

Predictors of readmission in adolescent anorexia nervosa: a 24- month retrospective cohort study

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Abstract

Background

Why do some adolescents with anorexia nervosa relapse after discharge while others sustain recovery? Up to 45% are readmitted, yet the determinants of readmission remain poorly understood and have rarely been studied in paediatric Southern European cohorts. This study aimed to explore clinical, psychiatric, treatment-related and psychosocial predictors of readmission over 24 months in a Portuguese paediatric cohort, to identify markers for risk-stratified discharge and post-discharge care.

Methods

Retrospective cohort study of 113 adolescents aged 12–17 years hospitalised for anorexia nervosa (DSM-5-TR criteria) in a public adolescent psychiatry inpatient unit between January 2015 and December 2023. Data were extracted from clinical records. Readmission was defined as any overnight inpatient admission to the unit within 24 months of discharge. Groups were compared using chi-square, Fisher's exact and Mann–Whitney U tests; Kaplan–Meier analysis with log-rank tests and multivariable Cox regression were used to identify independent predictors of time to readmission.

Results

Among the cohort (median age 15.0 years; 93.8% female), 39 (34.5%) were readmitted within 24 months, with relapse occurring at a median of four months after discharge and at a markedly low weight (median BMI 13.9 kg/m² at readmission). In multivariable Cox regression, shorter time to readmission was independently predicted by comorbid depression (adjusted hazard ratio [HR] 6.45, 95% confidence interval [CI] 1.50–27.79), nasogastric tube feeding during the index admission (adjusted HR 3.57, 95% CI 1.83–6.97), and the number of missed outpatient consultations (adjusted HR 1.12 per missed consultation, 95% CI 1.06–1.19), with a dysfunctional family environment showing a borderline association (adjusted HR 2.46, 95% CI 0.98–6.17).

Conclusions

In this cohort, readmission was associated less with nutritional severity at admission than with affective comorbidity, treatment intensity and post-discharge engagement. Systematic monitoring of outpatient attendance, active treatment of comorbid depression and closer transitional support for patients who required nasogastric feeding are potential targets for relapse prevention; the role of family intervention warrants further study.

Plain English summary

When a young person is admitted to hospital with anorexia nervosa, the aim is to make them physically safe and help them return home well. For many, however, recovery at home does not last, and they come back to the ward. We wanted to understand which young people are most likely to return to the hospital, so that support after discharge can be directed to those who are in need.

We looked at the charts of 113 adolescents treated at an adolescent psychiatric unit in Portugal. During a period of twenty-four months, thirty-nine were readmitted, most of them within four months. What set these adolescents apart was not how underweight they were when first admitted, nor how long they stayed in the hospital. Instead, those who returned were more likely to suffer from depression, to have needed a feeding tube during their first stay, and to have missed more follow-up appointments. Family conflicts may also play a part.

Close support in the first months after discharge, including regular appointments, treatment of depressive features and help for families, may reduce the chance of returning to hospital.

Background

Hospitalisation remains the cornerstone of care for severely ill adolescents with anorexia nervosa (AN), but for a substantial proportion it is the first of several admissions. Among paediatric populations, 20–45% of patients require at least one readmission, and repeated hospitalisations are consistently associated with poorer long-term psychiatric and psychosocial outcomes [1, 2]. Relapse risk is highest in the first year after weight restoration, peaking two to four months after discharge and remaining elevated for up to 18 months [3, 4]. Established risk factors include low body mass index (BMI) at discharge, incomplete weight restoration, persistent drive for thinness, younger age and familial psychopathology [5, 6]. Taken together, rehospitalisation appears to be not an isolated event but a marker of difficulty in sustaining recovery across transitions of care.

Adolescent admissions for AN in Europe are lengthy, averaging approximately 77 days [7], yet the optimal duration and structure of inpatient treatment, in comparison with adult samples, remains inconclusive [8]. Although inpatient care is essential in the presence of medical instability, it has been suggested that brief admissions for medical stabilisation followed by family-based treatment achieved outcomes comparable to those of extended weight-restoration admission, with substantially lower resource use [9]. Prolonged admissions may also carry unintended costs — disruption of education and peer relationships, perceived coercion and limited impact on relapse prevention.

Psychiatric comorbidity further complicates management: 47–73% of adolescents with AN meet criteria for at least one additional disorder, most commonly depressive, anxiety and obsessive–compulsive disorders, and rates of non-suicidal self-injury (NSSI), suicidal ideation and suicide attempts are high [10, 11]. Also, adolescents with AN who engage in NSSI show higher levels of depressive symptoms than those who do not [12, 13]. Depressive comorbidity may persist beyond nutritional recovery and is largely independent of BMI, suggesting a maintaining rather than merely secondary role in the illness [14, 15].

Despite extensive international research, Portugal remains underrepresented in the AN literature. To our knowledge, no study has reported readmission rates or long-term outcomes of adolescents hospitalised for AN in Portugal [16–19]. It therefore remains unclear whether internationally reported readmission rates apply to the Portuguese context, and which setting-specific factors influence outcomes.

Against this background, this study aimed to (1) characterise adolescents hospitalised for AN at index admission and describe the frequency, timing and clinical status at first readmission over 24 months of follow-up; (2) compare readmitted and non-readmitted patients across clinical, anthropometric, behavioural, psychiatric, familial and post-discharge adherence domains; and (3) identify factors independently associated with time to readmission.

Methods

Study design and setting

We conducted a retrospective longitudinal cohort study, reported in accordance with the STROBE guidelines (Additional file 1). Clinical records were reviewed for all adolescents with AN consecutively admitted to the adolescent psychiatry inpatient unit of a public tertiary referral centre in northern Portugal between 1 January 2015 and 31 December 2023. As the only public child and adolescent psychiatry inpatient unit serving the region, the centre is the main referral point for paediatric patients with severe AN. All diagnoses were established by the treating adolescent psychiatrists according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision (DSM-5-TR).

The unit provides inpatient care through a multidisciplinary team of psychiatrists, psychologists, paediatricians and nurses. Treatment begins with nutritional rehabilitation and individual psychotherapy, following a non-hypercaloric plan of 2000 kcal/day distributed across six meals that prioritises clinical stabilisation over immediate weight gain. Family involvement begins at admission, with family therapy tailored to each patient, and pharmacotherapy is used as clinically indicated for comorbid conditions.

Participants

Patients were eligible if they were aged 12–17 years, had a confirmed diagnosis of AN, had attended at least one outpatient consultation at the institution before the index admission, had been hospitalised at least once at the centre during the study period and had continued follow-up at the same institution. Patients were excluded if they met criteria for atypical AN, if another psychiatric disorder was the primary diagnosis, if incomplete clinical records precluded retrieval of the predefined study variables, or if transfer to another institution after discharge prevented continued follow-up. For patients with multiple admissions, the first hospitalisation during the study period was designated the index admission.

Of 132 patients screened, 19 were excluded because of incomplete records, transfer of care or a diagnosis of atypical AN, yielding a final cohort of 113 adolescents, of whom 39 were readmitted and 74

were not readmitted during the 24-month follow-up (Fig. 1). All non-readmitted patients completed 24 months of follow-up. The sample comprised all eligible patients admitted during the study period. Data were extracted from paper-based and electronic clinical records using a structured data-collection protocol.

STROBE flow diagram. From initial screening to final cohort and readmission status over the 24-month follow-up period.

Measures

Sociodemographic, clinical and anthropometric variables. These covered age at admission, sex, AN subtype (restricting or binge–purge), age at illness onset, age at diagnosis, duration of untreated illness and reproductive variables (age at menarche and menstrual status at admission). Anthropometric variables involved height, premorbid BMI, BMI at admission and BMI at discharge. Pre-treatment weight loss was calculated as the percentage decrease from premorbid weight to admission weight, and in-hospital weight gain as the percentage increase from admission to discharge weight. Treatment-related variables comprised length of stay, nasogastric tube feeding and number of prior hospitalisations, selected a priori as markers of illness severity, treatment intensity and prior service use.

Behavioural features and prior clinical history. These comprised overactivity, laxative use, childhood eating disturbances, prematurity, metabolic disease identified at birth and premorbid psychiatric history. Diagnoses were recorded only when explicitly documented in the clinical record.

Family psychopathology, social context and safeguarding. These comprised family structure, parental educational attainment, psychiatric history among first- and second-degree relatives and a binary indicator of clinically significant family dysfunction. This indicator, adapted from the prognostic framework of Morgan and Russell [20], denoted persistent relational difficulties within the family and was coded independently of parental separation or broader social adversity. Involvement of Child Protection Services (CPS) was recorded as a binary variable indicating whether a documented safeguarding referral had occurred during the index admission or follow-up.

Post-discharge follow-up and comorbidity. The interval from discharge to the first outpatient consultation was recorded in days and dichotomised as within or beyond seven days. Adherence was characterised by two count variables: missed appointments (scheduled consultations the patient failed to attend without prior notice) and cancelled appointments (consultations cancelled in advance). Both were counted from discharge after the index admission until first readmission or censoring (at 24 months or at last follow-up), matching the follow-up window of the survival analysis. Psychiatric comorbidities — depressive, anxiety and personality disorders — were recorded as documented at the first post-discharge outpatient consultation and partial weight restoration, based exclusively on the clinical record and without retrospective reinterpretation.

Outcomes

The primary outcome was hospital readmission during the 24-month follow-up, defined as any overnight inpatient admission to the unit after discharge from the index hospitalisation, whether for AN or for related medical or psychiatric complications. For comparative analyses, patients were classified as readmitted (readmitted group, RG) or not readmitted (non-readmitted group, NRG). Among readmitted patients, secondary outcomes comprised time to readmission, BMI at readmission, percentage weight loss at readmission and total number of readmissions during follow-up.

Statistical analysis

Analyses were performed in IBM SPSS Statistics, version 30. Continuous variables are presented as medians with interquartile ranges (IQR; 25th–75th percentiles) and categorical variables as frequencies and percentages. Reproductive variables were not applicable to male patients ($n = 7$), and age at menarche and secondary amenorrhoea were not applicable to premenarchal patients ($n = 25$); these variables were therefore analysed among applicable participants, without imputation. Except where indicated in table footnotes, all other variables were complete. Group comparisons used the χ^2 test, or Fisher's exact test when any expected cell count was below five, for categorical variables, and the Mann–Whitney U test for continuous variables.

Follow-up time was defined as the interval from discharge after the index admission to the first readmission, with non-readmitted patients censored at 24 months or at last recorded follow-up, whichever came first. Kaplan–Meier curves estimated readmission-free probability over time, and between-group differences were tested with the log-rank test. Cox proportional hazards regression was used to estimate hazard ratios (HR) with 95% confidence intervals (CI) for time to readmission. Candidate predictors for the multivariable model were selected based on clinical relevance and their univariable association with readmission. To limit overfitting, the multivariable model was restricted to four predictors, in line with the recommendation of approximately ten events per variable for Cox regression (39 events). Multicollinearity was assessed beforehand, and the proportional hazards assumption was verified using Schoenfeld residuals. All tests were two-tailed, with significance set at $p < 0.05$. Kaplan–Meier figures were drawn in Python using the lifelines package.

Use of large language models

A large language model was used to assist with language editing and manuscript formatting. It was not used for data collection, statistical analysis or interpretation of results. The authors reviewed and edited all suggested text and take full responsibility for the content of the manuscript.

Ethics

The study was approved by the Ethics Committee of ULS Santo António/ICBAS (reference 2025.279 (237-CAC-237-CE)). The requirement for written informed consent was waived given the retrospective

design and the absence of any intervention or direct patient contact.

Results

Cohort characteristics and readmissions

The median age at index admission was 15.0 years (IQR 13.8–16.4). The cohort was predominantly female (106/113, 93.8%), and restricting AN was the predominant subtype (105 patients, 92.9%); the remaining eight patients (7.1%) had the binge–purge subtype. The distribution of subtypes did not differ between the RG and the NRG ($p = 0.444$).

Thirty-nine patients (34.5%), all female, were readmitted within 24 months. The median time to first readmission was 134 days (IQR 50–251), approximately four months after discharge. At readmission, nutritional status had deteriorated substantially (median BMI 13.9 kg/m², IQR 13.0–15.0; median weight loss since discharge 14.0%, IQR 10.2–19.6), and the median number of readmissions during follow-up was 2 (IQR 1–3) (Table 1).

Table 1
Characteristics of hospital readmissions

Characteristic	Readmitted patients (n = 39)
Time to first readmission, days	134 (50–251)
BMI at readmission, kg/m ²	13.9 (13.0–15.0)
Weight loss since discharge, %	14.0 (10.2–19.6)
Total readmissions during follow-up, n	2 (1–3)

Values are presented as median (IQR). *BMI* body mass index, *IQR* interquartile range.

Comparisons according to readmission status

Clinical and anthropometric variables. Nasogastric tube feeding was more common in the RG than in the NRG (35.9% vs 6.8%, $p < 0.001$), as was prior psychiatric hospitalisation (30.8% vs 9.5%, $p = 0.005$) (Table 2). Age at onset, age at diagnosis, age at admission, duration of untreated illness, admission BMI, body weight and reproductive variables did not differ significantly between groups (Table 3). Discharge BMI was lower in the RG, although not significantly (15.7 vs 16.6 kg/m², $p = 0.068$). Median length of stay was similar in both groups (64 vs 58 days, $p = 0.692$).

Table 2
Clinical and treatment factors by readmission status

Characteristic	No readmission (n = 74)	Readmission (n = 39)	Test	p
Primary amenorrhoea ^a , n (%)	17 (25.4)	8 (20.5)	χ^2	0.570
Secondary amenorrhoea ^a , n (%)	50 (74.6)	31 (79.5)	χ^2	0.570
Nasogastric tube feeding, n (%)	5 (6.8)	14 (35.9)	χ^2	< 0.001
Previous hospitalisations, n (%)	7 (9.5)	12 (30.8)	χ^2	0.005
Restricting subtype, n (%)	70 (94.6)	35 (89.7)	Fisher	0.444
Female sex, n (%)	67 (90.5)	39 (100.0)	Fisher	0.094

Categorical variables are presented as frequency (percentage). Group comparisons used the χ^2 test or Fisher's exact test, as appropriate. ^a Percentages calculated among female patients (n = 67 and n = 39).

Table 3
Continuous variables by readmission status

Variable	No readmission (n = 74)	Readmission (n = 39)	p
<i>Baseline characteristics</i>			
Age at onset, years	13.9 (12.3–15.1)	13.6 (12.6–15.1)	0.289
Age at admission, years	15.0 (13.5–16.1)	14.7 (13.6–15.9)	0.599
Age at diagnosis, years	14.6 (13.5–15.8)	14.3 (13.1–15.6)	0.406
Duration of untreated illness, days	259 (153–413)	279 (169–520)	0.244
Age at menarche, years ^a	12.1 (11.1–13.1)	12.1 (11.0–13.3)	0.661
<i>Anthropometric measures</i>			
Height, cm	160 (155–164)	160 (154–162)	0.563
Premorbid weight, kg	51.5 (45.8–59.0)	50.0 (47.0–58.5)	0.550
Weight at admission, kg	35.4 (31.4–39.0)	35.0 (32.3–39.2)	0.800
Weight at discharge, kg	42.1 (38.9–44.8)	40.9 (38.5–44.0)	0.190
Premorbid BMI, kg/m ²	20.2 (18.6–23.3)	20.2 (18.1–22.2)	0.396
BMI at admission, kg/m ²	13.9 (12.9–15.0)	13.9 (13.2–14.8)	0.765
BMI at discharge, kg/m ²	16.6 (15.6–17.6)	15.7 (15.1–17.2)	0.068
<i>Treatment and follow-up</i>			
Length of stay, days	58 (35–77)	64 (29–103)	0.692
Missed appointments, n	3 (2–5)	6 (5–10)	< 0.001
Cancelled appointments, n	3 (2–5)	5 (3–10)	0.001

Values are presented as median (IQR); group comparisons used the Mann–Whitney U test. *BMI* body mass index, *IQR* interquartile range. ^a Restricted to participants who had reached menarche (n = 81).

Behavioural features. Overactivity was more prevalent in the RG (92.3% vs 74.3%, $p = 0.022$), as were laxative use (17.9% vs 1.4%, $p = 0.002$) and a history of substance use (7.7% vs 0.0%, $p = 0.039$). No significant differences were observed in childhood eating disturbances, prematurity, metabolic disease at birth, trauma-related disorders or attention-deficit/hyperactivity disorder (ADHD) (Table 4).

Table 4
Behavioural features and premorbid history by readmission status

Characteristic	No readmission (n = 74)	Readmission (n = 39)	Test	p
Overactivity, n (%)	55 (74.3)	36 (92.3)	χ^2	0.022
Laxative use, n (%)	1 (1.4)	7 (17.9)	Fisher	0.002
Childhood eating disturbances, n (%)	13 (17.6)	6 (15.4)	χ^2	0.768
Prematurity, n (%)	7 (9.5)	4 (10.3)	Fisher	1.000
Metabolic disease at birth, n (%)	6 (8.1)	6 (15.4)	Fisher	0.335
Trauma-related disorder, n (%)	16 (21.6)	14 (35.9)	χ^2	0.102
ADHD, n (%)	5 (6.8)	2 (5.1)	Fisher	1.000
History of substance use, n (%)	0 (0.0)	3 (7.7)	Fisher	0.039

Categorical variables are presented as frequency (percentage). Group comparisons used the χ^2 test or Fisher's exact test, as appropriate. *ADHD* attention-deficit/hyperactivity disorder.

Family and social context. Family dysfunction was more prevalent in the RG (84.6% vs 45.9%, $p < 0.001$), and CPS involvement was documented only in the RG (23.1% vs 0.0%, $p < 0.001$). Depressive disorders in first-degree relatives were also more common in the RG (51.3% vs 28.4%, $p = 0.016$). Family structure and parental educational attainment did not differ significantly between groups (Table 5).

Table 5
Family and social factors by readmission status

Characteristic	No readmission (n = 74)	Readmission (n = 39)	Test	p
Parental education, n (%)				
≤ 9 years	16 (21.6)	9 (23.1)	χ²	0.753
10–12 years	26 (35.1)	11 (28.2)		
≥ 13 years (higher education)	32 (43.2)	19 (48.7)		
Family structure, n (%)				
Two-parent household	56 (75.7)	25 (64.1)	Fisher	0.280
Separated or divorced parents	11 (14.9)	11 (28.2)		
Single-parent household	7 (9.5)	3 (7.7)		
Social context, n (%)				
Family dysfunction	34 (45.9)	33 (84.6)	χ²	< 0.001
CPS involvement	0 (0.0)	9 (23.1)	Fisher	< 0.001
Psychiatric history in first-degree relatives, n (%)				
Depression	21 (28.4)	20 (51.3)	χ²	0.016
Anxiety disorders	16 (21.6)	14 (35.9)	χ²	0.102
Other mood disorders	3 (4.1)	1 (2.6)	Fisher	1.000
Substance misuse	3 (4.1)	2 (5.1)	Fisher	1.000
Anorexia nervosa	13 (17.6)	4 (10.3)	χ²	0.301
Obesity	23 (31.1)	13 (33.3)	χ²	0.807
Psychiatric history in second-degree relatives, n (%)				
Any psychiatric disorder	28 (37.8)	20 (51.3)	χ²	0.169

Categorical variables are presented as frequency (percentage). Group comparisons used the χ^2 test or Fisher's exact test, as appropriate. Family structure was compared with the Fisher–Freeman–Halton exact test. Percentages may not sum to 100 owing to rounding. CPS Child Protection Services.

Psychiatric comorbidity and post-discharge follow-up. Comorbid depression at the first post-discharge consultation was present in 94.9% of readmitted patients, compared with 59.5% of non-readmitted

patients ($p < 0.001$). Anxiety disorders (82.1% vs 60.8%, $p = 0.021$), borderline personality disorder (12.8% vs 0.0%, $p = 0.004$), suicide attempts (28.2% vs 6.8%, $p = 0.002$) and NSSI (33.3% vs 16.2%, $p = 0.037$) were also more frequent in the RG (Table 6). The median interval from discharge to the first outpatient consultation was longer in the RG (15 vs 9 days, $p = 0.003$). Readmitted patients also had more missed (median 6 vs 3, $p < 0.001$) and cancelled consultations (median 5 vs 3, $p = 0.001$) during follow-up (Table 3).

Table 6
Comorbidity at first post-discharge consultation and follow-up by readmission status

Characteristic	No readmission (n = 74)	Readmission (n = 39)	Test	p
<i>Psychiatric comorbidity, n (%)</i>				
Depression	44 (59.5)	37 (94.9)	χ^2	< 0.001
Anxiety disorder	45 (60.8)	32 (82.1)	χ^2	0.021
Separation anxiety disorder ^a	9 (12.2)	6 (15.8)	χ^2	0.594
Obsessive–compulsive disorder	5 (6.8)	4 (10.3)	Fisher	0.493
Borderline personality disorder	0 (0.0)	5 (12.8)	Fisher	0.004
Bipolar disorder	1 (1.4)	0 (0.0)	Fisher	1.000
Suicide attempt	5 (6.8)	11 (28.2)	χ^2	0.002
Non-suicidal self-injury	12 (16.2)	13 (33.3)	χ^2	0.037
<i>Post-discharge follow-up</i>				
Time to first consultation, days, median (IQR)	9 (7–15)	15 (9–24)	Mann–Whitney	0.003
First consultation ≤ 7 days, n (%)	26 (35.1)	7 (17.9)	χ^2	0.056

Categorical variables are presented as frequency (percentage) and continuous variables as median (IQR). *IQR* interquartile range. ^a Data available for 38 readmitted patients.

Time to readmission

Four predictors – nasogastric tube feeding during the index admission, family dysfunction, comorbid depression at the first post-discharge consultation and number of missed consultations entered the survival analysis; no relevant multicollinearity was detected. Kaplan–Meier estimates showed significantly lower readmission-free survival among patients who required nasogastric tube feeding

(Fig. 2) and among those with comorbid depression (Fig. 3), with curves diverging early after discharge and remaining separated throughout follow-up (log-rank $p < 0.001$ for both).

Kaplan–Meier estimates of readmission-free survival over 24 months in adolescents who required nasogastric tube feeding during the index admission ($n = 19$) and in those who did not ($n = 94$). Readmission-free survival at 24 months was 26.3% vs 73.4% (log-rank $p < 0.001$). Numbers at risk are shown below the x-axis; non-readmitted patients were censored at 24 months or at last follow-up.

Kaplan–Meier estimates of readmission-free survival over 24 months in adolescents with ($n = 81$) and without ($n = 32$) comorbid depression at the first post-discharge consultation. Readmission-free survival at 24 months was 54.3% vs 93.8% (log-rank $p < 0.001$). Numbers at risk are shown below the x-axis; non-readmitted patients were censored at 24 months or at last follow-up.

In multivariable Cox regression (Table 7), comorbid depression was associated with the highest hazard of readmission (adjusted HR 6.45, 95% CI 1.50–27.79, $p = 0.012$), followed by nasogastric tube feeding (adjusted HR 3.57, 95% CI 1.83–6.97, $p < 0.001$) and number of missed consultations, with each additional missed consultation associated with a 12% increase in hazard (adjusted HR 1.12, 95% CI 1.06–1.19, $p < 0.001$). Family dysfunction was associated with a shorter time to readmission in univariable analysis (HR 4.98, 95% CI 2.09–11.91) but did not reach significance after adjustment (adjusted HR 2.46, 95% CI 0.98–6.17, $p = 0.054$); it was retained in the model because of its clinical relevance and a priori specification.

Table 7
Cox proportional hazards analyses for time to first readmission

Variable	Unadjusted HR (95% CI)	p	Adjusted HR (95% CI)	p
Nasogastric tube feeding	4.34 (2.25–8.38)	< 0.001	3.57 (1.83–6.97)	< 0.001
Family dysfunction	4.98 (2.09–11.91)	< 0.001	2.46 (0.98–6.17)	0.054
Comorbid depression	9.58 (2.31–39.80)	0.002	6.45 (1.50–27.79)	0.012
Missed consultations (per additional consultation)	1.16 (1.10–1.23)	< 0.001	1.12 (1.06–1.19)	< 0.001

Unadjusted hazard ratios were estimated by entering each variable separately; adjusted hazard ratios derive from a single model containing all four predictors, fitted on 39 readmission events. Missed consultations were entered as a continuous variable. Family dysfunction was retained for clinical relevance and a priori specification. *CI* confidence interval, *HR* hazard ratio.

Discussion

Readmission rate and the revolving-door phenomenon

In the present cohort, 39 of 113 adolescents (34.5%) required at least one readmission over 24 months. This rate lies within the international range, which increases with length of observation from approximately 25% at one year to close to 45% over longer follow-up [2, 15, 21].

A previous Portuguese study of an adolescent psychiatry inpatient unit, including all diagnoses, reported 12-month readmission in 11.5% of patients [19]. In our AN cohort, at least one in four patients was readmitted within the first year, more than twice that rate, suggesting that readmission risk is substantially higher in AN than among adolescent psychiatric inpatients as a whole.

Equally important is when this risk materialised. The median time to first readmission was 134 days, concentrating relapse in the early months after discharge, when therapeutic gains remain unconsolidated, monitoring is reduced and environmental stressors re-emerge. This temporal pattern also reframes the role of the admission itself: if the decisive period lies after discharge, the duration of inpatient care may matter less than the clinical state in which a patient leaves hospital and the continuity of support available thereafter. Consistent with this, length of stay was not associated with readmission in our cohort. Because length of stay in observational data is subject to confounding by indication, this finding cannot be taken as evidence that admission duration is irrelevant; it is nevertheless compatible with trial evidence that brief admission followed by structured outpatient treatment achieves outcomes comparable to those of longer admission [9].

Among the 39 readmitted adolescents, the median number of readmissions during follow-up was two, and readmission occurred in a state of severe nutritional relapse: median BMI had fallen to 13.9 kg/m², with a median weight loss of 14.0% since discharge, approaching values at index admission. A first readmission thus frequently marked entry into a cyclical course of repeated decompensation, consistent with the revolving-door phenomenon [15]. The clinical question is therefore less whether these adolescents can be stabilised in hospital than whether stabilisation can be sustained, which motivates the identification of independent, and ideally modifiable, predictors of readmission.

Comorbid depression and readmission

Comorbid depression showed the largest adjusted hazard ratio among the predictors examined. Because depression was recorded at the first post-discharge consultation, after partial weight restoration, this finding is unlikely to reflect starvation-related symptoms alone: depression was still documented once refeeding was under way, which is compatible with a maintaining role in the disorder rather than a mere complication of low weight. Within the RG it marked a wider psychiatric burden, co-occurring with higher rates of anxiety disorders, borderline personality disorder and self-harm, patterns also documented in previous literature [22].

Additionally, depressive features were managed pharmacologically whenever clinically indicated, although treatment was not systematically recorded and could not be analysed. The benefit of

antidepressants during the low-weight phase remains debated [23], and their effect after weight restoration may depend on the presence of depression [24]. Our findings therefore cannot guide the choice or timing of treatment. They do suggest, however, that affective comorbidity is not merely epiphenomenal to starvation, since its association with readmission persisted after adjustment for nasogastric feeding, a marker of illness severity. Depression in this context may behave as a disorder in its own right, one that does not resolve as a by-product of weight restoration and that warrants systematic assessment and targeted treatment alongside nutritional rehabilitation.

Self-injury and suicide attempts were also more frequent among readmitted patients. While these behaviours are often linked to the binge–purge subtype, their presence in this predominantly restrictive cohort suggests that they occur across both subtypes.

Adolescents with AN who self-injure experience higher levels of depression, broader psychopathology and more binge–purge features than those without self-injury [12, 13]. This pattern may indicate a dysregulated phenotype that diagnostic subtypes do not capture. For readmission risk, the extent of affective and behavioural dysregulation present at discharge may matter more than diagnostic subtype.

Nasogastric tube feeding as a marker of clinical severity

Nasogastric tube feeding during index admission was associated with more than threefold increase in the hazard of readmission, identifying it as a readily available clinical marker of post-discharge risk. This finding is best understood not as evidence that enteral feeding itself causes relapse, but as a marker of a high-severity clinical phenotype: patients requiring nasogastric feeding presented nutritional compromise severe enough to preclude adequate oral intake, often with markedly limited motivational engagement. The persistence of this association in the multivariable model indicates an independent dimension of clinical risk. These results are consistent with those of di Vitantonio and Chao [25], who found nasogastric feeding to be associated with readmission in adults with eating disorders. Nasogastric feeding may thus act as a proxy for a severity gradient combining low weight, high symptom burden and constrained engagement.

Clinically, these findings support incorporating the need for nasogastric feeding into structured discharge risk stratification. Patients who required enteral feeding during the index admission may be regarded as a high-risk subgroup warranting individually tailored transitional care plans, including more frequent outpatient contacts in the first four months, proactive outreach after any missed appointment and early escalation thresholds for clinical deterioration.

Treatment adherence and post-discharge follow-up

Readmitted adolescents missed and cancelled more outpatient appointments, and each missed consultation was independently associated with a 12% increase in the hazard of readmission.

There are several possible explanations for non-attendance. After discharge, adolescents lose the structure of the ward, and ambivalence towards treatment, common in AN, may re-emerge [26]. Families

take on responsibility for meals at home and may face practical difficulties in attending appointments. In some patients, missed appointments may also be an early sign of clinical deterioration, occurring before weight loss is evident. Non-attendance may therefore be both a consequence of relapse and a contributor to it.

Whatever the mechanism, an empty appointment slot deserves a response rather than a simple reschedule. Given that most readmissions occurred within the first four months, this period could include closer attention to attendance and a proactive response to a first missed consultation – a telephone call to the adolescent and family, or an earlier appointment – rather than passive rescheduling [27]. For those at highest risk, the intensity of follow-up in these months could be tailored to each adolescent's needs rather than to a standard schedule.

Family dysfunction, family psychopathology and safeguarding

Family dysfunction was among the most discriminating variables in univariable analyses: its prevalence nearly doubled in the RG and, although the adjusted hazard ratio reached only borderline significance, the point estimate remained substantially elevated. This finding is consistent with evidence that high expressed emotion, characterised by parental criticism, hostility and emotional over-involvement, is associated with relapse and poorer treatment response in adolescent AN [5, 28]. In our cohort, depression in first-degree relatives was also associated with readmission, and parents of adolescents with AN more often present subclinical anxiety and depressive symptoms [29, 30]. It may index a shared heritable affective vulnerability as well as environmental influences on the adolescent's recovery. Interventions that improve parental emotional availability, communication and problem-solving, delivered within family-based treatment and discharge planning, are therefore a plausible and potentially high-yield component of relapse prevention, although the borderline adjusted estimate requires confirmation in larger samples.

CPS referral occurred exclusively in the readmission group. This is particularly relevant in paediatric anorexia nervosa, where discharge planning depends on the assumption that the family can provide a safe nutritional environment at home and support ongoing outpatient care [31]. A referral to CPS suggests that at least one of these assumptions may no longer be reliable. This variable should be interpreted with caution given the small number of cases ($n = 9$).

Behavioural severity: overactivity and laxative use

Readmitted patients also carried a heavier load of severity-linked behaviours. Almost all showed marked overactivity, and laxative use and substance use were also more frequent, although the association with substance use rests on only three cases.

Overactivity deserves particular attention, as it was nearly universal among readmitted patients. Previous studies suggest that it often persists after weight restoration [2]. Inpatient care contains compulsive

exercise; discharge removes that containment. A patient may therefore appear stable on the ward yet leave with a behavioural pattern that, without targeted intervention, precedes relapse.

Together, laxative use, overactivity and substance use point to a subgroup with broader difficulties in behavioural regulation, echoing the dysregulation observed in the depression findings. Discharge planning should include an assessment of these behaviours, and inpatient treatment should target them as well as weight gain.

Weight gain and discharge BMI

Discharge BMI was lower in the readmitted group, although the difference did not reach significance ($p = 0.068$). Given consistent evidence linking low discharge weight to rehospitalisation [2, 32], this more likely reflects limited power than a true absence of effect. Both discharge weight and the rate of weight gain appear relevant [15, 21], which supports the use of an explicit weight target at discharge. How that target should be set is still debated. Individualised targets based on premorbid growth trajectories are increasingly preferred to fixed thresholds such as "ideal body weight". Even so, our findings suggest that weight criteria should not be the centre of discharge planning. They are better seen as a safeguard against premature discharge than as the main determinant of readmission.

Age, pubertal status and developmental considerations

Age and pubertal status at admission were not associated with readmission in this cohort. This is consistent with a literature in which age effects are inconsistent: Castro et al. found younger age to be predictive [21], whereas Pruccoli et al. reported the reverse, with no difference between premenarchal and postmenarchal patients [33]. In this clinically homogeneous single-centre cohort, demographic and reproductive variables carried little discriminative value.

System-level factors, the COVID-19 context and implications for service planning

The study period (2015–2023) encompassed the COVID-19 pandemic. Although the retrospective design does not allow pandemic-specific effects to be isolated, the years 2020 to 2023 likely increased both admission severity and pressure on post-discharge care continuity [34]. This context may have amplified the predictive importance of post-discharge variables, such as missed consultations, in a national context in which adolescent mental health services, including outpatient care, have been described as understaffed and insufficient relative to need [35]. Where post-discharge specialist capacity is limited, the predictors identified here may provide a practical basis for directing available resources towards the highest-risk patients.

Strengths and limitations

This study has several strengths. It was conducted in the only public adolescent psychiatry inpatient unit in the region, which captures most severe paediatric AN cases and limits referral bias. It includes nine

years of consecutive admissions and a 24-month follow-up, longer than in many similar studies. Continuity of care within the same institution allowed post-discharge data, such as missed appointments, to be recorded with little loss to follow-up. Cox regression allowed us to study time to readmission, not only whether it occurred. To our knowledge, this is also the first study of readmission in paediatric AN to examine CPS involvement.

The main limitation is the retrospective design. It restricted the available variables, does not allow causal conclusions, and any diagnostic errors in the records were carried into the analysis. Personality traits could not be assessed. Depression was recorded from clinical notes without a standardised instrument, so its timing relative to readmission could not be established. Medication and concurrent psychological or family interventions were not analysed. Family dysfunction was a binary, clinician-rated variable, which limits comparison with studies using validated scales. The small number of readmissions ($n = 39$) reduces the precision of the estimates, as shown by the wide confidence interval for depression. Missed consultations were analysed as a total over follow-up, and some may have been an early sign of relapse rather than a cause. Finally, only readmissions to the same unit were counted. Admissions to private, other regional or adult services were missed, as were patients who left care altogether, so the true readmission rate is probably higher.

Future research

Prospective cohort studies embedded within a transitional care framework would address the principal limitations of the present design, enabling standardised psychometric assessment and systematic tracking of post-discharge clinical trajectories. Multicentre collaboration would generate the evidence required to develop and validate a risk stratification score for readmission in paediatric AN.

Conclusions

In this 24-month follow-up of 113 adolescents hospitalised for AN, 34.5% were readmitted, at a median of four months after discharge, a rate within the international range that identifies the early post-discharge period as a window of concentrated relapse risk. Comorbid depression, nasogastric tube feeding during the index admission and missed outpatient consultations were independently associated with a shorter time to readmission, whereas family dysfunction showed a borderline association. Admission BMI and length of stay were not associated with readmission, challenging the assumption that nutritional severity at admission or inpatient duration governs relapse risk. Readmission thus appears to be a multidimensional outcome, associated more closely with affective comorbidity, treatment intensity, post-discharge engagement and, possibly, family context than with somatic status at admission. Several of these factors are amenable to intervention: discharge planning that incorporates attendance monitoring, active treatment of depressive comorbidity and targeted family support addresses the factors most closely associated with return to hospital. In a resource-constrained public system, such structured transitional care may do more to reduce readmission than longer admissions.

Abbreviations

ADHD

Attention-deficit/hyperactivity disorder

AN

Anorexia nervosa

BMI

Body mass index

CI

Confidence interval

CPS

Child Protection Services

DSM-5-TR

Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision

HR

Hazard ratio

IQR

Interquartile range

NRG

Non-readmitted group

NSSI

Non-suicidal self-injury

RG

Readmitted group

STROBE

Strengthening the Reporting of Observational Studies in Epidemiology

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics Committee of ULS Santo António/ICBAS (reference 2025.279 (237-CAC-237-CE)). The requirement for written informed consent was waived given the retrospective nature of the study and the absence of any intervention or direct patient contact.

Consent for publication

Not applicable.

Availability of data and materials

The datasets analysed during the current study are not publicly available owing to the privacy of minors receiving psychiatric care, but are available from the corresponding author on reasonable request and subject to approval by the institutional ethics committee.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

JF, JVG, SC and LC conceptualised the study. JF extracted the data. JF and SC curated the data and performed the formal analysis. JF, JVG, SC and LC interpreted the data. JF wrote the original draft of the manuscript. JVG and LC supervised the study and reviewed and edited the manuscript. All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

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JF is a medical student at the School of Medicine and Biomedical Sciences (ICBAS), University of Porto; this work forms part of her Master's thesis in Medicine.

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Figures

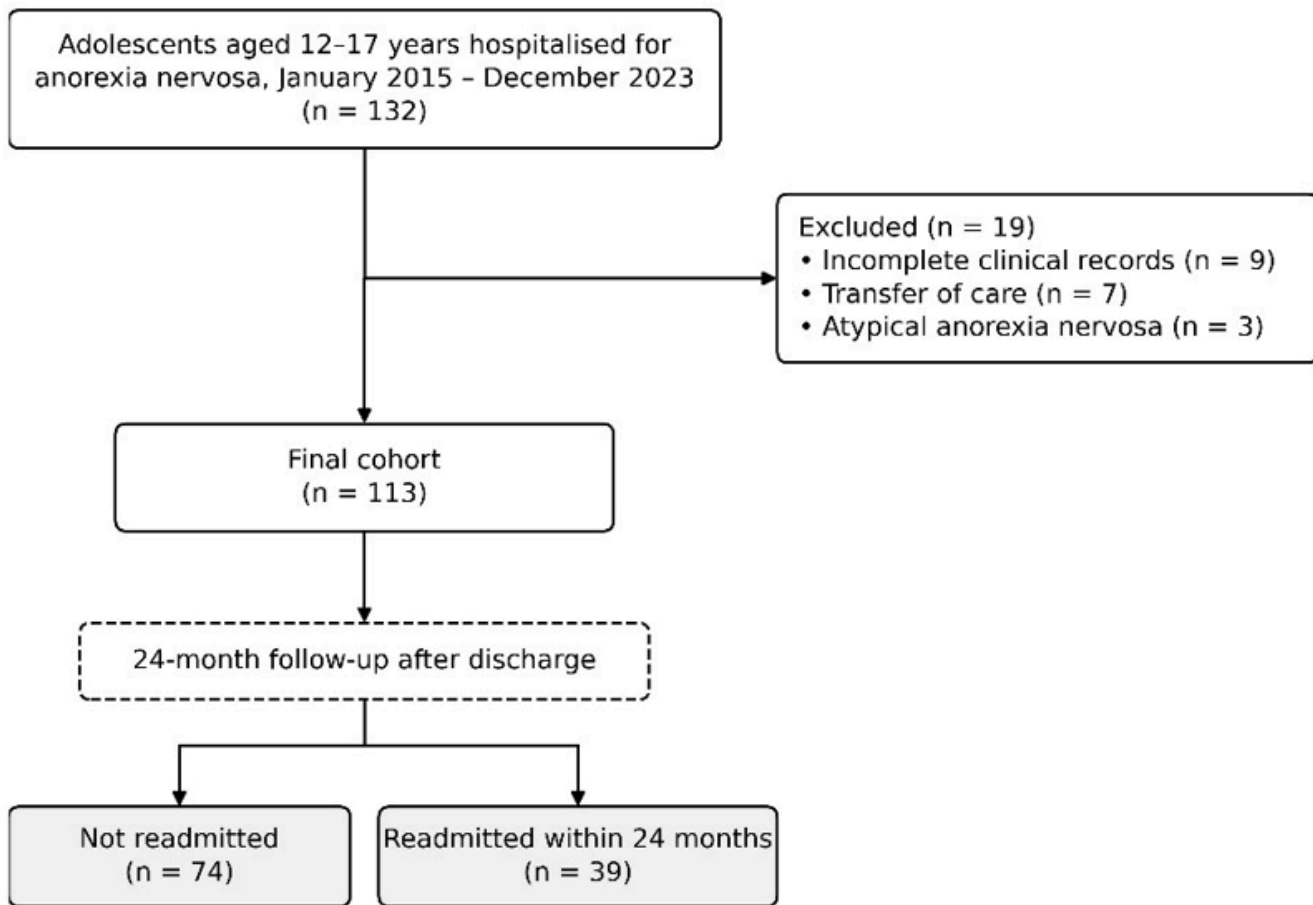


Figure 1

Flow diagram of patient selection

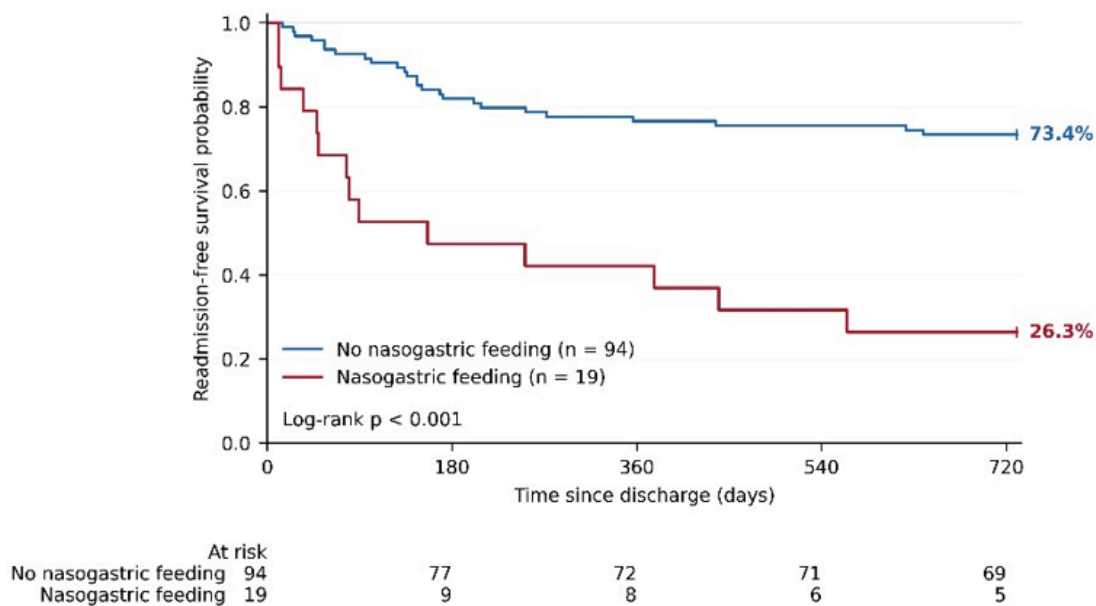


Figure 2

Readmission-free survival by nasogastric tube feeding during the index admission

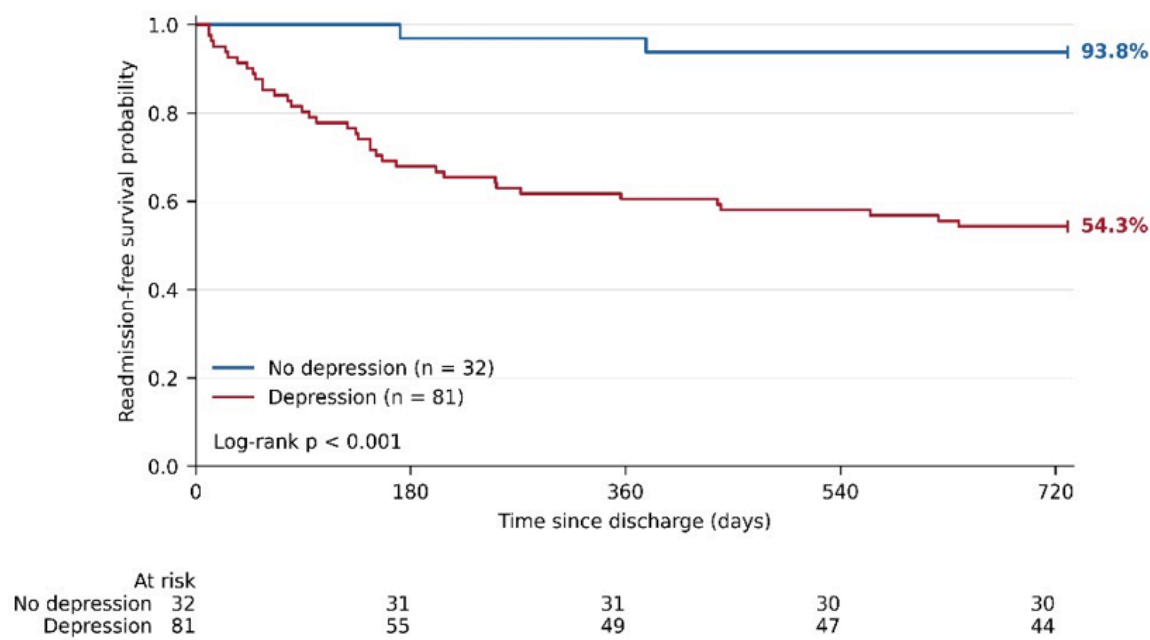


Figure 3

Readmission-free survival by comorbid depression at the first post-discharge consultation

Supplementary Files

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