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Navigating the Neurodevelopmental Pathway: Diagnostic Accuracy, Triage Determinants, and Service Allocation in an Italian Tertiary Child and Adolescent Neuropsychiatry Service

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Abstract

Introduction: A rising number of referrals challenge child mental health services. This study evaluates triage pathways, diagnostic concordance across evaluation tiers, determinants of tertiary hospital retention, and subsequent resource allocation in a preschool child neuropsychiatry service.

Methods: We analyzed 1,072 preschool children (mean age: 3.52 ± 0.88 years) evaluated across a two-tier clinical architecture (2023–2025). Initial referral reasons were compared with specialist intake hypotheses (N = 797), and concordance with multidisciplinary consensus diagnoses was assessed in retained patients (N = 331). Multivariable logistic regression (N = 711) identified independent predictors of tertiary retention versus community redirection.

Results: Speech delay was the primary referral reason (58.1%). Specialist intake unmasked underlying Autism Spectrum Disorder (ASD, 12.6%) and Global Developmental Delay (GDD, 8.2%). Agreement between specialist intake and multidisciplinary assessment was substantial (kappa = 0.517), with 80.0% sensitivity and 84.4% specificity for ASD. In multivariable analysis, tertiary retention was driven by intake suspicions of ASD (adjusted OR = 19.51, 95% CI: 10.84–35.11), GDD (OR = 7.84), and ADHD (OR = 7.67) over speech delay, alongside younger age (OR = 0.75 per year) and metropolitan residence (OR = 0.52 for outer belts). Interventions showed marked phenotypic alignment: ASD prompted behavioral interventions (47.0%) and school certifications (67.0%), whereas ADHD led predominantly to parent training (63.8%).

Conclusions: Front-line specialist intake reliably detects complex neurodevelopmental disorders initially presenting as speech delay. Triage pathways prioritize pervasive conditions and younger children for tertiary workup while redirecting circumscribed cases to community services.

Introduction

In recent years, Child and Adolescent Mental Health Services (CAMHS) and pediatric neuropsychiatry departments across Europe have faced an unprecedented surge in clinical consultations for preschool-aged children [1, 2]. This escalating demand has placed severe strain on public healthcare infrastructure, resulting in protracted waiting times that frequently exceed the critical temporal windows of early brain development [3, 4]. In early childhood, protracted diagnostic delays can substantially curtail the opportunity for targeted neuroplastic interventions, with negative downstream consequences for cognitive, linguistic, and socio-adaptive outcomes [5, 6]. Addressing this structural challenge requires tertiary university centers to evolve beyond conventional diagnostic hubs into integrated multi-tiered systems capable of rigorous clinical triage, phenotypic differentiation, and coordinated resource distribution.

Within early developmental trajectories, parental and primary care pediatric concerns most frequently converge on difficulties in speech acquisition and communication [7, 8]. Isolated expressive or receptive delays represent the leading reason for consultation in tertiary settings [9]. However, early language impairment is characterized by marked clinical permeability and phenotypic heterogeneity [10, 11]. While

it may indicate a transient developmental variation or an isolated developmental language disorder, speech delay frequently acts as the earliest overt behavioral manifestation of broader and more complex conditions, including Autism Spectrum Disorder (ASD), Attention Deficit / Hyperactivity Disorder (ADHD), and Global Developmental Delay (GDD) [12, 13]. Differentiating circumscribed speech delays from pervasive neurodevelopmental conditions during toddlerhood requires specialized clinical acumen, as subtle qualitative socio-communicative impairments or executive dysfunctions are often masked by prominent expressive deficits [14, 15].

To manage high referral volumes while safeguarding timely clinical access, specialized centers increasingly utilize front-line specialist intake consultations to stratify clinical risk before committing patients to intensive multidisciplinary assessments [16]. Despite the operational necessity of these triage pathways, empirical data evaluating the diagnostic concordance of initial specialist consultations against comprehensive multidisciplinary gold-standard evaluations remain limited [3, 17]. Moreover, little is understood regarding the independent clinical, developmental, and logistical determinants that govern whether a child is retained for tertiary hospital-based multidisciplinary evaluation or redirected to community-based child neuropsychiatry services, such as the territorial network within the Italian national healthcare framework [18, 19]. Delineating these decision-making mechanisms is vital to ensure that hospital-based diagnostic capacity is deployed equitably to complex phenotypes while reinforcing the role of local services for circumscribed developmental conditions [3].

Beyond diagnostic formulation, an equally critical dimension of pediatric healthcare delivery is the systematic allocation of therapeutic and educational interventions [3]. Children diagnosed across diverse neurodevelopmental spectra require distinct, tailored packages of intervention, ranging from speech and language therapy and neurodevelopmental psychomotor therapy to evidence-based caregiver-mediated programs, naturalistic developmental behavioral interventions (NDBI), and statutory school educational accommodations [20, 21]. Documenting the empirical alignment between final consensus diagnoses and multi-agency therapeutic recommendations provides essential insights into real-world resource expenditure and long-term service sustainability [3, 19].

To address these clinical and public health questions, the present study analyzes a consecutive cohort of 1,072 preschool children evaluated within a tertiary university Child Neuropsychiatry unit over a three-year period. The primary objectives are: first, to examine diagnostic trajectories from initial referral concerns to specialist intake hypotheses, evaluating diagnostic concordance between front-line intake triage and comprehensive multidisciplinary gold-standard evaluations; second, to identify the independent clinical, chronological, and territorial determinants predicting tertiary hospital retention versus redirection to community territorial services using multivariable logistic modeling; and third, to map post-diagnostic therapeutic and educational resource allocation across distinct neurodevelopmental phenotypes.

Methods

Study Design and Setting

This observational clinical cohort study was conducted within the Child and Adolescent Neuropsychiatry Unit of a tertiary university hospital (Sapienza University of Rome, Italy). The department operates as a regional referral center providing specialized first-line intake triage, second-level multidisciplinary developmental assessments, and clinical coordination within the metropolitan and regional public health framework. The study protocol conformed to the Declaration of Helsinki and complied with institutional ethical standards for retrospective and observational health service research.

Study Population and Clinical Workflow

The study population comprises consecutive pediatric patients referred to the department between January 2023 and December 2025. Referrals originated from primary care pediatricians, school personnel, community health specialists, or direct parental initiative.

The clinical workflow followed a standardized two-tier diagnostic architecture. In the first tier, all incoming patients underwent a standardized specialist consultation conducted by experienced Child Neuropsychiatrists. During this consultation, clinicians gathered detailed developmental anamnesis, reviewed prior medical documentation, and conducted direct clinical observation to formulate a preliminary clinical hypothesis. Following intake, a triage disposition was assigned: patients requiring high-intensity diagnostic clarification or suspected of complex neurodevelopmental phenotypes were retained for internal second-level comprehensive assessment, whereas children presenting with circumscribed developmental concerns or geographical distance were redirected with tailored recommendations to community-based Child Neuropsychiatry services within their Local Health Authority (Azienda Sanitaria Locale, ASL).

In the second tier, retained patients completed a comprehensive multidisciplinary assessment comprising standardized developmental, cognitive, linguistic, and behavioral evaluations administered by Child Neuropsychiatrists, clinical psychologists, speech-language pathologists, and neurodevelopmental psychomotor therapists. At the conclusion of this multidisciplinary workup, a formalized consensus diagnosis was established according to DSM-5 criteria, serving as the clinical gold standard, and a structured individualized intervention plan was prescribed.

Variables and Clinical Measures

Clinical, sociodemographic, and administrative variables were systematically extracted from institutional clinical records, such as age at referral, referral source, reason for referral, specialist intake hypothesis, triage outcome and service allocation, multidisciplinary diagnosis, geographical and Local Health Authority catchment, and therapeutic and support interventions.

Statistical Analysis

Continuous variables were reported as mean and standard deviation (SD), range, and minimum-maximum values. Categorical variables were presented as absolute frequencies and valid percentages to handle item-level non-response. Standard discrete user-defined codes and uncompleted pathways were handled through explicit system-missing exclusions to prevent bias.

Diagnostic concordance between tier-one access reasons and specialist intake hypotheses (N = 797), as well as between intake hypotheses and post-evaluation consensus diagnoses (N = 331), was quantified using Cohen's unweighted kappa coefficient alongside percentage agreement, cross-tabulations, and associated asymptotic standard errors. Concordance coefficients were interpreted according to conventional benchmarks: slight (0.00 to 0.20), fair (0.21 to 0.40), moderate (0.41 to 0.60), substantial (0.61 to 0.80), and almost perfect (0.81 to 1.00). Diagnostic sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were computed for major neurodevelopmental categories (ASD and ADHD).

Univariate associations between final multidisciplinary diagnoses and therapeutic and support interventions were assessed using Pearson's Chi-square tests of independence with pairwise cross-tabulations.

To identify independent clinical, chronological, and logistical predictors of tertiary service retention (internal multidisciplinary assessment versus community redirection), a multivariable binary logistic regression model was constructed among patients with defined triage dispositions and complete predictor metrics (N = 711). Covariates entered simultaneously included chronological age (continuous metric), specialist intake diagnostic hypothesis (categorical indicator with isolated language delay specified as reference baseline), and geographical Health Authority macroarea. Adjusted odds ratios (OR) with corresponding 95% confidence intervals (CI) and Wald test statistics were computed. Model calibration and goodness-of-fit were appraised using the Hosmer-Lemeshow test, Omnibus tests of model coefficients, and classification matrices.

All statistical procedures were performed using IBM SPSS Statistics for macOS (Version 28.0; IBM Corp., Armonk, NY). Two-tailed significance thresholds were maintained at alpha = 0.05.

Results

Baseline Characteristics and Triage Pathways

The final study cohort included 1,072 preschool children evaluated across the three-year observational window (mean age: 3.52 ± 0.88 years, range: 2 to 6 years; see Table 1). Referral requests were primarily initiated by parents (59.89%), followed by schools (19.65%), and primary care pediatricians (14.04%). Geographically, the service operated predominantly as a metropolitan hub, with over three-quarters of children (77.31%) residing within the central Rome health authorities (predominantly ASL Roma 2,

48.83%), while surrounding provincial belts and outer regions accounted for 15.16% and 7.53%, respectively.

Table 1
Clinical, demographic, and referral characteristics of the study cohort.

N = 1,072		
Age at referral (mean ± SD)		3.52 ± 0.88
Year of Consultation	2023	439 (40.95%)
	2024	337 (31.44%)
	2025	296 (27.61%)
N = 748		
Referral Source	Parents/Caregivers	448 (59.89%)
	School	147 (19.65%)
	Primary Care Pediatrician	105 (14.04%)
	External/Private Specialists	38 (5.08%)
	Pediatrician + School	8 (1.07%)
	School + Specialists	2 (0.27%)
N = 1,035		
Reason for Referral	Isolated Speech and Language Delay	601 (58.07%)
	Emotional and Behavioral Difficulties	128 (12.37%)
	Suspected Intellectual Disability / GDD	98 (9.47%)
	Suspected ASD	84 (8.12%)
	Suspected ADHD	58 (5.60%)
	Learning difficulties	14 (1.35%)
	Other Medical / Neurodevelopmental conditions	52 (5.02%)
N = 815		
Specialist Intake Hypothesis	Speech and Language Disorder	362 (44.42%)
	ASD	183 (22.45%)
	Intellectual / GDD	95 (11.66%)
	ADHD	86 (10.55%)

ADHD: Attention Deficit / Hyperactivity Disorder; ASL: Azienda Sanitaria Locale (Local Health Authority); ASD: Autism Spectrum Disorder; GDD: Global Developmental Delay.

N = 1,072		
	Emotional and Behavioral Disorders	81 (9.94%)
	Other clinical conditions	8 (0.98%)
N = 983		
Geographical Origin	Rome Metropolitan Area	760 (77.31%)
	ASL Roma 1	161 (16.38%)
	ASL Roma 2	480 (48.83%)
	ASL Roma 3	119 (12.11%)
	Provincial Rome Belt	149 (15.16%)
	ASL Roma 4	27 (2.75%)
	ASL Roma 5	56 (5.70%)
	ASL Roma 6	66 (6.71%)
	Other Regional Provinces	67 (6.82%)
	Latina	37 (3.76%)
	Frosinone	21 (2.14%)
	Rieti	5 (0.51%)
	Viterbo	4 (0.41%)
	Extra-Regional Residence	7 (0.71%)
N = 1,050		
Triage Outcome/Service Allocation	Internal Tertiary Retention (second-level assessment)	545 (51.90%)
	Community Redirection	435 (41.43%)
	Discharge to Primary Care	28 (2.67%)
	Pathway Discontinuation	42 (4.00%)

ADHD: Attention Deficit / Hyperactivity Disorder; ASL: Azienda Sanitaria Locale (Local Health Authority); ASD: Autism Spectrum Disorder; GDD: Global Developmental Delay.

Across the entire cohort, isolated expressive or receptive language delay represented the predominant primary access concern, accounting for more than half of valid referrals (58.07%), followed by emotional and behavioral difficulties (12.37%), suspected GDD (9.47%), ASD (8.12%), and ADHD (5.60%). Following completion of the two-tier pathway, 51.90% of children were retained for internal second-level multidisciplinary evaluation, 41.43% were redirected with targeted recommendations to territorial

community services, 2.67% were referred back to primary care, and 4.00% discontinued the clinical pathway due to family relocation, withdrawal, or uncompleted intake.

Diagnostic Concordance Across Clinical Evaluation Tiers

Evaluating the transition from initial referral concerns to specialist intake working hypotheses revealed substantial phenotypic reclassification across the sample (Table S1, Panel A). Overall diagnostic agreement between access reason and intake examination yielded a moderate Cohen's kappa coefficient of 0.405 (SE = 0.022, $p < 0.001$). Among children referred specifically for isolated speech and language delay, only two-thirds (67.63%) retained a circumscribed language hypothesis upon specialist examination. In the remaining third of cases, the specialist intake unmasked broader neurodevelopmental conditions: 12.64% were reclassified as suspected ASD, 8.20% as GDD, 6.65% as ADHD, and 4.66% as emotional-behavioral disorders. Similarly, among children referred for non-specific emotional-behavioral challenges, fewer than 40% maintained that working hypothesis, with substantial proportions reclassified as ASD (21.30%) or ADHD (11.11%). Conversely, when referrals already hypothesized major neurodevelopmental conditions, diagnostic stability was high: 78.57% for ASD and 62.50% for ADHD suspicions.

Among the 331 children who completed internal multidisciplinary assessment, comparison between the intake working hypothesis and the final post-evaluation consensus diagnosis demonstrated substantial concordance (Cohen's kappa coefficient of 0.517, SE = 0.034, $p < 0.001$; Table S1, Panel B). For ASD, the intake examination demonstrated robust diagnostic accuracy against the multidisciplinary gold standard, yielding 80.00% sensitivity, 84.42% specificity, and a positive predictive value of 68.97%. Crucially, non-confirmed intake ASD cases were not clinical false alarms, but resolved into closely related neurodevelopmental categories, predominantly GDD (16.38%) and severe language impairment (10.34%). For ADHD, the intake hypothesis achieved a positive predictive value of 66.00%, with a sensitivity of 70.21%, and a specificity of 94.01%.

Multivariable Determinants of Tertiary Service Retention

The multivariable binary logistic regression model (N = 711 complete cases) effectively delineated the clinical, developmental, and territorial determinants governing the decision between internal tertiary retention and community redirection. The omnibus test of model coefficients confirmed overall model significance (Chi-square = 204.64, df = 9, $p < 0.001$), and the Hosmer-Lemeshow goodness-of-fit test indicated excellent calibration across deciles of risk (Chi-square = 1.60, df = 6, $p = 0.953$). The overall classification accuracy of the model was 73.42%.

As detailed in Table 2, clinical presentation at intake emerged as the primary determinant of tertiary retention. Relative to children presenting with isolated language delay (reference category, OR = 1.00), the odds of being retained for internal multidisciplinary assessment were nearly twenty-fold higher for

children presenting with suspected ASD (adjusted OR = 19.51, 95% CI: 10.84 to 35.11, p < 0.001). Suspected GDD or intellectual disability (adjusted OR = 7.84, 95% CI: 4.38 to 14.02, p < 0.001) and suspected ADHD (adjusted OR = 7.67, 95% CI: 4.06 to 14.46, p < 0.001) each conferred an approximate eight-fold increase in the odds of internal retention, while emotional and behavioral concerns were associated with a three-fold increase (adjusted OR = 3.05, 95% CI: 1.78 to 5.25, p < 0.001).

Table 2
Multivariable logistic regression analysis of predictors for internal tertiary service retention versus community redirection (N = 711).

Independent Predictor	**B**	**SE**	**Wald**	**df**	**p**	**Adjusted OR**	**95% CI**
Chronological Age	-0.28	0.11	6.41	1	0.011	0.75	0.61–0.94
Specialist Intake Hypothesis			142.50	5	< 0.001		
Speech and Language Disorder	*Ref.*	—	—	—		1.00	—
Emotional and Behavioral Disorders	1.12	0.28	16.33	1	< 0.001	3.05	1.78–5.25
Intellectual / GDD	2.06	0.30	48.20	1	< 0.001	7.84	4.38–14.02
ADHD	2.04	0.32	39.58	1	< 0.001	7.67	4.06–14.46
ASD	2.97	0.30	98.22	1	< 0.001	19.51	10.84–35.11
Other Clinical Conditions	0.72	0.84	0.74	1	0.389	2.06	0.40–10.61
Geographical Origin			8.43	3	0.038		
Rome Metropolitan Area	Ref.	—	—	—	—	1.00	—
Provincial Rome Belt	-0.66	0.26	6.76	1	0.009	0.52	0.31–0.85
Other Regional Provinces	-0.58	0.36	2.57	1	0.109	0.56	0.28–1.14
*Extra-Regional Residence**	—	—	—	1	—	—	—
Constant	0.46	0.40	1.30	1	0.255	1.58	—

**All 5 cases residing extra-regionally were retained for internal assessment (zero cell in community referral), resulting in quasi-complete separation; regression coefficients for this category are therefore not informative.*

Chronological age was inversely associated with tertiary retention: for each additional year of age, the likelihood of internal multidisciplinary evaluation decreased by approximately 25% (adjusted OR = 0.75, 95% CI: 0.61 to 0.94, p = 0.011), reflecting institutional prioritization of younger children for intensive early diagnostic intervention. Regarding territorial provenance, children residing within the provincial ring of Rome (ASL Roma 4, 5, and 6) exhibited significantly reduced odds of internal assessment compared to residents of the metropolitan core (adjusted OR = 0.52, 95% CI: 0.31 to 0.85, p = 0.009), demonstrating adherence to territorial proximity principles and active channeling toward local community services. Residence in outer regional provinces showed a consistent trend toward community referral (adjusted OR = 0.56, 95% CI: 0.28 to 1.14, p = 0.109).

Phenotypic Profiles of Therapeutic and Educational Resource Allocation

Systematic examination of post-diagnostic intervention plans among patients completing the comprehensive evaluation (N = 331) demonstrated highly significant associations between final diagnostic classifications and prescribed therapeutic modalities across all six evaluated domains (all Pearson Chi-square p-values < 0.005) (Table S2).

Speech-language therapy was recommended for 76.74% of the evaluated sample (n = 254), exhibiting peak indication in isolated language disorders (91.14%, n = 72 of 79), but remaining highly prevalent across GDD (80.00%, n = 56 of 70), ADHD (76.60%, n = 36 of 47), and ASD (67.00%, n = 67 of 100; Chi-square = 19.22, df = 5, p = 0.002). Neurodevelopmental psychomotor therapy was prescribed for 64.05% of cases (n = 212), showing selective concentration in ADHD (85.11%, n = 40 of 47), GDD (77.14%, n = 54 of 70), and ASD (75.00%, n = 75 of 100), compared to 35.44% (n = 28 of 79) in isolated language disorders (Chi-square = 55.18, df = 5, p < 0.001).

Formal certification for school educational support (pursuant to Law 104/1992) was issued to 39.58% of the evaluated cohort (n = 131), displaying pronounced diagnostic differentiation (Chi-square = 83.18, df = 5, p < 0.001): indications were concentrated in ASD (67.00%, n = 67 of 100), ADHD (59.57%, n = 28 of 47), and GDD (35.71%, n = 25 of 70), whereas children with language disorders rarely qualified for educational certification (7.59%, n = 6 of 79). Evidence-based parent training programs were prescribed for 25.68% of cases (n = 85), demonstrating marked clinical specificity for emotional-behavioral disorders (71.88%, n = 23 of 32) and ADHD (63.83%, n = 30 of 47), compared to 13.00% (n = 13 of 100) in ASD and 11.39% (n = 9 of 79) in language delay (Chi-square = 94.29, df = 5, p < 0.001).

Third-level medical and genetic investigations (including neuroimaging, chromosomal microarrays, and metabolic screenings) were initiated in 12.08% of patients (n = 40), concentrated primarily in GDD (18.57%, n = 13 of 70) and ASD (19.00%, n = 19 of 100), while being infrequently utilized in ADHD (6.38%, n = 3 of 47) and language disorders (3.80%, n = 3 of 79; Chi-square = 17.51, df = 5, p = 0.004). Finally, evidence-based NDBI and structured behavioral therapies were recommended for 16.62% of children (n = 55), displaying near-exclusive diagnostic specificity for ASD (47.00%, n = 47 of 100), while remaining

virtually unprescribed in other conditions (5.71% in developmental delay, 2.13% in ADHD, and 1.27% in language disorders; Chi-square = 96.27, df = 5, $p < 0.001$).

Discussion

The present study provides an extensive empirical evaluation of diagnostic pathways, front-line triage concordance, determinants of tertiary retention, and post-diagnostic resource allocation within a large cohort of 1,072 preschool children evaluated at a university hospital Child Neuropsychiatry unit. By systematically tracing clinical trajectories across a standardized two-tier clinical architecture, our findings clarify how front-line specialist triage navigates escalating referral volumes documented across European pediatric mental health services [2], resolves early phenotypic ambiguity, prioritizes high-complexity developmental disorders for hospital-based multidisciplinary workups, and matches confirmed diagnostic profiles with tailored therapeutic and educational intervention packages in line with multi-tiered service frameworks [3, 16].

A central finding of this investigation lies in the marked divergence between initial referral concerns and post-triage working hypotheses. Over half of the cohort entered the service prompted by parental or primary care concerns regarding speech and communication delays, corroborating surveillance studies identifying expressive deficits as the primary trigger for early consultation [7, 8]. While expressive and receptive speech difficulties represent the most readily noticeable outward marker of developmental disruption for caregivers and early educators [9], our findings substantiate that isolated language delay frequently serves as a critical sentinel symptom for broader neurodevelopmental conditions [10]. At the initial specialist intake examination, nearly one-third of children referred exclusively for language delay were reclassified into broader clinical categories, predominantly ASD and GDD (Table S1, Panel A). Rather than indicating diagnostic instability, this moderate agreement empirically underscores the indispensable role of early specialist filtering in distinguishing circumscribed speech delays from pervasive socio-communicative and cognitive impairments. This diagnostic fluidity is consistent with the ESSENCE framework formulated by Gillberg [12], which posits that major neurodevelopmental conditions share substantial early phenotypic overlap and frequently emerge from non-specific early communication deficits before differentiating into clear-cut categorical diagnoses [11, 14].

When evaluated against comprehensive second-level multidisciplinary assessments (the clinical gold standard), the initial specialist intake consultation exhibited substantial diagnostic concordance (Table S1, Panel B). In particular, the intake filter demonstrated robust psychometric accuracy for ASD relative to consensus DSM-5 diagnoses [13, 15]. Importantly, false-positive cases at intake were not clinical misidentifications of neurotypical development; instead, children suspected of ASD at triage who were not confirmed upon extensive evaluation resolved almost entirely into closely related, high-need neurodevelopmental phenotypes, predominantly GDD with receptive language impairments and severe developmental language disorders (Table S1, Panel B). Similarly, specialist intake displayed high specificity and positive predictive value for preschool ADHD. These findings expand upon preliminary observations by De Marchena and colleagues [17] regarding front-line clinician impressions,

demonstrating that even a brief, structured specialist consultation provides an accurate and reliable filter for early risk stratification before families and centers embark on resource-intensive multidisciplinary pathways.

Multivariable modeling explicitly delineated the clinical, chronological, and logistical determinants that govern the allocation of tertiary hospital resources versus redirection to community territorial services. Clinical presentation at intake emerged as the principal driving factor. The odds of internal tertiary retention were nearly twenty-fold higher for children presenting with suspected ASD and approximately eight-fold higher for suspected GDD and ADHD relative to isolated language disorders (Table 2). This triage pattern reflects a rational tier-based healthcare delivery model recommended by the Lancet Commission on autism [3] and collaborative care models [16]: hospital-based tertiary resources are selectively reserved for pervasive, heterogeneous phenotypes requiring multi-professional psychometric batteries, standardized observation schedules, neurological evaluations, and third-level medical-genetic workups. Conversely, circumscribed language impairments without pervasive socio-communicative deficits are channeled toward territorial community child mental health units for localized speech and language rehabilitation, thereby curbing the inflation of university hospital waitlists [4] while safeguarding the role of community services within the regional public healthcare architecture [18, 19].

Chronological age was an independent negative predictor of tertiary retention, with younger preschool children being significantly more likely to be retained for internal multidisciplinary assessment (Table 2). This inverse association reflects intentional clinical prioritization of early toddlerhood, a direct operational translation of translational evidence demonstrating that early intervention yields maximal efficacy during critical neuroplastic developmental windows [5, 6]. Timely diagnostic confirmation in this temporal window enables immediate enrollment in targeted interventions before secondary emotional or behavioral complications consolidate or diagnostic windows are missed [1, 6]. Logistically, residential provenance exerted an independent effect: children residing within the outer provincial belts exhibited significantly lower odds of hospital retention compared to metropolitan residents (Table 2). This finding illustrates active adherence to territorial proximity principles, reinforcing that long-term developmental monitoring and routine rehabilitation should remain grounded within local community health authorities whenever feasible [18, 19].

Finally, mapping post-diagnostic recommendations demonstrated coherent, phenotype-specific resource allocation across all evaluated rehabilitation modalities (Table S2). ASD accounted for the most intensive multi-agency resource utilization, characterized by high rates of psychomotor therapy, speech therapy, statutory school educational support certifications, and naturalistic developmental behavioral interventions (NDBI). The selective deployment of NDBI for ASD directly reflects contemporary consensus and international clinical guidelines that prioritize naturalistic, ecologically grounded behavioral interventions in early childhood [5, 21]. Conversely, preschool ADHD exhibited a distinct therapeutic profile driven by psychomotor therapy, school support accommodations, and caregiver-mediated parent training programs. The marked prominence of parent training in this subgroup substantiates current clinical guidelines and meta-analytic evidence designating behavioral caregiver

interventions as the first-line psychosocial standard for preschool children presenting with ADHD symptoms [20]. Meanwhile, children diagnosed with language disorders engaged focused outpatient pathways, almost universally receiving speech therapy while rarely requiring statutory school disability certifications or tertiary medical investigations.

Several methodological strengths and limitations warrant consideration. A key strength is the large, unselected clinical cohort (N = 1,072) evaluated under standardized operational procedures within a public healthcare framework. However, the retrospective design within a tertiary university setting inherently reflects a degree of referral filter bias toward more complex or persistent presentations. Additionally, children redirected to local health units were not tracked longitudinally to ascertain ultimate diagnostic stability within the territorial network. Furthermore, clinical record abstraction precluded granular item-level psychometric modeling of cognitive, linguistic, and adaptive quotients, although all post-evaluation diagnoses were rigorously established via multidisciplinary clinical consensus according to DSM-5 criteria.

This study delineates the clinical utility and organizational efficacy of a structured, two-tier diagnostic workflow within a tertiary child and adolescent neuropsychiatry service. Our findings demonstrate that early specialist intake functions as a pivotal clinical filter capable of resolving initial phenotypic ambiguity, particularly by identifying complex neurodevelopmental disorders that commonly present under the guise of isolated speech and language delays. The robust diagnostic concordance observed between front-line intake hypotheses and multidisciplinary gold-standard evaluations confirms that early specialist assessment provides a reliable foundation for clinical decision-making and risk stratification.

Furthermore, multivariable modeling substantiates that tertiary service retention is governed by coherent clinical, developmental, and territorial priorities. The institutional pathway selectively channels high-complexity phenotypes, such as ASD and GDD, as well as younger children within critical developmental windows, into hospital-based multidisciplinary assessments while redirecting circumscribed conditions to community services in accordance with territorial proximity. Finally, the demonstrated concordance between formal diagnostic outcomes and specialized rehabilitation packages highlights a rational, phenotype-specific allocation of therapeutic and educational resources. Implementing standardized specialist triage frameworks can optimize patient flow, reduce diagnostic delay, and promote equitable resource distribution across integrated pediatric mental health networks.

Declarations

***Competing interests*:**

the authors declare no competing interests.

Artificial Intelligence Statement

artificial intelligence tools were not used in the generation, analysis or interpretation of study data. Generative AI tools were used to support language and grammar editing of the final manuscript. All final content was reviewed and approved by the authors.

Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Author Contribution

MR conceptualized the study and supervised all phases of the project. GS and CC contributed to data collection and curated the initial clinical dataset. VZ performed data curation and quality control, conducted the statistical analyses, and drafted the original manuscript. FP contributed to the writing and critical review of the manuscript. All authors reviewed and approved the final version of the manuscript.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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