The cycle of violence: effects of violence experience, behavior, and attitudes on adolescents' peer rejection networks

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Previous research on adolescent peer networks has mainly focused on friendship networks and their association with violence, but very limited research is available on peer rejection networks. This lack of knowledge hinders the effectiveness of preventing peer rejection and its negative effects. Based on the theory of the cycle of violence, the present study examines the extent to which parental physical abuse experiences, aggressive behavior toward peers and acceptance of violence are related to peer rejection networks at school. Social network analysis with a stochastic actor-oriented model of longitudinal data collected from high school students (Wave 1, $n = 620$; Wave 2, $n = 590$) confirms that adolescents who frequently use aggression toward their peers are more likely to be rejected, especially if those adolescents have experienced abuse. Similarly, peers are more likely to reject adolescents with high levels of accepting violence. The results also show that aggression toward peers generally tends to decrease over time but not for adolescents who reject a larger number of students. For students who reject many peers, aggression frequency increases. From the perspective of resilience theory, peer rejection, when combined with aggression toward peers and acceptance of violence, particularly in female adolescents, creates a significant risk factor for socio-emotional development. Therefore, tackling violence attitudes, experiences and behavior in the school environment and at home is crucial in overcoming the cycle of violence.

KEYWORDS

peer rejection, aggression, physical abuse, violence acceptance, social networks

Introduction

In the early lifespan, children's socio-emotional development is largely influenced by their parents or guardians (Halle and Darling-Churchill, 2016). New social relationships are established when children are at school, which is why the school peer group is of particular importance in this developmental phase of adolescence, as relationships with peers at school become increasingly important as a source of influence and support (Bukowski et al., 2015; Oshri et al., 2017). In contrast to the positive and supportive effects that a peer group can have on adolescents, developmental researchers have also studied problematic peer dynamics, particularly the impact of rejection on socio-emotional development of adolescent students (Coie et al., 1982; Berger et al., 2011). Previous findings suggest that rejection at high-school age can have long-lasting negative effects on development and thus predicts socio-emotional

adjustment in young adulthood (Nelson and Dishion, 2004). Rejection by peers in the sensitive phase of early adolescence can lead to violent behavior, which in turn leads to increased rejection within the peer group (Coie, 1990). Dishion et al. (2008) describe the principle that peer rejection reinforces deviant behaviors and attitudes in the formation of social relationships. This indicates that adolescents with violent behavior toward their peers are at high risk of experiencing very few positive interactions with their peer group compared to adolescents who have high social competence and are prosocial toward their peers.

A deeper understanding of negative peer dynamics in school classroom contexts is therefore particularly important, also with regard to appropriate intervention and prevention programs related to adolescents' socio-emotional development. Despite the importance attributed to this issue, the association between violence at school and peer rejection networks within school classes is largely understudied. The present study aims to examine three different dimensions of violence and their connection to peer rejection in order to shed more light on negative dynamics within the peer group in secondary schools, and, thus provide a basis for more targeted interventions and prevention strategies.

Effects of peer rejection on socio-emotional development in adolescence

Numerous studies have shown that experiencing peer rejection in childhood and adolescence is associated with poor socio-emotional outcomes later in life and, thus, can have severe consequences for rejected youth (Coie et al., 1982; Prinstein and Aikins, 2004; Lev-Wiesel et al., 2006; Masten, 2001). This finding was first highlighted by Hartup (1992) who identified that children who were rejected and isolated by their peer group in school were more likely to experience difficulties in emotion regulation in adolescence and adulthood. Peer rejection is further associated with difficulties in interpersonal relationships and increases the risk of developing aggression and other psychopathological behavior problems (Parker and Asher, 1987; Ladd and Troop-Gordon, 2003; Prinstein and Aikins, 2004; Platt et al., 2013). Dishion et al. (2010) and Kornienko et al. (2019) emphasize the connection between early antisocial behavior, school failure and school marginalization as well as the long-term transition from mild forms of antisocial behavior to dangerous forms of violence. The confluence model explains the dynamic interactions between peer rejection and membership of deviant peer groups and how these interactions contribute to the reinforcement of antisocial behavior in the school context during adolescence. It assumes that there is a common interplay between rejection and antisocial behavior that leads to self-organization in deviant groups in which peer influence affects problematic behavior (Kornienko et al., 2019). Additionally, peer rejection in adolescence has been found to be predictive of persistent aggression several years later in early adulthood (Dodge et al., 2003). This is consistent with the finding that peer rejection is particularly stable over time (Hardy et al., 2002; Jiang and Cillessen, 2005) and is evident across different social contexts (Katzer et al., 2009). Moreover, a chronic state of rejection has been potentially associated with particularly negative outcomes at school, including poor academic performance (DeRosier et al., 1994) and

high rates of externalizing behavior problems (Sturaro et al., 2011). Peer rejection is therefore a complex dynamic that can have potentially devastating effects on adolescent's socio-emotional development, with long-lasting consequences into adulthood.

The social capital theory perspective provides causes for peer rejection, whereas the motivation to achieve a higher status within the peer group is often linked to the pursuit of aggression in adolescents (e.g., Evans and Smokowski, 2015). Sijtsema et al. (2009) showed in their network study that adolescents who are aggressive toward their peers have a stronger desire to achieve a higher status than adolescents who are victims of this aggression. The theory states that individuals targeted by perpetrators have limited social capital, which makes it difficult for them to achieve higher social status within a group. A high social status can contribute to successful socio-emotional development because these adolescents experience more positive and less negative emotions (Dougherty, 2006). Aggressive perpetrators and adolescents who reject others can build up their social capital by undermining peers with low social status. Adolescents further conform to peer pressure by rejecting classmates who are socially stigmatized (Pál et al., 2016). Expressing a negative opinion toward classmates can be an attempt by adolescents to uphold their own social standing in a peer group (Bond et al., 2014). Therefore, rejecting peers is one way of dissociating oneself from peers of lower status (Card and Hodges, 2007).

Previous research has provided insights on identifying which adolescents are at particular risk of rejection in school. Various studies showed that adolescents who are aggressive toward their peers are more likely to be rejected by them (Coie and Kupersmidt, 1983; Dodge, 1983; Casper et al., 2020). A meta-analysis by Card et al. (2008) found that peers are more likely to reject adolescents who engage in direct aggression than those who engage in indirect aggression. Direct aggression describes violent behavior such as hitting and pushing as well as open verbal attacks such as threats, name-calling and taunting. Indirect aggression, on the other hand, refers to hurtful manipulation of relationships and damage to the social position of a person within a group, for example, by spreading rumors (Crick and Grotpeter, 1995; Card et al., 2008). Additionally, studies have found that the male gender is an especial risk factor for peer rejection, with research such as that of Rodkin et al. (2000) indicating that peers are more likely to reject male adolescents who are aggressive toward their peers than female adolescents engaging in the same behavior. In sum, previous research has shown conclusively that peer rejection in adolescence is associated with negative long-lasting socio-emotional outcomes, including the risk of developing aggressive behavior. Although peer rejection is known to be associated with aggression, the mechanisms underlying it remain poorly understood (Miller-Johnson et al., 2002; Ettekal and Ladd, 2020).

Peer rejection and the cycle of violence

Concerning the relationship between peer rejection and aggressive behavior, several theories provide explanations. The transactional model theory suggests that peer rejection and aggressive behavior toward peers are part of an ongoing cycle of interactions between peers (Ladd, 1989). This vicious cycle involves peers expressing their dislike and the rejected adolescent's reactions to that dislike (Coie, 1990). Furthermore, as Poulin and Boivin (2000) found, directly

aggressive adolescents are more likely to select each other than be influenced in their own aggressive behavior by the aggressive behavior of others. In other words, peers who display direct aggression select other aggressive friends rather than be influenced by others' aggression. For example, Kim and Cicchetti (2010) showed that higher externalizing behavior, such as aggression toward peers, contributed to later peer rejection, which in turn was related to more aggressive behavior. Regarding selection effects in terms of gender, several studies have shown that male students are at greater risk of being rejected by their peers for aggressive behavior, even though they often enjoyed popular status within their class (Coie and Kupersmidt, 1983; Dishion and Tipsord, 2011). Thus, these findings suggest that aggressive behavior is partially reinforced by increased peer attention, which can lead to increased peer rejection as a side effect. It is therefore important to include gender in studies on peer networks.

In addition to this cycle of peer rejection and aggressive behavior, other theories may explain why some adolescents exhibit aggressive behavior. According to social learning theory (Bandura, 1977), adolescents who have experienced parental physical abuse may learn violent behaviors through observation and imitation in their respective social relationships, such as peer relationships. Longitudinal studies (Smith et al., 2005; Mersky and Reynolds, 2007) have further confirmed the cycle of violence theory (Widom, 1989a,b), also referred to as intergenerational transmission of violence. This theory posits that violent victimization, particularly physical abuse by parents or other primary caregivers, increases the likelihood of later perpetration of violence. Similarly, according to the social information processing theory (Huesmann, 1988), the experience of parental physical abuse may lead to the attitude that violence is normal or acceptable in social relationships, thereby increasing the likelihood of violent behavior (Mcconville and Cornell, 2003; Ruiz-Hernández et al., 2020). Studies have shown that especially harsh and violent parenting contributes to later attitudes accepting violence (Bower-Russa, 2005). The transmission of violence between generations may occur through these attitudes toward violence, as children who experience violence at home are more likely to believe that violence is appropriate and acceptable and are at higher risk of developing violent behavior later in life (Capaldi et al., 2012; Fulu et al., 2013). When violence acceptance and violent behaviors deviate from social norms, they can result in peer rejection (Killen et al., 2015).

In addition to these vicious cycles observed in the context of peer relationships, child maltreatment, such as severe physical abuse by parents, has been found to contribute significantly to peer rejection. In their systematic review, Goemans et al. (2023) highlighted the significant association between child maltreatment and peer rejection from the perspective of the cycle of victimization (Widom, 2014). Adolescents who have been victimized by their parents are up to four times more likely to be rejected by their peers than those who have not experienced such abuse (Goemans et al., 2023). Other studies confirmed the specific link between physical parental abuse experiences and a higher chance of developing aggression toward peers (Nicholson et al., 2018; Wang et al., 2023; Yoon et al., 2021). Alarmingly, empirical studies have shown that severe parental physical abuse is very prevalent in Switzerland with rates ranging from 19 to 22%, 20 to 25% in the European Union (Enzmann et al., 2018; Kassis et al., 2018, 2022) and about 18% in the United States (Finkelhor et al., 2015). These prevalence rates show that physical abuse is an everyday reality for many adolescents worldwide. These experiences of abuse

are a significant adversity that result in subsequent risk factors (e.g., Kitzmann et al., 2003; Evans et al., 2008; Lindert et al., 2014) and a high likelihood of negative socio-emotional outcomes. These include externalizing symptoms like aggressive behavior problems (Kapella, 2011; Straus et al., 2017; Enzmann et al., 2018; Kassis et al., 2018) but also internalizing symptoms, such as dissociations (Tschoeke et al., 2021), which in turn can lead to peer rejection (Silberg, 2004; Favre et al., 2022). Regarding internalizing symptoms, such as dissociative symptoms, it has been shown that, like externalizing behavioral problems, they can also spread via peer networks, although these mechanisms of influence have not yet been sufficiently researched in peer network research (Dishion and Tipsord, 2011). It is therefore important to consider dissociative symptoms as a severe consequence of trauma and as internalizing behavior that can be influenced by peer networks.

Current research often focuses on individuals who are rejected by their peers and does not consider peer rejection from the perspective of both perpetrators and recipients. Given the empirically postulated link between peer rejection and violence in all its dimensions, exploring the complexities surrounding peer rejection and the impact of violence on adolescent development is necessary.

Cycle of violence in a resilience framework

Revealingly, even if the violence cycle is confirmed conclusively internationally, several studies pointed out that this recurring sequence of aggressive behavior is not the only pathway taken by the respective adolescents. Though we confirm that the violence cycle holds for almost 80% of physically abused adolescents, we can internationally identify that about 20% of physically abused adolescents develop healthy behaviors counterintuitively, not just without presenting psychopathological symptoms, and thus, can be called thriving because they are developing violence-resilience (Yule et al., 2019; Aksoy et al., 2022; Favre et al., 2022; Kassis et al., 2022).

Masten (2014) examined processes for promoting resilience pathways within a dynamic system and highlighted the ability of the system, not just the individual, to respond adaptively to a given adversity. One such adversity is the experience of abuse, which leads to a range of negative outcomes, including the development of internalizing and externalizing behavioral problems, and profoundly shapes adolescents' perceptions (Kitzmann et al., 2003; Evans et al., 2008; Danese and Tan, 2014). Experiences of violence also increase the risk of being victimized by peers, particularly in secondary school (Benedini et al., 2016). During adolescence, social relationships beyond the family become more complex and significant. Peer interactions play a crucial role in the socio-emotional development of adolescents, especially in dealing with negative events such as physical abuse experiences from parents (Rapee et al., 2019). Adolescents are generally very sensitive to peer acceptance and rejection, which can have a significant impact on resilience processes (Farineau et al., 2013; Favre et al., 2022). Peer interactions in peer networks can therefore serving as both a developmental barrier and a positive resource (Giletta et al., 2021). In the context of socio-emotional development in adolescence, peer rejection, as a malfunction of a relevant social system, can have long-term negative resilience consequences. Due to these insights, violence-resilience can be viewed as a dynamic and

complex process fostering positive development that involves multiple systems and is influenced by factors external to the individual (Aksoy et al., 2022; Favre et al., 2022; Kassis et al., 2022). According to a contemporary understanding of resilience theory, it is essential to consider developmental trajectories from the perspective of specific risk factors. For example, Luthar et al. (2000) states that the domains for resilient development are always associated with a specific risk factor, such as peer rejection. This argues in favor of considering rejection networks as a specific risk factor independent of positive networks. Furthermore, it is important to consider the respective domain and adversities longitudinally when studying resilience, as these factors influence the manifestation of resilience over time. Following Luthar's (Luthar et al., 2000; Luthar and Zelazo, 2003) theoretical insight that resilience always exists in domains and, thus, an individual does not have to be resilient in all domains, resilience and non-resilience can coexist, both rejecting peers and being rejected by peers can be considered non-resilient development in the social relationship domain. Positively framed and from a content perspective, we emphasize that an abused adolescent's resilience status could be also influenced by minimizing contextual risk factors, such as peer rejection at school. Therefore, the school environment is very important in promoting social interactions, academic achievement, and mental health (Wigfield et al., 2006). School is an essential place for implementing intervention and prevention programs that aim to decrease aggressive behavior among students. These programs help to foster resilience in the context of peer interactions and break the cycle of re-victimization. By addressing this issue, schools can create a safe and supportive environment for all students to thrive. In this way, a larger proportion of adolescents negatively affected by familial exposure to violence could be effectively supported on resilience pathways.

Being rejected can ultimately hinder the formation and maintenance of relationships, as studies have found that even relationships with teachers can be negatively affected (Demol et al., 2020). Peer rejection, on the other hand, has not been extensively researched, as studies have focused on who is rejected rather than who rejects. This is particularly relevant as social relationships are a central area of socio-emotional development and considering risk factors for resilient development, such as parental physical abuse, aggression, acceptance of violence and dissociation (Aksoy et al., 2022; Favre et al., 2022; Kassis et al., 2022), is an important step in identifying the underlying mechanisms of peer rejection. By taking these specificities into account, targeted school-based prevention and intervention programs focusing on the resilient socio-emotional development of adolescents physically abused by their parents can be initiated.

Stochastic actor-oriented model for in-depth analysis of peer rejection networks

A proven method to study peer dynamics, such as peer rejection and the socio-emotional development of adolescents, is social network analysis (Wasserman and Faust, 1994). A significant body of evidence shows the similarity between adolescents' behaviors and those of their friends (Cohen, 1977; Kandel, 1978; McPherson et al., 2001). However, current models using cross-sectional data did not provide answers about the social processes involved (Veenstra and Dijkstra, 2011).

Recent development of stochastic actor-oriented models allows for the simultaneous examination of whether adolescents choose their friends because they are like them (Lazarsfeld and Merton, 1954; Block and Grund, 2014) or if they are similar because they influence each other and thus become more alike over time (socialization). In these models, the effects of the network structure on friendship formation and behavioral influence are also controlled (Snijders et al., 2010; Veenstra and Dijkstra, 2011). For instance, friendships between two individuals are more likely if these individuals have a common friend. This so-called transitivity effect can affect the formation of friendships to a higher or lower extent than, for example, the similarity between two individuals. Thus, to disentangle underlying processes in friendship networks, it is crucial to apply methods in which network dependencies are explicitly acknowledged and part of the modeling (Veenstra and Dijkstra, 2011). Mostly studies on relationships analyze positive relationships, such as friendships. Negative relationships and rejection networks in adolescence are investigated to a lesser extent (e.g., Huitsing et al., 2012; Boda and Néray, 2015). According to Huitsing et al. (2012), this paucity may have to do with negative networks being more difficult to model, as there are usually fewer ties than in positive networks. Furthermore, sensitive questions are asked to survey negative networks, which can be an ethical challenge. Nevertheless, it is important to understand negative dynamics as they can have a long-lasting impact on socio-emotional development (Masten, 2009). However, social processes that explain positive relationships can also be applied to negative relationships. For instance, network structure effects, such as reciprocity, were reported for friendships as well as for negative relationships (Huitsing et al., 2012; Boda and Néray, 2015). In contrast, transitivity effects refer to 'an enemy of my enemy is not my enemy' and seem to be less important in negative networks, such as rejection networks, than in friendship networks (Boda and Néray, 2015). Further, studies show that negative relationships are more likely between adolescents who are dissimilar than between similar adolescents (Boda and Néray, 2015), which is supported by evidence showing that children and adolescents tend to exclude peers dissimilar to them in terms of individual characteristics (Hartup, 1993; García Bacete et al., 2017).

In sum, research on rejection networks is still in the initial stages, although Card (2010) argued over a decade ago that antipathies are essential for understanding peer relationships and their association with successful or unsuccessful socio-emotional development in adolescence.

The present study

Based on the theory of cycle of violence (Widom, 1989a,b) with a resilience framework, we aimed to examine the longitudinal relationship between rejection networks and violence dimensions, including experiences of parental physical abuse (experiences), aggression (behavior) and violence acceptance (attitude) among adolescents. Additionally, we aimed to analyze the impact of gender and dissociation as well as interactions between parental physical abuse experiences and aggression or dissociation on the likelihood of being rejected by peers and ask under which circumstances peer rejection hinders resilience development. Further, we investigated how the structure of rejection networks may shape the development of aggressive behavior through social learning and information

processing mechanisms, and how gender, violence acceptance and parental physical abuse experiences are associated with the development of aggression. These research gaps led to the following three research questions and six hypotheses. Based on previous literature, four hypotheses were formulated on the network level (see Table 1) and two hypotheses were formulated on the behavioral level.

Research questions and hypotheses on network level

R1: To what extent do network effects (structural factors, e.g., reciprocity) contribute to changes in adolescents' rejection over time and how do parental physical abuse experience, violence acceptance, aggression, gender and dissociation affect the likelihood of being rejected by peers? Based on the social learning theory (Bandura, 1977) and the cycle of violence theory (Widom, 1989a,b), we expected that peers would be more likely to reject adolescents who engage in aggression toward peers (Card et al., 2008), as well as participants with high violence acceptance (Killen and Brenick, 2011) and parental physical abuse experiences (Goemans et al., 2023; H1). We expected adolescents with dissociations to have a higher likelihood of being rejected (Favre et al., 2022; H2). Further, we hypothesized that the male gender (Rodkin et al., 2000) as well as gender similarity (Rambaran et al., 2015) are risk factors for peer rejection (H3).

R2: How does the interaction of parental physical abuse experience and aggression or the interaction of parental physical abuse experiences and dissociations affect the likelihood of being rejected by peers? Due to the association between physical abuse experiences and the development of aggression (e.g., Nicholson et al.,

2018) as well as the higher chance of being rejected with aggression (Killen and Brenick, 2011), we assumed that physical violence experiences are a mediator between aggression and rejection. We also expected that adolescents who experience parental physical abuse and dissociations are at higher risk of being rejected (Favre et al., 2022; H4).

Research questions and hypotheses on behavioral level

R3: What potential factors contribute to changes in aggressive behaviors among adolescents over time, and do rejection networks influence aggressive behavior? How specifically do gender, acceptance of violence and parental physical abuse experience influence aggressive behaviors? We did not expect a significant influence from rejection networks on aggressive behavior, as they represent negative networks (H5). Due to the cycle of violence (Widom, 1989a,b), we assumed that the dimensions of violence have an influence on the development of aggression (H6).

Methods

Participants and procedures

The analyzed data was conducted in the fall of 2020 (Wave 1) and the spring of 2022 (Wave 2) and is part of a broader longitudinal study of adolescents' violence resilience. The representative sample consisted of 620 (grade 7, Wave 1) and 590 (grade 8, Wave 2) pupils in 38 school

TABLE 1 Explanation of parameters in the RSiena model and hypotheses.

Effect	Explanations (Hypotheses)	Graphical representation
Outdegree (density)	Basic tendency to form rejection ties (H1; H2; H3)	
Reciprocity	Tendency toward reciprocation	
Transitive Triplets	Transitive closure ($i \to h \to j; i \to j$) of actors where rejected actors of rejected actors become directly rejected actors	
Indegree - Popularity	Incoming rejection ties make alters more attractive to receive rejection ties	
Outdegree - Popularity	Outgoing rejection ties make alters more attractive to receive rejection ties	
Outdegree - Activity	Tendency of actors who send many rejection nominations to send even more rejection nominations	
Ego - Effect	Actors with higher values on X have higher outdegree	
Alter - Effect	Actors with higher values on X have higher indegree (H4)	
Similarity - Effect	Rejection ties occur more often between actors with the same values on X	

Derived from Huitsing et al. (2014).

classes in German speaking North-Western Switzerland. Female (Wave 1, female = 49.7%) and male participants anonymously completed an online questionnaire in approximately 60 min after an oral introduction by trained research team members on the day of the study in respective classrooms during regular class hours. The adolescents' mean age was 11.7 years in Wave 1 (SD = 0.64) and 13.8 (SD = 0.43) in Wave 2. The pupils and their legal guardians completed informed consent forms without incentives. The project was approved by the research ethics committee of the University of Teacher Education FHNW Switzerland.

Of the total 140 classes in the broader study, only classes with more than 80% participating were considered for this analysis because with more than 20% of data missing in the networks, the model simulation can become unstable (Ripley et al., 2023). The missing data in our study is limited to the behavioral variable, as the networks are fully observed for both measurement time points in 38 school classes; that is, all students who were present at the time of the survey provided information on the sociometric questions, ensuring that any observed effect can be attributed solely to the missing behavioral data and is not influenced by missing ties. Adolescents with and without complete data in the behavior variable were compared using Little (1988) Missing Completely At Random (MCAR) test, which showed that the missing data were completely at random ($\chi^2 = 39.25$, df = 43, $p = 0.635$).

Therefore, the final sample of 38 classrooms was selected based on network stability and the proportion of missing data; classes with a Jaccard index lower than 0.2 were excluded, following Ripley et al. (2023) suggestion. Adolescents who did not participate at both measurement points (joiners, $n = 41$; leavers, $n = 71$) were documented with a separate composition change file and taken into account in the analysis as a control variable (Huisman and Snijders, 2003).

To collect sociometric data for our study, we asked students to nominate peers based on different types of relationships they had with other students in their class. To facilitate this nomination method (Cillessen and Marks, 2017), we provided each student with a list of their classmates, which contained randomized numbers that had been assigned to them beforehand. Using this list, students were able to nominate peers by selecting the randomly assigned number of the student in question. Based on the sociometric data collected in this way, we created networks of directed ties for different types of relationships, including rejection.

Measures

Gender and covariates were measured at baseline (Wave 1). Rejection networks and aggression toward peers were measured at both waves (Waves 1 and 2).

Rejection networks (Waves 1 and 2)

To assess rejection networks, adolescents were asked to nominate classmates they disliked in their class at both time points, with no limit on the number of nominations. Sociometric nominations have been found to be valid, reliable, and stable measures of peer relationships during adolescence (Bukowski et al., 2015). To get a genuine picture of the adolescents' peer rejection network, cross-gender nominations were allowed (Terry and Coie, 1991). We used peer nominations to construct peer networks for each school class separately at each time

point. To collect data for the rejection networks, the participants were asked to nominate classmates with the following question: "Who in your class do you like not so much?" Each network was modeled as an n x n directed adjacency matrix constructed from dichotomous cells. A peer tie directed from actor i (the nominator) to actor j (the nominee) is either absent (0) or present (Abecassis, 2003) in each of the adjacency matrices. The rejection network was used as a dependent variable in the analyses.

Behavior variable: aggression toward peers (Waves 1 and 2)

To assess aggression, we used the Overt Aggression subscale of the German Self-Report Behavior Aggression-Opposition Scale (Müller et al., 2012), which consists of the following five items: physically pushing around, threatening to hurt someone physically, physically hurting, teasing to make angry and name calling/insulting. Participants rated the items on a four-point Likert scale on whether they were perpetrators of direct aggression: 1 = never happened, 2 = once or twice a month, 3 = once a week and 4 = more than once a week, with higher scores indicating more frequent perpetration (Wave 1, Cronbach's alpha = 0.80; Wave 2, Cronbach's alpha = 0.86). To be able to scale the behavioral variable ordinally, as required for RSiena, we calculated quartiles.

Gender (Wave 1)

Gender was obtained from school class rosters in which adolescents were categorized as female = 0 or male = 1.

Parental physical abuse (Wave 1)

Five items from the Alabama Parenting Questionnaire (Frick, 1991) were used to assess parental physical abuse at Wave 1. Physical aggression and corporal punishment were evaluated, with a particular focus on severe parental physical abuse. A five-point Likert scale was utilized, with 1 = never and 5 = always. "My parents beat me so badly that I had to visit a doctor or rush to the hospital" and "My parents hit me with a belt, a stick or a hard stick when I did something wrong" were among the items on the scale (Wave 1, Cronbach's alpha = 0.83).

Violence acceptance (Wave 1)

Violence acceptance was assessed using a four-item subscale extracted from the Survey of Student Life, originally developed by Artz and Riecken (1994) and expanded by Artz et al. (2009). The survey used a four-point Likert scale, ranging from 1 = not true at all to 4 = completely true, to determine the extent to which adolescents tend to accept violence as a problem-solving technique for items like "Someone who does not fight back or defends her/himself is a coward" or "Violent action is a means to force oneself in and to be met with respect" (Wave 1, Cronbach's alpha = 0.74).

Dissociation (Wave 1)

The adolescents' level of dissociation was measured using a short scale from the existing Dissociation-Tension-Scale acute (DSS-acute; Stiglmayr et al., 2009). The DSS-acute includes one item each on somatoform, analgesia, derealization and depersonalization, for example, "It feels like my body does not belong to me." Adolescents rated on a four-point Likert scale, ranging from 1 = not at all to 4 = very strongly (Wave 1, Cronbach's alpha = 0.85).

Analytic approach

In this study, we used RSiena package 1.3.0 (Simulation Investigation for Empirical Network Analysis), a package of the statistical software R (Ripley et al., 2023; version 4), to estimate stochastic actor-oriented models (SAOM; Snijders et al., 2010) to examine associations between the three dimensions of violence and the rejection networks of Swiss adolescents in their respective classrooms. SAOMs combine two simulations: one simulates changes in rejection ties, and the other simulates changes in individual behavior. A SAOM is a statistical tool to study how social networks change over time, while taking into account both the individuals (actors) as well as the connections (ties) between them. The network is treated as a stochastic process whereby individuals decide on their ties and behavior on the basis of the benefit function, which may depend on factors such as the personal characteristics of the actors or the characteristics of their social environment. Thus, the individual characteristics of the actors as well as their position within the network are taken into account. The stochastic process incorporates micro-steps that actors can take, in which actors can either add new ties, remove existing ties, or maintain their current ties. Each of these micro-steps is performed stochastically, which means that the probability of a particular step occurring depends on the actor's benefit functions and the current state of the network. The idea that an actor's behavior may change in response to the network structure or the behavior of other actors is also reflected in the SAOM model. For example, if an actor observes that her or his peers dislike someone, she or he may be less likely to form ties with this person (Snijders et al., 2010). The likelihood of changes in the social network and the individual behavior is determined by simulations based on the first wave, taking into account that changes may occur continuously over time. All 38 separate rejection networks were combined and analyzed using a multigroup approach, which offers a higher statistical power compared to analyzing each classroom separately (Ripley et al., 2023). The model achieved good algorithm convergence, with an overall maximum convergence ratio below 0.25 and convergence t ratios below 0.1. The model includes two sets of parameters: structural effects and individual covariates.

First, we examined the effects of network structure on rejection dynamics, followed by the effects of chosen covariates on rejection network dynamics and the effects of covariates on behavior dynamics.

Model specification

Structural network effects

The purpose of including structural network effects is to capture how actors form and maintain rejection ties. The model included several network effects, such as outdegree (density), reciprocity and transitive triplets (Ripley et al., 2023). The density effect measures how likely people are to form rejection ties, taking into account the maximum number of possible nominations in the network. The reciprocity effect refers to the tendency to form mutual rejection ties. The transitivity effect represents the transitive closure of individuals where rejected adolescents of rejected classmates become directly rejected classmates. In addition, two degree-related effects were included to distinguish between actors who receive or send many (or few) rejection nominations and to increase the model's goodness of fit

(GOF; Ripley et al., 2023) and to control for the Matthew effect (Merton and Merton, 1968): the indegree popularity effect and the outdegree activity effect. The first effect reflects the tendency of actors who receive many rejection nominations to attract more rejection nominations over time, whereas the outdegree activity effect reflects the tendency of actors who send many rejection nominations to send even more rejection nominations over time.

Covariates effects

The present study also investigated how gender, severe parental physical abuse, violence acceptance, aggression, and dissociation influence rejection ties in the school class to answer R1. This was tested with three basic selection effects: ego, alter and similarity. The aim was to determine whether adolescents of a certain gender with parental physical abuse experience or externalizing behavior are more likely to reject other students (ego effect) and/or be rejected by other students (alter effect). The similarity effect captures whether rejection nominations are more likely to occur between adolescents with similar characteristics, such as the same gender. For the other covariates, only ego and alter effects were examined because there was no theoretical indication to assume a similarity effect. In addition, an interaction effect between parental physical abuse experience (alter) and aggression (alter) as well as the interaction between parental physical abuse experience (alter) and dissociation (alter) was included to answer R2. The dimensions of violence were also included to examine their influence on the development of aggression over time to answer R3.

Results

Descriptives

Table 2 presents the descriptive statistics, including the means and standard deviations, of the variables used in this study. Additionally, a t-test was conducted to compare the mean values of aggression as the behavioral variable between the two time points. For aggression, a t-test analysis revealed no mean difference between the two time points.

Table 3 shows the correlations between the variables used. Aggression correlated with all variables at the first time point. Only dissociation and violence acceptance did not correlate with rejection

TABLE 2 Sample descriptives of the 38 school classes included in the social network analysis.

Scale	Wave 1 $n = 620$	Wave 2 $n = 590$	t-test
	M (SD)	M (SD)	g/r
1–4	1.38 (0.53)	1.52 (0.63)	0.24 / 0.12
0 = female 1 = male % female	49.7%		
1–5	1.11 (0.36)		
1–4	1.35 (0.57)		
1–4	1.80 (0.65)		

g, Hedge's g; r, Pearson correlation coefficient.

indegrees. At the second time point, however, no significant correlation was found between aggression and rejection indegrees.

Table 4 provides information about the rejection networks, among them the average number of classmates rejected by each student (2.02) and the average degree of the rejection networks per measurement point (2.07 at Wave 1; 1.97 at Wave 2). The rejection network density appeared stable over time, as participants nominated the same number of classmates they did not like on average at both points in time. The proportion of reciprocal rejection can be seen from the reciprocity index. Thus, approximately 33% of mutual rejection nominations were made at both measurement points. The Jaccard indices show that a total of 20.3% of the rejections within the classes remained stable over time. In sum, these network indices indicated that the prerequisites for conducting a stochastic actor-oriented model and correctly estimating selection effects were accomplished (Veenstra and Steglich, 2012).

Rejection dynamics: network effects

The average parameter estimates for rejection dynamics is presented in the first part of Table 5. The structural network parameters were significant. Particularly noteworthy is the negative outdegree estimate, which explains that adolescents were selective in their rejection nominations; that is, they did not just randomly reject classmates. The positive reciprocity estimate means that when one adolescent rejected another, there was a higher likelihood that the rejected adolescent would also reject the first adolescent. Negative transitivity triplet estimates indicated that adolescents were not likely to reject third classmates who were rejected by directly rejected classmates. A positive indegree popularity estimate suggests that the more rejection nominations an individual received from their classmates, the higher the likelihood that they continued to receive rejection nominations over time. Adolescents who nominated many classmates were less likely to receive rejection nominations in return, represented by a negative outdegree popularity effect. A positive outdegree activity effect indicates that adolescents who actively reject more of their classmates are more likely to continue doing so over time.

Rejection dynamics: selection effects

The first part of Table 5 also describes characteristics of adolescents and selection effects that influence changes in rejection networks. The negative gender alter effect indicates that female adolescents received more rejection nominations than male adolescents. Gender ego did not appear to be significant. However, a significant negative estimate of gender selection similarity indicated that participants were more likely to reject opposite-gender peers. No significant effects were found for either parental physical abuse experiences or dissociations. The effect, however, was significant that adolescents with higher violence acceptance were more likely to be rejected by their classmates than adolescents with low violence acceptance, indicated by the positive alter effect. Similarly, the aggression alter effect was positively significant, indicating that adolescents who more frequently use aggression toward their peers are more likely to be rejected. This effect is amplified when the interaction effect between parental physical abuse experiences and aggression is taken into account. Therefore, the effect of aggression on rejection was stronger for those who had experienced parental physical abuse. The interaction effect between parental physical abuse and dissociation, however, was not significant, indicating that experiencing parental physical abuse at home and having internalizing symptoms in the form of dissociations did not significantly increase the likelihood of being rejected by peers.

Aggression dynamics

Table 6 shows the average parameter estimates for the behavior variable aggression to answer R3. Aggression appeared to be normally distributed, as indicated by the nonsignificant linear shape estimate. A positive quadratic shape effect indicates a self-reinforcing pattern in which adolescents who initially had a low level of aggression tended to further increase their aggression over the course of two school years, approaching an average and higher level. At the same time, those with a high level of aggression also showed a self-reinforcing trend. The indegree effect did not appear significant, but the outdegree

TABLE 3 Bivariate correlations of variables included in the social network analyses.

Wave	Variables	Aggression t1	Physical abuse t1	Dissociation t1	Violence acceptance t1	Rejection (Indegree) t1	Aggression t2	Rejection (Indegree) t2
Wave 1	Aggression t1	–	0.27**	0.22**	0.22**	0.18**	0.32**	0.19**
	Physical abuse t1		–	0.17**	0.17**	0.14**	0.07	0.23**
	Dissociation t1			–	0.13**	0.03	0.14**	0.09
	Violence acceptance t1				–	0.06	0.22**	0.23**
	Rejection (Indegree) t1					–	0.17**	0.45**
Wave 2	Aggression t2						–	0.16**
	Rejection (Indegree) t2							–

**$p < 0.01$.

TABLE 4 Descriptives of rejection networks for Wave 1 and Wave 2 of the 38 school classes included in the social network analyses.

	Period 1 from Wave 1 to Wave 2 rejection networks	
	Wave 1	Wave 2
Composition change		
n	620	590
Rejection tie change		
Number of ties	1,283	1,215
Density	0.03	0.03
Average degree M (SD)	2.07 (0.05)	1.97 (0.05)
Reciprocity	33.2%	33.9%
Jaccard Index (stability)	20.3%	
Change in aggression		
Stable aggression levels	40.9%	
Increasing aggression levels	25.5%	
Decreasing aggression levels	13.4%	

effect was positively significant, suggesting that as the number of outgoing ties of the ego increases, so does the level of aggression over time. The total alter effect was not significant, indicating that behavior toward peers in terms of aggression is not affected by the aggression behavior of rejected peers. No main effects of parental physical abuse were discovered on changes in aggressive behavior, but gender and violence acceptance showed significant positive influence on change in aggressive behavior. This suggests that being male and having a higher violence acceptance may be associated with an increase in aggression toward peers over time.

Discussion

Peer relationships play an important role in adolescents' socio-emotional development, especially in school where they encounter peers they have not chosen themselves. School is a critical socialization setting for young people, where building and maintaining relationships is of paramount importance (Bukowski et al., 2015; Oshri et al., 2017). This holds especially true for adolescents who have been physically abused by their parents and therefore lack closeness to parents, as peers can function as an important source of self-esteem and social support (Birkeland et al., 2014; Forster et al., 2020). Within the core set of social and emotional skills, relationship skills in adolescence are of particular importance because they enable students to build and maintain healthy and fulfilling relationships through effective communication, constructive conflict resolution and the ability to seek help when needed (Garibaldi and Josias, 2015). Successful socio-emotional development can be severely altered through experiences of peer rejection, especially during adolescence when relationships outside of the family gain significant importance. To better understand peer rejection processes, in this study, we focused on the effects of violence experiences, behavior and attitudes in peer rejection networks of adolescents.

TABLE 5 Average parameter estimates for network and selection effects.

	Peer rejection networks	
Parameters	Est.	SE
Network effects		
Outdegree (density)	−2.25***	0.15
Reciprocity	0.97***	0.09
Transitive triplets	−0.38***	0.05
Indegree—popularity	0.20***	0.02
Outdegree—popularity	−0.06***	0.02
Outdegree—activity	0.15***	0.01
Selection effects		
Gender alter	−0.19**	0.06
Gender ego	−0.13	0.07
Gender similarity	−0.12*	0.05
Dissociation alter	0.03	0.04
Dissociation ego	−0.01	0.04
Abuse experience alter	−0.10	0.13
Abuse experience ego	0.07	0.07
Violence acceptance alter	0.09*	0.04
Violence acceptance ego	−0.02	0.04
Aggression alter	0.31**	0.11
Aggression ego	0.08	0.08
Interaction abuse experience alter x aggression alter	0.55**	0.12
Interaction abuse experience alter x dissociation	−0.07	0.13

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$; all convergence t ratios < 0.1; overall maximum convergence ratio 0.21.

TABLE 6 Average parameter estimates for aggression dynamics.

	Peer rejection networks	
Parameters	Est.	SE
Aggression dynamics		
Linear shape	−0.24	0.19
Quadratic shape	0.41***	0.11
Indegree effect	−0.11	0.07
Outdegree effect	0.11*	0.05
Total alter aggression	0.15	0.10
Effect from gender	0.40*	0.16
Effect from abuse experience	0.13	0.17
Effect from violence acceptance	0.30**	0.11

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$; all convergence t ratios < 0.1; overall maximum convergence ratio 0.21.

Our findings demonstrate, in accordance with the results of Kros et al. (2021), that peer rejection is a reciprocal dynamic, with adolescents who are frequently rejected by their peers more likely to experience continued rejection in the future, suggesting that rejection can become a vicious cycle. Consistent with studies showing that peer

rejection is stable over time and thus a chronic stressor for affected adolescents, this finding underscores the urgency of closely examining negative peer dynamics (Hardy et al., 2002; Jiang and Cillessen, 2005). Future research should investigate whether this stability of rejection changes substantially depending on class composition, as in the case of peer victimization (Rambaran et al., 2020). Thus, it should be analyzed whether class composition has a significant influence on rejection processes. Furthermore, we found in accordance with Hypotheses 1 and 3 that violence acceptance as well as aggression and same gender predict adolescents' likelihood of being rejected by their peers, therefore making them risk factors for socio-emotional development. However, it has been shown that female adolescents received more rejection nominations than male adolescents. This contradicts our assumption that male gender is a risk factor for peer rejection. This may be linked to the fact that rejection can take different forms, including verbal aggression or active avoidance (Leary et al., 2003). Previous research has shown that this indirect form of aggression through social exclusion often occurs among female adolescents (Catanzaro, 2011). As there are different forms of social rejection that affect boys and girls differently, it would be important for future research to examine the specific forms of rejection using an intersectional framework. Previous research has been shown that a binary assessment of gender does not provide sufficient insights into developmental trajectories and therefore into the cycle of violence (Kassis et al., 2021). Dissociation showed no effect, which is why Hypothesis 2 could not be confirmed in our results. Hypothesis 4 could only be partially confirmed, as there was a significant interaction effect between parental physical abuse experiences and aggression in relation to rejection but not between parental physical abuse experiences and dissociations. It is revealing, but not surprising, that experiences of parental abuse did not significantly predict peer rejection and thus adolescents with enormously burdensome experiences of parental physical abuse do not have an increased risk of being rejected by their peers, unless they are aggressive toward their peers. As Bolger and Patterson (2001) have shown, adolescents who experience parental physical abuse at home are at an increased risk of developing psychopathological symptoms, such as aggressive behavior toward their peers, and thus of being rejected by their peers due to aggressive behavior. This is also reflected in our findings, as individuals' parental physical abuse experience was only significant as an accelerator of being rejected by peers through their own aggression toward peers, making youth with parental physical abuse experiences easier targets for peer rejection. This is of particular interest because although severe forms of parental physical abuse were identified in our study, on average (according to the mean value) these were experienced "rarely." Future research could also include the assessment of milder forms of parental abuse in SAOM's, such as face slapping, which show a higher prevalence but are also very damaging to the socio-emotional development and contribute to the development of psychopathological symptoms. Young people in general and physically abused adolescents specifically confronted with peer rejection can develop long-term adjustment problems (Parker and Asher, 1987; Ladd and Troop-Gordon, 2003; Prinstein and Aikins, 2004; Platt et al., 2013; Kornienko et al., 2019), and their experiences can even have a negative impact on the supportiveness of their relationships with teachers (Demol et al., 2020). This indicates that students who experience peer rejection may struggle to develop positive relationships with their teachers, which may further exacerbate the negative impact of peer rejection on their well-being and academic success. Therefore, it would be important to include the relationship with respective teachers in future research.

Looking at who rejects, we identified that peers reject the opposite gender significantly more, but peers high in violence acceptance or aggression do not reject others more, even though they themselves are rejected more often. This finding may suggest, from a social learning theory (Bandura, 1977) perspective, that these individuals have already learned to accept or engage in violence and, therefore, do not feel the need to reject others who exhibit similar behavior. Since aggressive behavior is normally rejected because it does not fit with social norms of a society, adolescents who themselves display aggressive behavior or accept violence may not comprehend violence as a violation of social norms but as an acceptable behavior or attitude. This is particularly interesting because our results suggest that as the number of peers one rejects increases, so does the level of aggression over time. This implies that one's own violent attitude or behavior does not lead to rejecting peers but to rejection *by* peers. Rejecting peers in turn leads to an increase in aggression toward peers, which is consistent with the findings of Gorman et al. (2011). Our insights follow results from Juvonen and Ho (2008), who showed that the development of aggressive behavior in a school can depend on high status. Previous research has thus shown that, depending on the school, aggressive behavior is often perpetrated by adolescents who enjoy high status and popularity and that these behaviors are thus reinforced via peer networks (Cohen and Prinstein, 2006). If these aggressive behaviors are not adhered to by other adolescents as social norms of a class or school, this can be accompanied by social punishment, for example through rejection (Juvonen and Galvan, 2008). Thus, our results may suggest that the association between higher levels of aggression and increasing rejection is related to class or school social norms that promote aggressive behavior. As there is still little research on this topic, this result should be tested with a larger sample in future research and include the social norms of a class or school.

As assumed for hypothesis five, no significant influence effect of the rejection networks on the development of aggression was found. Contrary to empirical findings so far (Kapella, 2011; Straus et al., 2017; Enzmann et al., 2018; Kassis et al., 2018), the results showed no significant relationship between parental physical abuse experiences and changes in aggressive behavior over time. Thus, Hypothesis 6 can only be partially confirmed. Reasons for this may include the complexity of the relationships between parental physical abuse and aggressive behavior. Other factors, such as gender and violence acceptance, may have stronger effects on changes in aggressive behavior and mask possible effects of parental physical abuse. Another explanation could be that, as recent studies show, a person-centered analysis of adolescents who have experienced parental abuse provides a more nuanced picture of their socio-emotional development. Adolescents with parental abuse experience belong to different patterns, which are not always (only) accompanied by aggressive behavior but can also show internalizing behavior (Aksoy et al., 2022; Favre et al., 2022; Kassis et al., 2022). However, without further analyses and research, it is difficult to determine the exact reasons why

no significant main effects of parental physical abuse on changes in aggressive behavior were found.

New insights for peer-led interventions and preventions

As Laninga-Wijnen and Veenstra (2021) noted in their review of peer network studies and interventions in adolescence, peer-led interventions are gaining popularity due to the central position of peers in students' lives. One obstacle is the effectiveness of these interventions, as the dynamics of peer relationships have not yet been sufficiently researched, especially in relation to rejection networks and their combination with positive networks. Decreased levels of aggression and violence acceptance showed a positive effect on peer rejection. Our findings may contribute to peer-led interventions to address negative peer dynamics in classrooms when implementing anti-aggression programs. This may have implications for the development of new approaches to aggression education in schools. Future studies should focus on the combination of positive and negative peer networks (Berger and Dijkstra, 2013), and consider violence and attitudes as well as parental abuse experiences as an accelerator of peer rejection. To our knowledge, this study is the first to show that aggressive behavior increases over time when individuals tend to reject many of their peers. Thus, peer rejection is not only a risk factor for rejected youth, but also for rejecting youth. This raises the question of whether anti-aggression programs focus sufficiently on rejecting students and whether this dynamic is recognized and taken into account. This new insight could help to address rejection in intervention and prevention programs to minimize aggressive behavior and thus buffer the development of aggression. Adolescence appears to be an important period for network-based interventions, as shown in the review and meta-analysis by Hunter et al. (2019). However, despite strong evidence for the influence of peers on adolescent health behaviors, not much has been conducted to date. We argue that peer networks in school settings are important, focusing on social network mechanisms in adolescent populations to promote positive health outcomes. However, socio-emotional development of adolescents could also benefit from these network-based interventions, which aim to influence the classroom through the most popular classmates (Hunter et al., 2019), challenging school norms about the acceptance of violence through prosocial interventions (Palacios et al., 2019).

New insights for resilience research

From the perspective of resilience theory, the results imply that peer rejection is a very strong risk factor for adolescents, compounded by aggression and violence acceptance, especially for female adolescents. To our knowledge, experiences of physical abuse have never been included in a SAOM. This is particularly significant from a resilience theory perspective, as the consideration of the social context of a school class corresponds to a contemporary understanding of resilience according to Ungar et al. (2019). We were thus able to show for the first time that the consideration of specific additional risk factors, in this case peer rejection, with a network-analytical framework plays a significant role in understanding the effects of experiences of parental physical abuse and the associated development of aggression. Considering that resilience in adolescence is a concept that pertains to relationships with teachers and peers at school and processes occurring within and among different systems, a more comprehensive approach is required. We support Masten (2015) proposal, which characterizes resilience as the capacity of a dynamic system, not solely confined to individuals, to adjust effectively and cope with developmental disruptions, such as parental abuse in adolescence. Future efforts to promote the socio-emotional development of adolescents should therefore focus on promoting positive peer relationships and preventing negative peer relationships, with a focus on particularly vulnerable adolescents. Although peer rejection is a complex mechanism, it can be addressed at different levels by promoting a conducive classroom climate, working on positive student–teacher relationships and sensitizing students as well as teachers about the consequences of violence acceptance (Hektner and Swenson, 2012).

Limitations

There are some limitations to this study that might affect the interpretation of the results. First, the sample of rejection networks was limited to Swiss school classes, as students in the Swiss school system spend most of their time in the same class during high school. However, peer relationships naturally go beyond the boundaries of the school class and can also occur at the school level or outside the school setting, especially in the context of problem behaviors such as aggressive behavior (Kiesner et al., 2003). Future research could examine different contexts, such as grade levels and whole schools. Each social network analysis focuses on a specific topic. In this study, we worked with the overall sample. If we had had a much larger sample, we could also have carried out social network analyses with subsamples as by gender, migration, and/or socio-economic status. Another limitation is that only one form of network was examined, whereas the interplay of the co-evolution of positive and negative networks could provide an even more detailed picture and should be considered in future research (Veenstra and Dijkstra, 2011; Huitsing et al., 2014), although negative networks are still fairly under-researched and it is therefore an important first step to emphasize the importance of effects in negative networks. From a resilience theory perspective, future research will need to include both specific risk and protective factors in order to gain a holistic understanding of the factors that influence young people's development in school. We have also only considered one form and no extent of a negative network and, thus, have not distinguished between, for example, disliked and hated peers (enemies), although hate is more closely related to a stronger emotional attachment and is often associated with negative interpersonal experiences (Abecassis, 2003; Hartup, 2003). Furthermore, aggression toward peers was self-reported in the present study; aggression could be reported in future studies from different perspectives, such as from the respective teacher or through peer nomination data. Although all currently known measures (Cillessen and Marks, 2017) were taken in the sociometric data collection (random order of names, unlimited number of nominations, computerized nominations) to obtain the most meaningful results

possible, and only classes with enough students were included with the Jaccard index, there were a large number of changes in the classroom composition due to unpredictable class changes, making the stability of the results uncertain. At the same time, it is a reality in schools in Switzerland that class compositions change again and again, which could also be a factor for rejection processes. Therefore, future research should factor in whether changes in class composition make a significant contribution to rejection processes. Longitudinal network studies face the challenge of achieving sufficient statistical power as well as avoiding type 1 and type 2 errors (Stadtfeld, 2018). To address these challenges, we designed the study according to Stadtfeld (2018), including ensuring a sufficiently large sample size as well as low attrition. Nevertheless, we would like to emphasize that researchers should proceed with caution when interpreting their results and follow all these steps as described in Stadtfeld (2018).

Conclusion

Three key questions were addressed in this study: First, we examined how gender, violence experiences (parental physical abuse), attitudes (violence acceptance) and behavior (aggression) as well as dissociations affect the likelihood of being rejected by peers. Second, we examined how the interaction of violence experiences and externalizing and internalizing behaviors affect the likelihood of being rejected by peers. Third, we explored how gender, violence attitudes and experiences contribute to changes in violence behaviors among adolescents over time. By addressing these questions, we gained a deeper understanding of the interplay between individual characteristics, negative peer relationships and the development of aggression and rejection in adolescence. The results of the longitudinal network analysis could confirm the hypothesis that rejection can have serious consequences, including an increased risk of behaving more violently over time, especially when rejecting many other classmates. Young people caught in the spiral of violence were shown to be at increased risk of being rejected by their peers. They may be more likely to seek acceptance in negative ways, such as through aggression or violent attitudes. Therefore, identifying and addressing the causes of peer rejection is particularly important, focusing on young people who reject many other classmates as well as adolescents who are rejected by peers. Teachers and schools should offer support and resources so that they can build healthy social relationships. From the perspective of resilience research, schools as dynamic systems can and should promote the resilience development of their students (Ungar et al., 2019) and, thus, influence reducing rejection within classes to support young people in their socio-emotional development. By targeting positive social interactions and teaching conflict resolution skills, schools can help reduce peer rejection and, thus, the risk of violent behavior and attitudes.

Data availability statement

The authors will make available the raw data supporting this article's conclusions without undue reservation, upon the project's completion in 2025. Requests to access the datasets should be directed to celineanne.favre@fhnw.ch.

Ethics statement

The studies involving humans were approved by Ethics Committee of the School of Education, University of Applied Sciences and Arts of Northwestern Switzerland (SNF-Project 100019_185,481). The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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