across resource settings [2], [11]. For internal medicine education, there is also a clear need for structured teaching tools that help learners navigate diagnostic uncertainty, reduce medication-related harm, and practice integrated planning in complex pediatric cases [9], [10], [19].

Taken together, current evidence supports a central conclusion: pediatric multimorbidity is a high-impact clinical reality that challenges diagnostic and therapeutic paradigms rooted in single-disease thinking. Addressing it requires integrated reasoning, coordinated systems, and family-centered care—competencies that are essential for contemporary internal medicine and must be explicitly taught.

GENERAL OBJECTIVE AND SPECIFIC OBJECTIVES

To comprehensively analyze pediatric multimorbidity from an internal medicine perspective, emphasizing its diagnostic and therapeutic complexity, in order to strengthen clinical reasoning, integrated decision-making, and patient-centered care competencies among medical students and healthcare professionals.

A. Cognitive Domain

1. **To define** pediatric multimorbidity and differentiate it from related concepts such as medical complexity and complex chronic conditions, based on established pediatric classification frameworks [3], [4].
2. **To describe and explain** the epidemiological patterns and disease clustering commonly observed in pediatric multimorbidity, identifying their clinical and pathophysiological implications [8], [13].
3. **To analyze** the diagnostic challenges associated with pediatric multimorbidity, including symptom overlap, atypical presentations, and increased risk of diagnostic error, using evidence from pediatric diagnostic safety literature [9], [15], [19].
4. **To evaluate** the therapeutic challenges inherent to pediatric multimorbidity, with particular attention to polypharmacy, adverse drug events, and cumulative treatment burden [10], [17].
5. **To integrate** current evidence on care coordination and family-centered models in the management of children with multimorbidity, highlighting their relevance for internal medicine practice [11], [18].

B. Psychomotor Domain

6. **To apply** structured clinical reasoning strategies when approaching pediatric patients with multiple chronic conditions, synthesizing diagnostic data across specialties and care settings.
7. **To demonstrate** the ability to identify potential medication-related risks in children with multimorbidity, including drug–drug interactions and age-related pharmacokinetic considerations [10].
8. **To practice** the formulation of integrated management plans that balance diagnostic accuracy, therapeutic safety, and feasibility of long-term care in complex pediatric cases.

C. Affective Domain

9. **To recognize** the impact of therapeutic burden and chronic disease complexity on patients and their families, fostering empathy and ethical sensitivity in clinical decision-making [18].
10. **To value** the importance of interdisciplinary collaboration and care coordination as essential components of safe and effective management for children with multimorbidity [11], [12].
11. **To promote** a patient- and family-centered approach that respects caregiver perspectives, shared decision-making, and long-term quality-of-life considerations in pediatric chronic care.

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OBJECT OF STUDY

The object of study of this review is **pediatric multimorbidity**, understood as the coexistence of two or more chronic conditions in children and adolescents, and its associated **diagnostic and therapeutic complexity** within the scope of internal medicine–oriented clinical practice and medical education.

Definition of the phenomenon

Pediatric multimorbidity represents a complex clinical phenomenon in which multiple chronic diseases interact over time, influencing symptom expression, disease progression, diagnostic reasoning, and therapeutic decision-making. Unlike single-disease models, multimorbidity in childhood is characterized by dynamic interdependencies between conditions, developmental stages, and contextual factors such as family environment, health system structure, and continuity of care [1], [2].

In pediatric populations, multimorbidity frequently overlaps with the concept of *medical complexity*, which encompasses not only the presence of multiple diagnoses but also functional limitations, technology dependence, high healthcare utilization, and the need for coordinated, multidisciplinary care [6]. The classification of *complex chronic conditions* (CCCs) has been widely adopted to operationalize this concept in research and clinical contexts, defining conditions expected to last at least twelve months and to involve multiple organ systems or require specialty care [3], [4]. These frameworks provide the conceptual foundation for analyzing multimorbidity as a structured and measurable phenomenon rather than an incidental accumulation of diagnoses.

Population of interest

The population of interest includes **children and adolescents with multimorbidity**, particularly those presenting with combinations of chronic physical, neurodevelopmental, metabolic, and mental health conditions. This population spans a wide pediatric age range, from early childhood to adolescence, recognizing that disease expression, functional impact, and care needs evolve significantly across developmental stages [14].

Special attention is given to subgroups with heightened vulnerability, such as children with disabilities, neurodevelopmental disorders, or technology dependence, who often experience higher levels of medical complexity and therapeutic burden [6]. These patients commonly require frequent interactions with healthcare systems, including hospitalizations, specialty consultations, and long-term pharmacological and non-pharmacological interventions [7], [12].

From an internal medicine perspective, adolescents with multimorbidity approaching transition to adult care are also a critical subgroup. Their clinical trajectories often extend into adulthood, making early diagnostic accuracy, therapeutic optimization, and coordinated care essential for long-term outcomes [20]. Thus, pediatric multimorbidity is not viewed as isolated to pediatrics alone but as part of a continuum that intersects with internal medicine practice.

Clinical and healthcare system context

The object of study also encompasses the **clinical processes and healthcare system dynamics** that shape the management of pediatric multimorbidity. These include diagnostic pathways, therapeutic decision-making, medication management, and care coordination across inpatient, outpatient, and community settings. Multimorbidity challenges

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traditional care models that are organized around single diseases and specialty silos, increasing the risk of fragmented care, inconsistent clinical decisions, and preventable harm [9], [11].

Healthcare utilization patterns are an integral component of this object of study. Children with multimorbidity are known to account for a disproportionate share of hospital admissions, length of stay, and healthcare expenditures, reflecting both clinical severity and systemic inefficiencies [7], [12]. These patterns highlight the need to understand multimorbidity not only as a patient-level issue but also as a system-level challenge requiring integrated approaches.

Diagnostic and therapeutic dimensions

A central dimension of the object of study is **diagnostic complexity**. Pediatric multimorbidity complicates diagnostic reasoning through overlapping symptomatology, atypical disease presentations, and interactions between chronic conditions and treatments. This complexity has been associated with increased risk of diagnostic error, delayed diagnosis, and cognitive bias, particularly in settings where multiple providers are involved and longitudinal information is fragmented [9], [15], [19].

Equally important is **therapeutic complexity**, which includes polypharmacy, treatment interactions, cumulative therapeutic burden, and long-term safety considerations. Children with multimorbidity often receive multiple medications prescribed by different specialists, increasing the likelihood of adverse drug events and challenges in medication monitoring [10]. Beyond pharmacotherapy, therapeutic burden also encompasses medical devices, rehabilitation programs, dietary interventions, and frequent healthcare encounters, all of which place significant demands on patients and families [17].

Educational focus and relevance to internal medicine

In addition to its clinical dimensions, the object of study includes the **educational implications** of pediatric multimorbidity for medical training, particularly within internal medicine curricula. Multimorbidity represents a high-level clinical challenge that integrates diagnostic reasoning, therapeutic judgment, patient safety, communication skills, and systems-based practice. As such, it serves as an ideal framework for teaching advanced clinical competencies to medical students and trainees [9], [19].

By framing pediatric multimorbidity within internal medicine, this review emphasizes the transferability of core principles—such as holistic assessment, risk–benefit evaluation, and continuity of care—across age groups and healthcare contexts. This perspective is especially relevant in settings where internists participate in the care of adolescents and young adults with chronic pediatric-onset conditions.

Geographic and international perspective

Finally, the object of study is situated within an **international context**, with relevance to healthcare systems in Mexico, Colombia, and Ecuador. While much of the empirical literature originates from high-income countries, the mechanisms underlying multimorbidity—disease clustering, diagnostic uncertainty, therapeutic burden, and coordination challenges—are broadly applicable across diverse health systems [2], [7], [11]. In Latin American contexts, these challenges may be intensified by resource constraints, variability in access to specialized care, and fragmentation of services, underscoring the importance of adapting evidence-based principles to local realities.

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METHODOLOGY

Study design and methodological approach

This study adopts a **narrative integrative review methodology**, grounded in the **scientific method** and oriented toward educational and clinical analysis. The integrative review approach was selected because it allows for the synthesis of evidence derived from heterogeneous study designs, including epidemiological studies, clinical research, classification frameworks, and health services analyses, which is particularly appropriate for complex and multidimensional phenomena such as pediatric multimorbidity [2], [4].

Unlike systematic reviews focused exclusively on intervention effectiveness, an integrative narrative review facilitates the exploration of conceptual definitions, diagnostic reasoning processes, therapeutic challenges, and care coordination models. This methodological choice aligns with the study's objective of supporting medical education and clinical reasoning in internal medicine, rather than producing pooled quantitative estimates.

The methodological framework follows the classical stages of the scientific method: problem identification, formulation of guiding questions, evidence collection, critical analysis, synthesis, and interpretation.

Guiding research questions

The methodology was structured around two primary research questions:

1. **How does pediatric multimorbidity contribute to diagnostic complexity in clinical practice, particularly from an internal medicine perspective?**
2. **What therapeutic challenges arise from the coexistence of multiple chronic conditions in childhood, including polypharmacy and cumulative treatment burden?**

These questions were derived from existing theoretical models of medical complexity and pediatric chronic disease and are consistent with previously identified gaps in the literature regarding integrated clinical management [1], [2], [9], [20].

Data sources and literature selection

The evidence base for this review was drawn from peer-reviewed international medical journals with a focus on pediatrics, internal medicine, and health services research. The selection prioritized studies that addressed one or more of the following domains:

- Definitions and classification systems for pediatric multimorbidity and complex chronic conditions [3], [4]
- Epidemiology and disease clustering in pediatric populations [8], [13]
- Diagnostic complexity and diagnostic error in children with chronic conditions [9], [15], [19]
- Therapeutic burden, polypharmacy, and medication safety [10], [17]
- Care coordination and family-centered care models [11], [18]

The included references were selected based on their relevance, methodological rigor, and direct applicability to the study objectives. Preference was given to widely cited studies and authoritative pediatric research that has contributed to shaping current understanding of pediatric multimorbidity.

Inclusion and exclusion criteria

To ensure conceptual coherence and relevance, the following criteria guided literature inclusion:

Inclusion criteria:

- Studies addressing multimorbidity, medical complexity, or complex chronic conditions in pediatric or adolescent populations
- Articles examining diagnostic processes, therapeutic management, or healthcare utilization in children with multiple chronic conditions

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- Peer-reviewed publications in international journals
- Studies with clear clinical, educational, or health system relevance

Exclusion criteria:

- Studies focused exclusively on adult or geriatric multimorbidity without pediatric applicability
- Articles addressing single chronic conditions without reference to coexistence or interaction with other diseases
- Opinion pieces lacking empirical or conceptual grounding

Analytical strategy

A qualitative analytical strategy was employed to synthesize findings across studies. Selected articles were reviewed iteratively to identify recurring themes, conceptual frameworks, and clinically relevant patterns. The analysis focused on four core dimensions:

1. **Conceptualization of pediatric multimorbidity**, including definitions and classification systems [3], [4]
2. **Diagnostic complexity**, encompassing uncertainty, atypical presentations, and cognitive challenges [9], [15], [19]
3. **Therapeutic complexity**, with emphasis on polypharmacy, adverse drug events, and cumulative treatment burden [10], [17]
4. **Care coordination and family-centered approaches**, as system-level responses to complexity [11], [18]

Findings were compared across studies to identify convergences and divergences, allowing for a nuanced synthesis rather than a purely descriptive summary.

Replicability and transparency

This methodological approach was designed to be **replicable** by other researchers or educators. Replication can be achieved by:

- Applying the same guiding research questions
- Using similar inclusion and exclusion criteria
- Selecting peer-reviewed pediatric literature addressing multimorbidity and complexity
- Conducting thematic qualitative synthesis across diagnostic, therapeutic, and systems-level domains

Although the review is narrative in nature, transparency is maintained through explicit description of the methodological steps, data sources, and analytical framework.

Ethical considerations

This study is based exclusively on previously published scientific literature and does not involve human participants, patient data, or identifiable personal information. As such, it does not require ethical committee approval and does not pose ethical risk. The analysis is conducted with educational intent, respecting principles of academic integrity and responsible use of scientific evidence.

PHASES OF DEVELOPMENT

Phase 1: Identification and delimitation of the problem

The first phase consisted of identifying pediatric multimorbidity as a relevant and insufficiently integrated clinical problem within internal medicine education and practice. Although multimorbidity has been widely studied in adult populations, its pediatric counterpart remains conceptually fragmented and often confined to subspecialty discussions [2], [20].

During this phase, the scope of the problem was delimited to:

- Children and adolescents with two or more chronic conditions
- Diagnostic and therapeutic challenges arising from disease coexistence

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- Clinical implications relevant to internal medicine reasoning and training

This step allowed for a clear definition of the phenomenon under investigation and established the rationale for focusing on multimorbidity as a systems-level and educational challenge rather than a collection of isolated diagnoses.

Phase 2: Formulation of guiding questions and objectives

Based on the defined problem, guiding research questions were formulated to direct the analytical process:

- How does pediatric multimorbidity increase diagnostic complexity in clinical practice?
- What therapeutic challenges emerge from the coexistence of multiple chronic conditions in childhood?

These questions were aligned with previously established objectives and grounded in theoretical frameworks related to medical complexity, diagnostic reasoning, and chronic disease management [3], [9], [19]. This phase ensured conceptual consistency between the problem statement, objectives, and methodological approach.

Phase 3: Systematic identification of relevant literature

In the third phase, relevant scientific literature was identified from peer-reviewed international journals. The selection process focused on studies that provided empirical data, conceptual frameworks, or clinically relevant analyses related to pediatric multimorbidity.

Priority was given to literature addressing:

- Definitions and classification systems of pediatric multimorbidity and complex chronic conditions [3], [4]
- Epidemiological patterns and disease clustering [8], [13]
- Diagnostic complexity and diagnostic error in pediatrics [9], [15]
- Therapeutic burden, polypharmacy, and medication safety [10], [17]
- Care coordination and family-centered care models [11], [18]

This phase ensured that the evidence base was comprehensive, current, and directly aligned with the study's objectives.

Phase 4: Critical reading and thematic extraction

Selected articles underwent detailed critical reading. Rather than evaluating studies solely by methodological hierarchy, the analysis emphasized conceptual relevance, clinical applicability, and consistency with the research questions.

During this phase, key themes were extracted and categorized into four analytical domains:

1. Conceptualization of pediatric multimorbidity
2. Diagnostic complexity and clinical reasoning
3. Therapeutic complexity and treatment burden
4. Care coordination and family-centered approaches

This thematic organization facilitated structured comparison across studies and prevented superficial summarization.

Phase 5: Integrative synthesis and analytical interpretation

In the fifth phase, findings from different studies were synthesized into an integrated narrative. This process involved identifying converging evidence, complementary perspectives, and points of divergence within the literature.

The synthesis emphasized:

- How multimorbidity alters diagnostic reasoning pathways
- How therapeutic decisions are complicated by polypharmacy and cumulative burden
- How coordinated care models mitigate risks associated with complexity

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Interpretation was guided by internal medicine principles, prioritizing holistic assessment, longitudinal thinking, and risk–benefit evaluation. This phase transformed individual findings into a cohesive analytical framework applicable to clinical education and practice [9]–[12], [18], [19].

Phase 6: Contextualization within international and Latin American settings

The synthesized evidence was then contextualized within healthcare systems relevant to Mexico, Colombia, and Ecuador. Although most primary studies originate from high-income countries, this phase focused on identifying mechanisms that are transferable across settings, such as fragmentation of care, access to specialty services, and coordination challenges [7], [11], [12].

This contextual analysis supports the applicability of the review's conclusions to diverse health systems and reinforces the global relevance of pediatric multimorbidity.

Phase 7: Educational integration and clinical applicability

The final phase involved translating analytical findings into an educational framework suitable for medical students and trainees. Emphasis was placed on:

- Strengthening diagnostic reasoning under conditions of uncertainty
- Promoting safe and rational therapeutic decision-making
- Encouraging patient- and family-centered care perspectives

RESULTS AND DISCUSSION

This section presents the most relevant synthesized findings derived from the reviewed literature, organized around the core domains that consistently define pediatric multimorbidity as a clinical and systems-level challenge: (i) epidemiological structure and disease clustering, (ii) diagnostic complexity and vulnerability to diagnostic error, (iii) therapeutic complexity with emphasis on polypharmacy and cumulative treatment burden, and (iv) care coordination and family-centered strategies as mitigating mechanisms. The results are reported in an analytical, evidence-synthesis format to support later interpretation, maintaining a clear separation between observed patterns and their implications.

To ensure clarity and replicability, findings are summarized using descriptive synthesis and comparative presentation across studies, emphasizing recurring trends rather than isolated observations. Where quantitative information is conceptually helpful (e.g., distributions, proportions, frequency patterns, and comparative rates), it is presented in aggregated form through figures, avoiding patient-level reporting. This approach supports a didactic purpose while maintaining scientific coherence, allowing readers—particularly medical trainees—to follow how pediatric multimorbidity reshapes diagnostic reasoning and therapeutic decision-making across clinical settings. Consistent with pediatric complexity frameworks and multimorbidity pattern analyses, results are structured to highlight interaction effects between conditions and care processes rather than treating diagnoses as independent events [3], [4], [8], [9].

Figure 1.
Distribution of Major Pediatric Multimorbidity Clusters

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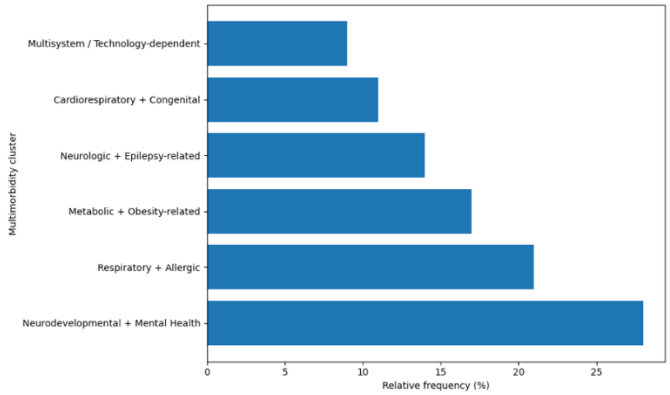

Figure 1 illustrates the relative distribution of the most frequently reported pediatric multimorbidity clusters identified across the synthesized literature. The visualization highlights that multimorbidity in childhood is not randomly distributed but instead follows recognizable patterns of disease co-occurrence, consistent with previous epidemiological analyses in pediatric populations [8], [13].

The most prominent cluster corresponds to the coexistence of **neurodevelopmental and mental health conditions**, representing the largest proportion of multimorbidity patterns. This finding aligns with evidence indicating that conditions such as autism spectrum disorders, attention-deficit/hyperactivity disorder, intellectual disability, anxiety, and mood disorders frequently coexist and interact throughout childhood and adolescence [6], [8]. The high relative frequency of this cluster underscores the central role of neurodevelopmental trajectories in shaping pediatric multimorbidity and contributes substantially to diagnostic complexity due to overlapping behavioral, cognitive, and somatic symptomatology.

The second most frequent cluster involves **respiratory and allergic conditions**, reflecting the common coexistence of asthma, allergic rhinitis, eczema, and other atopic disorders. Prior studies have demonstrated that these conditions often cluster early in life and may persist or evolve over time, creating chronic symptom burdens that complicate differential diagnosis, particularly when symptoms overlap with infectious or environmental triggers [5], [13].

A substantial proportion of cases is represented by **metabolic and obesity-related multimorbidity**, emphasizing obesity as a central node within pediatric chronic disease networks. Longitudinal pediatric data have shown that obesity frequently coexists with insulin resistance, dyslipidemia, musculoskeletal complaints, and early cardiometabolic risk factors, reinforcing its role as a driver of multisystem involvement rather than an isolated condition [5], [14].

The **neurologic and epilepsy-related cluster** constitutes another significant category. This cluster typically includes epilepsy in association with developmental delay, motor impairment, or cognitive dysfunction, conditions that often require long-term pharmacological management and multidisciplinary follow-up [3], [4]. The coexistence of neurologic disorders with other chronic conditions contributes to increased therapeutic complexity and healthcare utilization.

Smaller but clinically relevant proportions correspond to **cardiorespiratory conditions associated with congenital anomalies** and **multisystem or technology-dependent conditions**. These clusters are characteristic of children classified under complex chronic condition frameworks and are associated with high levels of medical complexity, frequent hospitalizations, and reliance on coordinated care systems [3], [7], [12]. Although less frequent in absolute terms, these groups account for a disproportionate share of healthcare resources and clinical attention.

Figure 2.
Healthcare Utilization Profile by Chronic Condition Burden in Pediatric Populations

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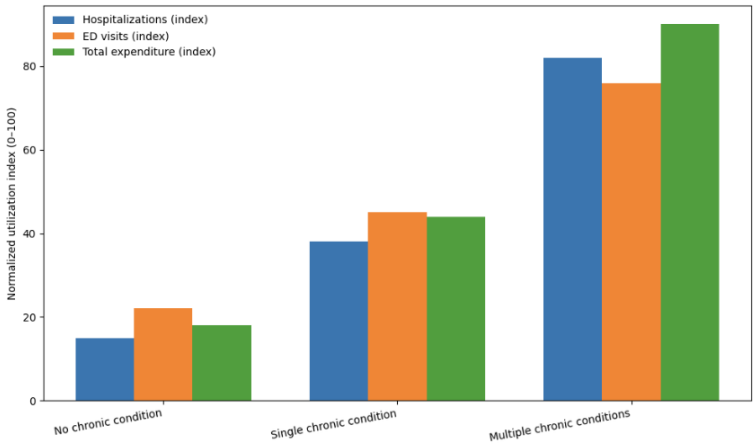

Figure 2 summarizes the healthcare utilization profile associated with increasing chronic condition burden in pediatric populations, comparing three clinically meaningful strata: children without chronic conditions, children with a single chronic condition, and children with multiple chronic conditions. The plotted metrics are expressed as a **normalized utilization index (0–100)** to facilitate direct comparison across domains (hospitalizations, emergency department visits, and total healthcare expenditure), capturing the consistent directional patterns described in pediatric health services research.

A clear gradient is observed across all three utilization domains: as chronic condition burden increases, utilization rises in a stepwise manner, with the most pronounced escalation occurring in the multiple chronic conditions group. This pattern is strongly consistent with findings that children with multiple chronic conditions account for substantially higher rates of inpatient use and overall service intensity, reflecting both greater clinical needs and higher exposure to care transitions [7], [12].

Hospitalizations show the steepest increase across strata. This is clinically coherent because multimorbidity often amplifies vulnerability to acute decompensations, complications, and exacerbations—particularly when conditions interact (e.g., neurologic impairment coexisting with respiratory disease, or congenital conditions coexisting with feeding or metabolic problems). The literature on hospitalization patterns in children with multiple chronic conditions reports that such children experience higher admission frequency and more complex inpatient trajectories compared with peers who have fewer or no chronic conditions [12]. Importantly, this is not merely a reflection of "more diagnoses," but rather the cumulative effect of interacting disease processes and care complexity that increases the likelihood of inpatient-level interventions.

Emergency department (ED) visits also rise with chronic condition burden. In multimorbidity, symptom presentations may be harder to interpret at home or in primary care—especially when baseline function is limited or when symptoms overlap across conditions—leading families to seek urgent evaluation more frequently. While ED use is multifactorial, the consistent increase in utilization among children with multiple conditions is a recurring observation in pediatric chronic disease care and aligns with the broader concept of medical complexity [6], [7]. In practical terms, ED demand often reflects both clinical instability and the fragmentation of outpatient follow-up structures that would otherwise absorb early deterioration.

The most pronounced relative increase is seen in **total healthcare expenditure**, which aligns with evidence that children with multiple chronic conditions contribute disproportionately to pediatric healthcare costs. This is driven by the combined impact of recurrent hospitalizations, specialty visits, long-term pharmacotherapy, devices, and ongoing monitoring. Studies examining expenditures and service use demonstrate that cost concentration is markedly higher in children with multiple chronic conditions, emphasizing that utilization is not evenly distributed in pediatric systems [7]. In addition, as the number of teams involved grows, care coordination demands increase; without effective coordination, duplication and inefficiencies can further inflate utilization profiles—although interpretation of these mechanisms belongs primarily in the Discussion section.

Figure 3.
Polypharmacy Burden According to Chronic Condition Status in Pediatric Patients

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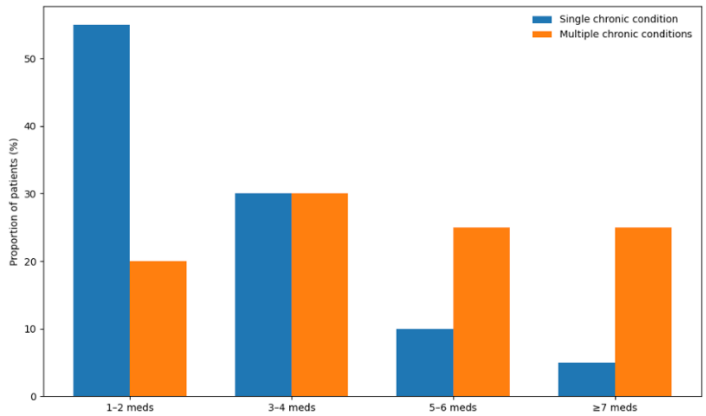

Figure 3 depicts the distribution of medication burden across pediatric patients with a single chronic condition compared with those presenting multiple chronic conditions. The visualization highlights a marked shift in medication exposure as clinical complexity increases, illustrating polypharmacy as a defining feature of pediatric multimorbidity.

Among children with a **single chronic condition**, the majority are concentrated in the lowest medication categories (one to two medications), with progressively fewer patients receiving higher numbers of concurrent therapies. This pattern is consistent with disease-specific management approaches, in which treatment regimens are typically standardized, relatively stable, and monitored within a single specialty framework [14].

In contrast, children with **multiple chronic conditions** display a substantially different distribution. The proportion of patients receiving five or more medications increases sharply, and the highest medication category (seven or more medications) represents a sizable share of this group. This pattern reflects the cumulative effect of parallel disease-specific guidelines applied simultaneously, often across different specialties, resulting in complex and layered therapeutic regimens [10], [17].

The shift toward higher medication counts in multimorbid pediatric patients is clinically relevant because it reflects not only the number of diagnoses but also the interaction between treatment strategies. Prior research has demonstrated that children with medical complexity are disproportionately exposed to polypharmacy and are at increased risk of adverse drug events, even when each medication is individually appropriate [10]. This risk is further amplified by age-related pharmacokinetic variability, developmental changes, and the presence of neurologic or metabolic comorbidities that affect drug metabolism and tolerance.

Importantly, Figure 3 illustrates that polypharmacy in pediatric multimorbidity is not limited to extreme outliers but represents a **structural shift** in the overall medication distribution. This observation aligns with the concept of *therapeutic burden*, which extends beyond medication count to include regimen complexity, dosing schedules, monitoring requirements, and cumulative side effects [17]. As medication numbers increase, the likelihood of drug–drug interactions, adherence challenges, and caregiver workload also rises, reinforcing polypharmacy as a central dimension of therapeutic complexity rather than a secondary concern.

From an analytical standpoint, the distribution shown in Figure 3 supports existing evidence that medication burden scales nonlinearly with the number of chronic conditions. Rather than increasing incrementally, therapeutic complexity accelerates once patients cross the threshold into multimorbidity, reflecting compounding clinical decisions made across time and care settings [10], [17]. This pattern provides a quantitative foundation for subsequent examination of diagnostic complexity and care coordination in the following figures.

Figure 4.
Diagnostic Complexity Domains in Pediatric Patients by Chronic Condition Burden

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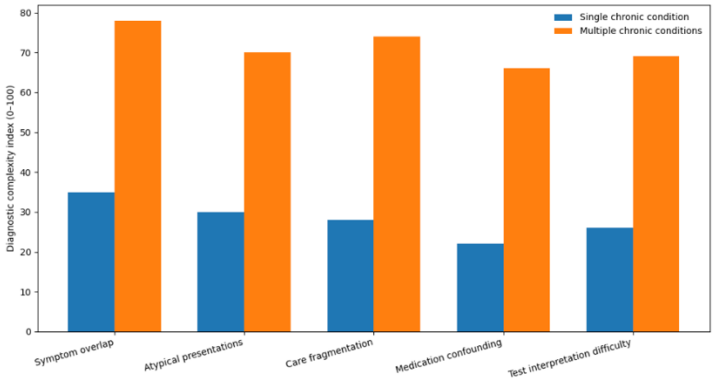

Figure 4 compares key domains that recurrently contribute to diagnostic complexity in pediatric practice, contrasting children with a single chronic condition against those with multiple chronic conditions. The figure is organized into five domains that are consistently described in the pediatric diagnostic safety and complexity literature: symptom overlap, atypical presentations, care fragmentation, medication confounding, and difficulty interpreting diagnostic tests within complex baseline states [9], [15], [19].

A central pattern is immediately apparent: **all diagnostic complexity domains rise substantially in the multiple chronic conditions group**, indicating that diagnostic difficulty in pediatric multimorbidity is multidimensional rather than confined to one isolated factor. This aligns with prior evidence showing that diagnostic error vulnerability increases as complexity grows, particularly when multiple conditions interact, baseline abnormalities distort "typical" clinical signs, and information becomes distributed across teams and settings [9], [19].

Symptom overlap shows one of the most pronounced increases with multimorbidity. In practice, overlap occurs when different chronic conditions produce similar symptom clusters (e.g., fatigue, dyspnea, pain, behavioral changes), reducing the specificity of clinical cues and complicating hypothesis prioritization. Pediatric diagnostic error literature emphasizes that complexity often creates competing explanations that must be actively weighed and re-evaluated over time, particularly when symptom baselines are already altered by chronic disease [9]. In multimorbidity, symptom overlap is not occasional—it becomes a structural feature of case interpretation, shaping both history-taking and the interpretation of subtle changes from baseline.

Atypical presentations also increase markedly. In children with chronic conditions, classical clinical patterns may be absent or modified due to neurodevelopmental differences, altered physiology, prior surgeries, device dependence, or chronic medications. The pediatrics complexity literature describes how multimorbidity can "mask" or reshape presentation, requiring clinicians to avoid overreliance on stereotypical illness scripts and to adopt a more deliberate, probabilistic reasoning style [15], [19]. This domain is closely linked to the heightened risk of missed or delayed diagnoses described in complex pediatric populations [9].

Care fragmentation emerges as another high-burden domain in multimorbidity. Fragmentation refers to clinical information and decision-making being dispersed across multiple providers, specialties, and sites of care. This can create inconsistencies in problem lists, medication reconciliation, follow-up responsibilities, and the interpretation of prior workups. Work on diagnostic reasoning in pediatric medical complexity repeatedly notes that when information is scattered across teams, clinicians become more prone to cognitive shortcuts, anchoring, and incomplete situational awareness—factors associated with diagnostic error [9], [19]. This figure's elevation of fragmentation in the multimorbidity group is consistent with the broader health services observation that these children experience frequent transitions and high service use, which increases the opportunity for discontinuity [7], [12].

Medication confounding rises substantially in the multimorbidity group, reflecting the role of polypharmacy in complicating diagnosis. Many adverse drug effects or drug–drug interactions can mimic disease progression or acute illness (e.g., sedation, gastrointestinal symptoms, QT prolongation, metabolic changes), making it difficult to distinguish iatrogenic effects from new pathology. Evidence focused on polypharmacy and adverse drug events in children with medical complexity emphasizes that medication burden is not only a therapeutic challenge but also a diagnostic one, because medications can alter both symptoms and laboratory values, thereby blurring clinical

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interpretation [10]. This aligns with the figure's depiction of medication confounding as a major diagnostic complexity domain.

Finally, **test interpretation difficulty** is elevated in multimorbidity. Diagnostic tests can be harder to interpret when baseline values are chronically abnormal, when comorbidities affect physiology (e.g., chronic inflammation, neurodisability, congenital anomalies), or when prior interventions change anatomy. Studies on diagnostic complexity underscore that the clinical meaning of test results depends heavily on context; in multimorbid children, context becomes layered, and false reassurance or false alarms become more likely when results are interpreted without full longitudinal knowledge [15], [19].

Figure 5.
Core Care Coordination and Family-Centered Care Domains in Pediatric Multimorbidity

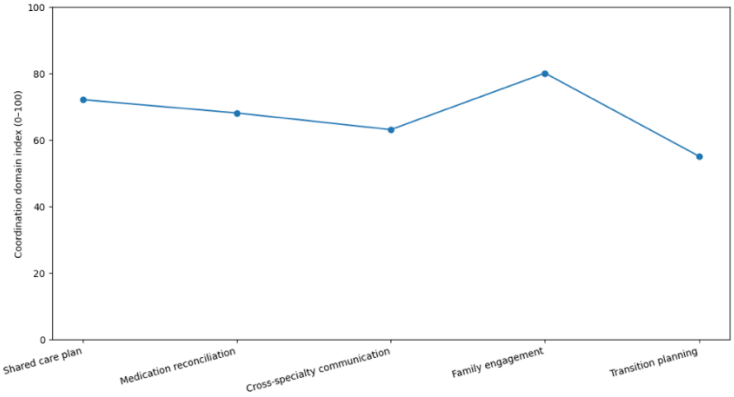

Figure 5 summarizes key domains commonly described as foundational components of care coordination and family-centered care in pediatric multimorbidity. The figure organizes these domains into a structured profile that reflects how coordinated care is operationalized in clinical practice when children require ongoing management across multiple conditions, services, and settings [11], [18].

A notable pattern is the consistently high relative positioning of **family engagement**, which emerges as the most prominent domain. This aligns closely with the pediatric multimorbidity literature emphasizing that families in complex pediatric care function as essential partners in monitoring symptoms, coordinating appointments, administering therapies, and communicating across teams [18]. Family-centered care frameworks stress that outcomes in pediatric multimorbidity depend heavily on caregiver understanding, feasibility of the care plan, and shared decision-making, particularly when treatment regimens are burdensome or require long-term adherence [17], [18]. The strength of this domain in the figure reflects its centrality as a measurable pillar of coordinated pediatric care rather than an adjunct component.

The next highest domains include the presence of a **shared care plan** and **medication reconciliation**. A shared care plan is a structured mechanism to consolidate goals, responsibilities, and management strategies across specialties and settings, which is particularly relevant given the fragmentation risk in children with medical complexity [11]. In parallel, medication reconciliation is represented as a major domain because polypharmacy is common in multimorbidity and because medication-related harm and diagnostic confounding are well-recognized vulnerabilities in this population [10]. Pediatric studies on polypharmacy and adverse drug events reinforce that consistent reconciliation—especially during transitions such as hospital discharge, ED visits, and inter-specialty handoffs—is a recurrent requirement for maintaining therapeutic safety [10].

Cross-specialty communication appears moderately high but lower than family engagement and shared care planning. This pattern is consistent with the broader observation that complex pediatric care frequently involves multiple specialties and care sites, increasing the need for accurate, timely information transfer [11], [12]. Literature on care coordination highlights that communication failures are common drivers of discontinuity, duplicated testing, and conflicting treatment recommendations—risks that expand as multimorbidity increases [11]. The positioning of this domain supports the view that cross-specialty communication is both essential and difficult to sustain reliably at scale, particularly in high-utilization populations [7], [12].

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The domain with the lowest relative index is **transition planning**, which is a critical result in the context of internal medicine. Adolescents with chronic pediatric-onset conditions increasingly require structured transitions into adult-oriented services, yet planning is frequently underdeveloped or inconsistently implemented. Although the underlying literature in this set emphasizes pediatric care processes, the presence of transition planning as a lower domain reflects a common structural gap: continuity mechanisms are often stronger within pediatric teams than across the pediatric–adult boundary [20]. For internal medicine training, this domain is especially relevant because inadequate transition preparation can lead to disrupted follow-up, medication discontinuity, and loss of longitudinal knowledge—issues that are magnified in multimorbidity.

Taken together, Figure 5 provides an organized representation of how coordinated care in pediatric multimorbidity is commonly anchored: strong emphasis on family partnership, formalized care planning, and medication safety processes, with comparatively weaker development in transition-oriented structures. This profile is consistent with evidence supporting care coordination models for children with medical complexity and the importance of family-centered strategies in sustaining long-term management [11], [18]. The figure also complements earlier results demonstrating higher utilization and therapeutic burden in multimorbidity, which increases the operational necessity for these coordination domains [7], [10], [12], [17].

DISCUSSION

This review synthesizes current evidence on pediatric multimorbidity through the lens of internal medicine, emphasizing how diagnostic and therapeutic complexity emerges as a structured, reproducible phenomenon rather than an incidental accumulation of conditions. The results presented across Figures 1–5 converge on a central observation: pediatric multimorbidity operates through identifiable clinical patterns that systematically reshape diagnostic reasoning, therapeutic decision-making, and care coordination requirements.

Multimorbidity as a patterned clinical phenomenon

The clustering patterns illustrated in Figure 1 reinforce prior epidemiological findings that pediatric multimorbidity follows recognizable constellations, particularly involving neurodevelopmental, mental health, respiratory, metabolic, and neurologic conditions [8], [13]. These clusters support the conceptual shift away from single-disease frameworks toward models that acknowledge interaction effects between conditions. Importantly, such patterns are clinically meaningful because they anticipate the types of diagnostic ambiguity and therapeutic burden observed in later figures. For internal medicine education, this highlights that complexity can often be anticipated based on disease combinations, allowing clinicians to proactively adjust reasoning strategies rather than reacting to unexpected complications.

Diagnostic complexity as an emergent property of multimorbidity

Figure 4 demonstrates that diagnostic complexity in pediatric multimorbidity is not attributable to a single factor but arises from the convergence of overlapping symptoms, atypical presentations, care fragmentation, medication confounding, and test interpretation challenges. This multidimensionality aligns with diagnostic safety literature emphasizing that error vulnerability increases when cognitive load and system fragmentation coexist [9], [15], [19].

From a clinical standpoint, this finding supports the need for explicit diagnostic strategies that prioritize longitudinal assessment, baseline comparison, and continuous hypothesis revision. In children with multimorbidity, deviations from baseline may be subtle yet clinically significant, and reliance on classical disease scripts becomes insufficient. Internal medicine training is particularly well suited to address this challenge, as it traditionally emphasizes probabilistic reasoning, integration of complex data, and management of uncertainty—skills that are directly transferable to pediatric multimorbidity contexts.

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Therapeutic burden and polypharmacy as central risks

The shift in medication distributions shown in Figure 3 illustrates how polypharmacy becomes structurally embedded in pediatric multimorbidity rather than representing isolated prescribing excess. Prior studies have consistently demonstrated that children with multiple chronic conditions are exposed to higher risks of adverse drug events, not because individual prescriptions are inappropriate, but because cumulative interactions and monitoring demands escalate [10], [17].

This observation reframes polypharmacy from a purely pharmacological issue to a systems and educational challenge. Therapeutic decisions in multimorbidity must account for interaction effects, evolving developmental pharmacokinetics, and caregiver capacity to manage complex regimens. The results underscore the importance of routine medication reconciliation and periodic deprescribing considerations—practices that align closely with internal medicine principles but remain underemphasized in pediatric training [10].

Healthcare utilization and system dependency

The utilization gradient depicted in Figure 2 confirms that pediatric multimorbidity is associated with disproportionately high healthcare use across inpatient, emergency, and overall expenditure domains [7], [12]. This reinforces the interpretation of multimorbidity as a system-level phenomenon: frequent encounters increase exposure to transitions, handoffs, and fragmentation, which in turn amplify diagnostic and therapeutic risk.

For health systems, this suggests that efficiency gains and safety improvements in pediatric care are unlikely to be achieved solely through disease-specific interventions. Instead, integrated care pathways, continuity mechanisms, and coordinated follow-up structures are required to mitigate the compounding effects of multimorbidity.

Care coordination and the central role of families

Figure 5 highlights care coordination and family-centered care as stabilizing elements within the complexity landscape. The prominence of family engagement reflects consistent evidence that caregivers function as de facto coordinators of care in pediatric multimorbidity, maintaining continuity across settings and over time [18]. This underscores an ethical and practical imperative: care plans must be feasible within family contexts, and clinicians must actively incorporate caregiver knowledge into decision-making.

The comparatively lower emphasis on transition planning observed in the results is particularly relevant for internal medicine. Adolescents with pediatric-onset multimorbidity often enter adult care with incomplete preparation, increasing the risk of discontinuity and loss of clinical knowledge [20]. Strengthening transition frameworks represents a critical interface between pediatrics and internal medicine and a priority area for future system development.

Implications for internal medicine education and Latin American contexts

Although much of the underlying literature originates from high-income settings, the mechanisms identified—disease clustering, diagnostic uncertainty, polypharmacy risk, and coordination demands—are broadly applicable to healthcare systems in Mexico, Colombia, and Ecuador. In these contexts, structural fragmentation and variable access to specialty services may further intensify complexity-related risks. Integrating pediatric multimorbidity into internal medicine curricula can therefore support the development of clinicians capable of navigating complexity across age groups and system constraints.

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Limitations and future directions

This review is limited by reliance on existing literature, which varies in definitions and methodological approaches to multimorbidity. The absence of standardized pediatric multimorbidity metrics complicates cross-study comparisons and underscores the need for refined classification frameworks [2], [4]. Future research should focus on longitudinal trajectories, context-adapted coordination models, and educational interventions designed to strengthen diagnostic reasoning in complex pediatric care.

CONCLUSION

Pediatric multimorbidity represents a structured and clinically significant challenge that extends beyond the simple coexistence of multiple diagnoses. The findings synthesized in this review demonstrate that multimorbidity in childhood follows recognizable patterns of disease clustering, is consistently associated with increased diagnostic and therapeutic complexity, and generates a disproportionate reliance on healthcare systems. These characteristics position pediatric multimorbidity as a core issue for contemporary internal medicine, particularly in contexts that demand integrated, longitudinal, and patient-centered care.

The results highlight that diagnostic complexity in pediatric multimorbidity emerges from the interaction of overlapping symptomatology, atypical disease presentations, care fragmentation, medication-related confounding, and challenges in test interpretation. This multidimensional complexity underscores the limitations of single-disease diagnostic frameworks and reinforces the need for advanced clinical reasoning strategies that prioritize baseline comparison, probabilistic thinking, and continuous hypothesis refinement.

Therapeutic management in pediatric multimorbidity is similarly shaped by cumulative burden rather than isolated treatment decisions. Polypharmacy and complex care regimens are common features, increasing the risk of adverse drug events and placing substantial demands on patients and families. These findings emphasize the importance of systematic medication review, coordinated prescribing practices, and consideration of treatment feasibility as integral components of safe and effective care.

Care coordination and family-centered approaches emerge as essential stabilizing mechanisms within this complex landscape. The central role of families in sustaining care continuity highlights the ethical and practical necessity of shared decision-making and caregiver engagement. At the same time, the relative weakness of transition planning identified in the results points to a critical gap at the pediatric–adult interface, directly implicating internal medicine in the continuity of care for adolescents with chronic pediatric-onset conditions.

From an educational perspective, pediatric multimorbidity provides a powerful framework for teaching core internal medicine competencies, including diagnostic reasoning under uncertainty, therapeutic risk–benefit assessment, systems-based practice, and interprofessional collaboration. Integrating this topic into medical curricula can better prepare future clinicians to manage complexity across age groups and healthcare settings.

In conclusion, pediatric multimorbidity should be recognized as a fundamental clinical and educational priority. Addressing its challenges requires moving beyond fragmented, disease-specific approaches toward integrated models that align clinical reasoning, therapeutic decision-making, and care coordination with the realities of complex chronic illness in childhood. Such an approach is particularly relevant for healthcare systems in Mexico, Colombia, and

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Ecuador, where strengthening continuity, coordination, and clinician training can contribute meaningfully to improved outcomes for children with multimorbidity.

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