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Pain and Quality of Life in Chronic Tic Disorders: The Role of Resilience, Sense of Coherence, and Illness Acceptance

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Abstract

Aim: While tics constitute the primary symptom of tic disorders, the associated pain remains a significant yet frequently overlooked aspect of functioning for individuals with these conditions. Repetitive, rapid movements and vocalisations can lead to chronic discomfort, impacting daily functioning and quality of life. This study aimed to evaluate the influence of tic-related pain on the quality of life in adults, and to examine the role of personal resources – resilience, sense of coherence, and illness acceptance – in these relationships.

Method: The study involved 76 adults diagnosed with Gilles de la Tourette Syndrome or chronic motor tics disorder. The following instruments were utilised: the Polish adaptation of the *Yale Global Tic Severity Scale* (YGTSS), a *Visual Analogue Scale* (VAS) for assessing tic-related pain, the abbreviated *World Health Organisation Quality of Life Questionnaire* (WHOQOL-BREF), the *Sense of Coherence Scale* (SOC-29), the *Psychological Resilience Measurement Scale* (SPP-25), and a sociodemographic questionnaire.

Results: Tic severity was positively correlated with pain, with this relationship being stronger among women. The most intense pain was significantly associated with a lower quality of life in the psychological domain, and regression analysis confirmed that higher levels of pain were significantly linked to poorer psychological well-being. Resilience correlated positively with all quality of life domains. A general sense of coherence was significantly associated with lower pain and a higher quality of life across all domains, while illness acceptance correlated negatively with pain and demonstrated a significant mediating effect in the relationship between pain and psychological quality of life.

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Conclusion: Tic-related pain substantially diminishes quality of life, particularly in the psychological dimension. Psychological resources – resilience, sense of coherence, and illness acceptance – play a crucial protective role, underscoring the necessity of strengthening these resources within clinical interventions.

Keywords: Tourette Syndrome, pain, quality of life, resilience, sense of coherence, illness acceptance

Gilles de la Tourette Syndrome (GTS) and chronic tic disorders are neurodevelopmental conditions typically manifesting in childhood. They are characterised by the presence of motor and/or vocal tics persisting for a minimum of one year, with tics exhibiting variability in number, type, and severity (Jankovic & Kurlan, 2011). The prevalence of GTS, the most common of the tic disorders, is estimated at 1% in the paediatric population and approximately 0.01% among adults; GTS is diagnosed four times more frequently in males than in females (Yilmaz & Jankovic, 2025). Research indicates a significant role for genetic factors in the pathogenesis of tic disorders, with a polygenic susceptibility model appearing most probable (Qi et al., 2019). The majority of individuals with tics present with at least one co-occurring condition, most frequently including attention-deficit/hyperactivity disorder (ADHD), obsessive-compulsive disorder (OCD), depression, anxiety disorders, conduct disorders, sleep disturbances, migraines, self-injurious behaviour (SIB), and autism spectrum disorder (ASD) (Robertson, 2015). This underscores the heterogeneity and complexity of tic disorders.

Adults and adolescents with tics exhibit a significantly reduced quality of life compared to individuals without involuntary movements and vocalisations (Watson et al., 2024). Psychologically, quality of life is understood as a subjective evaluation of the positive and negative aspects of one's life situation in relation to individual values, goals, and expectations. In contrast, the medical perspective more frequently emphasises its health-related dimension (HRQoL), defined as the impact of health status, symptoms, and functioning on overall life satisfaction (Karimi & Brazier, 2016). According to the WHO concept, quality of life is a multidimensional construct encompassing four domains of functioning: physical, psychological, social, and environmental (WHOQOL Group, 1998). Recent research indicates that the diminished quality of life in individuals with tics stems not only from the involuntary movements or vocalisations themselves but also from numerous co-occurring difficulties that collectively impair psychological and social functioning (Szejko et al., 2024). In discussions concerning the determinants of quality of life in individuals with tic disorders, increasing attention is also being paid to tic-related pain, which represents a significant, yet often underestimated, factor contributing to reduced well-being (Green et al., 2025).

Pain is a complex sensory and emotional experience, defined as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (Raja et al., 2020). Contemporary perspectives indicate that both acute and chronic pain should be considered within a biopsychosocial model. This is because the experience of pain is not merely

a direct consequence of a physiological stimulus but rather a personal experience resulting from the dynamic interaction of biological, psychological, and social factors (Cheatle, 2016). In the context of chronic pain, which persists for longer than three months, the significance of these factors becomes particularly pronounced, and pain can evolve into a dominant clinical issue, partially independent of its primary somatic origin (Treede et al., 2019).

Research on chronic pain further demonstrates that its impact on quality of life is multifaceted, extending beyond the physical domain to encompass emotional, social, and cognitive consequences. Chronic pain has been shown to correlate with impaired functioning in daily activities, sleep, social participation, and professional work. Moreover, it is associated with heightened psychological distress and cognitive difficulties, collectively contributing to a diminished quality of life (Anselmo et al., 2024; Hadi et al., 2019). These associations stem from the understanding that the experience of pain is influenced not solely by stimulus intensity but also by its interpretation, affective responses, and coping mechanisms. Neuroimaging studies corroborate this by revealing that cortical processing of pain more strongly reflects the evaluation of its unpleasantness than its mere intensity, thereby underscoring the critical role of the affective dimension of pain in psychological well-being and quality of life (Stankewitz et al., 2023). Within this framework, pain associated with tics should not be regarded as a secondary, minor symptom of involuntary movements but rather as a potentially significant mechanism contributing to reduced psychological and daily functioning in individuals with tic disorders.

Quality of life is influenced not only by disease-related factors but also by protective resources, which can mitigate the consequences of stressful experiences. These resources include psychological resilience, understood as the capacity to adapt and regain equilibrium following stressful experiences (Southwick et al., 2014); a sense of coherence, which refers to the conviction that life events are predictable, comprehensible, and meaningful (Eriksson & Lindström, 2006); and acceptance of illness, which facilitates constructive adjustment to health limitations and minimises their impact on psychological and functional well-being (Dijkstra et al., 2008). These resources represent crucial mechanisms enabling the maintenance of a satisfactory quality of life, even in the presence of chronic health problems.

The aforementioned premises formed the basis for formulating the following research question: to what extent does tic-related pain influence the quality of life of adults with tic disorders, and do personal resources – resilience, sense of coherence, and acceptance of illness – mediate or moderate this relationship? To address this research question, a set of hypotheses was developed, reflecting the current state of knowledge regarding the psychosocial determinants of well-being in chronic pain.

H1: Higher tic severity will be associated with greater tic-related pain, particularly among women. Previous research indicates that greater tic severity correlates with increased physical discomfort and pain experience, with women more frequently exhibiting stronger sensory and affective reactions to tics than men (Szejko et al., 2024).

H2: A higher level of tic-related pain will be associated with a lower quality of life across all WHOQOL-BREF domains. Studies consistently show that tic-related pain, muscle strain, and fatigue significantly impair physical and psychological functioning, thereby contributing to a reduction in overall well-being (Green et al., 2025).

H3: Higher psychological resilience, a stronger sense of coherence, and greater acceptance of illness will be positively associated with quality of life across all its domains. Personal resources, such as resilience (Yazdi-Ravandi et al., 2013), sense of coherence (Sawma & Sanjab, 2022), and acceptance of illness (Oskędra et al., 2021), are well-established predictors of well-being in chronic illnesses.

H4: It is hypothesised that psychological resilience, sense of coherence, and acceptance of illness will play a significant role in the relationship between tic-related pain and quality of life. Psychological resources are described as important variables related to the appraisal and regulation of chronic symptoms, including pain; in research, they are sometimes conceptualised as potential mediators or factors associated with a weaker link between the burden of illness symptoms and well-being (Min et al., 2013; Southwick et al., 2014; Stuifbergen et al., 2000).

Method

Participants

The study involved 76 adults diagnosed with Gilles de la Tourette Syndrome (GTS) or chronic motor tics disorder (CMTD): 38 men and 38 women aged between 18 and 51 years (M = 31.34, SD = 10.17). Individuals diagnosed with chronic vocal tics did not participate in the study. Of the participants, 31 men and 26 women had a diagnosis of GTS, and 7 men and 12 women had a diagnosis of CMTD. The time since diagnosis ranged from 2 to 48 years, with a mean disease duration of 20 years and 8 months (SD = 12.98).

Measures

The Polish adaptation of the *Yale Global Tic Severity Scale* (YGTSS) (Stefanoff & Wolańczyk, 2005) was utilised to assess motor and vocal tics, including their frequency, intensity, complexity, and overall impairment in daily functioning. The YGTSS comprises two parts: the first part lists simple and complex motor and vocal tics that occurred within the preceding week. The second part evaluates the number, frequency, severity, and complexity of tics, as well as the general impairment to daily functioning, and includes separate subscales for motor and vocal tics. Responses are rated on a 0-to-5 scale, yielding a total score of

up to 100 points. A higher score indicates greater tic disorder severity and associated difficulties in daily functioning. The validation study of the Polish adaptation demonstrated acceptable internal consistency (α = .73), and factor analysis confirmed a two-factor structure corresponding to motor and vocal tics.

A *Visual Analogue Scale* (VAS) was employed to assess current and worst tic-induced pain, as well as its location. Pain intensity is rated on a scale from 0 (*no pain/discomfort*) to 10 (*extreme pain/very severe discomfort*). Due to its single-item nature, internal consistency is not calculated for the VAS. Nevertheless, existing research highlights its high reliability and validity (Bijur et al., 2001), rendering it an effective tool for assessing subjective experience of pain.

The World Health Organisation's *Quality of Life Questionnaire* – short version (WHOQOL-BREF), consisting of 26 items, was used to evaluate quality of life across four domains: *Physical Functioning* (activities of daily living, energy, pain, sleep), *Psychological Well-Being* (self-esteem, emotions, cognitive functions, spirituality), *Social Relationships* (interpersonal contacts, social support, sexual activity), and *Environment* (financial resources, sense of security, healthcare, home conditions, leisure time, transport). Additionally, it includes two items assessing global quality of life and self-rated health. Responses are provided on a 5-point scale, with higher values indicating a higher quality of life. The Polish adaptation of this instrument was developed by Wołowicka and Jaracz (2001) and exhibits satisfactory internal consistency. In the validation study, Cronbach's alpha coefficients: .81 for the physical domain, .78 for the psychological, .69 for the social, and .77 for the environmental, while the overall questionnaire achieved a value of .90.

The Polish adaptation of Antonovsky's *Sense of Coherence Questionnaire* (SOC-29) (Koniarek et al., 1993) was utilised to assess the sense of coherence. It comprises 29 statements across three subscales: *Comprehensibility* (perceiving life as ordered and predictable), *Manageability* (reflecting the belief in one's ability to cope with difficulties using available resources), and *Meaningfulness* (associated with perceiving life challenges as worthy of engagement). Respondents rate each item on a 7-point Likert scale, with the total score ranging from 29 to 203 points; higher values indicate a stronger sense of coherence. The Polish adaptation of the instrument demonstrates satisfactory internal consistency, with an overall score α = .78.

The study also employed the *Psychological Resilience Measurement Scale* (SPP-25) by Ogińska-Bulik and Juczyński (2008). In addition to an overall score, the scale allows for the assessment of five dimensions of resilience: *Perseverance and Determination in Action* (perseverance), *Openness to New Experiences and a Sense of Humour* (openness), *Personal Competencies in Coping and Tolerance of Negative Emotions* (competencies), *Tolerance for Setbacks and Viewing Life as a Challenge* (tolerance for setbacks), and *Optimistic Attitude Towards Life and the Ability to Mobilise in Difficult Situations* (optimism). In validation studies, the scale demonstrated high reliability for the overall score, achieving a Cronbach's alpha coefficient of α = .89. Reliability coefficients for individual subscales ranged from .67 to .75, with perseverance at .72, openness at .68, competencies at .74, tolerance for setbacks at .67, and optimism at .75.

The *Acceptance of Illness Scale* (AIS), adapted into Polish by Juczyński (2009), is a self-report instrument used to assess the degree of acceptance of one's illness. It reflects the extent to which an individual has adapted to the limitations and consequences resulting from a chronic condition. Responses are given on a 5-point Likert scale, and the total score ranges from 8 to 40 points; higher values indicate greater acceptance of the illness. The description of the Polish adaptation indicated good internal consistency ($\alpha = .85$) and satisfactory score stability ($r = .64$).

Furthermore, a sociodemographic questionnaire was administered to collect demographic and health data, including co-occurring disorders. Certain questions regarding pain coping strategies and treatment evaluation were not included in the analyses presented in this article.

Research Procedure

Data were collected in July 2023. The research sample comprised members of support groups for adults with tics, operating in various locations across Poland. Participants were requested to complete a set of paper-based questionnaires, with no time constraints imposed for their completion. Additionally, one of the research instruments (YGTSS) involved a one-on-one interview conducted online within one week following the submission of the paper questionnaires. Consequently, the sample size was determined by participant availability and willingness to participate in the study, rather than by a formal sample size calculation or statistical power analysis. All participants were informed of the study's objective, and their informed consent to participate was obtained. Inclusion criteria were: a diagnosis of GTS or chronic motor or vocal tics, established by a physician in accordance with DSM-5, and an age of ≥18 years. Participants retained the option to withdraw from the study at any stage, without the requirement to provide a reason.

Data Analysis

Descriptive statistics and Pearson's correlation coefficients were calculated for pain (current and worst), tic severity, quality of life domains, resilience, sense of coherence, and acceptance of illness. Differences in pain severity between women and men were tested using the Mann–Whitney *U* test, which was justified by the violation of the normality assumption and the small sample sizes of the compared groups. The association between pain and psychological quality of life was analysed using linear regression. The roles of resilience, SOC, and acceptance of illness in the relationship between pain and QoL were investigated using mediation and moderation models; indirect effects were estimated using bootstrapping (5,000 bootstrap samples, 95% CI) in accordance with the recommendations of Preacher and Hayes (2008). A significance level of $\alpha = .05$ (two-tailed tests) was adopted, and analyses were conducted on the entire sample and separately by sex. Furthermore, a sensitivity analysis for correlation tests ($\alpha = .05$,

power = .80) was performed, which indicated that with this sample size, it was possible to detect effects of at least $r = .43$.

Results

Tic-Related Pain

Pain experienced from tics was reported by 73.7% of participants (56 out of 76 subjects). No significant sex differences were observed for either current or worst pain ($p > .05$). Tic severity correlated positively with pain levels only in women ($r = .68–.80$, $p < .01$), whereas this relationship did not reach statistical significance in men.

Tic-Related Pain and Quality of Life

Correlation coefficients between current and worst pain and quality of life (QoL) across the four WHOQOL-BREF domains (physical, psychological, social, and environmental) are presented in Table 1. The analysis revealed that only worst pain was significantly negatively correlated with quality of life in the psychological domain ($r = –.42$, $p = .009$). No significant associations were noted in the other domains for any pain indicator, and current pain intensity was not significantly related to any dimension of quality of life ($p > .05$).

Table 1

The Relationship Between Tic-Related Pain Intensity and Quality of Life Domains (WHOQOL-BREF)

Pain intensity	Quality of life domains			
	Physical	**Psychological**	**Social**	**Environmental**
Current pain	$r = –.16$	$r = –.25$	$r = –.05$	$r = –.06$
Worst pain	$r = –.28$	$r = –.42$*	$r = –.02$	$r = –.07$

Note. All values are Pearson's correlation coefficients (r).
* $p < .01$.

Regression analysis results corroborated these relationships: worst pain remained significantly associated with lower quality of life in the psychological domain ($b = –4.11$, $p = .009$, $R^2 = .17$). No significant mediation or moderation effects of pain were found in the relationship between tic severity and quality of life ($p > .05$).

Psychological Resilience

Resilience exhibited a strong positive correlation with all domains of quality of life across the entire sample. In gender-specific analyses, differences were primarily observed in the environmental domain, which remained not significantly associated with resilience in women. Detailed correlation coefficients for the dimensions of resilience are presented in Table 2. Resilience was not significantly correlated with either current or worst pain, both in the overall sample and in gender-specific analyses (all $p > .05$).

Table 2

Correlations Between Resilience Dimensions and Quality of Life Domains (WHOQOL-BREF)

Resilience dimension	Quality of life domain											
	Physical			Psychological			Social			Environmental		
	T	M	W	T	M	W	T	M	W	T	M	W
Perseverance	.47*	.60*	.37	.30	.46*	.14	.38*	.54*	.25	.27	.66*	–.11
Openness	.51*	.65*	.42	.70**	.75**	.70**	.66**	.70**	.71**	.49*	.52*	.41
Competence	.70**	.75**	.67*	.49*	.42	.59*	.44*	.45	.42	.49*	.65*	.20
Tolerance for setbacks	.65**	.81**	.58*	.72**	.77**	.71**	.70**	.81**	.65*	.51*	.76**	.20
Optimism	.68**	.86**	.48*	.55**	.65*	.41	.48*	.54*	.41	.48*	.74**	.06

Note. T – total sample; M – men; W – women. All values are Pearson's correlation coefficients (r).
* $p < .05$; ** $p < .001$.

Sense of Coherence (SOC), Pain, and Quality of Life

As depicted in Table 3 (p. 193), a higher overall sense of coherence was associated with lower pain intensity and improved quality of life across all WHOQOL-BREF domains. In the full sample, SOC was negatively correlated with pain and positively correlated with quality of life. A similar pattern was observed in analyses conducted separately for men and women, with stronger associations noted among men. In men, the sense of coherence was significantly associated with both pain intensity and all quality of life domains. In women, however, coherence was positively and significantly associated with all quality of life domains, while its associations with pain did not reach statistical significance.

Moderation analysis revealed no significant association between the overall sense of coherence and the strength of the relationship between pain and psychological quality of life; the pain × SOC interaction was not significant in either the full sample ($b = -.07$, $SE = .11$, $t = -.64$, $p = .528$) or in sex-stratified analyses

($p > .17$). Mediation analysis indicated a statistically significant indirect effect for the overall SOC score. Higher pain intensity was significantly associated with a lower level of coherence (path a: $b = -1.52$, $SE = 0.64$, $t = -2.37$, $p = .023$, 95% CI [−2.82, −.22]). A higher level of coherence, in turn, was significantly associated with a higher psychological quality of life when controlling for pain (path b: $b = 1.31$, $SE = 0.27$, $t = 4.85$, $p < .001$, 95% CI [.76, 1.86]).

Table 3

Correlations Between Overall Sense of Coherence, Tic-Related Pain, and Quality of Life Domains (WHOQOL-BREF)

	Sense of coherence (overall)		
	Total sample	**Men**	**Women**
Pain intensity			
Current pain	$r = -.36$*	$r = -.40$*	$r = -.31$
Worst pain	$r = -.41$**	$r = -.44$**	$r = -.34$
Quality of life domain			
Physical	$r = .59$***	$r = .61$***	$r = .55$***
Psychological	$r = .62$***	$r = .72$***	$r = .51$***
Social	$r = .48$***	$r = .58$***	$r = .36$*
Environmental	$r = .53$***	$r = .49$***	$r = .47$***

Note. All values are Pearson's correlation coefficients (r).
* $p < .05$; ** $p < .01$; *** $p < .001$.

The total effect of pain on psychological quality of life was significant (path c: $b = -4.11$, $SE = 1.49$, $t = -2.75$, $p = .009$, 95% CI [−7.14, −1.08]). However, after accounting for the mediator, the direct effect weakened and did not reach statistical significance (path c': $b = -2.12$, $SE = 1.20$, $t = -1.77$, $p = .085$, 95% CI [−4.55, .31]). The indirect effect was significant (ab = −1.99, BootSE = 0.87, 95% CI [−3.89, −.41]), which is consistent with a partial mediating effect of the overall sense of coherence in the analysed relationship. The model for the mediator explained 13.5% of the variance in the sense of coherence, $F(1, 36) = 5.62$, $p = .023$, while the final model explained 52.0% of the variance in psychological quality of life, $F(2, 35) = 18.92$, $p < .001$.

Additionally, analyses of the three components of SOC indicated that the sense of comprehensibility was consistently associated with a higher quality of life across all its domains ($r = .59$–$.74$, $p < .001$). Conversely, the sense of manageability ($r = -.34$ to $-.55$, $p \leq .035$) and the sense of meaningfulness ($r = -.50$ to $-.67$, $p \leq .001$) exhibited negative associations, which may reflect more complex coping processes within the studied group.

The components of the sense of coherence displayed only weak, statistically non-significant associations with pain: the sense of comprehensibility showed a negative association, while the senses of manageability and meaningfulness showed positive associations.

Acceptance of Illness

Acceptance of illness was significantly associated with lower pain and higher psychological quality of life ($r = –.40$ to $–.44$, $r = .64$, $p < .05$). Mediation analysis indicated that acceptance of illness mediated the relationship between worst pain and psychological quality of life. A higher level of worst pain was associated with lower acceptance of illness (path a: $b = −1.75$, $SE = 0.59$, $t = −2.96$, $p = .005$, 95% CI [−2.95, −.55]), and higher acceptance of illness was associated with higher psychological quality of life after controlling for pain (path b: $b = 1.42$, $SE = 0.35$, $t = 4.02$, $p < .001$, 95% CI [.70, 2.13]). The total effect of worst pain on psychological quality of life was significant (path c: $b = −4.11$, $SE = 1.49$, $t = −2.75$, $p = .009$, 95% CI [−7.14, −1.08]), whereas the direct effect ceased to be significant after accounting for the mediator (path c': $b = −1.62$, $SE = 1.40$, $t = −1.16$, $p = .253$, 95% CI [−4.46, 1.21]). The indirect effect was significant: ab = −2.48; BootSE = 0.88, 95% CI [−4.29, −.83]. The model for the mediator explained 19.5% of the variance in acceptance of illness, $F(1, 36) = 8.75$, $p = .005$; while the final model explained 43.5% of the variance in psychological quality of life, $F(2, 35) = 13.47$, $p < .001$.

Discussion

The aim of the present study was to determine the relationship between tic-related pain and the quality of life in adults with chronic tic disorders, and to evaluate the role of psychological resources – resilience, sense of coherence, and acceptance of illness – in these relationships. Most of the findings confirmed the initial hypotheses, while simultaneously revealing the complex nature of the mechanisms under investigation. A key conclusion drawn from the study is that episodes of tic-related pain at their highest intensity are more significant for psychological quality of life than the current pain level, and their association with well-being is linked to psychological resources, particularly illness acceptance and sense of coherence.

In line with the hypothesis, greater tic severity was associated with more intense pain, with this relationship being particularly pronounced among women. This finding suggests that biomechanical overload resulting from intense tics may constitute a significant mechanism for pain generation, and simultaneously may be moderated by biological sex factors – including differing somatosensory sensitivity, more frequently reported in women (Szejko et al., 2024). A similar phenomenon has been observed in Parkinson's disease, where women reported

significantly greater intensity of somatic pain related to motor symptoms than men (Beiske et al., 2009). In other movement disorders, such as dystonia (Martino et al., 2024), Huntington's disease (Sprenger et al., 2021), or multiple system atrophy (MSA) (Campese et al., 2023) – women also more frequently reported the occurrence of pain and a greater burden associated with it, although sex differences in its intensity were not reported.

This pattern indicates that the differences observed in the present study may result from a combination of factors: biological factors influencing pain perception (Failla et al., 2024), and psychological and social factors determining how pain experiences are reported and regulated. Research on chronic pain shows that men more often use action-oriented coping strategies, which may result in lower levels of reported pain in self-report measures (El-Shormilisy et al., 2015). A similar phenomenon has been described in the context of tics, where men more frequently relied on self-suggestion to facilitate coping and on increasing activity as a way to reduce pain (Małek, 2025). It can therefore be assumed that the relationship between tic severity and the pain they induce is not universal and may be modified by sex-related factors, coping strategies used, and individual sensory profiles, rather than solely by symptom intensity.

In the analysed model, only pain at its highest intensity was significantly associated with lower psychological quality of life. Previous research on the quality of life of individuals with tics indicates that reduced psychological well-being most often co-occurs with depressive and anxiety disorders (Isaacs et al., 2021), as well as with reduced self-esteem, feelings of stigmatisation, and social isolation (Watson et al., 2024).

The lack of an association between pain intensity and other domains of quality of life can be interpreted in the context of adaptation of individuals with tics to moderate, repetitive discomfort and the development of compensatory strategies that reduce its impact on daily functioning. Mechanisms of habituation and adaptation to constant sensory stimuli are well-documented with respect to premonitory urges, which – due to the repeatability and predictability of tic patterns – may undergo partial habituation over time (Woods et al., 2025). Neurophysiological studies further indicate that the cortico-striatal-thalamic circuit exhibits the ability for sensory and motor habituation, which may reduce the subjective sensation of discomfort with moderate tic severity (Yael et al., 2015).

It is important that, in the present study, it was not the pain experienced at the time of measurement, but the strongest pain experienced in the past, that was associated with reduced quality of life. Similar associations have been reported in the literature regarding chronic pain in various diseases (Listik et al., 2023; Mutubuki et al., 2020; Paplaczyk et al., 2015). In the context of tic disorders, this may mean that single episodes of exceptionally severe tics and associated overloads are linked to reduced psychological well-being, regardless of the level of pain experienced daily. This result underscores the particular importance of incidental, intense pain experiences as a risk factor for the deterioration of psychological functioning.

The results concerning psychological resources confirmed their significant adaptive role. The strong, positive association of resilience with quality of life

across all WHOQOL-BREF domains in the entire sample, found in this study, is consistent with previous work on chronic pain. Studies of patients with pain disorders show that higher resilience is associated with better quality of life in physical, psychological, social, and environmental dimensions, regardless of age and pain intensity (Yazdi-Ravandi et al., 2013). A similar pattern was demonstrated in young individuals with chronic diseases, where resilience proved to be one of the key predictors of higher quality of life and better psychosocial functioning despite the burden of illness (Oleś, 2015). The results of the current study therefore confirm that resilience also plays an important adaptive role in chronic tic disorders.

The lack of significant correlations between resilience and the intensity of tic-induced pain (current and strongest) can be interpreted in light of theoretical approaches in which resilience is treated primarily as a resource influencing the way the experience of pain is processed and regulated, rather than the intensity of nociceptive stimuli itself. Research indicates that resilience is associated with less distress, better functioning, and less pain interference with activity rather than with a lower level of pain as such (Chng et al., 2022; Goubert & Trompetter, 2017). Experimental and clinical studies also indicate that resilience more often predicts a reduced affective component of pain (suffering, distress) than a direct reduction in its sensory intensity (Hemington et al., 2017). This result suggests that resilience in individuals with tic disorders may primarily support overall well-being, rather than regulate pain perception.

The lack of a significant association between resilience and the environmental domain in women may reflect the fact that this area of quality of life is more strongly determined by external factors – housing conditions, safety levels, access to services and material resources – than by individual psychological resources. Studies using WHOQOL-BREF show that the environmental domain is strongly linked to socioeconomic context and the quality of the physical environment (Chang et al., 2020).

Sense of coherence partially explained the association between pain and psychological quality of life. This finding is consistent with previous research showing that a stronger sense of coherence is associated with better quality of life and lower stress in individuals with chronic illnesses, regardless of disease aetiology, type, severity, or symptom burden (Delgado, 2007; Fok et al., 2005; Galletta et al., 2019; Moons & Norekvål, 2006).

Illness acceptance demonstrated an even stronger effect, indicating a significant mediating role in the relationship between pain and psychological quality of life. This result is consistent with the neurophysiology and neurochemistry of pain, and its cognitive and emotional dimensions – the perception of one's illness and associated affective reactions modify pain sensations (de Walden-Gałuszko, 2001). This resource is associated with lower levels of subjective pain and lower functional disability (Kocjan, 2016), as well as less catastrophising, lower levels of avoidance, and greater engagement in activities despite symptoms (Ramírez-Maestre et al., 2014). The mediation results suggest that these resources are linked not so much to the intensity of pain itself, but to its psychological meaning and consequences for functioning.

Notably, none of the analysed resources (resilience, sense of coherence, illness acceptance) moderated the relationship between pain and quality of life. This finding is consistent with the trend observed in chronic pain research, where personal resources are most often described as direct predictors of well-being or variables mediating the relationship between symptom severity and psychological functioning, and much less frequently as factors buffering the association between pain and quality of life itself (Dymecka & Gerymski, 2020; Xu et al., 2023). It can therefore be assumed that in tic disorders, these resources improve overall functioning and reduce the psychological consequences of pain, but do not act as a buffering factor weakening the direct relationship between pain level and psychological distress. This result is consistent with the interpretation that psychological resources are primarily associated with the overall level of well-being and the way individuals relate to pain, rather than with changing the strength of the relationship between pain and quality of life itself.

The obtained results indicate a complex pattern of relationships related to quality of life in individuals with tics, in which clinical factors (tic severity, pain intensity) and psychological factors (resilience, sense of coherence, illness acceptance) co-occur. Cognitive and emotional processes that mediate pain processing and the protection of psychological well-being appear to be particularly important. In light of these findings, acceptance-based interventions (Acceptance and Commitment Therapy, ACT), psychoeducation, and CBIT (Comprehensive Behavioural Intervention for Tics) seem to be justified directions for clinical interventions in adults with tic disorders. The results of the present study suggest that interventions aimed at developing illness acceptance and a sense of coherence may be particularly important in limiting the negative impact of episodes of severe pain on psychological functioning.

Several important limitations must be considered when interpreting the obtained results. Firstly, the cross-sectional nature of the study precludes drawing conclusions about causal relationships. The mediation analyses allow only for the description of statistical interdependencies between variables, not the direction of influence. Only longitudinal studies would allow for a reliable assessment of whether and to what extent the discussed resources modify the long-term impact of pain on quality of life.

The study relied solely on self-report measurement tools, which are susceptible to, among other things, memory bias or subjective interpretation of symptom severity. The lack of clinical assessments of tic severity and co-occurring disorders, objective pain indicators, and behavioural measures limits the possibility of independently confirming the results based on different data sources.

Although the sample size is comparable to other studies on tic disorders in adults, it remains moderate, especially in the context of analyses stratified by sex and moderation models, which require greater statistical power. Furthermore, the recruitment method may have been associated with a risk of selection bias. Individuals who were functioning relatively well or had greater health awareness may have decided to participate in the study, which consequently limits the generalisability of the obtained results to the entire population of adults with tics. Due to the moderate sample size, and especially the smaller numbers in

analyses conducted separately for women and men, the results of mediation and moderation models should be treated as preliminary and exploratory, requiring confirmation in larger samples.

Fourthly, the study did not control for a number of clinical and psychosocial variables known to affect pain and quality of life in tic disorders, such as co-occurring disorders (e.g., OCD, ADHD, anxiety disorders), pharmacological treatment, severity of premonitory urges, or social support. These factors can modify both the experience of pain and its psychological consequences.

Declarations

Declaration of conflict of interest
The author declares that there are no potential conflicts of interest with respect to the research, authorship, or publication of this article. The author has no relevant financial or non-financial interests to disclose and no competing interests related to the subject matter of this manuscript. Furthermore, the author confirms that she is not affiliated with, nor involved in the activities of, any organization or entity that could have a financial or non-financial interest in the topics or materials discussed in this manuscript.

Entities that contributed to the publication and their contribution
Not applicable

Ethical approval
The study has been approved by the Ethics Committee (number and name of the institution): the Bioethics Committee of the Regional Medical Chamber in Gdańsk (KB-32/23).

Data availability statement
The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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Statements and declarations regarding the use of AI
In preparing this article, the author used artificial intelligence-based tools to proofread the text (EditGPT). The author bears full responsibility for the final content of the manuscript.

Declaration of authors' contributions to the manuscript
Agnieszka Małek: Conceptualization; Data management; Formal analysis; Research; Investigation; Methodology; Project management; Supervision; Resources; Validation; Visualisation; Writing – original draft; Writing – review & editing.

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