Understanding Anxiety in Adolescents with Chronic Illness: A Longitudinal Study of the Moderating Role of Parental Anxiety and Classmate Support

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Abstract

Adolescents with chronic illnesses are at increased risk of developing anxiety symptoms. However, little is known about underlying mechanisms important to consider specifically for this population. This longitudinal study contributes to our understanding of these mechanisms by examining whether parental anxiety and classmate support moderate the association between chronic illness and generalized anxiety in adolescents. Data from the TRacking Adolescents' Individual Lives Survey (TRAILS) were used (N = 2230), with measurements at mean ages 11.1 and 16.3. Inconsistent with the first hypothesis, adolescents with chronic illness did not report a stronger increase in anxiety symptoms over time. Also inconsistent with the second hypothesis, parental anxiety did not moderate the effect of chronic illness on adolescents' generalized anxiety symptoms. In contrast, classmate support was found to be a moderating factor, which supports the third hypothesis. These findings suggest that the relationship between chronic illness and anxiety symptoms is primarily present among adolescents who receive high levels of classmate support. This provides evidence for the importance of considering that peer support doest not have the same protective effect on all adolescents. The present study adds to the literature by emphasising that the psychological impact of chronic illness is not uniform but most importantly shaped by environmental and illness-related factors. Future research should explore perceived parenting as a moderator to better understand how to support adolescents witha chronic illness. For practice, this study suggests that considering the context of peer support may improve interventions for adolescents with chronic illnesses.

Keywords: adolescents, chronic illness, generalized anxiety, parental anxiety, classmate support, peer support, mental health

Samenvatting

Adolescenten met chronische ziekten lopen een verhoogd risico op het ontwikkelen van angstsymptomen. Er is echter weinig bekend over de onderliggende mechanismen die specifiek voor deze populatie relevant zijn. Deze longitudinale studie draagt bij aan ons begrip van deze mechanismen door te onderzoeken of ouderlijke angst en steun van klasgenoten de associatie tussen chronische ziekte en gegeneraliseerde angst bij adolescenten modereren. Gegevens van de TRacking Adolescents' Individual Lives Survey (TRAILS) werden gebruikt (N = 2230), met metingen op gemiddelde leeftijden van 11.1 en 16.3 jaar. In tegenspraak met de eerste hypothese rapporteerden adolescenten met een chronische ziekte geen sterkere toename van angstsymptomen in de loop van de tijd. Ook tegenstrijdig met de tweede hypothese bleek ouderlijke angst geen modererende rol te spelen. Daarentegen bleek steun van klasgenoten wel een modererende factor te zijn, wat de derde hypothese ondersteunt. Deze bevindingen suggereren dat de relatie tussen chronische ziekte en angstsymptomen vooral aanwezig is bij adolescenten die veel steun krijgen van klasgenoten. Dit benadrukt het belang om te overwegen dat steun van klasgenoten niet hetzelfde beschermende effect heeft op alle adolescenten. Het huidige onderzoek voegt toe aan de literatuur dat de impact van een chronische ziekte niet uniform is, maar vooral gevormd wordt door omgeving- en ziektegerelateerde factoren. Toekomstig onderzoek zou ervaren ouderschap als moderator moeten onderzoeken om beter te begrijpen hoe adolescenten met een chronische ziekte ondersteund kunnen worden. Voor de praktijk suggereert dit onderzoek dat het rekening houden met de context van steun van leeftijdsgenoten interventies voor adolescenten met een chronische ziekte kan verbeteren.

Kernwoorden: adolescenten, chronische ziekte, gegeneraliseerde angst, ouderlijke angst, steun van klasgenoten, steun van leeftijdsgenoten, mentale gezondheid

Introduction

Adolescence is a critical developmental period characterized by biological, psychological, and social changes (Olsson et al., 2003). This stage is also marked by increased vulnerability to mental health challenges, as heightened sensitivity to peer evaluation and social stressors during this period contributes to anxiety disorders (Blakemore & Mills, 2014). In this period, anxiety disorders are among the most prevalent mental health conditions affecting children and adolescents, with prevalence rates ranging from 4% to 25% in the general population (Pao & Bosk, 2011; Pinquart & Shen, 2011). For adolescents with chronic illnesses, these developmental challenges are often compounded by medical and social stressors. In the Netherlands, over one in four adolescents are living with a chronic condition, such as diabetes, asthma, or eczema (Verwey-Jonker Institute, 2021). While they participate in school, sports, and work like their peers, they generally face more challenges, feel less supported, have fewer friends and worry more about the future (Verwey-Jonker Institute, 2021).

The present study investigates whether having a chronic illness is associated with the development of generalized anxiety symptoms during adolescence. Prior research suggests that this relationship may be influenced by environmental factors, including parental anxiety and classmate support (La Greca et al., 2002; McClure et al., 2001; Pao & Bosk, 2011; Jackson, 2012). Therefore, the present study examines these variables as potential moderators.

Chronic illness and generalized anxiety

Generalized anxiety disorder (GAD) is one of the most common mental disorders (Spitzer et al., 2006). According to the DSM-IV diagnostic criteria, GAD is characterized by excessive worries about multiple events or activities, which are difficult to control and persist for at least six months (Wagner, 2001). Adolescents with chronic illnesses are especially vulnerable to GAD (Cobham et al., 2020). Chronic illness is defined as a long-term condition that at present cannot be

cured but can be controlled by medication and other therapies and is a factor that contributes to the development of anxiety symptoms (Brady et al., 2017).

Research suggests that up to 40% of adolescents with chronic illnesses experience anxiety symptoms, which is significantly higher than the 15-20% in the general adolescent population (Shain et al., 2019). The persistent stressors related to their chronic illness, such as unpredictability of symptoms and frequent medical appointments, can reduce the quality of life and contribute to psychological symptoms (Pao & Bosk, 2011). Additionally, these adolescents struggle with treatment compliance and self-management of their health, further exacerbating stress and negatively impacting their overall well-being (Bennett et al., 2021).

Adolescents with chronic illnesses are at significantly higher risk of developing internalizing problems, such as anxiety, compared to their healthy peers (Shain et al., 2019; Cobham et al., 2020; McDougall et al., 2020). This association is supported by empirical studies showing that adolescents with chronic illnesses experience significantly higher levels of generalized anxiety symptoms (Bennett et al., 2021). Additionally, Compas et al. (2006) found that the way adolescents cope with the stress of a chronic illness influences their psychological adjustment. The findings indicated that adolescents who engaged in secondary control coping (e.g., positive thinking, cognitive restructuring, acceptance) experienced lower levels of anxiety, whereas those who showed disengagement coping (e.g., avoidance, denial, wishful thinking) were more likely to develop heightened anxiety symptoms. Similarly, Hocking et al. (2010) found that chronic (bowel) illnesses are associated with increased anxiety, primarily due to the adolescents' disengagement coping strategies. Based on these findings it is hypothesized that chronic illness predicts an increase in adolescents' generalized anxiety symptoms (H1).

While much of the existing research focuses on the direct effects of chronic illness on adolescents, theoretical models emphasise environmental factors are essential in this relationship

(Lohan et al., 2015). The Disability-Stress-Coping Model (Wallander & Varni, 1998) provides a useful framework for understanding the increased prevalence of anxiety among adolescents with chronic illness. This model proposes that psychological adjustment not only depends on medical factors but also on coping strategies, social support and parental adjustment. According to this model, stressors related to chronic illness do not directly lead to mental health problems. How adolescents and their families cope with challenges affects the impact.

Additionally, in line with the transactional stress and coping model (Thompson et al., 1998), chronic illness can be viewed as a potential stressor that requires continuous adaptation by both the individual and their family system. Psychological adjustment depends on various interacting factors, including illness characteristics (e.g., type, severity, and age of onset), demographic variables (e.g., age, gender, socioeconomic status), and adaptational processes (e.g., cognitive appraisals, coping strategies, and social support). When adolescents perceive their illness as uncontrollable or highly threatening, they may engage in maladaptive coping strategies, such as avoidance or excessive worry, which can heighten anxiety levels (Schmidt et al., 2002). Empirical support for the transactional stress and coping model comes from White et al. (2005), who found that adolescents' perception of illness uncertainty played a role in how parental distress influenced their adjustment. These results reinforce the idea that perceptions of stressors and coping shape adolescents' psychological adjustment rather than the illness itself.

The transactional stress and coping model emphasises the role of environmental and psychological factors in shaping how adolescents perceive and respond to stressors (Thompson et al., 1998). This framework helps explain why some adolescetns with chronic illnesses develop anxiety while others do not. For example, when the environment provides strong support and adaptive coping mechanisms, it can buffer the experience of stressors and the impact on adolescents' anxiety (Thompson et al., 1998; Rudolph et al., 1995). Conversely, if parents struggle to manage the challenges related to the chronic illness of their child, the situation can intensify the

adolescents' perception of stress, increasing their vulnerability to anxiety. Thus, while the relationship between stressors and anxiety remains, the environment can either strengthen or weaken its impact (Rudolph et al., 1995).

Parental effects

Parental anxiety has been identified as a key factor in the relationship between chronic illness and anxiety in adolescents, influencing how adolescents adjust to their condition (Pao & Bosk, 2011). Parents of children with chronic illnesses often experience heightened anxiety due to concerns about their child's health, treatment, and long-term prognosis (Zelman & Ferro, 2018; Pinquart, 2019). This parental anxiety is particularly relevant, as it has been associated with lower quality of life and reduced adaptive behaviour in offspring, further increasing their vulnerability to developing anxiety symptoms (Jones & Reilly, 2016; Pinquart, 2019).

Empirical studies have consistently found associations between parental anxiety and increasing the risk of anxiety disorders in offspring (Sweeney & Wilson, 2023). Adolescents who grow up with an anxious parent are more vulnerable to developing anxiety symptoms themselves, as they are frequently exposed to anxious behaviours and emotional responses in their daily environment (McClure et al., 2001). In line with the transactional stress and coping model (Thompson et al., 1998), parental anxiety can influence children's cognitive and emotional responses to stress, which in turn increases their vulnerability to developing anxiety. Moreover, adolescents often model their emotional responses and coping strategies after their parents, meaning that anxious parents may unintentionally reinforce maladaptive coping mechanisms, such as avoidance and worry, in their children (Cobham et al., 2020). This is supported by Bennett et al. (2021), who found that adolescents' emotional and behavioural problems were correlated with parental anxiety.

Despite growing awareness of this issue, the role of parental anxiety in shaping the psychological outcomes for adolescents with chronic illnesses remains underexplored. Existing literature tends to overrepresent maternal perspectives, often overlooking the potential impact of paternal anxiety (Sweeney & Wilson, 2023). Paternal support might become especially important for adolescents with a chronic condition, as fathers tend to encourage independence more than mothers do (Oris et al., 2015). It was found that both maternal and paternal anxiety have the propensity to negatively impact their child's development (Sweeney & Wilson, 2023). Therefore, it is essential to better understand how parental anxiety contributes to the development of anxiety symptoms in adolescents with chronic illness.

Thus, chronic illness is expected to influence the development of generalized anxiety in adolescents, regardless of parental anxiety. It is hypothesized that parental anxiety reinforces this association, as is confirmed by prior research (Pao & Bosk, 2011; Jones & Reilly, 2016; Pinquart, 2019; Cobham et al., 2020; Bennett et al., 2021). In other words, the impact of stressors, such as chronic illness, on adolescents' anxiety symptoms is larger when parents also experience anxiety. Therefore, the second hypothesis is proposed as follows: Parental anxiety positively moderates the association between chronic illness and adolescents' generalized anxiety symptoms (H2).

Peer support

Besides parental influences, peers also have a significant impact on adolescents' development and well-being. During adolescence, peer relationships provide a critical source of emotional support (Nickerson & Nagle, 2005). Especially acceptance by classmates contributes to a sense of belonging and self-worth (La Greca et al., 2002; Lidgren et al., 2017). According to La Greca et al. (2002), support from peers can buffer the impact of stressors, such as adjusting to a chronic illness or coping with a difficult medical treatment. At the same time, poor peer

relationships can be an additional source of stress, making them more vulnerable to other life challenges (Shiu, 2001).

Research has shown that adolescents with chronic illness often report lower levels of peer support, which may contribute to increased anxiety symptoms (La Greca et al., 2002). Specifically, classmate support may influence the relationship between having a chronic illness and developing anxiety symptoms. When adolescents experience strong support from their classmates, this may reduce the impact of the illness on their anxiety by making them feel more accepted and connected (La Greca et al., 2002). Conversely, peer difficulties, such as reduced participation in social activities, can reinforce the negative effects of the illness on anxiety, increasing the risk of internalising problems (Siu, 2001; Verwey-Jonker Institute, 2021). Varni et al (1996) showed that adolescents with chronic illness who receive little peer support are more likely to develop internalising symptoms, including anxiety. This finding emphasises that the level of peer support plays an important role in determining how strongly the illness is related to anxiety symptoms.

Along the same lines, Jackson (2012) argued that a positive school climate, where peers are supportive and understanding, fosters social integration and reduces feelings of isolation. This kind of peer environment may be particularly important for adolescents with chronic illnesses, who face unique social and emotional challenges related to their illness (Blakemore & Mills, 2014). A lack of peer support can lead to feelings of exclusion, which may heighten the risk of developing anxiety symptoms (Jackson, 2012). Interestingly, empirical research by Oris et al. (2015) found conflicting evidence, suggesting that adolescents with chronic illnesses feel equally supported by their peers as compared to their healthy counterparts.

Despite these mixed findings, prior research indicates that adolescents who experience more peer support may develop fewer anxiety symptoms due to their illness. (La Greca et al.,

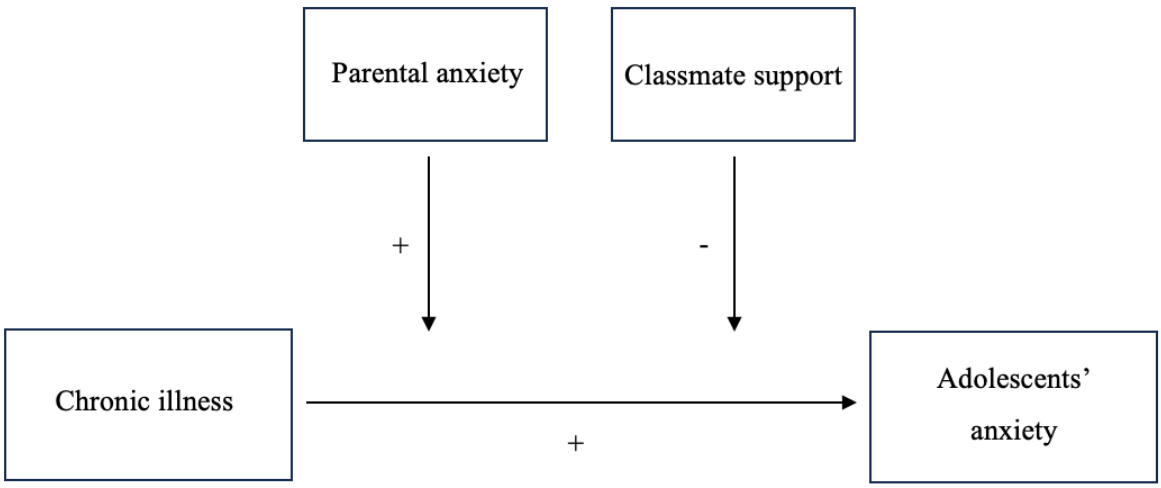
2002; Jackson, 2012). In line with the transactional stress and coping model (Thomspon et al., 1998), classmate support can serve as a protective factor, helping adolescents to cope with stressors related to their chronic illness and thus reduce feelings of anxiety. Therefore, it is hypothesized that classmate support negatively moderates the association between chronic illness and generalized anxiety symptoms in adolescents, such that the relationship is weaker when classmate support is high (H3).

Present study

The present study hypothesizes that chronic illness in early adolescence will lead to an increase in generalized anxiety symptoms during adolescence. Additionally, it is expected that parental anxiety will strengthen the association between chronic illness and adolescents' anxiety symptoms. Finally, the present study examines whether classmate support moderates this association. Classmate support has the potential to buffer the negative impact of chronic illness on anxiety, with strong classmate support weakening the association between chronic illness and adolescents' anxiety symptoms. All hypothesized relationships are displayed in Figure 1.

Figure 1

Conceptual Model for the Main Relationships



Methods

Procedure

The present study uses existing data retrieved from the TRacking Adolescents' Individual Lives Survey (TRAILS), a population-based prospective cohort study among Dutch adolescents. TRAILS is a longitudinal, multidisciplinary study on mental health and social development during adolescence and young adulthood. It examines social, psychological, and biological factors. Data (questionnaires, interviews, tests and/or physical measurements) is collected from adolescents, parents, teachers, and classmates.

TRAILS has followed pre-adolescents until the age of 24. The participants of the study were born between 1989 and 1991 at the time of the baseline. At the start of TRAILS (2000), participants were ten to twelve years old and measurements were conducted every two to three years (Oldehinkel et al., 2015). The TRAILS study received ethical approval from the Dutch Committee on Research Involving Human Subjects.

The original sample selection for TRAILS consisted of two stages. First, the study approached 135 primary schools in five municipalities in the northern Netherlands with an invitation to participate. Thirteen schools (9.6%) declined to participate, resulting in the exclusion of 338 children from the initial population of 3483. In the second stage, parents and children received study information, after which TRAILS contacted parents for consent.

Sample

The TRAILS study followed a total of 2230 adolescents (*M*age = 11.1, *SD* = 0.6, 51% female, baseline T1) between the years 2001 and 2017. The present study used data from T1 and T3. At T3, there were 1816 participants (81% retention rate, *M*age = 16.3, *SD* = 0.7, 52% female). Additionally, based on a combination of parental education, occupation, and income, which together determine socioeconomic status (SES), 25.3% of the participants came from families

with a low SES, 49.5% from families with a middle SES, and 25.2% from families with a high SES.

To assess the potential impact of attrition bias, an attrition analysis was conducted to examine whether there were significant baseline differences (at T1) between participants who remained in the study and those who dropped out. Independent samples t-tests were conducted on relevant variables, such as chronic illness at T1, adolescents' anxiety at T1 and classmate support at T1. A significant difference was found in adolescents' anxiety levels, $t(2205) = -2.876$, $p = .004$. Participants who dropped out reported significantly lower anxiety ($M = .617$, $SD = .474$) compared to those who remained in the study ($M = .681$, $SD = .445$).

Measurements

Chronic illness (T1)

The independent variable chronic illness was operationalized with the Health Questionnaire at T1. The questionnaire, filled out by a parent informant, includes a section specifically addressing chronic conditions. For each condition, participants were asked whether their child had experienced the condition in the past year (0 = "*no*", 1 = "*yes*" and 9 = "*don't know*"). Additionally, there was an open question asking, *"does your child have a significant condition that was. not mentioned in the list of illnesses?"* (0 = "*no*" and 1 = "*yes, namely*"). This approach allowed for the inclusion of conditions that were not specifically listed in the list of chronic illnesses.

Adolescents' anxiety symptoms (T3)

The dependent variable adolescents' anxiety symptoms is measured using the RCADS (Revised Children's Anxiety and Depression Scale), specifically the subscale for GAD. The subscale includes six items and were self-reported by adolescents. The items ask about the frequency of feelings related to worry and anxiety. For example, "*I worry that something bad will*

happen to me" or "*I worry about what is going to happen*". The response categories ranged from 0 = "*never*", to 4 = "*always*". The Cronbach's alpha for this subscale was 0.78. Higher scores indicated greater levels of generalized anxiety symptoms.

Parental anxiety (T1)

Parental anxiety was measured using a set of questions from the psychiatric disorders in the family questionnaire, which was filled in by both parents at T1. TRAILS developed the questionnaire, which consists of five questions regarding the presence of anxiety symptoms in the parent. Parents were asked whether they or their partner had experienced anxiety-related symptoms, with response options 0 = "*no*", 1 = "*probably not*", 2 = "*probably yes*", 3 = "*yes*" and "9 = "*don't know*". Additionally, parents were asked about the specific type of anxiety symptoms. The response options included *generalized anxiety*, *social phobia*, *specific phobia*, *panic attacks*, *obsessive-compulsive disorder*, and "*I don't know.*" Finally, parents were asked about any treatments received for anxiety (*outpatient treatment*, *day treatment*, *hospitalization*, or "*I don't know*"). A sum score was calculated by combining the anxiety scores from both the mother and father, with higher scores indicating greater levels of parental anxiety symptoms.

Classmate support (T1)

Classmate support was measured using the subscale 'social well-being friends and classmates' from the Social Participation and Friendship (SPF) questionnaire at T1 and T3. This subscale consists of 17 items, such as "*my friends like to do things together with me*," and was filled in by the child. Responses were given on a 5-point Likert scale, ranging from 1 = "*never*" to 5 = "*always*". The Cronbach's alpha for this subscale was 0.93, indicating a high level of internal consistency. Higher scores on this scale indicated better perceived support from classmates.

Control variables

The following variables were controlled for: gender at T1 and SES at T1. Gender was self-reported by adolescents, with 0 = "*girl*" and 1 = "*boy*". SES was assessed using a composite score, which is based on parental education, parental occupation and household income. SES scores were categorized as 1 = "*low*", 2 = "*middle*" and 3 = "*high*", based on a 25% low, 50% middle and 25% high distribution. Factor analyses showed that SES captures a strong unidimensional construct, and reliability was high (Cronbach's $\alpha = .84$).

Analysis

All statistical analyses were conducted using JASP version 0.19.3 (2025). First, descriptive statistics were computed for the key variables, including chronic illness, adolescents' anxiety symptoms, parental anxiety, and classmate support. Additionally, bivariate correlations between these variables were examined.

Several assumptions were checked before proceeding to the main analyses. First of all, normality of residuals was assessed through a residual histogram and a Q-Q plot, confirming a normal distribution. Multicollinearity was assessed using the variance inflation factor (VIF). Initial analyses showed that the VIF values for the interaction terms exceeded 10, indicating potential multicollinearity. To address this, the continuous predictors were mean-centred before computing the interaction terms. All values dropped below 10 after centring, confirming that multicollinearity was no longer a concern and the assumption was met. Additionally, linearity and homoscedasticity were examined using residual scatterplots, which indicated an even spread of data points, suggesting these assumptions were met. Outliers were also identified and addressed, as necessary. Missing data were handled using listwise deletion, as implemented in JASP. This means that only participants with complete data on all variables in this study included in the analysis (N= 1400).

Then, the regression analyses were performed to examine the relationships between the key variables. To assess longitudinal associations, the dependent variable (adolescents' anxiety) is measured at T3, while the main independent variable (chronic illness) is assessed at T1. Hierarchical linear regression analyses were conducted to test the main hypothesis. Model 1 includes control variables gender and SES. In Model 2, all main effects including adolescents' anxiety at T1, chronic illness, parental anxiety and classmate support were added to test H1. In Model 3, interaction terms chronic illness × parental anxiety and chronic illness × classmate support were added to test H2 and H3.

Results

Descriptive statistics

Descriptive analyses were conducted for the continuous variables. The mean scores revealed a minimal increase in adolescents' anxiety symptoms on group level. For adolescents' anxiety at T1 the mean was $M = .685$ ($N = 1400$, $SD = .438$) although the mean for anxiety at T3 was $M = .509$ ($N = 1400$, $SD = .414$). A Pearson correlation analysis was conducted to assess the associations between the key variables of the present study. Descriptive statistics and correlations are presented in Table 1.

Table 1

Descriptive Statistics and Correlations

					Correlations					
N = 1400	*M*	*SD*	Range	%	1	2	3	4	5	6
1. Chronic illness*				18.798 (1)						
2. Anxiety T1	.685	.438	0-3		.022					
3. Anxiety T3	.509	.414	0-3		.005	.305***				

4. Classmate support	3.805	.634	1-5		-.024	-.084***	.003			
5. Parental anxiety	.180	.409	0-3		.048**	-.022	.038	-.018		
6. Gender*				49.260 (1)	.047**	-.111***	-.286***	-.153***	-.014	
7. SES	.685	.438	0-3		-.048**	-.009	.011	.002	-.060**	-.017

Note. * *Chronic illness:* 0 = no, 1 = yes. *Gender:* 0 = girl, 1 = boy. Range = potential range.

** $p < .05$. ***$p < .001$.

A small but significant positive correlation was found between chronic illness and parental anxiety ($r = .048$, $p < .05$), indicating that adolescents with a chronic illness were more likely to have a parent who reported higher anxiety levels. Chronic illness was also positively correlated with gender ($r = .047$, $p < .05$), suggesting that boys were slightly more likely than girls to have a chronic illness. In addition, a significant negative correlation was found between chronic illness and SES ($r = –.048$, $p < .05$), indicating that adolescents from lower SES backgrounds were more likely to have a chronic illness.

Furthermore, there was a moderate positive correlation between adolescents' anxiety at T1 and T3 ($r = .305$, $p < .001$), indicating that adolescents with higher levels of anxiety at age 11 also reported higher anxiety at age 16. Classmate support was significantly negatively correlated with anxiety at T3 ($r = –.084$, $p < .001$), indicating that adolescents who experienced more support from classmates reported lower anxiety symptoms at age 16. No other associations were found for adolescents' anxiety.

Finally, gender showed several significant associations. Gender showed a small to moderate negative correlation with adolescents' anxiety symptoms at T1 ($r = –.111$, $p < .001$) and T3 ($r = –.286$, $p < .001$), indicating that girls reported higher levels of anxiety than boys at both age 11 and

16. Gender was also negatively correlated with classmate support ($r = –.153$, $p < .001$), indicating that girls perceived more support from classmates than boys. Furthermore, SES showed a small negative correlation with parental anxiety ($r = –.060$, $p < .05$), indicating that parents from lower SES backgrounds reported more anxiety.

Linear regression analysis

A linear regression analysis was conducted to examine the association between chronic illness and adolescents' generalized anxiety symptoms, as well as the potential moderating roles of parental anxiety and classmate support (see Table 2).

Table 2

Linear Regression Coefficients for Predictors of Adolescents' Anxiety at T3

N = 1400	*B*	*SE (B)*	β	95% CI	*F*	*df*	*p*	ΔR^2
Model 1					60.152	2	< .001	.079
Gender	-.233***	.021		[-.275, -.191]			<.001	
SES	.015	.015	.026	[-.014, .045]			.311	
Model 2					43.482	6	< .001	.158
Gender	-.209***	.021		[-.249, -.168]			<.001	
SES	.019	.014	.032	[-.010, .047]			.194	
Anxiety T1	.291***	.056	.253	[.141 .362]			<.001	
Chronic illness	.006	.025		[-.043, .056]			.800	
Parental anxiety	.034	.025	.033	[-.015, .038]			.176	
Classmate support	-.009	.016	-.014	[-.041, .023]			.580	
Model 3					33.242	8	.763	.103
Gender	-.214***	.053		[-.319, -.110]			<.001	

SES	.016	.014	.028	[-.012, .045]	.259
Anxiety T1	.249***	.056	.250	[.138, .360]	<.001
Chronic illness	.007	.025		[-.042, .057]	.775
Parental anxiety	.021	.029	.021	[-.035, .078]	.454
Classmate support	-.028	.019	-.044	[-.066, .009]	.135
Illnes x ParAnx	.047	.058	.023	[-.067, .161]	.419
Illness x ClasSup	.072*	.036	.057	[.000, .143]	.048

Note. Standardized coefficients can only be computed for continuous predictors.

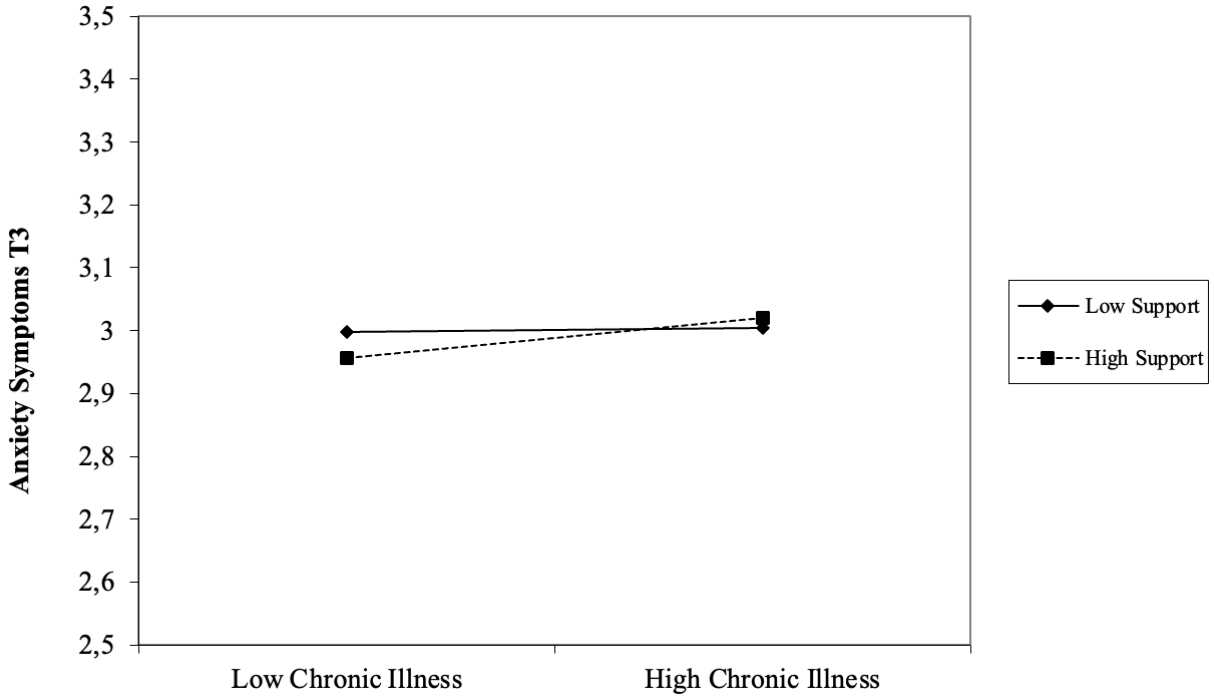
* $p < .05$. ** $p < .01$. ***$p < .001$

Chronic illness was not significantly associated with adolescents' generalized anxiety symptoms in any of the models, indicating that the presence of a chronic illness did not predict higher levels of anxiety at T3. Across all models, gender emerged as a significant predictor, indicating that girls reported higher anxiety levels than boys (Model 3: $B = –.214$, SE = .053, $\beta = –.263$, $p < .001$). Additionally, in Model 2, adolescents' anxiety at T1 was significantly positively associated with anxiety at T3 ($B = .291$, SE = .056, $\beta = .253$, $p < .001$), such that previous higher anxiety levels predicted higher anxiety levels over time.

Primarily, a significant interaction effect was found in Model 3 between chronic illness and classmate support ($B = .072$, SE = .036, $\beta = .057$, $p < .05$). As illustrated in Figure 2, this interaction revealed that the association between chronic illness and anxiety symptoms depended on the level of classmate support. For adolescents who experience low levels of support, chronic illness had little effect on anxiety symptoms. In contrast, for adolescents with high classmate support, chronic illness was associated with more anxiety symptoms. Notably, in the absence of chronic illness, high classmate support was associated with lower anxiety, indicating a protective effect for healthy adolescents that does not extend to adolescents with a chronic illness.

Figure 2

Moderating Effect of Classmate Support on the Relationship Between Chronic Illness and Anxiety



Post-hoc analyses

To further explore whether chronic illness was related to adolescents' anxiety symptoms, a post hoc analysis was conducted. A linear regression analysis was performed to examine whether chronic illness was associated with anxiety symptoms at T3 without controlling anxiety at T1. These results also showed no significant effect of chronic illness on anxiety symptoms (B = .008, SE = .026, β = .008, p = .752). This indicates that the presence of a chronic illness does not significantly predict subsequent levels of anxiety symptoms in adolescents at T3, even when prior anxiety symptoms at T1 are not controlled for.

Discussion

The present study aimed to examine whether adolescents with a chronic illness experience higher levels of generalized anxiety symptoms over time compared to their peers without a chronic illness. It was also investigated whether parental anxiety and classmate support moderated

this association. Results showed that chronic illness was not associated with an increase in adolescents' anxiety symptoms over time. Furthermore, no moderation effect was found for parental anxiety. Classmate support however, did appear to have a moderating effect. These results imply that the relationship between chronic illness and anxiety symptoms is primarily present among adolescents who receive high levels of classmate support.

In contrast with Hypothesis 1, the findings show that adolescents with a chronic illness did not report higher levels of generalized anxiety symptoms over time. This finding contradicts the transactional stress and coping model (Thomspon et al., 1998) and related empirical work (Compas et al., 2006; Hocking et al., 2010), which indicated that adolescents with chronic illnesses are tend to use disengagement coping strategies, making them more vulnerability to experience anxiety. Additionally, earlier findings suggested that this increased risk may be attributed to illness-related stressors, such as unpredictability of symptoms and frequent hospital visits (Pao & Bosk, 2011). The way chronic illness was assessed in the present study may explain why there is no association between chronic illness and adolescents' generalized anxiety symptoms. Since chronic illness was operationalized as a binary variable, the analysis may have overlooked important differences in illness severity or perceived burden. According to the transactional stress and coping model (Thomspon et al., 1998) chronic illness can act as a stressor, but the psychological impact depends on illness characteristics. If most of the adolescents had less severe illnesses and did not perceive their illness as threatening, these factors may explain why no association with anxiety symptoms was found. The present study did not take specific characteristics of chronic illness into account. However, previous research has shown the importance of doing so. For example, Hommel et al (2003) operationalized chronic illness in terms of illness severity and illness uncertainty and found an association between illness uncertainty and anxiety in adolescents. This finding suggest that not all chronic illnesses have the same psychological impact. Future studies should therefore include these illness-specific

characteristics to find a potential relationship and develop a more nuanced understanding of the association between chronic illness and anxiety in adolescents.

In contrast with Hypothesis 2, the findings show that the association between chronic illness and adolescents' generalized anxiety symptoms is not stronger for the group with more parental anxiety. This finding contradicts previous empirical work (Cobham et al., 2020), because it was found that parental anxiety can negatively influence adolescents' psychological adjustment and how they cope with having a chronic illness. The lack of a moderating effect might be because how adolescents view their parents' support is more important than parental anxiety when it comes to the association between chronic illness and anxiety. This could be an explanation because several studies emphasise the importance of perceived parenting as a risk factor or possible mechanism through which anxiety is reinforced during adolescence (McClure et al., 2001; Wolfradt et al., 2003). It is not necessarily the presence of anxiety in parents, but how adolescents perceive their parents' behaviour in response to their chronic illness that can increase their feelings of anxiety (McClure et al., 2001). Adolescents with a chronic illness who perceive parenting as overprotective may feel more stressed or socially restricted, which can contribute to their anxiety. In contrast, adolescents without a chronic illness who perceive parenting as less controlling may feel more autonomy which can lead to better psychological outcomes (Nickerson & Nagle, 2005). The present study only assessed parental anxiety, not the adolescent's perception of parenting behaviour. Therefore, the lack of moderating effect may be explained by this missing mechanism. Future research should examine whether adolescents' perceived parenting plays is more of an influence rather than parental anxiety in the relationship between chronic illness and anxiety symptoms.

The findings of the present study seem to support the third hypothesis that classmate support may play a moderating role in the relationship between chronic illness and anxiety symptoms in adolescents. The result of this study indicates that this effect of peer support

primarily appears in adolescents experiencing high support. In adolescents with low levels of support, the relationship between chronic illness and anxiety seems to be absent. It should be noted, however, that the relationship was only borderline significant. Furthermore, the appearance of a positive effect rather than a negative effect between chronic illness and anxiety in adolescents who experience high support was unexpected based on the hypothesis. This finding contradicts related empirical work (La Greca et al., 2002) and the transactional stress and coping model (Thomspon et al., 1998), which demonstrate that peer support can act as a protective factor, helping adolescents to cope with stressors related to their chronic illness and decrease feelings of anxiety. The absence of a negative moderating effect could indicate an altered function of classmate support among adolescents with chronic illness. A possible explanation is that classmate support leads to more pressure to 'fit in' rather than protection. Previous findings indeed suggest that adolescents with high levels of support experience a stronger need to conform to the physical and social standards of their peers (Jackson, 2012). According to Blakemore and Mills (2013) it appears that the need to be accepted by peers is particularly acute during adolescence and can reinforce feelings of anxiety. This may be particularly true for adolescents with chronic illness, who may already feel different from their healthy peers (La Greca et al., 2002).

Nonetheless, in contrast to the present study, in which an effect only appears to be present in adolescents who experience high support, Oris et al. (2015) found no difference in peer support groups in their study regarding the relationship between chronic illness and mental well-being. Differences in operationalizations of the construct peer support could possibly explain these variations. The present study approached peer support as perceived classmate support, while the study of Oris et al. (2015) operationalised the concept as quality of communication, the degree of trust and alienation in peer relationships. In addition, previous studies emphasise that peer support in the context of chronic illness is often defined as support from someone with a shared life

experience (Lewis et al., 2016; Evans et al., 2021). When peer support is approached in this way, it might be more effective in providing support in a protective way rather than classmate support. Future research should consider a typological approach for assessing peer support in adolescents with chronic illness. For instance, differentiate between general peer support and groups that are primarily focused on shared experiences. This could contribute to a better understanding of how and for whom peer support is actually protective in promoting adolescents' well-being.

Strengths and limitations

Despite the longitudinal design of this study and the inclusion of a large sample of adolescents, the findings should be interpret with some caution. First, the present study did not differentiate between types of chronic illnesses. This approach grouped all adolescents with a chronic illness together, irrespective of their severity, visibility, or frequent hospital visits. This methodological choice may have influenced the results, as psychological outcomes can vary depending on illness-specific characteristics (Schmidt et al., 2002). Future research could address this limitation by including more detailed medical information. For instance, the study by Bennett et al. (2021) focuses specifically on adolescents receiving treatment in a paediatric hospital. Comparing such a clinical sample to a healthy control group could offer relevant insights into the role of specific chronic illnesses and their severity in adolescents' mental health. Second, following recommendations from previous studies (Oris et al., 2015; Sweeney & Wilson, 2023), maternal and paternal anxiety were combined into a single parental variable to reflect overall parental influence. However, substantially fewer fathers with anxiety ($N = 95$) were included in this study compared to mothers ($N = 280$). Future research with more balanced samples of mothers and fathers will be necessary to more reliably examine the role of parental effects in this context. Third, the time span of three years between measurement waves may have limited the ability to identify important developmental fluctuations and transitions. Additionally, attrition bias should be taken into account when interpreting the results of the present study. The final sample

may not be fully representative of the original population, as adolescents with fewer anxiety symptoms are underrepresented. Although the difference in anxiety levels between dropouts and participants who remained is relatively small, this may affect the external validity of the present study. Future research could benefit from including shorter measurement intervals to reduce attrition and better capture developmental changes. Despite these limitations, the findings provide important insights into the long-term associations between chronic illness and anxiety symptoms in adolescence.

Conclusion and implications

The present study took a first step in exploring the potential role of parental anxiety and classmate support as moderators of the association between chronic illness and adolescents' generalized anxiety symptoms. Contrary to expectations, it was found that chronic illness did not lead to an increase in adolescent anxiety symptoms over time. Furthermore, this study found no moderating effect of parental anxiety. However, peer support did appear to influence the relationship between chronic illness and anxiety. This finding indicates that for adolescents who experience high classmate support, chronic illness leads to more anxiety symptoms. In contrast, for adolescents who experience low classmate support, the association between chronic illness and anxiety is absent.

By combining a longitudinal approach with the exploration of moderating factors such as parental anxiety and classmate support, this study makes an important contribution to existing research on chronic illness and psychological well-being in adolescents. Theoretically, the findings provide an important insight that peer support does not always play a protective role but may act differently depending on the context. Whereas previous research approached peer support as a buffer against stressors, the current results suggest that peer support may also be associated with increased pressure to conform to the standards of peers. This highlights the importance of a

more nuanced approach to the context in which peer support operates, such as how it can be different for adolescents with a chronic illness. Additionally, the present study provides an important insight that illness-specific characteristics, such as severity and uncertainty of symptoms, are crucial to include when studying the psychological impact of a chronic illness. Furthermore, the present study is relevant for society because it seems that classmate support on its own does not appear to have the expected protective effect in reducing anxiety symptoms in adolescents with a chronic illness. Practice may benefit from exploring alternative forms of support, such as peer support groups. Healthcare institutions or schools could play a proactive role in facilitating access to these groups. A promising example is the "Classmate Support Model" by Lindgren et al. (2016), which shows that classmates are willing to act as ambassadors and provide support if they are properly informed and guided. Future intervention developers could draw on this model as inspiration for designing structured peer support programs tailored to adolescents with chronic illnesses.

In conclusion, the aim of this study was to examine whether there is an association between chronic illness and generalised anxiety symptoms over time and whether parental anxiety and classmate support play a moderating role. Results showed that chronic illness was not a predictor of increasing anxiety and that parental anxiety had no reinforcing effect. However, classmate support did appear to moderate the association between chronic illness and anxiety in an unexpected way. The most important message of this study is that peer support is not necessarily in every form protective for adolescents with chronic illnesses. Depending on the context, support may even be associated with additional pressure and anxiety. This highlights the need to focus on adolescents' social environment, both in research and in practice. Only then can we really contribute to their mental well-being.

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Appendix I

Reflection on Interdisciplinarity

Research into the development of anxiety in adolescents with a chronic illness is complex and it can be very valuable to gain insights from multiple disciplines. In this way we connect different (sub)fields to better or deeply understand the problem. Besides my own discipline pedagogical sciences, it is also interesting to look closer at medical, psychological and social aspects.

Firstly, a medical ethical perspective can help us understand how we define health and illness in adolescents. For example, this perspective gives us a chance to get a deeper knowledge of what it means for adolescents to grow up with a condition that others might not see or understand. Maybe this will shed a light on concepts like stigma, autonomy and quality of life. I think these concepts are very important in this vulnerable period of time and can have an impact on psychological outcomes.

Secondly, developmental psychology may add another layer helping us understand why adolescence is such a vulnerable period. There can be a focus on how emotional and cognitive development in this phase can make adolescents more vulnerable to stress and peer pressure especially when they also have to cope with a chronic illness. It may also be interesting to integrate the developmental psychology with the medical ethical perspective for more knowledge. For example, when an adolescent does not feel seen or accepted by others because of their illness, it can impact their development just as much as the illness itself.

Additionally, gender studies may provide more insights into interpreting the results of my thesis. For example, in my thesis gender came out to be an extremely impactful predictor for adolescents'' anxiety. In the literature this is something that has been studied a lot as well, so this gender difference is not completely new. Yet, the discipline of gender studies can take a closer

look at how the impact of facilitators and barriers (like classmate support and parental anxiety) can differ between boys and girls. I think this might have to do with gender norms and expectation patterns. It is also closely linked to developmental psychology, so we can integrate these disciplines to get a deeper knowledge of how there are gender differences in adolescents ways of dealing with a chronic illness. They might have different needs, which we can try to theoretically understand better to come up with a better support system from a young age to prevent anxiety in a later stage.

I also believe that the systems theory is a valuable lens to add. These adolescents grow up in a system with parents, schools, peers, and healthcare professionals. All these actors play a role in shaping how an adolescent deals with illness and anxiety. In my thesis I was already aware of this and included parental anxiety and classmate support. But future research could explore this system more systematically by looking at different (two-way) interactions. For example, it may be possible that the way parents react to the illness is of influence on how others treat the adolescent.

Another important part of interdisciplinarity is including the perspectives of stakeholders. In my thesis I used existing data, but I often felt the need to meet the participants and just talk to them. Insights from adolescents themselves are essential. When adolescents share their experiences, we can learn from their stories and needs. In this way we get a chance to find out ‘how’ having a chronic illness can impact their lives and not just ‘that’ it impacts their psychological outcomes. Each illness and each adolescent is different, with a story of their own. Also, I think it is important to stay close to the experiences of adolescents themselves because they are the ones we want to help. If we would like to develop an intervention for example, we need to identify their needs.

This is also why I believe qualitative research would be valuable in future research. Interviews or even video diaries could allow participants to express themselves in their own

words. My thesis process and my internship at UMC Utrecht changed the way I think about research altogether. I really have a passion for research on the psychological experiences of children and adolescents with chronic illnesses. It has shown me how insightful it is when adolescents are not just subjects of research but co-creators of knowledge. Their input makes the science behind it more meaningful.

Appendix II

AI Statement

For this document, I used artificial intelligence (AI) as a tool to assist in improving spelling/grammar of the original text. Specifically, I employed OpenAI's ChatGPT to help with the following:

- **Synonyms**: I provided the original draft of the text and asked for suggestions of which other words fit the sentence as well to avoid redundancy.
- **Structure**: I provided the text I wrote and asked whether the structure is clear or needs some improvement, for example by adding linking words.
- **Structuring the post-hoc analyses section**: I asked for guidance on how to describe the results of my post hoc analyses.
- **Gain inspiration for integrating my interdisciplinary reflection**: I asked for suggestions on how the theorethical and methodological insights I wrote down in my interdisciplinary reflection could be helpful for writing the discussion section. My goal was to gain inspiration for how I could use my insights to deepen the interpretation of my findings.
- **Formulating the abstract**: I first asked what elements need to be included in a good scientific abstract. Then I provided the most important sentences of my introduction, methods, results and conclusion sections and asked for guidance in summarizing these so I could write my abstract.

Prompts used:

1. For example, "How can I change the word therefore/amplify/indicating that?" - This prompt was used to request AI assistance in suggestions for synonyms to improve my word choice.

2. “Is the structure of this text clear?” - This prompt was used to ask for feedback on improving the structure of the original text I wrote.
3. "Can you give an example for how to describe my post-hoc analyses for the Pearson correlation and the linear regression analysis when I want to explain whether there is an association between chronic illness and anxiety?” - This prompt was used to help formulate a clear description of results because I didn't know exactly how that worked with a post-hoc analysis.
4. "How can I use the theorethical and methodological insights of my interdisciplinary reflection appendix to be creative in my discussion section? I really want to use the insights I formulated, but I don't know how to use them in relation to my results.” - This prompt was used to ask for inspiration for linking my interdisciplinary reflection to the interpretation of my results.
5. “What elements need to be in a good scientific abstract?” & “Can you summarize these most important parts of my thesis so that I can formulate my abstract?” - This prompt was used to guide the formulation of my final abstract.

The final output reflects my understanding of the original content and learning goals, and I am fully responsible for the final submission.

End of AI Statement