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Adaptation and Psychometric Validation of the Child and Adolescent Forms of the Glasgow Antipsychotic Side-Effect Scale (GASS)

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Short Title: Child & Adolescent GASS Validation

ABSTRACT

OBJECTIVE This study aimed to adapt the Glasgow Antipsychotic Side-effect Scale (GASS) into Turkish for the assessment of antipsychotic medication side effects in children and adolescents, and to evaluate its validity and reliability.

METHODS The Turkish adaptation of the scale was conducted according to participant age groups, and child and adolescent forms were developed. Internal consistency of the scale was examined, and exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed to assess construct validity. The underlying factor structure of the scale items was examined through EFA, and the accuracy of the obtained model was tested using CFA. The child form (CF) consists of 10 items, and the adolescent form (AF) consists of 14 items.

RESULTS The scale was administered to a sample of 247 participants; 60.3% were male, and the mean age was 12.66±3.56 years. EFA with varimax rotation revealed a three-factor structure for the CF and a four-factor structure for the AF. The total variance explained by the scale was 63.45% for the child form and 63.51% for the adolescent form. In the CF, Cronbach's alpha coefficients for the subfactors (F1–F4) ranged between 0.50 and 0.79; in the AF, internal consistency coefficients ranged between 0.63 and 0.76, indicating acceptable reliability. According to Tukey's test of additivity, a total score was not appropriate for the scale (CF:$F=104.705$; $p<0.001$; AF: $F=44.395$; $p<0.001$).

CONCLUSION The Turkish version of the GASS is a valid and reliable measurement tool for assessing and monitoring antipsychotic side effects in children and adolescents. The findings support that, rather than using a total score, a subscale-based profile approach may be more meaningful and clinically informative in evaluating antipsychotic side effects in this population.

KEYWORDS Antipsychotic; child, adolescent; side effect; validity; reliability; scale adaptation.

INTRODUCTION

Antipsychotic medications are widely used in children and adolescents for the treatment of schizophrenia spectrum disorders, bipolar disorder, conduct disorder, Tourette syndrome, and autism spectrum disorder (ASD) [1, 2]. In particular, second-generation antipsychotics (SGAs) have become one of the most frequently prescribed medication classes in child and adolescent psychiatric practice [3]. However, both short and long-term use of antipsychotics may be associated with a broad range of adverse effects, including extrapyramidal symptoms (EPS), sedation, weight gain, metabolic disturbances, endocrine changes, gastrointestinal complaints, and increased cardiovascular risk [4, 5].

Children and adolescents may demonstrate different antipsychotic side-effect profiles compared with adults because of developmental differences in pharmacokinetics and pharmacodynamics[6–8]. Previous studies have shown adverse effects such as weight gain, metabolic side effects, sedation, and extrapyramidal symptoms in the pediatric population receiving antipsychotic treatment; has shown that children and adolescents may be more susceptible [9].

Previous pediatric studies have reported adverse effects associated with SGA treatment [10, 11]. Studies demonstrating the efficacy of risperidone in the treatment of irritability in children with ASD have identified weight gain and sedation as the most frequently reported adverse effects [11]. Similarly, olanzapine has been associated with substantial weight gain and adverse metabolic effects, including increases in body mass index, waist circumference, fasting glucose levels, and lipid abnormalities in adolescents [10]. Although aripiprazole is generally better tolerated than other SGAs, pediatric studies have reported an increased risk of extrapyramidal symptoms, particularly akathisia [12]. Overall, studies of SGAs in pediatric populations indicate that the prevalence of weight gain may reach 20–30%, while rates of hyperprolactinaemia may be as high as 60% [13, 14]. These adverse effects may contribute not only to physical health risks but also to treatment non-adherence. A substantial proportion of children and adolescents discontinue antipsychotic treatment because of side effects [9]. Treatment discontinuation may lead to symptom exacerbation and functional impairment. Therefore, early identification and systematic monitoring of adverse effects are critical for improving treatment adherence and clinical outcomes [15].

Although several rating scales have been developed and validated to assess the therapeutic effects of psychotropic medications, comparatively less attention has been directed toward instruments designed to systematically assess medication-related adverse effects [16]. In routine clinical interviews, side-effect monitoring is often unsystematic, which may result in the underrecognition of symptoms that parents may not notice or that children may be reluctant to

report [17, 18]. In this context, standardised side-effect assessment and rating scales represent an important tool for clinical practice [18]. A review of the literature indicates that only a limited number of instruments are available for monitoring medication-related adverse effects in children and adolescents. Several instruments have been used to assess psychotropic medication side effects in pediatric populations, including the Dosage Record and Treatment Emergent Symptom Scale used in child and adolescent psychopharmacology research, the Pediatric Adverse Event Rating Scale developed for assessing adverse events in children and adolescents receiving psychotropic treatment, and the Side Effects Form for Children and Adolescents [19–22]. However, few validated tools are specifically designed to systematically assess antipsychotic-related adverse effects in pediatric populations. Moreover, these instruments are not antipsychotic-specific and typically involve clinician-rated components, making them time-consuming to administer in routine clinical settings [20, 21, 23]. To our knowledge, no validated, reliable, and easy-to-administer antipsychotic-specific side-effect screening scale is currently available for use in children and adolescents in Türkiye.

Because different informants complete the child and adolescent forms, the type of adverse effects that are noticed and prioritised may differ between parents and adolescents. [24, 25]. Differences between child self-report and parent proxy-report have also been observed with respect to both the presence and severity of symptoms. In a study involving children with cancer, children's self-reports—particularly for subjective symptoms—systematically diverged from parent reports, highlighting the importance of a multi-informant approach to symptom assessment [26]. The Glasgow Antipsychotic Side-Effect Scale (GASS), developed and validated by Waddell and Taylor, is a brief self-report instrument designed to provide a systematic assessment of SGA-related adverse effects within a short time frame in adult outpatient populations [27]. The Turkish validity and reliability of the adult version of the scale have previously been established, demonstrating its feasibility for use in clinical practice [28]. However, the perception and reporting of medication-related adverse effects differ between parents and children in paediatric populations. For this reason, the development and Turkish adaptation of age-specific versions—the Child Form (CF) for ages 6–12 years and the Adolescent Form (AF) for ages 13–17 years—may help address an important gap in both clinical practice and research in Türkiye. The aim of the present study was to adapt the GASS Child (6–12 years) and Adolescent (13–17 years) Forms into Turkish and to examine their validity and reliability.

METHOD

Study Design and Procedure

This single-centre, cross-sectional study was conducted between 2 June 2025 and 1 September 2025 at the Child and Adolescent Psychiatry Outpatient Clinic.

Inclusion and Exclusion Criteria

Inclusion criteria were being a parent of a child aged 6–12 years receiving antipsychotic treatment for at least three months or an adolescent aged 13–17 years receiving antipsychotic treatment for at least three months; the ability to read, understand, and complete the questionnaire; and clinically observed normal intellectual functioning.

Exclusion criteria included intellectual disability severe enough to interfere with form completion, a history of major neurological or medical comorbidity, and clinician-observed communication or behavioural difficulties that would preclude meaningful participation in the study.

Diagnostic Assessment and Questionnaire Administration

Psychiatric diagnoses were established using the semi-structured Schedule for Affective Disorders and Schizophrenia for School-Aged Children – Present and Lifetime Version–DSM-5 (K-SADS-PL-DSM-5) and, when necessary, supplementary clinician-administered interviews based on DSM-5-TR criteria [29–31]. Questionnaires for children aged 6–12 years were completed by their parents, whereas questionnaires for adolescents aged 13–17 years were completed by the adolescents themselves.

Data Quality Control

To enhance data accuracy, attention-check items were embedded within the questionnaire to identify inattentive responding. Participants who failed these items—for example, those incorrectly answering an instruction-based question (e.g., “If you are reading this question, please select the indicated option”)—were excluded from the analysis.

Ethical approval for the study was obtained from the XX University Ethics Committee (Approval No:2025/09-32). Written informed consent was obtained from the parents of all child and adolescent participants prior to study inclusion. In addition, age-appropriate assent was obtained from all participating children and adolescents.

Data Collection Instruments

Sociodemographic Form

The sociodemographic form collected data on participants' age, sex, height, weight, BMI, age at thelarche and menarche for female participants, current medications, medication dosages, and duration of medication use.

Glasgow Antipsychotic Side-Effect Scale (GASS)

The original GASS is designed as a self-report instrument for adult patients [27]. Items 1–20 assess side effects experienced during the previous week, whereas Items 21–22 refer to the preceding three months. For Items 1–20, response options are scored as follows: "not at all" (0), "once" (1), "a few times" (2), and "every day" (3). Items 21 and 22 are scored as "yes" (3) or "no" (0). A total score is obtained by summing all item scores. Recommended cut-off scores for males and females are 0–12 (absent/mild), 13–26 (moderate), and >26 (severe side-effect burden). Item content is grouped into the following domains: sedation and central nervous system, cardiovascular effects, EPSs anticholinergic, gastrointestinal, genitourinary effects, screening for diabetes mellitus, prolactin-related effects, and weight gain. In the original version of the GASS, each item is accompanied by an additional column assessing whether the reported side effect is experienced as distressing [27].

Each side effect was assessed using two components: a frequency rating on a four-point Likert scale (A items) and a separate dichotomous distress rating indicating whether the reported symptom caused discomfort (B items).

Translation Process

In the first stage, permission to translate the scale and to develop child and adolescent versions was obtained from the original author, and the author of the Turkish validity and reliability study of the adult version was informed about the adaptation process. In the second stage, items not relevant to child and adolescent populations were removed following consultation with the original scale developer, while age-appropriate side-effect items were retained. Both

forms were independently translated from English into Turkish by two professional translators. The two Turkish versions were then reconciled into a single version by the research team and back-translated into English by a professional translator. The back-translated version was reviewed for semantic equivalence by an independent native English-speaking expert, and the final Turkish versions of both forms were approved by the original developers.

In the final stage, the revised scales were administered to 15 adolescents (AF) and to 15 parents (CF) to assess item clarity, comprehensibility, and response fluency. No difficulties were reported.

The final versions of the child and adolescent forms developed following the psychometric evaluation are provided as Supplementary Appendices 1 and 2.

Statistical Analysis

Sample size was determined in accordance with recommendations from the measurement and factor analysis literature, targeting at least 5–10 participants per item [32, 33]. Accordingly, a target sample of 90–180 parents was planned for the CF-18 items, and 110–220 adolescents for the AF-22 items.

The data were analyzed using IBM SPSS Statistics version 23, IBM AMOS version 24, and JASP version 0.19.3.0. Exploratory factor analysis (EFA) was performed separately for the adolescent and child forms. For the adolescent form, confirmatory factor analysis (CFA) was conducted in IBM AMOS version 24 using the bootstrap maximum likelihood (Bootstrap ML) estimation method. For the child form, CFA was performed in JASP version 0.19.3.0 using the *lavaan* package. Descriptive statistics for continuous variables were presented as mean ± standard deviation and median (minimum–maximum), while categorical variables were presented as frequencies and percentages. Statistical significance was set at $p<0.05$.

RESULTS

Sociodemographic characteristics of the participants

A total of 16 participants were excluded due to failure to pass the attention-check items or provision of incomplete data. Following these exclusions, the final sample consisted of 247 participants, including 119 children and 128 adolescents. The mean age of the sample was 9.51 years in the CF group, 15.59 years in the AF group, and 12.66 years

overall. Females comprised 20.2% of the CF group and 57.8% of the AF group, accounting for 39.7% of the total sample. Detailed sociodemographic characteristics of the participants are presented in Table 1.

In the CF group, the most prevalent diagnosis was attention-deficit/hyperactivity disorder (ADHD) (87.2%), followed by autism spectrum disorder (ASD) (13.7%), oppositional defiant disorder (10.3%), intellectual disability (10.3%), and specific learning disorder (9.4%). In the AF group, the most common diagnoses were depressive disorders (37.6%) and ADHD (36.8%), followed by ASD (12.0%), tic disorders (7.7%), social anxiety disorder (6.0%), intellectual disability (6.0%), and bipolar mania (5.1%). When the total sample was considered, ADHD was the most frequent diagnosis (62.0%), followed by depressive disorders (19.7%), ASD (12.8%), tic disorders (6.4%), and specific learning disorder (6.4%). Detailed diagnostic distributions for the CF and AF groups and the total sample are presented in Table 2.

Analysis of medication use showed that, in the CF group, the most frequently prescribed medications were SGAs (99.2%), methylphenidate (59.0%), atomoxetine (15.1%), selective serotonine reuptake inhibitors (SSRIs) (5.9%), and guanfacine (5.9%). In the AF group, SGAs (100.0%), SSRIs (48.4%), methylphenidate (29.6%), atomoxetine (5.5%), benzodiazepines (3.1%), and guanfacine (2.3%) were most commonly used. Detailed rates of psychotropic medication use are presented in Table 3.

For AF, EFA was conducted using principal component analysis with Varimax rotation. Initially, the factor structure was examined by retaining factors with eigenvalues greater than 1. During the analysis, items with anti-image correlation coefficients below 0.50, extraction values below 0.30, or cross-loadings with a difference of less than 0.10 between factor loadings were sequentially removed. After each item removal, the analysis was repeated. During this iterative process, some factors were found to be represented by only two items. As factors with fewer than three items were considered inadequate in terms of structural validity and interpretability, the number of factors was reduced accordingly, and the analysis was repeated. The final solution yielded a more parsimonious, statistically acceptable, and theoretically interpretable factor structure.

Glasgow item 22A(weight gain) was removed because its anti-image correlation coefficient was below 0.50, and Glasgow item 19A(galactorrhea) was removed because its extraction value was below 0.30 [34]. Based on the predefined factor retention criteria requiring a minimum of three items per factor and the absence of cross-loading items (defined as a loading difference of less than 0.10 between factors), Glasgow items 3A(dizziness), 7A(akathisia), 14A(constipation), 18A(mastalgia), 20A(libido), and 21A(menstruation) were also removed from the scale due to cross-loading.

After removal of these items, a four-factor structure comprising 14 items was obtained. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was 0.840, and Bartlett's test of sphericity was significant ($\chi^2 = 594.181$, $p<0.001$), indicating that the data were suitable for factor analysis. All remaining items had extraction values of at least

0.332, and all diagonal values in the anti-image correlation matrix exceeded 0.50. The four-factor solution explained 63.51% of the total variance (see Table 4).

Before conducting CFA, the data were screened for potential problems, including outliers, skewness, kurtosis, and missing values. Because multivariate normality is an assumption of the maximum likelihood estimation method, multivariate normality was assessed. The multivariate normality test yielded a critical ratio of 34.801, indicating that the assumption of multivariate normality was not met. Studies have shown that while a value below 10 is considered an excellent result, values up to 20 generally do not pose a problem [35]. Therefore, bootstrap maximum likelihood (ML) estimation was used for CFA. A first-order CFA of the 14-item model demonstrated acceptable model fit, with fit indices of CMIN/DF = 1.579 (112.092/71), GFI = 0.889, IFI = 0.925, CFI = 0.922, RMSEA = 0.068, and SRMR = 0.072. In addition, all standardized factor loadings were statistically significant ($p<0.05$) (see Table 5 ande Figures 1-2).

EFA of the AF form identified a four-factor structure. However, according to the Tukey test of additivity, calculation of a total scale score was not appropriate ($F = 44.395$, $p < 0.001$). Internal consistency was good for Factors 1, 2, and 3, with Cronbach's alpha coefficients of 0.762, 0.746, and 0.740, respectively. Factor 4 yielded a Cronbach's alpha coefficient of 0.627, indicating acceptable internal consistency (see table 6).

For the CF, EFA was performed using principal component analysis with Varimax rotation. All diagonal values in the anti-image correlation matrix were required to exceed 0.50. Accordingly, Glasgow items 2A(sedation), 9A(parkinsonism), 16A(enuresis), and 18A(weight gain) were removed because their anti-image correlation coefficients were below 0.50, and the factor analysis was repeated. Following their removal, all anti-image correlation coefficients exceeded 0.50. Based on the extraction values, items with values below 0.30 were considered inadequate; therefore, Glasgow items 3A(dizziness) and 15A(nausea) were excluded. According to factor analysis criteria, each factor should contain at least three items, and the difference between an item's loadings on different factors should exceed 0.10 to avoid cross-loading. Accordingly, Glasgow item 11A(vision) was removed because it demonstrated cross-loading.

After these items were removed, a three-factor structure consisting of 11 items was obtained. The KMO measure was 0.714, and Bartlett's test of sphericity yielded a χ^2 value of 545.155 ($p<0.001$), indicating that the data were suitable for factor analysis. All remaining items had extraction values of 0.30 or higher, and all diagonal values in the anti-image correlation matrix exceeded 0.50. The final three-factor solution explained 63.45% of the total variance (see Table 7).

Because the variables were ordinal, CFA was conducted in JASP using the *lavaan* (latent variable analysis) package developed for the R programming language. Maximum likelihood (ML) estimation was used. Glasgow item 13A(urination) was removed because it did not contribute significantly to the model. The final model demonstrated fit indices of GFI=0.882, IFI=0.851, CFI=0.845, RMSEA=0.122, and SRMR=0.073. (see Table 8 and Figure 3)

EFA of the CF identified a three-factor structure. However, according to the Tukey test of additivity, calculation of a total scale score was not appropriate ($F = 104.705$, $p<0.001$). Internal consistency analysis demonstrated acceptable reliability for Factor 1 (Cronbach's $\alpha = 0.781$), low reliability for Factor 2 (Cronbach's $\alpha = 0.504$), and acceptable reliability for Factor 3 (Cronbach's $\alpha = 0.687$) (see Table 9).

In the AF, the most frequently reported discomfort items were Glasgow item 22 (29.1%), reflecting weight gain, followed by item 1 (20.3%) and item 2 (10.2%), both related to sedation, item 7 (8.6%), and item 6 (7.8%), both corresponding to extrapyramidal symptoms (EPSs). In the CF, the most commonly reported discomfort items were Glasgow item 18 (22.7%), indicating weight gain, followed by item 9 (4.2%) related to EPSs, item 17 (3.4%) reflecting autonomic secretion, and item 8 (2.5%) and item 16 (2.5%), both corresponding to EPSs. Item-level discomfort reporting rates for both the child and adolescent forms are presented in detail in Table 10.

DISCUSSION

In this study, the Turkish adaptation of the GASS was developed for both the CF (ages 6–12) and the AF (ages 13–17), and its validity and reliability were examined. The AF demonstrated a clinically interpretable four-factor structure, whereas the CF demonstrated a three-factor structure that was also clinically interpretable. For each form, the use of a single total score was not supported, and a subscale or profile-based assessment was found to be more appropriate. Because the scale was designed to assess antipsychotic side effects broadly, the high prevalence of SGA use in our sample likely influenced the resulting factor structure and item distribution. Therefore, the identified side-effect profile primarily reflects adverse effects associated with SGA treatment.

The findings indicate that the antipsychotic side-effect profile in children and adolescents shows distinct patterns according to age group and informant source. In the child group, the predominance of neurodevelopmental disorders, particularly ADHD and ASD, along with the frequent concomitant use of methylphenidate and other ADHD medications alongside antipsychotics, suggests that antipsychotic treatment is often part of combined pharmacotherapy in this age group. In contrast, the adolescent group showed a more heterogeneous diagnostic distribution, with increased rates of depressive and anxiety disorders and a higher prevalence of SSRI use, indicating that internalizing disorders contribute more substantially to the clinical presentation with advancing age. Examination of side-effect reporting revealed that weight gain was the most frequently reported distressing adverse effect in both adolescent self-reports and parent-proxy reports. Sedation-related symptoms were among the most commonly reported items in the adolescent form, whereas extrapyramidal symptoms were more prominent in the child form. Autonomic adverse effects

were reported less frequently. These findings suggest that the pattern of antipsychotic side-effect reporting differs between children and adolescents and may be influenced by both developmental characteristics and the source of information [36, 37]. Notably, item selection was guided by psychometric adequacy and structural coherence rather than reporting frequency alone, highlighting that commonly reported symptoms may not necessarily contribute meaningfully to the measurement model.

The EFAs indicated that the factor structures of both the CF and AF differed psychometrically from the system-based grouping of side effects in the original adult scale. This finding suggests that clinically defined side-effect clusters may not map directly onto data-driven factors. Age-related differences in pharmacodynamics, pharmacokinetics, and physiology, together with distinctions between observable and subjective side effects according to the informant, may account for this divergence [6]. In addition, differences in treatment characteristics and prescribing patterns between pediatric and adult populations may also have contributed to the observed differences in factor structure [38].

Internal consistency was evaluated at the subscale level, as the results of the Tukey test of additivity indicated that a single total score was not appropriate for either form. Cronbach's alpha coefficients ranged from 0.627 to 0.762 for the AF and from 0.504 to 0.786 for the CF, indicating acceptable to good internal consistency across the subscales. These findings are consistent with expectations for a developmentally heterogeneous population assessed using a multidimensional instrument that captures clinically distinct domains of antipsychotic side effects.

Given that Cronbach's-α is influenced by item number and construct homogeneity, the limited number of items per subscale and the inherently heterogeneous clinical nature of antipsychotic side effects likely contributed to lower alpha values in some subscales. Therefore, the alpha coefficients observed in this study indicate a level of reliability that is adequate for the intended clinical use of the scale, particularly for profile-based assessment of side effects. Notably, Cronbach's-α was not reported in the original GASS study [27]. The Arabic version demonstrated good reliability with a Cronbach's-α of 0.793 [39], and more recent adaptations have reported similar values ranging from weak to good reliability (0.604–0.79 and 0.51–0.84) [40–42]. These findings suggest that the translation and adaptation process did not compromise internal consistency.

The construct validity of the child and adolescent forms of the GASS was supported in this study. EFAs yielded a three-factor structure for the CF and a four-factor structure for the AF. In contrast, adaptations of the original scale into Arabic and Bangla reported seven-factor solutions [40, 43]. Our findings support the adequacy of a reduced-item Turkish version of the original 22-item GASS, with 10 items for the CF and 14 items for the AF. In the clozapine-specific GASS, seven items were also removed from the original scale; however, these exclusions were based on content-related considerations—including clozapine specificity, clinical relevance, and patient reporting frequency—rather than statistical factor loadings [44]. In the original GASS, items were grouped by the authors into clinically meaningful thematic side-effect domains, rather than derived through sample-based empirical methods such as factor analysis, and no subscale scoring was defined [27]. The use of rating scales to assess adverse effects of psychotropic agents has become increasingly common worldwide [23] . In validation studies of the UKU-Side Effect Rating Scale, including Turkish and international adaptations, item reductions resulted in shorter versions with sex-specific item counts, and a four-factor structure was confirmed [45, 46].

The fit indices obtained from the CFAs indicated that the four-factor structure of the AF and the three-factor structure of the CF showed an overall acceptable-to-marginal model fit. In the AF, the CMIN/DF, CFI, IFI, RMSEA, and SRMR values indicated an overall acceptable model fit. In the CF, although the CMIN/DF and SRMR values supported the proposed model, the relatively high RMSEA and lower incremental fit indices suggested a less optimal fit. These differences may reflect the multidimensional nature of the constructs, the relatively small number of items retained in the CF, and the use of parent-proxy reporting. Overall, the findings support the proposed factor structures for both forms as clinically interpretable and psychometrically acceptable.

The side-effect profile of antipsychotics in pediatric populations remains poorly delineated, and symptoms are often nonspecific, making them difficult to recognize and report [47]. In pediatric samples, low reporting rates for certain side-effect items may reflect developmental characteristics, such as age-related differences in symptom awareness, emotional insight, and the ability to recognize or communicate internal experiences, as well as attribution difficulties and other reporting barriers, rather than the true prevalence of adverse effects. Moreover, subjective experiences reported by children and adolescents may differ from side effects observed by parents. Discrepancies between self-report and parent-proxy report are particularly common for subjective symptoms. In the present study, the pattern of adverse-effect reporting differed between the adolescent self-report and child parent-proxy forms, with sedation-related

symptoms being more prominent in the adolescent form and extrapyramidal symptoms more prominent in the child form, while weight gain was the most frequently reported adverse effect in both forms. Consistent with this finding, Montgomery et al. demonstrated that parents may not fully capture children's internal or subjective symptoms, underscoring the importance of child self-report in side-effect assessment [26].

Internal symptoms such as blurred vision, which were removed from the parent-proxy child form, may be difficult for parents to recognize unless explicitly communicated by the child. These findings underscore the importance of systematic side-effect monitoring and proactive counseling to improve recognition and reporting of adverse effects in pediatric clinical practice [48].

The removal of items from the AF does not necessarily indicate that these side effects are absent in adolescents; rather, although they may be clinically relevant, they may have shown limited psychometric discrimination. More plausibly, this may be related to the low reporting frequency of certain symptoms within the short assessment window. In the present sample, sensitive or sex-specific items, particularly those related to prolactin-associated adverse effects and menstrual changes, may have shown limited psychometric performance because they were infrequently reported. In addition, the relatively small proportion of female participants and variability in pubertal status (e.g., menarche and thelarche) may also have contributed to the weaker performance of these items. Additionally, the use of a three-month assessment window for items 21–22 may have introduced temporal heterogeneity within the scale (i.e., "past week" vs. "past three months"), thereby contributing to weaker factor loadings. Together, these findings suggest that, in pediatric populations, both developmental characteristics and item format—including time frame and level of privacy—can substantially influence scale performance. Although antipsychotic-related adverse effects are known to occur across a wide spectrum in children and adolescents, their reporting and monitoring remain insufficiently studied, and they are often reported at low rates in clinical research, resulting in underreporting and underrecognition in routine practice [47]. In a study focusing on youths with neurodevelopmental disorders such as ADHD, ASD, and intellectual disability, certain side effects—particularly EPSs—were found to be masked by complex behavioral patterns, leading to delayed recognition and reduced reporting by both families and adolescents themselves [49]. The high proportion of these diagnostic groups in our sample may similarly have complicated the interpretation of side effects and their differentiation from behavioral variants. This divergence was also evident for extrapyramidal symptoms. Unlike the original GASS and other adult side-effect scales, such as the UKU and Liverpool scales, which generally assess

extrapyramidal symptoms as a single domain, the pediatric forms identified separate EPS-related subclusters, possibly reflecting differences between observable motor signs and more subjective symptoms such as akathisia [23, 50–52].

Strengths

This study addresses an important gap in the assessment of antipsychotic-related side effects in pediatric populations. The evaluation of two separate forms represents an approach that accounts for developmental differences and the impact of informant source on measurement. The combined use of exploratory and confirmatory factor analyses during scale development provided statistical support for the proposed factor structures, thereby strengthening the structural validity of both forms. Moreover, evaluating the scale at the subscale level rather than using a single total score allows for a more nuanced and clinically meaningful monitoring of antipsychotic side-effect profiles in children and adolescents.

LIMITATIONS

The single-center design and the clinically heterogeneous sample may limit the generalizability of the findings. The absence of test–retest reliability assessment restricts conclusions regarding the temporal stability of the scale. Additionally, the brief and multidimensional structure of the instrument may have contributed to borderline fit indices in CFAs. Inherent differences between parent-proxy and adolescent self-reporting may have led to underreporting of certain side effects, complicating the interpretation of items removed from the scale. Finally, the inclusion of multiple antipsychotic agents precluded a detailed examination of drug-specific side-effect profiles.

CONCLUSION

This study provides a comprehensive psychometric evaluation of the adaptation of GASS for children and adolescents. The findings demonstrate that two informant-specific forms—parent-proxy for children and self-report for adolescents—can be validly and meaningfully assessed within a three-factor structure for the child form and a four-factor structure for the adolescent form. The exclusion of certain items from the final scale does not imply the absence of these side effects in pediatric populations; rather, it highlights the influence of developmental factors, attribution difficulties, privacy-related reporting barriers, and the short assessment window on side-effect reporting. Evaluating

the scale at the subscale level rather than relying on a single total score may facilitate a more detailed and clinically relevant assessment of antipsychotic side effects in children and adolescents.

In conclusion, this study fills an important gap by offering a developmentally sensitive, informant-specific tool for the systematic assessment of antipsychotic-related side effects in pediatric psychiatric practice. Future studies should evaluate test–retest reliability, include larger and multicenter samples, and examine the scale's sensitivity to treatment-related change to further strengthen its clinical and research utility.

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Ethical Approval and Informed Consent. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant international guidelines on human experimentation and were approved by the XX University Ethics Committee (Approval No: 2025/09-32). Written informed consent was obtained from all participants and their legal guardians prior to enrollment.

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ABBREVIATIONS ADHD, attention-deficit/hyperactivity disorder; AF, adolescent form; ASD, autism spectrum disorder; BDZ, benzodiazepine; BMI, body mass index; CA, Cronbach's-α; CF, child form; CFA, confirmatory factor analysis; CI, Confidence Interval; CVEO, Cumulative variance explained ratio; CVER, Cumulative variance explained ratio; DSM-5-TR, Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision; EFA, exploratory factor analysis; EPS, extrapyramidal symptoms; GASS, Glasgow Antipsychotic Side-effect Scale; KMO, Kaiser–Meyer–Olkin; ML, maximum likelihood MS, mood stabilizers; SGA, second-generation antipsychotic; SNRI, serotonin–norepinephrine reuptake inhibitor; SSRI, Selective serotonin reuptake inhibitor; VEO, Variance explained ratio

REFERENCES

1. GRCEVICH SJ, FINDLING RL, ROWANE WA, et al (1996) Risperidone in the Treatment of Children and Adolescents with Schizophrenia: A Retrospective Study. Journal of Child and Adolescent Psychopharmacology 6:251–257. https://doi.org/10.1089/cap.1996.6.251

2. Correll CU (2008) Antipsychotic Use in Children and Adolescents: Minimizing Adverse Effects to Maximize Outcomes. FOCUS 6:368–378. https://doi.org/10.1176/foc.6.3.foc368

3. Panagiotopoulos C, Ronsley R, Elbe D, et al (2010) First do no Harm: Promoting an Evidence-Based Approach to Atypical Antipsychotic Use in Children and Adolescents. Journal of the Canadian Academy of Child and Adolescent Psychiatry 19:124–137

4. Libowitz MR, Nurmi EL (2021) The Burden of Antipsychotic-Induced Weight Gain and Metabolic Syndrome in Children. Frontiers in Psychiatry 12:623681. https://doi.org/10.3389/fpsyt.2021.623681

5. Cicala G, Barbieri MA, Santoro V, et al (2020) Safety and Tolerability of Antipsychotic Drugs in Pediatric Patients: Data From a 1-Year Naturalistic Study. Frontiers in Psychiatry 11:152. https://doi.org/10.3389/fpsyt.2020.00152

6. Liang J, Ringeling LT, Hermans RA, et al (2023) Clinical pharmacokinetics of antipsychotics in pediatric populations: a scoping review focusing on dosing regimen. Expert Opinion on Drug Metabolism & Toxicology 19:501–509. https://doi.org/10.1080/17425255.2023.2252340

7. Radojčić MR, Pierce M, Hope H, et al (2023) Trends in antipsychotic prescribing to children and adolescents in England: cohort study using 2000–19 primary care data. The Lancet Psychiatry 10:119–128. https://doi.org/10.1016/S2215-0366(22)00404-7

8. Gerlach M, Egberts K, Dang S-Y, et al (2016) Therapeutic drug monitoring as a measure of proactive pharmacovigilance in child and adolescent psychiatry. Expert Opinion on Drug Safety 15:1477–1482. https://doi.org/10.1080/14740338.2016.1225721

9. Correll CU (2009) Cardiometabolic Risk of Second-Generation Antipsychotic Medications During First-Time Use in Children and Adolescents. JAMA 302:1765–1773. https://doi.org/10.1001/jama.2009.1549

10. Sikich L, Frazier JA, McClellan J, et al (2008) Double-Blind Comparison of First- and Second-Generation Antipsychotics in Early-Onset Schizophrenia and Schizo-affective Disorder: Findings From the Treatment of Early-Onset Schizophrenia Spectrum Disorders (TEOSS) Study. American Journal of Psychiatry 165:1420–1431. https://doi.org/10.1176/appi.ajp.2008.08050756

11. MARTIN A, LANDAU J, LEEBENS P, et al (2000) Risperidone-Associated Weight Gain in Children and Adolescents: A Retrospective Chart Review. Journal of Child and Adolescent Psychopharmacology 10:259–268. https://doi.org/10.1089/cap.2000.10.259

12. Robb AS, Andersson C, Bellocchio EE, et al (2011) Safety and Tolerability of Aripiprazole in the Treatment of Irritability Associated With Autistic Disorder in Pediatric Subjects (6–17 Years Old): Results From a Pooled Analysis of 2 Studies. Primary Care Companion for CNS Disorders 13:. https://doi.org/10.4088/PCC.10m01008gry

13. Kirino E (2012) Efficacy and safety of aripiprazole in child and adolescent patients. European Child & Adolescent Psychiatry 21:361–368. https://doi.org/10.1007/s00787-012-0270-0

14. Calarge C, Nicol G, Xie D, Zimmerman B (2012) Correlates of weight gain during long-term risperidone treatment in children and adolescents. Child and Adolescent Psychiatry and Mental Health 6:21. https://doi.org/10.1186/1753-2000-6-21

15. Pringsheim T, Panagiotopoulos C, Davidson J, Ho J (2011) Evidence-based recommendations for monitoring safety of second-generation antipsychotics in children and youth. Paediatrics & Child Health 16:581–589. https://doi.org/10.1093/pch/16.9.581

16. Schooler NR, Chengappa KNR, Rush AJ, et al (2009) Adverse effects measures. In: Handbook of Psychiatric Measures, 2nd ed. American Psychiatric Publishing, Washington, DC, pp 159–161

17. Dittrich ATM, Draaisma JMT, van Puijenbroek EP, Loo DMWM te (2020) Analysis of Reporting Adverse Drug Reactions in Paediatric Patients in a University Hospital in the Netherlands. Pediatric Drugs 22:425–432. https://doi.org/10.1007/s40272-020-00405-3

18. Barnes TRE (2003) Evidence-based guidelines for the management of side effects of antipsychotic drugs. British Journal of Psychiatry 182:37–44

19. Prien RF, Robinson DS (1994) Clinical Evaluation of Psychotropic Drugs: Principles and Guidelines. Raven Press, New York

20. Guy W (1976) ECDEU Assessment Manual for Psychopharmacology. U.S. Department of Health, Education, and Welfare, Rockville, MD

21. Wiener JM (1977) Psychopharmacology in Childhood and Adolescence. Basic Books, New York

22. March J, Karayal O, Chrisman A (2007) CAPTN: The Pediatric Adverse Event Rating Scale. 23–28

23. Lingjærde O, Ahlfors UG, Bech P, et al (1987) The UKU side effect rating scale: A new comprehensive rating scale for psychotropic drugs and a cross-sectional study of side effects in neuroleptic-treated patients. Acta Psychiatrica Scandinavica 76:1–100. https://doi.org/10.1111/j.1600-0447.1987.tb10566.x

24. Eiser C, Varni JW (2013) Health-related quality of life and symptom reporting: similarities and differences between children and their parents. European Journal of Pediatrics 172:1299–1304. https://doi.org/10.1007/s00431-013-2049-9

25. De Los Reyes A, Youngstrom EA, Swan AJ, et al (2011) Informant discrepancies in clinical reports of youths and interviewers' impressions of the reliability of informants. Journal of Child and Adolescent Psychopharmacology 21:417–424. https://doi.org/10.1089/cap.2011.0011

26. Montgomery KE, Vos K, Raybin JL, et al (2021) Comparison of child self-report and parent proxy-report of symptoms: Results from a longitudinal symptom assessment study of children with advanced cancer. Journal for Specialists in Pediatric Nursing 26:e12316. https://doi.org/10.1111/jspn.12316

27. Waddell L, Taylor M (2008) A new self-rating scale for detecting atypical or second-generation antipsychotic side effects. Journal of Psychopharmacology 22:238–243. https://doi.org/10.1177/0269881107087976

28. Akpınar Aslan E, Batmaz S, Yüncü ÖA, et al (2020) The validity and reliability of the Turkish version of the Glasgow Antipsychotic Side-effect Scale (GASS). Clinical Psychiatry 23:290–301

29. American Psychiatric Association (2022) Diagnostic and Statistical Manual of Mental Disorders, DSM-5-TR. American Psychiatric Association Publishing

30. Unal F, Oktem F, Cetin Cuhadaroglu F, et al (2019) Reliability and Validity of the Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version, DSM-5 November 2016-Turkish Adaptation (K-SADS-PL-DSM-5-T). Turkish Journal of Psychiatry 30:42–50. https://doi.org/10.5080/u23408

31. Kaufman J, Birmaher B, Axelson D, et al (2016) Schedule for Affective Disorders and Schizophrenia for School-Aged Children: Present and Lifetime Version (K-SADS-PL), DSM-5 November 2016 Working Draft. Child and Adolescent Research and Education Program, Pittsburgh, PA

32. Yong AG, Pearce S (2013) A Beginner's Guide to Factor Analysis: Focusing on Exploratory Factor Analysis. The Quantitative Methods for Psychology 9:79–94. https://doi.org/10.20982/tqmp.09.2.p079

33. Comrey AL, Lee HB (2013) A First Course in Factor Analysis, 2nd ed. Psychology Press, New York

34. Nunnally JC (1978) Psychometric Theory, 2nd ed. McGraw-Hill, New York

35. Gürbüz S (2024) Amos ile Yapısal Eşitlik Modellemesi, 3rd ed. Seçkin Yayıncılık, Ankara

36. Tomlinson D, Plenert E, Dadzie G, et al (2021) Reasons for disagreement between proxy-report and self-report rating of symptoms in children receiving cancer therapies. Supportive Care in Cancer 29:4165–4170. https://doi.org/10.1007/s00520-020-05930-y

37. Pillay J, Boylan K, Newton A, et al (2018) Harms of Antipsychotics in Children and Young Adults: A Systematic Review Update. Canadian Journal of Psychiatry 63:661–678. https://doi.org/10.1177/0706743718779950

38. Kealey E, Scholle SH, Byron SC, et al (2014) Quality Concerns in Antipsychotic Prescribing for Youth: A Review of Treatment Guidelines. Academic Pediatrics 14:S68–S75. https://doi.org/10.1016/j.acap.2014.05.009

39. AlRuthia Y, Alkofide H, Alosaimi FD, et al (2018) Translation and cultural adaptation of Glasgow Antipsychotic Side-effects Scale (GASS) in Arabic. PLOS ONE 13:e0201225. https://doi.org/10.1371/journal.pone.0201225

40. Qambar M. Bokhari, Iram Zehra Bokharey*, Shahid H. Warris, et al (2023) Urdu Translation and Adaptation of Glasgow Antipsychotic Side-Effect Scale (GASS). Pakistan Journal of Professional Psychology: Research and Practice 14:. https://doi.org/10.62663/pjpprp.v14i1.22

41. Zahangir TI, Ahmed HU, Datta J, et al (2025) Adaptation and validation of the Glasgow Antipsychotic Side-Effect Scale in Bangladesh. East Asian Archives of Psychiatry 35:208–214. https://doi.org/10.12809/eaap2544

42. Maria N (2014) Validation of the Glasgow Antipsychotic Side-Effect Scale (GASS) in Greece. Journal of Psychology & Clinical Psychiatry 1:. https://doi.org/10.15406/jpcpy.2014.01.00024

43. Zahangir TI, Mostafa G, Asif-Al-Naim M, et al (2025) Assessment of Linguistic Equivalence and Internal Consistency of the Culturally Adapted Bangla Version of the Glasgow Antipsychotic Side-Effect Scale (GASS-B). https://doi.org/10.5281/ZENODO.17910981

44. Hynes C, Keating D, McWilliams S, et al (2015) Glasgow Antipsychotic Side-effects Scale for Clozapine—Development and validation of a clozapine-specific side-effects scale. Schizophrenia Research 168:505–513. https://doi.org/10.1016/j.schres.2015.07.052

45. Usta H, Ünal GG, Gica Ş (2020) Turkish Validity Reliability of Udvalg for Kliniske Undersøgelser Side Effect Rating Scale in Patients with Chronic Schizophrenia. NI 58:7–10. https://doi.org/10.5455/NYS.20200621093100

46. Chen K-P, Lung F-W (2017) Reliability and Validity of the Short Version of Udvalg for Kliniske Undersogelser in Antipsychotic Treatment. Psychiatric Quarterly 88:787–796. https://doi.org/10.1007/s11126-017-9494-y

47. Khalil H, Hoppe D, Ameen N (2021) Characteristics of voluntary reporting of adverse drug events related to antipsychotics in Australia: 14-year analysis. Therapeutic Advances in Drug Safety 12:20420986211012854. https://doi.org/10.1177/20420986211012854

48. Dhillon N, Heun R (2018) Nocturnal Enuresis is an Under-recognised Side Effect of Clozapine: Results of a Systematic Review. Global Psychiatry 2:21–30. https://doi.org/10.2478/gp-2018-0007

49. Lee J, Shepperd R, Smith M, Anand G (2023) Recognising side effects of antipsychotics in children with intellectual disabilities. BMJ Case Reports 16:e251974. https://doi.org/10.1136/bcr-2022-251974

50. Sharma M, Suthar N, Yadav P (2025) Extrapyramidal Symptoms in Psychiatric Disorders: Current Insights, Risk Factors, and Future Directions: A Narrative Review. Journal of Research 3:. https://doi.org/10.52340/jr.2025.03.02.28

51. Day JC, Wood G, Dewey M, Bentall RP (1995) A Self-Rating Scale for Measuring Neuroleptic Side-Effects: Validation in a Group of Schizophrenic Patients. British Journal of Psychiatry 166:650–653. https://doi.org/10.1192/bjp.166.5.650

52. Caroff SN, Hurford I, Lybrand J, Campbell EC (2011) Movement Disorders Induced by Antipsychotic Drugs: Implications of the CATIE Schizophrenia Trial. Neurologic Clinics 29:127–148. https://doi.org/10.1016/j.ncl.2010.10.002

TABLES

Table 1. Descriptive statistics for variables

	Child Form		Adolescent Form		Total	
	Mean ± SD	Median (min:max)	Mean ± SD	Mean ± SD	Median (min:max)	Mean ± SD
Age (years)	9.51 ± 1.98	9.4 (6: 16.24)	15.59 ± 1.71	15.72 (9.08: 17.88)	12.66 ± 3.56	13 (6: 17.88)

Weight (kg)	37.31 ± 14.03	35 (15: 78)	65.53 ± 18.21	63.5 (28: 122)	51.94 ± 21.57	50 (15: 122)
Height (cm)	136.75 ± 14.12	135 (101: 187)	163.56 ± 9.73	163 (132: 193)	150.7 ± 18.01	155 (101: 193)
BMI (kg/m2)	19.54 ± 4.36	18.6 (11.7: 36)	24.32 ± 5.94	23.2 (13.8: 44.3)	22.01 ± 5.75	20,7 (11.7: 44.3)
Telarche Age (years)	11	11 (11: 11)	11.43 ± 0.98	11 (9: 14)	11.43 ± 0.98	11 (9: 14)
Menarche Age (years)	12	12 (12: 12)	12.27 ± 0.96	12 (10: 15)	12.27 ± 0.95	12 (10: 15)
	Frequency	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Sex assigned at birth						
Female	24	20.2	74	57.8	98	39.7
Male	95	79.8	54	42.2	149	60.3

BMI: body mass index

Table 2. Descriptive statistics for clinical diagnoses

	Child Form N (%)	**Adolescent Form N (%)**	**Total N (%)**
Major Depressive Disorder	2 (1.7)	44 (37.6)	46 (19.7)
Bipolar Mania	0 (0)	6 (5.1)	6 (2.6)
Disruptive Mood Dysregulation Disorder	0 (0)	1 (0.9)	1 (0.4)
Psychotic Disorder	0 (0)	5 (4.3)	5 (2.1)
Panic Disorder	0 (0)	1 (0.9)	1 (0.4)
Social Anxiety Disorder	2 (1.7)	7 (6)	9 (3.8)
Obssesive-Compulsive Disorder	0 (0)	4 (3.4)	4 (1.7)
Anorexia Nervosa	0 (0)	1 (0.9)	1 (0.4)
Attention-Deficit/Hyperactivity Disorder	102 (87.2)	43 (36.8)	145 (62)
Oppositional Defiant Disorder	12 (10.3)	2 (1.7)	14 (6)
Tic Disorder	6 (5.1)	9 (7.7)	15 (6.4)
Autism Spectrum Disorder	16 (13.7)	14 (12)	30 (12.8)
Post-Traumatic Stress Disorder	0 (0)	1 (0.9)	1 (0.4)
Adjustment Disorder	0 (0)	2 (1.7)	2 (0.9)
Conversion Disorder	0 (0)	4 (3.4)	4 (1.7)
Dissociative Disorder	0 (0)	1 (0.9)	1 (0.4)
Intellectual Disability	12 (10.3)	7 (6)	19 (8.1)
Specific Learning Disorder	11 (9.4)	4 (3.4)	15 (6.4)

Table 3. Descriptive statistics of participants using psychotropic medications.

	Child Form N (%)	**Adolescent Form N (%)**	**Total N (%)**
Second-generation Antipsychotic	118 (99.2)	128 (100)	246 (99.6)
First-generation Antipsychotic	1 (0.8)	2 (1.6)	3 (1.2)
Methylphenidate	72(59.0)	37(29.6)	109 (44.1)
Atomoxetine	18 (15.1)	7 (5.5)	25 (10.1)
Selective-Serotonin Reuptake Inhibitors	7 (5.9)	62 (48.4)	69 (27.9)
Serotonin-Norepinephrine Reuptake Inhibitors	0 (0)	1 (0.8)	1 (0.4)
Guanfacine	7 (5.9)	3 (2.3)	10 (4)

Mood Stabilizers	0 (0)	11 (8.6)	11 (4.5)
Benzodiazepines	0 (0)	4 (3.1)	4 (1.6)

Table 4. EFA results according to the adolescent form

	Factor 1	Factor 2	Factor 3	Factor 4	Extraction	Anti-image correlation coefficient
Glasgow 11A	0.759				0.654	0.851
Glasgow 12A	0.791				0.683	0.801
Glasgow 15A	0.557				0.574	0.891
Glasgow 17A	0.674				0.591	0.889
Glasgow 4A		0.632			0.621	0.837
Glasgow 5A		0.757			0.686	0.806
Glasgow 6A		0.712			0.597	0.886
Glasgow 10A		0.633			0.517	0.882
Glasgow 1A			0.77		0.697	0.781
Glasgow 2A			0.832		0.785	0.787
Glasgow 9A			0.639		0.676	0.822
Glasgow 8A				0.543	0.507	0.861
Glasgow 13A				0.716	0.644	0.851
Glasgow 16A				0.802	0.659	0.756
Özdeğer	2.466	2.297	2.078	2.049		
VAO	17.615	16.41	14.846	14.639		
KVAO	17.615	34.025	48.871	63.51		

VEO: Variance explained ratio, CVER: Cumulative variance explained ratio, K-M-O=0.840; Bartlett's Test (χ^2 = 594.181; p<0.001) A=frequency of the side effect (Likert response).

Table 5. CFA Results According to the Adolescent Form

			β^1 (%95 GA)	β^2 (%95 GA)	S. error	Test Statistics	p	R^2
Glasgow 11A	<---	F1	0.711 (0.535: 0.846)	0.608 (0.388: 0.866)	0.087	7.005	**<0.001**	0.505
Glasgow 12A	<---	F1	0.621 (0.397: 0.778)	0.652 (0.393: 0.9)	0.105	6.214	**<0.001**	0.386
Glasgow 15A	<---	F1	0.655 (0.461: 0.83)	0.601 (0.382: 0.895)	0.092	6.524	**<0.001**	0.429
Glasgow 17A	<---	F1	0.738 (0.578: 0.869)	1 (1: 1)	---	---	---	0.545
Glasgow 4A	<---	F2	0.672 (0.488: 0.814)	1.003 (0.627: 1.561)	0.178	5.634	**<0.001**	0.451
Glasgow 5A	<---	F2	0.632 (0.419: 0.816)	0.946 (0.541: 1.525)	0.175	5.408	**<0.001**	0.399
Glasgow 6A	<---	F2	0.697 (0.525: 0.841)	1.286 (0.814: 2.047)	0.223	5.766	**<0.001**	0.486
Glasgow 10A	<---	F2	0.612 (0.437: 0.776)	1 (1: 1)	---	---	---	0.375
Glasgow 1A	<---	F3	0.668 (0.412: 0.81)	1.537 (0.668: 2.639)	0.261	5.896	**<0.001**	0.447
Glasgow 2A	<---	F3	0.884 (0.673: 1.007)	1.775 (0.952: 2.984)	0.283	6.273	**<0.001**	0.781
Glasgow 9A	<---	F3	0.612 (0.433: 0.86)	1 (1: 1)	---	---	---	0.374
Glasgow 8A	<---	F4	0.604 (0.223: 0.905)	1.546 (0.439: 5.898)	0.366	4.218	**<0.001**	0.365
Glasgow 13A	<---	F4	0.725 (0.393: 1.023)	1.294 (0.707: 3.784)	0.291	4.44	**<0.001**	0.526
Glasgow 16A	<---	F4	0.508 (0.157: 0.803)	1 (1: 1)	---	---	---	0.259

β^1: Standardized beta coefficient, β^2: Unstandardized beta coefficient, CI: Confidence Interval, A=frequency of the side effect (Likert response).

Table 6. Internal consistency results for the adolescent form

	Mean ± standard deviation	Item-total Correlation	CA when item is deleted	CA
Factor 1				
Glasgow 11A	0.33 ±0.75	0.589	0.687	
Glasgow 12A	0.46 ± 0.92	0.554	0.717	0.762
Glasgow 15A	0.41 ± 0.80	0.515	0.731	

Glasgow 17A	0.75 ± 1.18	0.586	0.682	
Factor 2				
Glasgow 4A	0.56 ± 0.96	0.548	0.684	
Glasgow 5A	0.49 ± 0.96	0.536	0.690	0.746
Glasgow 6A	0.83 ± 1.18	0.584	0.663	
Glasgow 10A	0.52 ± 1.05	0.503	0.707	
Factor 3				
Glasgow 1A	1.37 ± 1.23	0.553	0.691	
Glasgow 2A	0.83 ± 1.08	0.706	0.479	0.740
Glasgow 9A	0.42 ± 0.88	0.478	0.754	
Factor 4				
Glasgow 8A	0.36 ± 0.842	0.415	0.600	
Glasgow 13A	0.19 ± 0.587	0.501	0.467	0.627
Glasgow 16A	0.18 ± 0.648	0.432	0.536	

CA:Cronbach's Alpha, A=frequency of the side effect (Likert response).

Table 7. EFA results according to the child form

	Factor 1	Factor 2	Factor 3	Extraction	Anti-Image correlation coefficient
Glasgow 4A	0.737			0.717	0.679
Glasgow 5A	0.779			0.648	0.766
Glasgow 10A	0.718			0.614	0.789
Glasgow 6A		0.877		0.804	0.582
Glasgow 13A		0.844		0.775	0.615
Glasgow 14A		0.526		0.447	0.898
Glasgow 1A			0.575	0.584	0.546
Glasgow 7A			0.613	0.648	0.805
Glasgow 8A			0.589	0.509	0.812
Glasgow 12A			0.745	0.722	0.771
Glasgow 17A			0.708	0.509	0.614
Özdeğer	2.341	2.331	2.308		
VAO	21.28	21,191	20.983		
KVAO	21.28	42.471	63.454		

VEO: Variance explained ratio, CVER: Cumulative variance explained ratio, K-M-O=0.714; Bartlett's Test (χ^2= 545.155; p<0.001); A=frequency of the side effect (Likert response).

Table 8. DFA results according to the child form

	β[1]	95% Confidence Interval		S. Error	p	R^2
		Lower Limit	Upper Limit			
Factor 1						
Glasgow 4A	0.800	0.701	0.898	0.050	**<0.001**	0.639
Glasgow 5A	0.711	0.597	0.825	0.058	**<0.001**	0.505
Glasgow 10A	0.713	0.600	0.827	0.058	<0.001	0.509
Factor 2						
Glasgow 6A	0.620	0.452	0.788	0.086	<0.001	0.385
Glasgow 14A	0.672	0.503	0.841	0.086	**<0.001**	0.452
Factor 3						
Glasgow 1A	0.240	0.053	0.428	0.096	0.012	0.058

Glasgow 7A	0.834	0.737	0.932	0.050	**<0.001**	0.696
Glasgow 8A	0.647	0.519	0.775	0.065	**<0.001**	0.419
Glasgow 12A	0.657	0.531	0.784	0.064	**<0.001**	0.432
Glasgow 17A	0.451	0.289	0.614	0.083	**<0.001**	0.204

β1: Standardized beta coefficient

Table 9. Internal consistency results for the child form.

	Mean ± standard deviation	Item-total correlation	CA when item is deleted	CA
Factor 1				
Glasgow 4A	0.084±0.381	0.624	0.717	0.786
Glasgow 5A	0.067±0.362	0.650	0.684	
Glasgow 10A	0.050±0.315	0.616	0.728	
Factor 2				
Glasgow 6A	0.042±0.273	0.417	---	0.504
Glasgow 14A	0.160±0.537	0.417	---	
Factor 3				
Glasgow 1A	0.370±0.801	0.294	0.700	0.687
Glasgow 7A	0.151±0.577	0.554	0.612	
Glasgow 8A	0.168±0.615	0.484	0.630	
Glasgow 12A	0.336±0.805	0.544	0.591	
Glasgow 17A	0.538±1.056	0.451	0.653	

CA: Cronbach's Alpha

Table 10. Distress reporting rates in the Child and Adolescent form in additional column

	Adolescent N (%)	Child N (%)
Glasgow 1B	26 (20.3)	2 (1.7)
Glasgow 2B	13 (10.2)	0 (0)
Glasgow 3B	9 (7)	0 (0)
Glasgow 4B	4 (3.1)	1 (0.8)
Glasgow 5B	2 (1.6)	1 (0.8)
Glasgow 6B	10 (7.8)	0 (0)
Glasgow 7B	11 (8.6)	1 (0.8)
Glasgow 8B	4 (3.1)	3 (2.5)
Glasgow 9B	4 (3.1)	5 (4.2)
Glasgow 10B	3 (2.3)	0 (0)
Glasgow 11B	3 (2.3)	0 (0)
Glasgow 12B	3 (2.3)	1 (0.8)
Glasgow 13B	1 (0.8)	0 (0)
Glasgow 14B	3 (2.3)	2 (1.7)
Glasgow 15B	1 (0.8)	1 (0.8)
Glasgow 16B	3 (2.3)	3 (2.5)
Glasgow 17B	6 (4.7)	4 (3.4)
Glasgow 18B	3 (2.3)	27 (22.7)
Glasgow 19B	0 (0)	-
Glasgow 20B	2 (1.6)	-
Glasgow 21B	4 (4.9)	-
Glasgow 22B	37 (29.1)	-

B=distress associated with the reported side effect (yes/no).

FIGURES

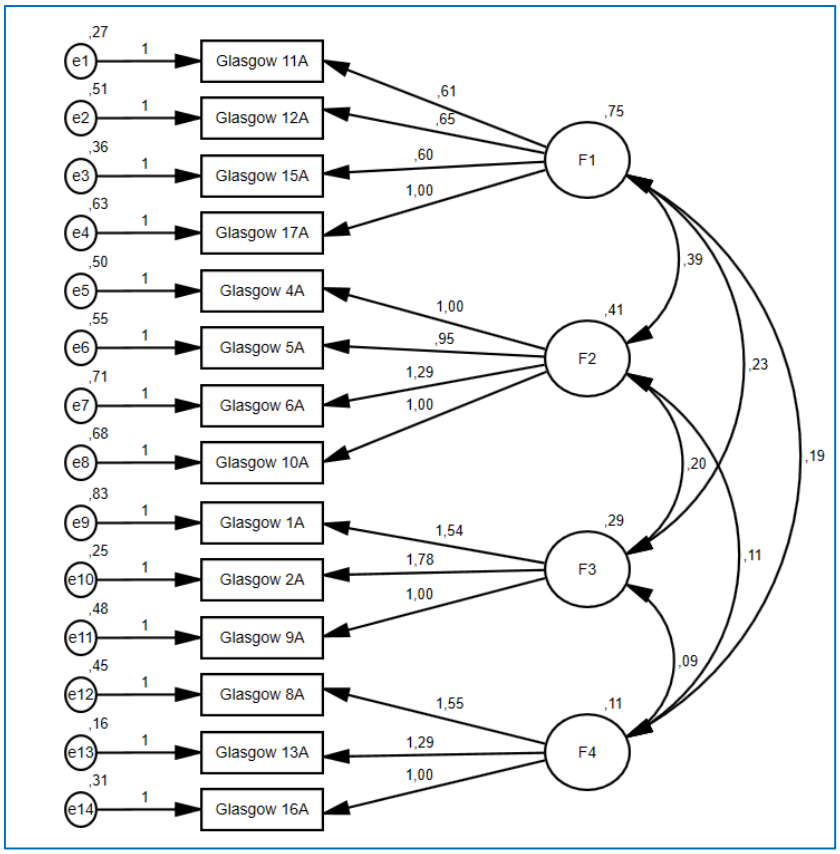
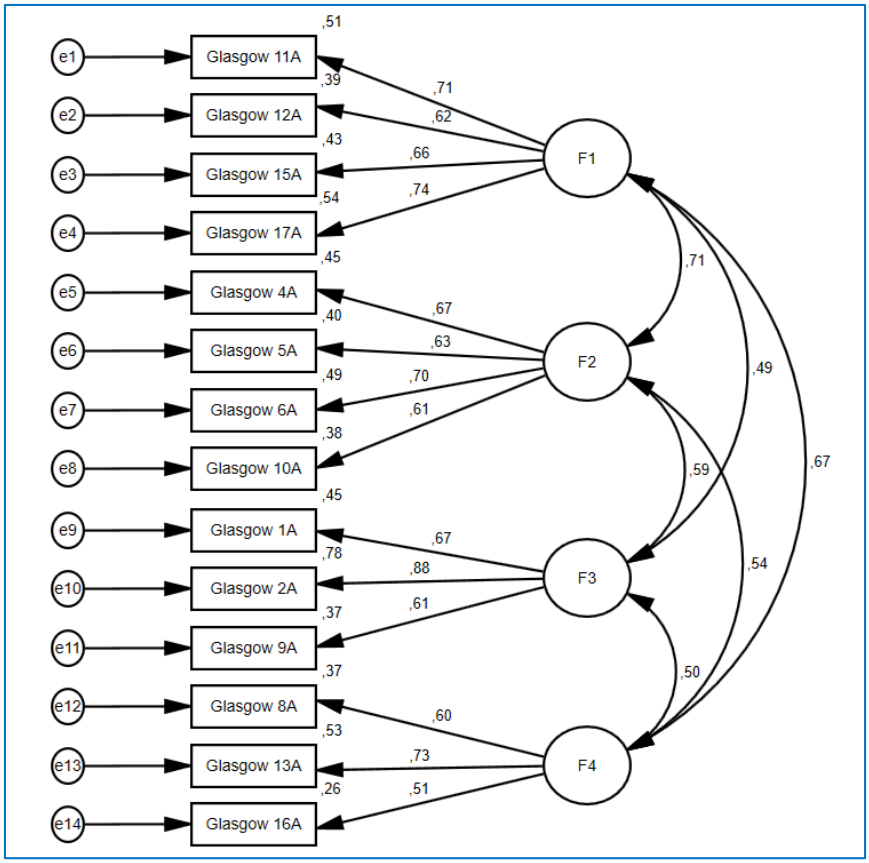


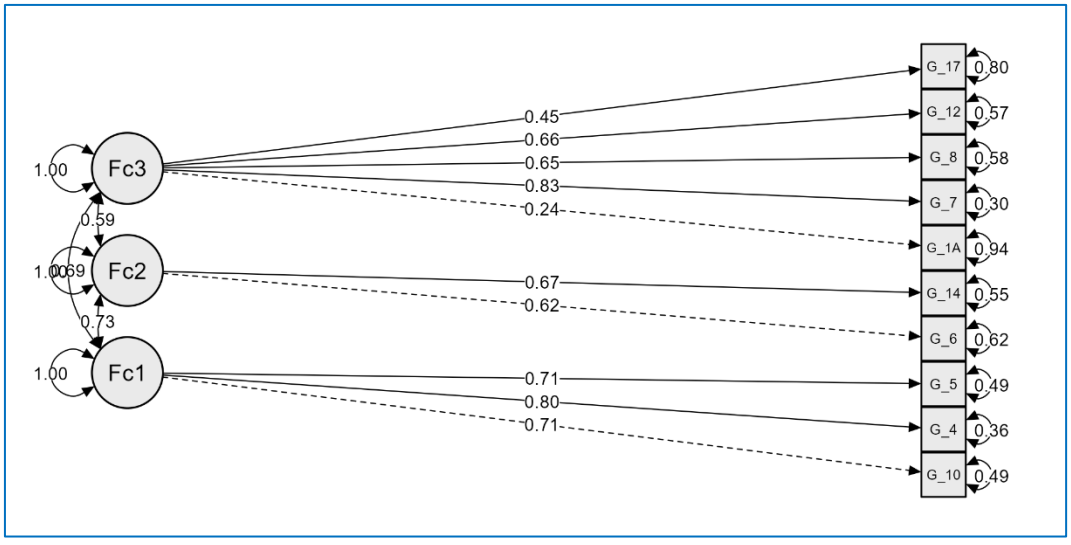
Figure 1. Unstandardized beta coefficients according to adolescent form



576

577 **Figure 2.** Standardized beta coefficients according to adolescent form

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579

580 **Figure 3.** Standardized beta coefficients according to the child form

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- finalversion1317ENagesselfreportAdolescentFormGASS10.07.26.docx
- FinalversionGASSEN613agesparentproxyChildForm10.07.26.docx