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# Quality over quantity: A transactional model of social withdrawal and friendship development in late adolescence

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## Abstract

The aim of this study was to test a longitudinal, transactional model that describes how social withdrawal and friendship development are interrelated in late adolescence, and to investigate if post-secondary transitions are catalysts of change for highly withdrawn adolescents' friendships. Unilateral friendship data of 1,019 adolescents (61.3% female, 91% Dutch-origin) from the Tracking Adolescents' Individual Lives Survey (TRAILS) cohort were collected five times from ages 17 to 18 years. Social withdrawal was assessed at 16 and 19 years. The transactional model was tested within a Structural Equation Modeling framework, with intercepts and slopes of friendship quantity, quality, and stability as mediators and residential transitions, education transitions, and sex as moderators. The results confirmed the presence of a transactional relation between withdrawal and friendship quality. Whereas higher age 16 withdrawal predicted having fewer, lower-quality, and less-stable friendships, only having lower-quality friendships, in turn, predicted higher age 19 withdrawal, especially in girls. Residential transitions were catalysts of change for highly withdrawn youth's number of friends: higher withdrawal predicted a moderate increase in number of friends for adolescents who relocated,

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and no change for those who made an educational transition or did not transition. Taken together, these results indicate that the quality of friendships—over and above number of friends and the stability of those friendships—is particularly important for entrenching or diminishing withdrawal in late adolescence, and that relocating provides an opportunity for withdrawn late adolescents to expand their friendship networks.

#### KEYWORDS

adolescence, friendship, post-secondary transition, social withdrawal, transactional model

## 1 | INTRODUCTION

Studies about longitudinal, transactional relations between social withdrawal and friendship development in late adolescence are rare. We investigated to what extent friendship network characteristics—friendship quantity, quality, and stability—and changes in these characteristics, affect and are affected by social withdrawal in this phase of life. Social withdrawal is an umbrella term referring to the voluntary self-isolation from others through the consistent display of solitary behaviors (Rubin et al., 2009). While the underlying motivation to withdrawal can vary between individuals and differentiates between withdrawal types (i.e. shyness, unsociability, and avoidance; Coplan & Armer, 2007), phenotypic withdrawal behaviors overlap across withdrawal types. 'Social withdrawal' in the current study refers to the global, multidimensional, behavioral phenotype of consistently displaying solitary behaviors. Previous studies have focused primarily on unidirectional effects of withdrawal on friendships. Nevertheless, bidirectional, transactional associations between withdrawal and friendships are likely. Transactional models of development detail associations between developmental processes, such as between individuals' withdrawal behaviors and their interpersonal environment, while considering how individuals both actively shape and respond to their interpersonal environment over time (Gazelle & Rubin, 2019; Sameroff & Mackenzie, 2003). Stated differently, the nature of one's interpersonal environment can be predicted by one's behavior, and may mediate<sup>1</sup> how this behavior diminishes or becomes entrenched over time (Dodge & Pettit, 2003; Sameroff & Mackenzie, 2003). A transactional model of the development of social withdrawal suggests that children's withdrawal behaviors contribute to problems initiating and maintaining friendships and, in turn, friendship difficulties contribute to becoming more withdrawn (Rubin et al., 2009). When the social environment improves and becomes "kinder' and 'gentler'" (Rubin et al., 2009, p.13), children increase their motivation to socially engage with peers, leading to decreases in withdrawal. This process is likely to occur not only in childhood, but to persist throughout adolescence. Friendship development continues and begins to play a more prominent role in individuals' socio-emotional adjustment in adolescence and early adulthood (Bagwell & Schmidt, 2011; Berndt, 1982; Hartup & Stevens, 1999; Youniss & Haynie, 1992), and withdrawal remains a robust predictor of social maladjustment throughout these ages and beyond (Barzeva et al., 2019; Bowker et al., 2014; Nelson et al., 2020).

Despite the theoretical basis and emerging evidence for a transactional relation between withdrawal and friendship development, no study to date has investigated bi-directional effects between withdrawal and friendship dimensions. The extant friendship literature has identified three primary friendship network dimensions (Bukowski & Hoza, 1989; Demir & Urberg, 2004; Nangle et al., 2003; Poulin & Chan, 2010): quantity (i.e. the number of friendships in which an adolescent is involved), quality (i.e. the perceived positive and negative characteristics of the interactions with friends), and stability (i.e. the amount of change in friendship bonds over time due to friendship formation or termination). Throughout adolescence, the size of the social network increases (Asendorpf & Wilpers,

1998; Wrzus et al., 2012), and friendships increase in quality (De Goede et al., 2009; Selfhout et al., 2008, 2009; Way & Greene, 2006) and become more stable on average (Meter & Card, 2016; Poulin & Chan, 2010). Engaging in multiple friendships provides youth with opportunities to develop greater social competence across various relationships and reflects adolescents' ability to initiate friendships; whereas high-quality, stable friendships meet adolescents' socioemotional needs for belonging, provide social support, and reflect friendship maintenance abilities (Nangle et al., 2003; Parker & Asher, 1993; Waldrip et al., 2008). Adolescents who are able to initiate and maintain friendships—evidenced by having many, high-quality, and stable friendships—develop important socio-emotional skills, and experience less distress and maladjustment (Glick & Rose, 2011; Waldrip et al., 2008), whereas those who are unable to do so may miss out on these benefits and consequently experience negative socio-emotional outcomes, such as persistent or increasing withdrawal. Simultaneously investigating these three distinct but interrelated friendship network characteristics offers nuanced information about the specific dimensions of friendships that affect and are affected by withdrawal, while controlling for their interdependence.

As mentioned, there is ample evidence that withdrawal contributes to friendship initiation and maintenance difficulties. In childhood and early adolescence, withdrawal has been associated with having few friends (Ladd et al., 2011; Van Zalk et al., 2014), low friendship quality (Barstead et al., 2017; Biggs et al., 2012; Rubin et al., 2006), and a decreased likelihood of maintaining the same friendships across the school year (i.e. lower friendship stability; Ladd et al., 2011; Oh et al., 2008; Proulx & Poulin, 2013). Withdrawn late adolescents and young adults reported a slower increase in the size of their social networks (Asendorpf & Wilpers, 1998) and lower-quality best friendships (Nelson, 2013) than non-withdrawn peers. Highly withdrawn youth's difficulties initiating and maintaining friendships may be due to anxiety-related cognitions and behaviors (Ladd et al., 2011; Rubin et al., 2009). Fearing negative evaluation in social situations may prevent them from self-disclosing and developing intimacy with peers, which inhibits initiating friendships and maintaining high-quality ones. Highly withdrawn youth are also less likely to approach and to display positive affect around peers and friends (Schneider, 2009), thereby exacerbating friendship formation difficulties.

The reverse effect, how friendships diminish or exacerbate adolescents' withdrawal, has rarely been investigated, but several studies suggest the existence of this pathway. Positive peer experiences have been related to lower levels of and decreases in withdrawal (Barzeva et al., 2019a, 2019b; Kingery et al., 2010), possibly because having a positive peer network may increase adolescents' motivation to engage with potential friends, offer opportunities to disprove negative self-evaluations and develop social competencies, and provide social support (Barzeva et al., 2019b; Gazelle & Rudolph, 2004; Rubin et al., 2009). Conversely, experiencing persistent social difficulties may be anxiety-provoking and confirm highly withdrawn adolescents' negative self-evaluations in social interactions, leading to avoidance of social situations and increased withdrawal (Ladd et al., 2011). Indeed, having few friends has been associated with lower social competence (Von Salisch et al., 2014), higher social anxiety (Van Zalk & Van Zalk, 2015), and more depressive symptoms (Ueno, 2005). Having low-quality friendships has been linked to low self-worth, low social competence, and internalizing problems (Meeus et al., 2016; Rubin et al., 2004); and having low friendship security to persistently high levels of anxiety (Wood et al., 2017). The direct effect of the three friendship network characteristics on withdrawal remains to be tested.

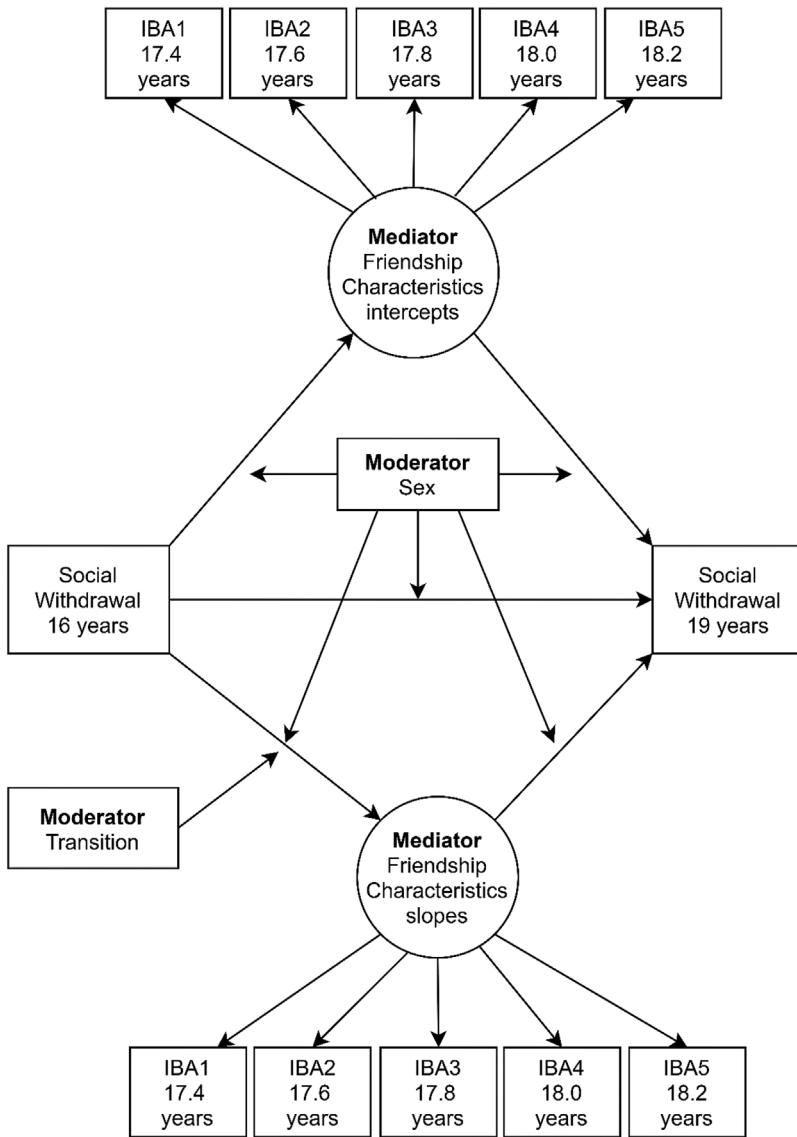
Friendship characteristics can change over time (Meter & Card, 2016). From a transactional perspective of development, it is interesting to identify the conditions under which this change occurs (Sameroff, 2009; Sameroff & Mackenzie, 2003). Possible catalysts of change in the friendship networks of highly withdrawn late adolescents are post-secondary transitions. That is, highly withdrawn youth who transition into new educational or residential environments may experience more change in their friendship networks than withdrawn youth who do not transition. The Ecological Transition Model (which falls under the broader umbrella of stage-environment fit theory; Eccles et al., 1993; Gazelle & Faldowski, 2019; Gazelle & Rubin, 2019) posits that transitions in individuals' environments serve as turning points that prompt the reorganization of the person-environment system, resulting in discontinuity of behavior, for better or for worse. During the post-secondary transition, adolescents gain more autonomy from parents, enter tertiary education or the work force, and often relocate to different cities (Duineveld et al., 2017; Tanner, 2006), exposing them to new peers, social roles, and social environments. On the one hand, novel social interactions may be

stressful, especially for highly withdrawn adolescents who struggle to approach new peers to initiate interaction. Lacking in friendship initiation and maintenance skills, transitioning withdrawn adolescents may be especially prone to maintaining low friendship quantity, quality, and stability. They may even experience a further deterioration of these friendship network characteristics, since pre-transition friendships commonly dissolve or decrease in quality during school and residential transitions (Oswald & Clark, 2003). On the other hand, undergoing a post-secondary transition into a new social environment may encourage highly withdrawn adolescents to engage in more social interactions with peers; this transition may therefore provide opportunities to develop new, positive friendships with like-minded friends (Back et al., 2011), especially if the new environment is “kinder” and “gentler,” or better-fitting (Rubin et al., 2009).

In many educational systems, such in the United States and most Canadian provinces, all youth undergo the post-secondary transition at about the same age, making it difficult to compare transitioning to non-transitioning same-aged peers without major confounding (i.e. it is difficult to discern if the observed effects are due to the transition itself or reflect normative developmental changes). In the Dutch educational system, the post-secondary school transition can occur at any age between 16 and until after 19 years (Nuffic, 2019), which means that, although many Dutch adolescents change schools during late adolescence, not all do so. Secondary education in the Netherlands has multiple academic and vocational tracks of various durations that are segregated within the same or in different schools. Adolescents may transition between these tracks, exit a secondary education track without obtaining a diploma, transition into post-secondary education environments after obtaining a secondary education diploma, or enter the workforce. This offers the opportunity to compare the friendship development of same-age withdrawn and non-withdrawn adolescents who have undergone a transition into new (non-)educational environments with those who have not. Differences between transitioning and non-transitioning youth are expected because undergoing an education transition leads to a shift in the social environment that might disrupt adolescents' existing friendships and prompt attempts to initiate and maintain new friendships.

Another common but understudied post-secondary transition that changes one's social environment—often co-occurring with an educational transition in late adolescence—is a residential transition. Unique about post-secondary relocations is that they are mostly defined by relocating out of the parental home. Before this relocation, parents have considerable influence on their adolescent's peer networks and the pool of peers from which the adolescents form friendships (Arnett, 2007; Tanner, 2006). This may apply especially to highly withdrawn youth, who commonly experience parental overcontrol and overprotection (Bögels et al., 2001; Rubin et al., 2009). When leaving the parental home, adolescents gain self-directedness and control over the structure of their social networks (Arnett, 2007; Duinveld et al., 2017; Tanner, 2006), and have the opportunity to seek out and enter more positive, self-selected social environments (Caspi & Roberts, 2001; Eccles et al., 1993). In these new environments, highly withdrawn adolescents are exposed to new peers who are unfamiliar with their previous social reputations and may become friends more easily. Alternatively, it is possible that highly withdrawn adolescents rely more strongly on their parents' directiveness, structure, and support for their social needs. When moving away from parental purview, they lose this assistance and may struggle to initiate and maintain friendships independently. Thus, post-secondary residential transitions may also disrupt adolescents' existing social environments, leading to improvement or deterioration in friendships. Taken together, it is unknown which of the two possible outcomes of post-secondary transitions (i.e. friendship improvements or deterioration) predominates in highly withdrawn adolescents, and under which post-secondary transition condition.

Finally, girls and boys may differ in the bi-directional associations between withdrawal and friendship development. Although withdrawal contributes to difficulties initiating and maintaining friendships in both girls and boys, high withdrawal in boys may be a greater risk factor for negative outcomes because inhibited behavior violates gender-normative expectations of male assertiveness and dominance. Compared to girls, peers respond more negatively to boys' withdrawn behavior, and withdrawal appears to be more strongly associated with internalizing problems in boys (Doey et al., 2014). Thus, highly withdrawn boys may struggle more to establish friendships than highly withdrawn girls. Because boys tend to prefer belonging to a large peer network (Rose & Rudolph, 2006), having few friends might



**FIGURE 1** Simplified conceptual diagram of the moderated mediation model. Friendship characteristics include friendship quantity, quality, and stability (not shown)

relate to more severe withdrawal for boys than for girls. Low friendship quality and stability might reflect more severe withdrawal for girls, because girls tend to prefer more intimate relationships (Gorrese & Ruggieri, 2012; Hall, 2011; Rose & Rudolph, 2006). Thus, sex may moderate how withdrawal predicts and is predicted by friendship network characteristics.

**1.1 | The present study**

Figure 1 depicts the transactional model (see Supplementary Materials, Figure S1 for the statistical model). In this moderated mediation model, social withdrawal predicts baseline levels and changes in friendship quantity, quality, and stability, which in turn predict future social withdrawal (i.e. the continuity of withdrawal is mediated by the

intercept and slope of the three friendship network characteristics). Transition status was modeled as a moderator of how withdrawal predicts changes in the friendship network, and sex as a moderator of all paths. Because friendship quantity, quality, and stability are interrelated characteristics that co-evolve over time (Hartup & Stevens, 1999; Lodder et al., 2017; Nangle et al., 2003; Poulin & Chan, 2010), all three were modeled simultaneously to identify their unique effects.

We aimed to answer three questions: (1) To what extent do friendship network characteristics—and changes in these characteristics—affect and are affected by social withdrawal (i.e. do baseline levels and changes in friendship quantity, quality, and stability mediate the (dis)continuity of withdrawal over time)? Due to the known stability of withdrawal, we hypothesized a moderate direct effect from age 16 to age 19 withdrawal. We hypothesized that higher age 16 withdrawal would predict lower friendship quantity, quality, and stability, which in turn would predict higher age 19 withdrawal. The latter hypothesis indicates an indirect effect of age 16 to age 19 withdrawal through the friendship characteristics' intercepts and slopes, which we predicted would be small due to the use of prospective data and including moderators and multiple mediators in the model (all which reduce the indirect coefficient; Walters, 2019). (2) Do education and residential transitions, as post-secondary catalysts of change, moderate the association from pre-transition withdrawal to changes in friendship characteristics? We expected that non-transitioning adolescents, withdrawn and non-withdrawn, would report the (small) increases in friendship quantity, quality, and stability that are normative during adolescence. For non-withdrawn transitioning youth, we expected that they would increase in friendship quantity and quality, but have lower friendship stability than non-withdrawn non-transitioning youth, due to entering a new social environment. For transitioning withdrawn adolescents, we also hypothesized that their friendship stability would be lower than that of non-transitioning youth. We did not have unequivocal expectations regarding the effects on friendship quantity and quality, because relocating and education transitions could be either barriers or opportunities for highly withdrawn adolescents' friendship development. (3) Does sex moderate any of the paths in the model? We hypothesized that boys' withdrawal would be affected more by friendship quantity changes than girls' withdrawal, whereas girls' withdrawal would be affected more by friendship quality and stability changes.

## 2 | METHOD

### 2.1 | Participants

Participants included a subsample of 1,019 adolescents (61.3% female, 91% Dutch-origin) from the population-based Tracking Adolescents' Individual Lives Survey (TRAILS) cohort. The TRAILS cohort consists of youth born between 1989 and 1991 and recruited from primary schools in five municipalities in rural and urban areas of the North of the Netherlands. Additional details about the TRAILS recruitment and assessment procedure have been reported elsewhere (De Winter et al., 2005; Huisman et al., 2008; Oldehinkel et al., 2015). The subsample of the current study represents the 46.8% of the larger cohort who participated in an Internet-based Assessment (IBA). IBA data was collected five times between ages 16 (wave T3;  $M_{\text{age}} = 16.2, SD = 0.64$ ) and 19 years (wave T4;  $M_{\text{age}} = 18.9, SD = 0.54$ ) of TRAILS. In addition, we used withdrawal data collected during ages 16 and 19 years. Compared with adolescents who did not participate, IBA participants included a higher proportion of girls who were somewhat younger and more withdrawn at age 16 (but not at age 19; Table S1). Table 1 depicts the participants' characteristics.

### 2.2 | Data collection procedure

The Dutch Central Committee on Research Involving Human Subjects approved the TRAILS study. Adolescent participants provided written consent at ages 16 and 19. A parent or guardian provided written consent for adolescent participation before and at age 16. During the age 16 assessment, adolescents completed questionnaires in groups

**TABLE 1** Characteristics of participants, friendship networks, and nominated friends per Internet Based Assessment (IBA) wave

	IBA 1 (n = 707)	IBA 2 (n = 731)	IBA 3 (n = 958)	IBA 4 (n = 942)	IBA 5 (n = 940)
<b>Participant characteristics</b>					
Age, years <i>M (SD)</i>	17.4 (0.55)	17.6 (0.54)	17.8 (0.56)	18.0 (0.55)	18.2 (0.56)
Female %	63.2	64.3	62.1	63.4	62.9
Dutch % <sup>†,‡</sup>	91.4	91.0	90.6	91.2	91.3
Friendless %	2.1	1.4	1.1	0.6	0.5
<b>Friendship network characteristics <i>M (SD)</i></b>					
Friendship quantity	5.25 (1.80)	5.33 (1.78)	5.20 (1.83)	5.21 (1.81)	5.20 (1.78)
Friendship quality	3.29 (0.31)	3.21 (0.33)	3.21 (0.35)	3.18 (0.38)	3.15 (0.37)
Friendship stability	–	.86 (.20)	.81 (.22)	.77 (.24)	.76 (.24)
Prop. females in girls' networks	.75 (.22)	.75 (.23)	.75 (.24)	.75 (.27)	.77 (.27)
Prop. males in boys' networks	.79 (.24)	.80 (.23)	.76 (.27)	.78 (.28)	.77 (.29)
<b>Nominated Friends' Characteristics</b>					
N nominated friends	3,671	3,846	4,878	4,847	4,833
Age of friends, years <i>M (SD)</i>	17.5 (1.62)	17.5 (1.54)	17.6 (1.64)	17.7 (1.87)	17.9 (2.25)
Friendship duration, months <i>M (SD)</i>	51.5 (29.3)	49.3 (27.4)	49.6 (29.0)	44.6 (31.6)	42.6 (31.7)
Friend known via: (%)					
Class	30.4	30.4	29.7	28.7	29.3
School	25.0	24.8	24.3	23.1	24.3
Neighborhood	7.4	6.9	6.7	6.3	6.0
Elementary school	6.3	6.1	6.2	5.3	5.1
Club or activity	8.4	8.6	8.7	9.1	9.2
Other <sup>§</sup>	22.5	23.2	24.3	27.5	26.1

Note. Social withdrawal at ages 16 and 19 years could range from 0 to 2 ( $M_{age16} = 0.42$ ,  $SD = 0.36$ ;  $M_{age19} = 0.31$ ,  $SD = 0.34$ ).

<sup>†</sup>Ethnicity refers to the adolescents' parental ethnicity; data about race was not collected.

<sup>‡</sup>Non-Dutch ethnicities included: Surinamese, Antillean, Indonesian, Turkish, Moroccan, or another ethnicity not specified.

<sup>§</sup>Included: work, through another friend, housemate, sibling, cousin, church, dating, ex-girl/boyfriend, internet, and other-not listed.

at school, under the supervision of a research assistant. During the age 19 assessment, information was collected with online questionnaires. Between 16 and 19 years, participants were invited to complete additional Internet-Based Assessments (IBA) with shorter intervals than the usual waves. The IBA data collection began in January 2007, approximately 7 months after participants completed the age 16 assessment. The IBA consisted of items about life events occurring in the past two months, the psychological and behavioral consequences of these events, and friendship experiences. The participants received a personal login code through email to access the IBA on a secure website. Participants completed the IBA five times across one year in February, April, June, September, and November (IBA1-5, respectively). They could nominate up to seven friends in the IBA friendship portion. Per nominated friend, they answered questions including the friend's demographic characteristics, where they met, and the duration and quality of the friendship. Please note that longitudinal network data collection is practically difficult during late adolescence because the networks expand beyond the school. The IBA offers a methodology to examine peer relationships both inside and outside of the school setting by using egocentric networks.



## 2.3 | Measures

*Social withdrawal* was assessed at age 16 with the mean of five items from the Youth Self-Report (YSR; Achenbach, 2001) withdrawn/depressed scale, and at age 19 with the same five items from the Adult Self-Report (ASR; Achenbach & Rescorla, 2003). The YSR withdrawn/depressed scale has moderate test-retest reliability, and correlates moderately positively with other measures of withdrawal (Achenbach & Rescorla, 2007). The ASR withdrawn scale has high test-retest reliability and also correlates moderately positively with measures of anxiety and social introversion (Achenbach & Rescorla, 2003). All items reflecting depression symptoms (i.e., sad, enjoys little, lacks energy) were excluded from this scale. The remaining five items are: *I would rather be alone than with others*; *I am secretive or keep things to myself*; *I refuse to talk*; *I am too shy or timid*; and *I keep from getting involved with others*. Items were selected based on face validity and previous research (e.g., Booth-LaForce & Oxford, 2008; Chango et al., 2014; Eggum et al., 2009; Tang et al., 2017), and were found to be longitudinally measurement invariant in adolescence and early adulthood (Barzeva et al., 2019a, 2019b). Items were rated on a 3-point scale, with 0 = Not at all, 1 = A little or sometimes, and 2 = Always or often true, in the past 6 months. Cronbach's alpha was .68 and .66 at T3 and T4, respectively. For scales with fewer than ten items, an internal reliability cutoff of  $\alpha > .60$  is considered acceptable (Loewenthal, 2004).

*Friendship quantity* was measured by the number of friendship nominations. At IBA1, participants were instructed to list up to seven friends. At each subsequent wave, participants could indicate if they were still friends with each friend that was nominated one wave prior, and list any new friends they had made in the meantime. Number of friends at each wave could range from 0 to 7.

*Friendship quality*. Participants rated each nominated friend on five questions capturing four friendship quality dimensions conceptualized by Bukowski et al. (1994): security/intimacy, help/support, conflict, and companionship/time spent together. Specific items were selected based on the face validity of their representation of these quality dimensions, and whether similar items had been applied in previous friendship network studies (Malcolm et al., 2006; Waldrip et al., 2008). The questions regarded the two months prior to the IBA wave and were: *How well could you talk with this friend about how you are doing?* (rated 1 = Very poorly to 5 = Very well, then converted to a 4-point scale for consistency with other items); *Did this friend help you with practical things?*; *Did you ever have a big fight with this friend?* (reverse scored); *How often did you have contact with this friend during the week?*; and *How often did you have contact with this friend during the weekend?* (all rated 1 = Never to 4 = Often). Items about contact with friends did not specify if participants should include digital contact (e.g. texting, chatting, or gaming) in their response. Friendship quality at each wave was calculated as the mean item rating across all nominated friends per participant, a common approach in investigations of the quality of youth's large friendship networks (e.g. Malcolm et al., 2006; Waldrip et al., 2008). Friendship quality scores could range from 1 to 4, with a higher score indicating higher quality. The within-person alpha (analysis of multilevel reliability; Geldhof et al., 2014) of the five items was .69, .73, .77, .84, and .79 at IBA 1–5, respectively.

*Friendship stability* was determined by the Friendship Stability Index (Chan & Poulin, 2009), calculated as:

$$\frac{N \text{ renominated friends } IBA_x}{N \text{ total friends } IBA_{x-1} + N \text{ new friends } IBA_x}$$

The number of renominated friends at an IBA wave (x) was divided by the total number of unique friends across that IBA wave (x) and one wave prior (x-1). Four stability scores, between each of the five IBA waves, were calculated. Scores could range from 0 = Complete instability to 1 = Complete friendship stability.

*Education and Residential transitions* were dichotomous variables, where 0 = did not transition and 1 = transitioned. An affirmative response at age 19 to one or more of the following items, in an Events History Calendar that inquired about the previous 2 years, indicated an education transition: *Started a new educational program*; *Terminated an educational program without receiving a diploma*; and *Successfully completed an educational program*. The events to determine a residential transition were: *Moved to a new location*; *Moved away from the parental home to live alone or with a partner*; and *Moved away from home but returned to the parental home*. The education and residential transition variables capture transitions occurring between 17 and 19 years, covering the time-span of adolescents' IBA participation, with most transitions occurring at or just prior to IBA1 (Started a new educational program  $M_{\text{age}} = 17.1$ ,  $SD = .80$ ; Terminated

an educational program  $M_{\text{age}} = 17.3, SD = .78$ ; Successfully completed an educational program  $M_{\text{age}} = 17.1, SD = .81$ ; Moved to a new location  $M_{\text{age}} = 17.0, SD = .80$ ; Moved away from the parental home  $M_{\text{age}} = 17.1, SD = .78$ ; Moved away from home but returned  $M_{\text{age}} = 17.1, SD = .58$ .

*Adolescent's sex* was a dichotomous variable, coded 0 = female and 1 = male.

### 3 | STATISTICAL ANALYSES

Analyses were conducted in MPlus Version 8.4 (Muthén & Muthén, 1998–2017) using Bayesian estimation with uninformative priors, 100 thousand iterations, and 2 Monte Carlo chains. In models with latent variable interactions, Bayesian estimation outperforms the maximum-likelihood estimation (Asparouhov & Muthén, 2020). Both estimators converge on the same solution with large sample sizes (Asparouhov & Muthén, 2010). Analyses were pre-registered on the Open Science Framework ([osf.io/rp9uy](https://osf.io/rp9uy)); of note, we previously planned and pre-registered a similar study with a different analytical approach. We changed our plan of analysis to a more parsimonious model. Deviations are outlined in the new pre-registration).

First, we specified independent latent growth curve models (LGCMs) of friendship quantity, quality, and stability, and checked model fit. Goodness-of-fit cut-offs that indicate a good model fit are comparative fit index (CFI)  $\geq .95$  and root mean square error of approximation (RMSEA)  $\leq .06$  (Hu & Bentler, 1999). The linear slope factor loadings in the growth models were specified as 0 to 4 at IBA1–5, respectively. Second, we ran the baseline mediation model (Model 1), excluding the moderators. We specified the intercepts and slopes of the three friendship characteristics, and allowed them to correlate. A direct path from age 16 withdrawal (SW16) to age 19 withdrawal (SW19), a path from SW16 to the friendship characteristics' intercepts and slopes (hereby referred to as intercepts and slopes), and a path from the intercepts and slopes to SW19 were specified. The MPlus 'model indirect' statement was used to compute the indirect effect of SW16 on SW19 through the intercepts and slopes.

Third, we added the moderators residential transition, education transition, and sex to Model 1 to test the moderated mediation model (Model 2). First, we created interaction terms by multiplying SW16 by the three moderators. Second, we created latent interaction terms between all intercepts and slopes and sex (using the "xwith" statement in MPlus and "random" analysis type). Building on Model 1, we regressed the intercepts on sex and SW16\*sex. We regressed the slopes on residential transition, education transition, and all SW16 interaction terms, and regressed SW19 on sex, SW19\*sex, and the latent interaction terms. The mediated effect was manually calculated because "model indirect" cannot be used with latent interactions. Interaction terms were further investigated by plotting the simple slopes. Because model fit information is not reported in latent interaction models, an alternative approach was used to estimate goodness-of-fit (Sardeshmukh & Vandenberg, 2017); in a third model (Model 3), we excluded all latent interaction terms from Model 2, specifying only the main moderator effects. If Model 3 showed good fit to the data, we could evaluate if including latent interaction terms in Model 2 led to improvements in BIC, CFI, and RMSEA compared to Model 1.

Lastly, several sensitivity analyses were conducted. We tested if the results replicated when including participants who completed three or more IBA waves ( $n = 926$ ); when excluding the items *How often did you have contact with this friend during the week/weekend?* from the friendship quality measure; when using the maximum friendship quality instead of the mean; and when modeling age 16 and 19 withdrawal as latent variables. More information and the results of these sensitivity analyses are found in the Supplementary Materials.

### 4 | RESULTS

Table 1 depicts the friendship network and nominated friends' characteristics and Table 2 the correlations between withdrawal and the friendship network characteristics. One adolescent reported having no friends across all waves. 70% of adolescents reported a post-secondary transition during their IBA participation (65.9% education and 24.9%

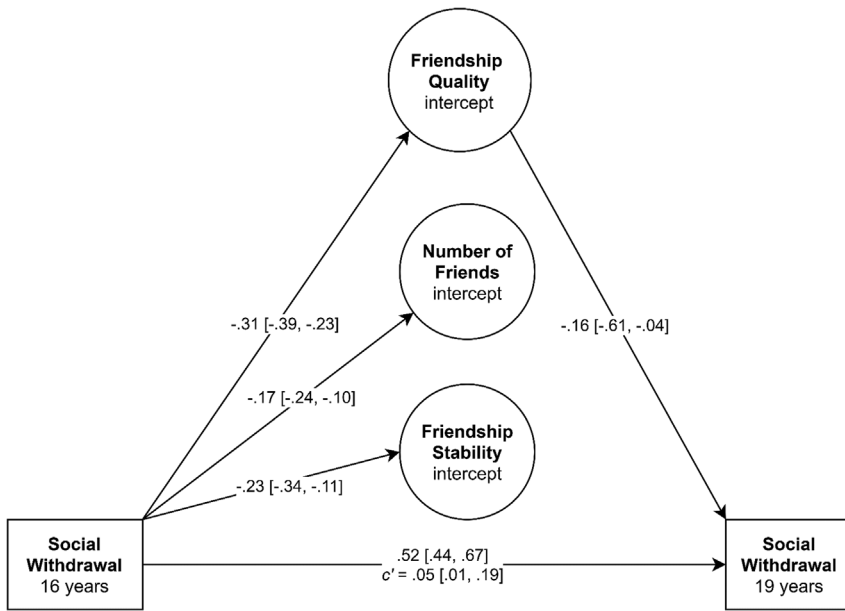
**TABLE 2** Correlations between social withdrawal and friendship quantity, quality, and stability

Variable (age)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Social withdrawal (16)															
2 Social withdrawal (19)	.56**														
3 FN (17.4)	-.17*	-.18**													
4 FN (17.6)	-.14*	-.15**	.84**												
5 FN (17.8)	-.14*	-.14**	.71**	.78**											
6 FN (18.0)	-.13*	-.13**	.62**	.67**	.79**										
7 FN (18.2)	-.12*	-.13**	.55**	.59**	.68**	.80**									
8 FQ (17.4)	-.25**	-.22**	-.05	-.02	.05	.08*	.05								
9 FQ (17.6)	-.24**	-.18**	-.02	-.08*	-.00	.03	.03	.56**							
10 FQ (17.8)	-.21**	-.18**	-.01	-.05	-.06	.02	.03	.50**	.56**						
11 FQ (18.0)	-.22**	-.15**	-.01	-.02	-.01	-.05	.02	.44**	.50**	.56**					
12 FQ (18.2)	-.23**	-.16**	.02	-.03	.03	-.00	-.03	.46**	.47**	.48**	.55**				
13 FS (17.4-17.6)	-.11*	-.05	.15**	.08*	.10*	.10*	.10*	.12**	.08*	.07	.02	.03			
14 FS (17.6-17.8)	-.14*	-.06	.08*	.07	.21**	.15**	.13**	.11**	.14**	-.01	-.01	.02	.31**		
15 FS (17.8-18.0)	-.07*	-.06	.06	.04	.15**	.12**	.13**	.16**	.12**	.10**	-.00	-.02	.28**	.31**	
16 FS (18.0-18.2)	-.05	-.03	.05	.05	.14**	.08*	.06	-.00	.06	.08*	.09**	-.01	.15**	.17**	.32**

Note. FN, friendship quantity (number of friends); FQ, friendship quality; FS, friendship stability.

\*\* $p < .01$ .

\* $p < .05$ .



**FIGURE 2** Model 1 significant standardized estimated effects [95% CI]; Total effect of age 16 withdrawal on age 19 withdrawal was  $\beta = .56$  [.51, .59]. *c'* indicates the indirect effect of age 16 withdrawal on age 19 withdrawal through the friendship quality intercept. Correlations between the mediators are not depicted

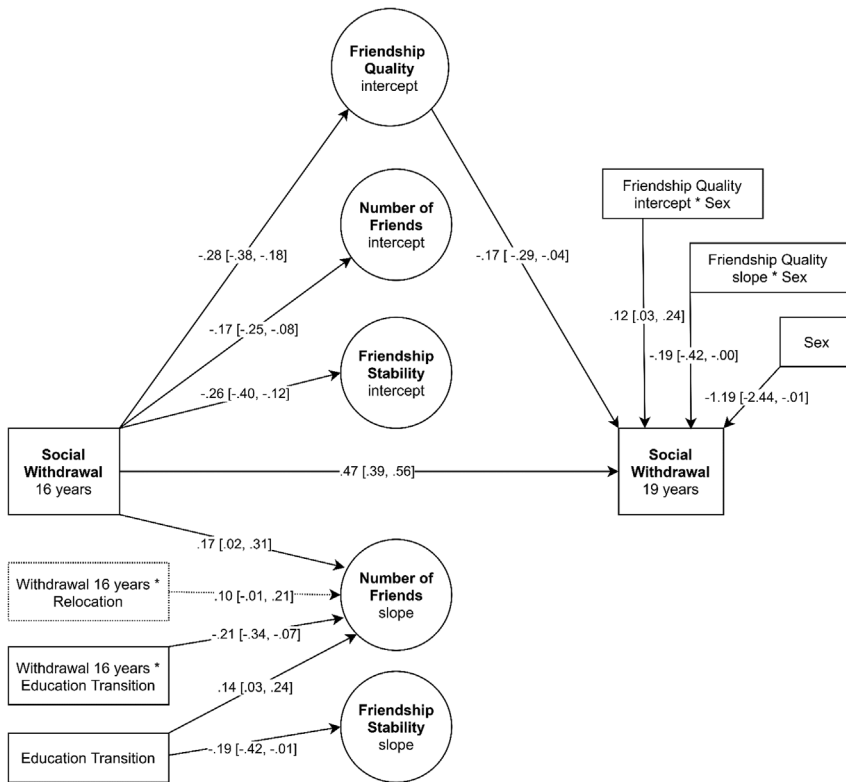
residential transition<sup>ii</sup>). Of the adolescents who relocated, 83.9% also had an education transition; of the adolescents who reported an education transition, 31.7% relocated. All friendship characteristics' LGCMs showed good fit to the data (Table S2). Although we planned to use MLR estimation, we opted for Bayesian because it is the preferred estimator for latent interaction models, and Model 2 did not converge with MLR. Differences between MLR, MLF, and Bayes estimates were minor (Table S3). All models stabilized at Potential Scale Reduction (PSR)  $\leq 1.005$  with the Bayes estimator.

#### 4.1 | Transactional effects between social withdrawal and friendship development

Model 1 (excluding moderators) showed good fit to the data (BIC = 14576.35; CFI = .95, RMSEA = .05). Figure 2 depicts the significant Model 1 effects (Table S3 shows all effects and Table S4 the intercepts and slopes correlations). There was a strong direct effect from age 16 to age 19 withdrawal ( $\beta = 0.52$ ), and a small indirect effect on the continuity of withdrawal through the friendship quality intercept ( $\beta = 0.05$ ). Age 16 withdrawal predicted having lower quality friendships ( $\beta = -0.31$ ), which in turn predicted higher age 19 withdrawal ( $\beta = -0.16$ ). Higher age 16 withdrawal also predicted a lower intercept of friendship quantity ( $\beta = -0.17$ ) and stability ( $\beta = -0.23$ ), but neither predicted age 19 withdrawal. Contrary to hypotheses, there were no mediating effects of the friendship characteristics' slopes.

#### 4.2 | Moderating effects of education and residential transitions

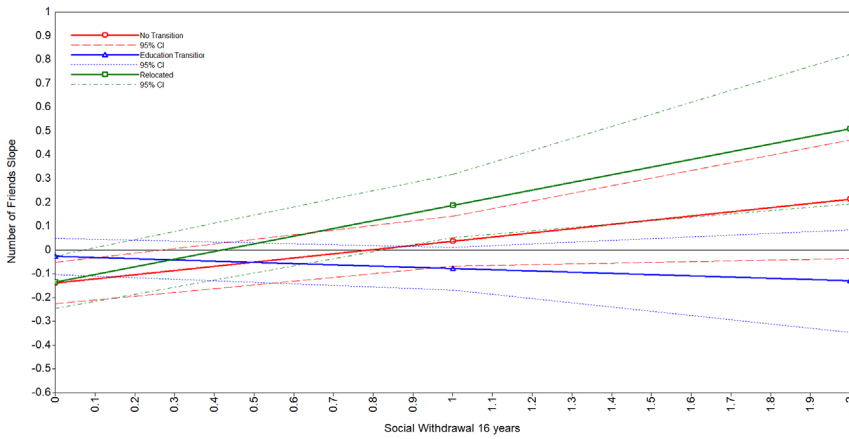
Figure 3 depicts the significant Model 2 effects (including moderators). Table S5 displays all estimated effects and Table S6 the simple slope estimates. Model 3 showed good fit to the data (BIC = 14470.66, CFI = .95, RMSEA = .04). The BIC in Model 3 was smaller than in Model 1, indicating that including moderators and latent interactions improved model



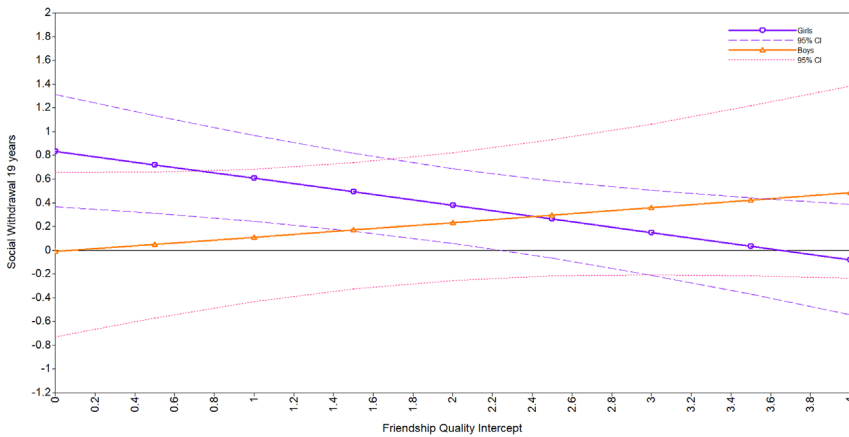
**FIGURE 3** Model 2 significant standardized estimated effects [95% CI]. The effect of withdrawal by relocation status on the slope of number of friends (dashed line) was not statistically significant in the model, but simple slopes revealed significant group differences. Correlations between the mediators are not depicted

fit. Our hypotheses that—withdrawn and non-withdrawn—non-transitioning adolescents would have small increases in all friendship characteristics were not supported: they had no change (or practically insignificant decreases) in friendship quantity (Figure 4), quality (Figure S2), and stability (Figure S3). Contrary to expectations that transitioning non-withdrawn youth would increase in friendship quantity and quality, we found that they showed small, but not meaningful, decreases in all friendship characteristics. The hypothesis that transitioning non-withdrawn youth would have lower friendship stability than non-transitioning non-withdrawn youth was supported, but only for education transitions.

Whether post-secondary transitions were catalysts of change for withdrawn adolescents' friendship networks depended on the type of transition. There was a significant interaction effect of age 16 withdrawal and education transition on the friendship quantity slope ( $\beta = -0.21$ ), and a marginally significant interaction effect of age 16 withdrawal and residential transition on the friendship quantity slope ( $\beta = 0.10$ , 95% CI =  $-0.01, 0.21$ ; Figure 3). Figure 4 depicts the simple slopes of age 16 withdrawal predicting changes in number of friends for non-transitioning, education-transitioning, and residential-transitioning adolescents. Although age 16 withdrawal positively predicted the friendship quantity slope for non-transitioning adolescents ( $B = 0.18$ ), this effect was not significant for highly withdrawn adolescents (the region of significance [ROS] ends at +1SD mean withdrawal). For adolescents who made an education transition, there was no effect of age 16 withdrawal on friendship quantity changes ( $B = -0.05$ , 95% CI =  $-0.19, 0.08$ ). For adolescents who made a residential transition, age 16 withdrawal predicted a moderate increase in friendship quantity ( $B = 0.32$ ), especially for highly withdrawn adolescents (ROS begins at +1SD mean withdrawal).



**FIGURE 4** The effect of withdrawal at age 16 on changes in number of friends across 17 to 18 years varies by post-secondary transition status (non-transitioning, education transitioning, relocated)



**FIGURE 5** Girls and boys differ on how friendship quality predicts age 19 withdrawal

### 4.3 | Moderating effects of sex

Sex predicted age 19 withdrawal, with boys reporting lower levels than girls ( $\beta = -1.19$ ; Figure 3). Having lower baseline friendship quality predicted higher age 19 withdrawal for girls ( $B = -0.23$ ,  $CI = -0.40, -0.06$ ; ROS ends at friendship quality = 2.20), but not boys ( $B = 0.12$ ,  $CI = -0.11, 0.42$ ; Figure 5). Although there was also a significant interaction effect of friendship quality slope and sex on age 19 withdrawal, simple slopes tests indicated that girls' and boys' friendship quality slopes did not differ from zero (Girls:  $B = 0.56$ ,  $CI = -1.38, 2.43$ ; Boys:  $B = -2.40$ ,  $CI = -5.73, 0.13$ ). There were no differences between girls and boys on how baseline or changes in friendship quantity or stability predicted age 19 withdrawal.

## 5 | DISCUSSION

Friendship development is a dynamic process with implications for adolescents' socioemotional adjustment. Social withdrawal is detrimental for friendship development (Ladd et al., 2011; Oh et al., 2008; Rubin et al., 2006), and

friendship difficulties are, in turn, predictive of withdrawal. (Barzeva et al., 2019b; Kingery et al., 2010). A gap in the extant literature is the absence of an integrated empirical test of this longitudinal, transactional process. The first aim of this study was to test a transactional model of social withdrawal and friendship development in order to better understand which specific friendship network characteristics predict and are predicted by withdrawal in late adolescence. The second aim was to investigate if post-secondary transitions are catalysts of change of these friendship network characteristics, that is, if education and residential transitions are associated with improvements or deterioration of highly withdrawn late adolescents' friendship networks.

Consistent with research in childhood, social withdrawal in late adolescence predicted having fewer, lower quality, and less stable friendships. This indicates that the friendship difficulties of highly withdrawn children persist into late adolescence. In turn, only friendship quality predicted future levels of withdrawal. Together, a transactional pattern between withdrawal and friendship quality emerged, in which higher withdrawal predicts lower friendship quality, and vice versa. This means that the transactional model was specific to the quality of the friendship network. As described previously, transactional models detail associations between developmental processes while considering how individuals both shape and respond to their interpersonal environment over time (Gazelle & Rubin, 2019; Sameroff & Mackenzie, 2003). Individuals' interpersonal environment is predicted by their behavior, and mediates how this behavior becomes entrenched over time (Dodge & Pettit, 2003; Sameroff & Mackenzie, 2003). A transactional relation between withdrawal and friendship quality shows that quality, over and above quantity and stability, is a critical underlying friendship-related mechanism of the entrenchment of withdrawal in late adolescence. This may be because highly withdrawn youth are inhibited when around others and have difficulties self-disclosing. Because self-disclosure is essential to developing intimacy with friends and to asking for and obtaining support when needed (Ladd et al., 2011)—central facets of friendship quality—withdrawn behaviors are disadvantageous to the development and maintenance of high-quality friendships. In turn, when friendship quality is low, adolescents feel more lonely, have lower self-worth, and experience more internalizing problems (Oswald & Clark, 2003), leading to greater avoidance of social situations and becoming more withdrawn. The specificity of the transactional relation between withdrawal and friendship quality, over and above quantity, also suggests that having even one close and supportive friend may lead to the discontinuity of withdrawal. Engaging in even one high-quality friendship is conducive to feeling socially integrated and supported (Nangle et al., 2003; Parker & Asher, 1993; Waldrip et al., 2008), can prevent negative self-evaluations, and help highly withdrawn youth develop social competencies in a safe context (Gazelle & Rudolph, 2004; Wei et al., 2005). Helping highly withdrawn late adolescents and early adults improve the quality of existing friendships—rather than focusing solely on making new friends—is a plausible intervention for decreasing withdrawal and improving well-being.

Our findings indicated that residential transitions provided an opportunity for highly withdrawn youth to expand their friendship networks: highly withdrawn adolescents made more friends (2 to 3 new ones in one year) than other adolescents when they made a residential transition, but did not make more friends when making an education transition or no transition. The finding that residential, rather than education transitions were catalysts of change for highly withdrawn youth's number of friends could be explained by differences in how much each transition caused disruptions in the friendship network, and the amount of novelty and autonomy each transition provided. Residential transitions in late adolescence prompted the reorganization of the person-environment system vis-à-vis attempts to initiate new friendships. Post-secondary residential transitions are major developmental milestones because they are defined by moving out of the parental home (Arnett, 2007). Indeed, almost all residential-transitioning adolescents in our sample indicated that they moved out of the parental home to live independently. As described previously, parental over-control and overprotection may restrict withdrawn adolescents' engagement in social situations and development of social skills and autonomy (Bögels et al., 2001; Rubin et al., 2009). When moving out of the parental home, highly withdrawn adolescents not only experience a disruption of existing friendship bonds because their geographic proximity to friends inevitably changes, but they also gain self-directedness and more control over their social networks. They have more autonomy to seek out and enter better-fitting or kinder social environments that provide more opportunities to develop new friendships (Caspi & Roberts, 2001; Duineveld et al., 2017; Eccles et al., 1993; Tanner, 2006).

The transition status of non-withdrawn adolescents had no meaningful effect on their friendship network size, likely because these adolescents had already developed greater autonomy before the transition and fit-in better within their social environment.

Education transitions, when not accompanied by residential changes, appeared to maintain the status quo of the network because education transitions may cause minimal disruptions of existing friendship bonds when the education-transitioning adolescent remains in the same geographic location. Youth's reliance on schools for social interaction decreases after childhood (Poulin & Pedersen, 2007). Because adolescents have more opportunities to interact with friends outside of the school setting, a change in school did not affect these friendship bonds. A second possible explanation is that most changes in the social environment from before to after a post-secondary education transition were small. Most education-transitioning adolescents started a new educational program. Although they entered a new educational program with new peers, the social structure of this educational environment might not be novel enough to prompt highly withdrawn adolescents to attempt to change their interpersonal and friendship-formation strategies. In other words, the way withdrawn adolescents initiate and maintain friendships in the context of one educational program may carry over to the next educational program because the two social contexts are very similar (Eccles et al., 1993; Gazelle & Faldowski, 2019).

Finally, sex was explored as a moderator of all pathways in the transactional model. Lower friendship quality predicted higher age 19 withdrawal for girls, but not for boys. Consistent with previous work, low friendship quality reflected more severe withdrawal for girls, perhaps because girls tend to prefer involvement in more intimate, dyadic relationships (Gorrese & Ruggieri, 2012; Hall, 2011; Rose & Rudolph, 2006). Engaging in low-quality friendships may have elicited more internalizing problems, evaluative concerns, and loneliness in girls (Rose & Rudolph, 2006), leading to an increase in withdrawal behaviors. We hypothesized an effect of the number of friends on boys' withdrawal, because boys tend to prefer belonging to the larger peer network (Rose & Rudolph, 2006), but found no evidence for this. By late adolescence, the peer network becomes more difficult to define because friendships no longer occur exclusively within one cohesive group, such as in the school or classroom (Poulin & Pedersen, 2007). The reference point for popularity or belonging might shift away from the number of friends that boys have at school to more dyadic features (LaFontana & Cillessen, 2010), thereby reducing the effect of friendship quantity on withdrawal.

## 5.1 | Limitations and future directions

Several limitations should be considered when interpreting these results. First, we used a global conceptualization of withdrawal, which did not assess underlying motivations. The various motivational reasons for withdrawing, such as fear of negative evaluation, social disinterest, or peer rejection, and spending time alone (Coplan et al., 2021; Nguyen et al., 2019) could be differentially associated with friendship quantity, quality, and stability. For example, unsociable-withdrawn youth experience solitude more positively (Coplan et al., 2021; Daly & Willoughby, 2020) and may have fewer difficulties initiating and maintaining friendships than anxious-withdrawn youth (Ladd et al., 2011). Although underlying withdrawal motivations may be more or less strongly related to friendship outcomes, withdrawn youth of any subtype tend to have worse friendship experiences than non-withdrawn ones (e.g., Barstead et al., 2017; Nelson, 2013), and there is considerable overlap between the subtypes (Barstead et al., 2017; Closson et al., 2019; Eggum-Wilkens et al., 2020; Nelson, 2013). Nevertheless, assessing adolescents' reasons for withdrawing when investigating the relations between friendship network changes and withdrawal might enlarge our understanding of these processes.

Second, we used an egocentric network approach, capturing how adolescents perceived their friendships through unilateral nominations, without considering nominated friends' perceptions. The nominated peers may or may not have reciprocally nominated the target adolescent. Reciprocally-nominated friendships have higher friendship quality (Cairano et al., 2007) and stronger affective relationships, but both reciprocal and unilateral friendships differ from non-friends or acquaintances (Newcomb & Bagwell, 1995). Highly withdrawn youth may report poorer



friendship quality because of negative cognitive biases which make them more rejection-sensitive (Gazelle & Druhen, 2009) or vigilant toward the negative aspects of their friendships. In that case, their friends may perceive their relationship more positively. Nevertheless, because unilateral friendships reflect subjective perceptions, they are as important for adjustment as reciprocal friendships (Berndt & McCandless, 2009; Poulin & Chan, 2010); and using unilateral assessments is a suitable methodology for collecting longitudinal network data in late adolescence, when networks expand beyond the school. Regardless, investigating the differences between unilateral and reciprocal friendships regarding withdrawal is warranted. Relatedly, we did not assess the withdrawal levels of the nominated peers. Withdrawn children are more likely to have a withdrawn best friend (Rubin et al., 2006), and withdrawn children report lower friendship quality with withdrawn friends than with non-withdrawn friends (Schneider, 1999). It would be interesting to examine how homophily in withdrawal between friends, through peer selection and influence processes (for a review of these processes in the context of internalizing behaviors, see Neal & Veenstra, 2021), affect adolescents' friendship development.

Third, we did not assess the amount of digital communication that adolescents had with their friends. It is possible that digital communication moderated the degree to which post-secondary transitions disrupted adolescents' existing friendships. That is, the absence of differences in the stability of friendships between transitioning and non-transitioning adolescents could be due to adolescents maintaining long-distance, digital communication with friends, leading to higher friendship network stability. It would be interesting for future studies to investigate how digital communication during post-secondary transitions affects the associations between withdrawal and adolescents' friendship network characteristics.

Fourth, we did not account for romantic relationship involvement. Late adolescence is an important period for the formation and maintenance of romantic relationships, and involvement in romantic relationships affects adolescent friendships (Camirand & Poulin, 2019; Zimmer-Gembeck, 2002). Romantic partners begin replacing friends as the main source of intimacy and support, and youth begin spending more time with romantic partners in lieu of friends. Involvement in romantic relationships may lead to more friendship conflict and dissolutions (Zimmer-Gembeck, 2002), thereby influencing friendship network characteristics. However, highly withdrawn adolescents become romantically involved at an older age than more sociable adolescents (Boisvert & Poulin, 2016), and high-quality romantic relationships involvement may buffer the negative effects of poor friendship network characteristics on withdrawal. Future studies could examine the bi-directional influences of romantic relationship characteristics on friendship characteristics and test if romantic involvement moderates the effects of friendships on withdrawal.

## 6 | CONCLUSION

The friendship difficulties of highly withdrawn youth persist into late adolescence. The quality of the friendship network emerged as the key underlying friendship-related mechanism of the entrenchment of withdrawal in late adolescence. Focusing on improving the quality of highly withdrawn late adolescents' existing friendships could be beneficial for diminishing withdrawal. Whether post-secondary transitions are opportunities or barriers to highly withdrawn adolescents' friendship development depends on the type of environment into which they transition. Providing highly withdrawn adolescents more autonomy and opportunities to select better-fitting social environments, which naturally occurs during post-secondary residential transitions, could help them initiate new friendships. Continued investigation into the dynamic friendship networks of individuals, and implications for adjustment and well-being across the lifespan, is warranted.

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## ENDNOTES

- <sup>i</sup> Although Sameroff and Mackenzie (2003) suggest that transactions generally require moderator analyses, they acknowledge that, per the seminal work of Baron and Kenny (1986), mediator analyses are preferable when a moderate to strong association between predictor and outcome is expected. This is indeed the case in the current study: the stability of social withdrawal between the two assessment waves was (and was a priori expected to be) moderate.
- <sup>ii</sup> 52.1% started a new educational program; 15.9% terminated an educational program without receiving a diploma; 40.8% successfully completed an educational program; 16.9% moved to a new location; 21.7% moved away from the parental home to live alone or with a partner; 2.5% moved away from home but later returned to the parental home.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## DATA AVAILABILITY STATEMENT

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

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