



The relationship between duration of untreated symptoms and clinical outcomes in first episode eating disorders

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ABSTRACT

The relationship between duration of untreated symptoms and clinical outcomes in eating disorders (EDs) is not fully understood. We explored whether the duration of prodrome (DOP) or duration of untreated eating disorder (DUED) impacts clinical outcomes. Emerging adults ($N = 236$) aged 16–25 years, with an early-stage ED were recruited at the outset of treatment, completing a semi-structured interview to establish DOP and DUED. Clinical outcomes were measured at baseline and 12-months. DUED was positively correlated with binge eating ($r_s = .236, p < .001$) and vomiting ($r_s = .131, p = .047$) at baseline, and negatively correlated with BMI for anorexia nervosa at follow-up ($r_s [58] = -.26, p = .038$). After subsequent regression analysis, the only significant finding was DUED as a predictor of the presence of binge eating at baseline. Future studies should examine symptom duration in more diverse samples.

1. Introduction

Eating disorders (EDs) are serious psychiatric illnesses which impact about 8 % of women and 2 % of men across their lifetime (Galmiche et al., 2019). They are disabling disorders causing significant financial burden (Treasure et al., 2020). Peak onset for EDs is during adolescence or early adulthood (Treasure et al., 2020), with approximately 80 % of cases developing before age 25 (Solmi et al., 2022). This is a sensitive time for brain development (Taber-Thomas and Pérez-Edgar, 2015), establishing educational/career paths, and navigating relationships (Ranta et al., 2014). An ED during adolescence or emerging adulthood

has been implicated in the erosion of psychosocial resources at a critical point in development (Richards, 2022).

Provision of early specialist treatment is associated with a better prognosis (Ambwani et al., 2020; Treasure et al., 2015). There have been a small number of formal initiatives aiming to improve the early treatment of EDs (e.g., Dalton et al., 2024; Gumz et al., 2018, 2023) (Dalton et al., 2024; Gumz et al., 2018, 2023). In the UK, the First Rapid Early Intervention for Eating Disorders (FREED) service model and care pathway for emerging adults has been established and found to produce superior clinical results in comparison to treatment as usual (Austin et al., 2022; Fukutomi et al., 2020; McClelland et al., 2018). A key aim of

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FREED is to reduce the duration of untreated eating disorder (DUEd), operationalised as the time between clinical onset of an ED diagnosis and commencement of specialist, evidence-based treatment (Austin et al., 2021). However, a previous review shows that studies assessing the association between DUEd and later treatment outcomes, i.e., looking beyond cross-sectional baseline severity, are sparse (McClelland et al., 2023).

Early intervention approaches to EDs can be best informed by a deeper understanding of the initial symptoms and illness phases of an ED, including not only DUEd, but also the preceding prodromal period (Stice et al., 2010). ED prodrome is operationalised as the emergence of one or more symptoms which predict the onset of an ED (McClelland et al., 2020). The current interest in the prodromal period of EDs has largely been inspired by the field of psychosis. Psychosis research has previously explored prodromal characteristics to define this early illness stage and to better inform assessment tools (Seiler et al., 2020). Further investigation has demonstrated that psychosis DOP predicts later clinical outcomes (Barajas et al., 2019). This research has supported the creation of treatment interventions specifically for the prodromal period of psychosis (Kuharic et al., 2019).

Research into the prodromal period of EDs thus far has largely focused on the relationship between early symptoms and prediction of later clinical onset (Gómez Del Barrio et al., 2022; Stice et al., 2021; Yamamiya et al., 2022). There are still no published data comparing the impact of the DOP on clinical outcomes in a treatment-seeking sample. Therefore, the purpose of this study is to explore the impact of the DOP and DUEd on clinical outcomes.

2. Methods

2.1. Participants

Patients were recruited from the First Episode Early Intervention in Eating Disorders – Upscaled (FREED-Up) study (Austin et al., 2022; Flynn et al., 2021). Patients were 278 consecutive referrals to four specialist outpatient ED services in England. All participants were aged 16–25 with any DSM-5 ED and illness duration of <3 years. 263 participants (95 %) completed onset interviews. The current analysis excludes those transferred from child/adolescent services ($n = 25$) given that they had already begun their first specialist treatment prior to the point of research assessment. Individuals who provided contradictory information during interview were excluded ($n = 2$), leaving 236 participants (85 % of original sample). Diagnoses were anorexia nervosa (AN, $n = 93$, 39.4 %), bulimia nervosa (BN, $n = 66$, 28.0 %), binge eating disorder (BED, $n = 2$, 0.8 %), and other specified feeding or eating disorder (OSFED, $n = 75$, 31.8 %).

2.2. Measures

2.2.1. Onset interview

Full details of the interview process can be found in Flynn et al. (2025) and the Supplementary Materials. In brief, an adapted version of the Eating Disorder Diagnostic Scale (EDDS, Stice et al., 2000) was administered, using a ‘life chart’ to review the past three years and track the emergence of and fluctuation in ED symptoms and physical changes.

2.2.2. Eating Disorder Examination Questionnaire (EDE-Q)

The EDE-Q (Fairburn et al., 2008) is a 28-item measure used to assess ED psychopathology over the past 28 days. It also counts the frequency of ED behaviours including binge eating, vomiting, laxative use, and excessive exercise (Fairburn et al., 2008). The self-report EDE-Q was completed by patients at 3, 6, and 12 months after commencing treatment.

2.2.3. Body mass index

Weight was self-reported by patients at 3, 6, and 12 months after

commencing treatment. These data were checked against objective weight measurements gathered by clinicians across treatment.

2.3. Procedures

2.3.1. Clinical

Full details on the FREED service model have been previously published (Allen et al., 2020; Brown et al., 2018). In brief, patients are provided with an evidence-based psychotherapy treatment tailored to developmental and illness stage, with dietetic intervention and psychopharmacology as needed, within four weeks of specialist referral. Details on treatment and illness course (i.e., service use and rates of remission) during the FREED-Up study can be found in Austin et al. (2022).

2.3.2. Research

At one site, FREED-Up participants were approached in-person to complete the onset interview immediately after clinical assessment. These interviews were held face-to-face ($n = 98$, 41.5 %). For the three remaining sites, participants were contacted by phone immediately after clinical assessment, and a phone interview was scheduled within a week thereafter ($n = 138$, 58.4 %). Onset interviews were a maximum of 1.5 h in duration.

2.4. Analysis

Normality of variables (DOP, DUEd, BMI, EDE-Q, ED behaviour counts) was assessed via Kolmogorov-Smirnov tests. Most variables were non-normally distributed, thus non-parametric Spearman's rho was used to explore correlations between DOP/DUEd and clinical outcomes (BMI, EDE-Q score, ED behaviour counts). Significant findings were followed with a regression approach as best fit the data. For regression equations using non-normally distributed continuous variables, data were transformed using the binary log function to meet the assumptions of regression (all variables became normally distributed, with skewness and kurtosis <1). For regression models with zero-inflated count data, zero-inflated negative binomial (ZINB) regression models were run in R using the pscl package. ZINB models were compared against standard negative binomial models using Akaike information criterion to ensure best fit was chosen. Only data from patients with AN were used in analyses of BMI.

3. Results

3.1. Sample characteristics

Baseline demographics and clinical characteristics are shown in Table 1.

3.2. Relationship between duration and ED cognitions

There was no significant correlation between DOP and EDE-Q score at baseline ($r_s [233] = .08, p = .21$) or at 12-month follow-up ($r_s [148] = .05, p = .54$) and no significant correlation between DUEd and EDE-Q score at baseline ($r_s [231] = -.01, p = .83$) or at 12-month follow-up ($r_s [146] = .06, p = .45$).

3.3. Relationship between duration and ED behaviours

There was no significant correlation between DOP and frequency of any measured ED behaviours (binge eating, vomiting, laxative use, or excessive exercise) at baseline or at 12-month follow-up (see Supplementary Material). There was a significant correlation between DUEd and baseline binge eating ($r_s [233] = .24, p < .001$) and vomiting ($r_s [233] = .13, p = .047$), although this became non-significant by 12-months ($r_s [148] = -.06, p = .53$, $r_s [148] = .06, p = .49$, respectively).

Table 1
Baseline demographic and clinical characteristics.

Characteristic	M ± SD
Age	20.46 ± 2.40
Age of onset	19.07 ± 2.42
DUED (months)	17.03 ± 10.13
DOP (months)	33.39 ± 44.19
Sex (F:M)	219:17
Diagnosis (n; %)	
AN	93; 39.4 %
BN	66; 28 %
BED	2; 0.8 %
OSFED	75; 31.8 %
BMI, full sample	20.36 ± 4.57
BMI, underweight only	16.62 ± 1.34
EDE-Q global score	4.17 ± 1.16
Ethnicity (n; %)	
White	158; 66.9 %
Asian	21; 8.9 %
Black	10; 4.2 %
Mixed	18; 7.6 %
Other	10; 4.2 %
Unknown	19; 8.1 %
Occupation (n; %)	
School/university	142; 61.8 %
Employed	67; 29.1 %
Unemployed	21; 9.1 %

BMI: Body mass index; DOP: Duration of prodrome; DUED: Duration of untreated eating disorder; EDE-Q: Eating Disorder Examination Questionnaire.

There were no other significant correlations between DUED and frequency of ED behaviours at either timepoint.

Following the analysis plan, ZINB regression was run on significant correlations involving count data. DUED was a significant predictor of the presence of binge eating at baseline ($\beta = -.41$, $SE = 0.16$, $z = -2.44$, $p = .010$), but only trended toward significance as a predictor of frequency of binge episodes ($\beta = .15$, $SE = 0.08$, $z = 1.89$, $p = .058$). The model explained 4.9 % of the variance in binge eating at baseline (Nagelkerke $R^2 = 0.049$). DUED was not a significant predictor for either the presence or frequency of vomiting at baseline ($\beta = 0.12$, $SE = 0.09$, $z = -1.32$, $p = .19$; $\beta = -0.21$, $SE = 0.14$, $z = -1.50$, $p = .$). The model explained 1.8 % of the variance in vomiting behavior (Nagelkerke $R^2 = 0.018$).

3.4. Relationship between duration and weight outcomes

For those patients who were underweight, there was no significant correlation between DOP and BMI at baseline ($r_s [90] = .07$, $p = .53$), or at 12-month follow-up ($r_s [60] = -.17$, $p = .19$). Similarly, there was no significant correlation between DUED and BMI at baseline ($r_s [88] = .02$, $p = .85$); however, this became significant by 12-month follow-up ($r_s [58] = -.26$, $p = .038$).

A linear regression was run to determine if DUED predicted BMI at follow-up. The fitted linear regression model was: 12-month BMI = $20.25-.49*(\log_2 [\text{DUED}])$. The overall model trended toward significance but did not reach the set threshold of $\alpha \leq .05$ ($F(1,58) = 3.38$, $p = .07$). The model explained 5.5 % of the variance in BMI ($R^2 = 0.055$).

4. Discussion

This study examined the period prior to first specialist treatment in emerging adults accessing an early intervention ED service. This period included both DOP, i.e., the emergence of prodromal symptoms preceding ED onset, and DUED, the time from clinical onset to specialist treatment. On average, prodromal symptoms appeared 33 months prior to treatment while a diagnosable ED appeared 17 months prior to treatment. DOP was not a significant predictor of any outcomes tested, while DUED was a significantly predictor of the presence of binge eating

at baseline.

In the current study, one factor likely impacting the relationship between DUED and the presence of binge eating at baseline is that individuals with binge-type eating disorders often experience a longer DUED (Austin et al., 2021). Thus, we cannot assume a causal relationship between DUED and binge eating. It is still unclear if a longer DUED results in more binge type ED presentations, if binge type ED presentations go undetected for longer, or some combination of the two.

The absence of significant relationships between the DOP and outcomes suggests that prodromal symptoms, at least as conceptualised within this study and applied to this population, do not predict baseline severity or treatment response. This is an important finding—many ED studies report duration of untreated symptoms yet there remains no consensus on how this construct should be measured. Some studies include prodrome in their estimates, while others focus only on the period after clinical onset. Our findings suggest tentative support that measuring DUED (the period from clinical onset to evidence-based treatment) may be more useful than measuring DOP. Future research may wish to measure DUED in a standardized way to further clarify its impact on clinical presentation and outcomes.

This study must be considered in the context of its limitations. First, the only prodromal symptoms in this work related to EDs. Previous work by our group suggests that prodromal symptoms of EDs include broad symptoms of psychiatric disorders, such as anxiety and depression (McClelland, 2020). Finally, the current analysis only examined the impact of DOP/DUED on outcomes. Future research may wish to examine the interplay of DOP/DUED with other potential predictors of outcome. There is also a need for our work to be replicated and extended in different healthcare systems. There is considerable variation within and between countries in how ED care is provided (Allen et al., 2023), which may influence links between DUED and outcomes. As our sample primarily consisted of white females, different results may also emerge in different demographic groups.

CRedit authorship contribution statement

Amelia Austin: Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Michaela Flynn:** Writing – review & editing, Validation, Project administration, Methodology, Investigation. **Katie Richards:** Writing – review & editing, Validation, Investigation. **Karina Allen:** Writing – review & editing, Supervision, Methodology, Investigation, Funding acquisition, Conceptualization. **Victoria A. Mountford:** Writing – review & editing, Methodology, Investigation, Conceptualization. **Danielle Glennon:** Writing – review & editing, Methodology, Investigation, Conceptualization. **Amy Brown:** Writing – review & editing, Methodology, Investigation, Conceptualization. **Nina Grant:** Writing – review & editing, Investigation. **Mary Franklin-Smith:** Writing – review & editing, Investigation. **Monique Schelchase:** Writing – review & editing, Investigation. **William Rhys Jones:** Writing – review & editing, Investigation. **Gabrielle Brady:** Writing – review & editing, Investigation. **Lucy Serpell:** Writing – review & editing, Investigation. **Ulrike Schmidt:** Writing – review & editing, Supervision, Methodology, Funding acquisition, Conceptualization.

Patient consent statement

All participants gave informed consent prior to inclusion in the study.

Data availability statement

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

Ethics approval statement

This study was approved by the Camberwell St. Giles Research Ethics Committee REC (16/LO/1882) and the NHS Health Research Authority (Integrated Research Application System number 210751). The study conforms to the standards required by the Declaration of Helsinki.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.psycom.2025.100217>.

References

- Allen, K.L., Mountford, V., Brown, A., et al., 2020. First episode rapid early intervention for eating disorders (FREED): from research to routine clinical practice. *Early Intervent. Psychiatr.* 14 (5), 625–630.
- Allen, K.L., Mountford, V.A., Elwyn, R., et al., 2023. A framework for conceptualising early intervention for eating disorders. *Eur. Eat. Disord. Rev.* 31 (2), 320–334.
- Ambwani, S., Cardi, V., Albano, G., et al., 2020. A multicenter audit of outpatient care for adult anorexia nervosa: symptom trajectory, service use, and evidence in support of “early stage” versus “severe and enduring” classification. *Int. J. Eat. Disord.* 53 (8), 1337–1348.
- Austin, A., Flynn, M., Richards, K., et al., 2021. Duration of untreated eating disorder and relationship to outcomes: a systematic review of the literature. *Eur. Eat. Disord. Rev.* 29 (3), 329–345.
- Austin, A., Flynn, M., Shearer, J., et al., 2022. The first episode rapid early intervention for eating disorders - Upscaled study: clinical outcomes. *Early Intervent. Psychiatr.* 16 (1), 97–105.
- Barajas, A., Pelaez, T., González, O., et al., 2019. Predictive capacity of prodromal symptoms in first-episode psychosis of recent onset. *Early Intervent. Psychiatr.* 13 (3), 414–424.
- Brown, A., McClelland, J., Boysen, E., Mountford, V., Glennon, D., Schmidt, U., 2018. The FREED Project (first episode and rapid early intervention in eating disorders): service model, feasibility and acceptability. *Early Intervent. Psychiatr.* 12 (2), 250–257.
- Dalton, B., Davies, M.R., Flynn, M., et al., 2024. Virtually delivered guided self-help for binge eating disorder and bulimia nervosa: findings from a service evaluation. *Behav. Cognit. Psychother.* 52 (3), 211–225.
- Fairburn, C.G., Beglin, S.J., 2008. Eating disorder examination Questionnaire (6.0). In: Fairburn, C.G. (Ed.), *Cognitive Behaviour Therapy and Eating Disorders*. Guilford Press, New York.
- Flynn, M., Austin, A., Lang, K., et al., 2021. Assessing the impact of First Episode Rapid Early Intervention for Eating Disorders on duration of untreated eating disorder: a multi-centre quasi-experimental study. *Eur. Eat. Disord. Rev.* 29 (3), 458–471.
- Flynn, M., Austin, A., Richards, K.L., et al., 2025. Characterising the Period of Untreated Eating Disorder: Illness Trajectory in Early-Stage Eating Disorders.
- Fukutomi, A., Austin, A., McClelland, J., et al., 2020. First episode rapid early intervention for eating disorders: a two-year follow-up. *Early Intervent. Psychiatr.* 14 (1), 137–141.
- Galmiche, M., Déchelotte, P., Lambert, G., Tavolacci, M.P., 2019. Prevalence of eating disorders over the 2000–2018 period: a systematic literature review. *Am. J. Clin. Nutr.* 109 (5), 1402–1413.
- Gómez Del Barrio, A., Ruiz Guerrero, F., Benito Gonzalez, P., et al., 2022. A retrospective investigation of the prodromal stages of eating disorders and use of health services in young patients the year prior to the diagnosis. *Early Interv. Psychiatr.* 16 (2), 162–167.
- Gumz, A., Weigel, A., Wegscheider, K., Romer, G., Löwe, B., 2018. The psychenet public health intervention for anorexia nervosa: a pre-post-evaluation study in a female patient sample. *Prim. Health Care Res. Dev.* 19 (1), 42–52. <https://doi.org/10.1017/S1463423617000524>.
- Gumz, A., Reuter, L., Löwe, B., Voderholzer, U., Schwennen, B., Fehrs, H., et al., 2023. Factors influencing the duration of untreated illness among patients with anorexia nervosa: a multicenter and multi-informant study. *Int. J. Eat. Disord.* 56 (12), 2315–2327.
- Kuharic, D.B., Kekin, I., Hew, J., Kuzman, M.R., Puljak, L., 2019. Interventions for prodromal stage of psychosis. *Cochrane Database Syst. Rev.* 11.
- McClelland, J., 2020. Symptomatology Prior to the Onset of Eating Disorders. Prodromal Eating Disorders in Adolescents and Young Adults: Systematic Review and Empirical Research Project. Doctoral thesis. King's College London.
- McClelland, J., Hodsoll, J., Brown, A., et al., 2018. A pilot evaluation of a novel first episode and rapid early intervention service for eating disorders (FREED). *Eur. Eat. Disord. Rev.* 26 (2), 129–140.
- McClelland, J., Robinson, L., Potterton, R., Mountford, V., Schmidt, U., 2020. Symptom trajectories into eating disorders: a systematic review of longitudinal, nonclinical studies in children/adolescents. *Eur. Psychiatry* 63 (1), e60.
- McClelland, J., Austin, A., Flynn, M., Mountford, V., Simic, M., Schmidt, U., 2023. Early stages of eating disorders in young people: duration of untreated illness, prodrome and their relationship to outcomes. Manuscript Prepar.
- Ranta, M., Dietrich, J., Salmela-Aro, K., 2014. Career and romantic relationship goals and concerns during emerging adulthood. *Emerg. Adulthood* 2 (1), 17–26.
- Richards, K.L., 2022. Implementation Processes and Outcomes in Early Intervention for Eating Disorders: A Multi-Method Investigation. Doctoral thesis. King's College London.
- Seiler, N., Nguyen, T., Yung, A., O'Donoghue, B., 2020. Terminology and assessment tools of psychosis: a systematic narrative review. *Psychiatr. Clin. Neurosci.* 74 (4), 226–246.
- Solmi, M., Radua, J., Olivola, M., et al., 2022. Age at onset of mental disorders worldwide: large-scale meta-analysis of 192 epidemiological studies. *Mol. Psychiatr.* 27 (1), 281–295.
- Stice, E., Telch, C.F., Rizvi, S.L., 2000. Development and validation of the eating disorder diagnostic Scale: a brief self-report measure of anorexia, bulimia, and binge-eating disorder. *Psychol. Assess.* 12 (2), 123–131.
- Stice, E., Ng, J., Shaw, H., 2010. Risk factors and prodromal eating pathology. *JCPP (J. Child Psychol. Psychiatry)* 51 (4), 518–525.
- Stice, E., Desjardins, C.D., Rohde, P., Shaw, H., 2021. Sequencing of symptom emergence in anorexia nervosa, bulimia nervosa, binge eating disorder, and purging disorder and relations of prodromal symptoms to future onset of these disorders. *J. Abnorm. Psychol.* 130 (4), 377–387.
- Taber-Thomas, B., Pérez-Edgar, K., 2015. Emerging adulthood brain development. *Oxford Handbook Emerg. Adulthood* 126–141.
- Treasure, J., Stein, D., Maguire, S., 2015. Has the time come for a staging model to map the course of eating disorders from high risk to severe enduring illness? An examination of the evidence. *Early Intervent. Psychiatr.* 9 (3), 173–184.
- Treasure, J., Duarte, T.A., Schmidt, U., 2020. Eating disorders. *The Lancet* 395 (10227), 899–911.
- Yamamiya, Y., Desjardins, C.D., Stice, E., 2022. Sequencing of symptom emergence in anorexia nervosa, bulimia nervosa, binge eating disorder, and purging disorder in adolescent girls and relations of prodromal symptoms to future onset of these eating disorders. *Psychol. Med.* 1–9.