Siblings as Buffers: Social Problems and Internalizing and Externalizing Behaviors Across Early Adolescence

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Youth who struggle to maintain positive peer relationships are more likely to display emotional and behavioral problems, particularly during adolescence. Alternative avenues of social support may buffer against these maladaptive outcomes, particularly sibling relations, as they oftentimes predict adolescent outcomes above and beyond that of parents and peers. The present study examined the role of objective sibling warmth on the longitudinal association between social problems and maladjustment in a sample of 45 adolescent sibling dyads, further testing how effects varied between younger (M_{age} = 12.1; 24 females) and older (M_{age} = 14.5; 21 females) siblings. Sibling interactions were observed during cooperative and stressful problem-solving tasks, and later coded for expressions of warmth directed from one sibling to the other. Adolescent social problems and internalizing and externalizing behaviors were collected by multi-informant report and at a 1-year follow-up. Multilevel analyses indicated that adolescents with older siblings who exhibited more warmth were buffered against the effect of social problems on externalizing behaviors, with marginal effects for internalizing symptoms. Younger sibling warmth did not serve as a buffer for older sibling maladjustment. These findings emphasize the importance of considering how multiple dimensions of social support operate to influence functioning, particularly early in adolescence.

Keywords: siblings, social problems, internalizing, externalizing, problem-solving

Though the majority of children in the U.S. grow up with at least one sibling (78%; Knop & Siebens, 2018), research on the developmental impact of sibling relationships lags behind that of parents and peers, leaving an advantageous avenue of research on social support largely neglected (Feinberg et al., 2012). Multiple avenues of support are particularly beneficial during the transition to adolescence as the peer context increases in saliency and complexity (Thompson et al., 2006), which can cascade into the development of emotional and behavioral problems for those who struggle to navigate this changing social landscape (Bornstein et al., 2010). However, given the close proximity and availability of sibling relationships across this time period (Cicirelli, 1995), younger adolescents may be able to turn to their older sibling for warmth,

companionship, and support to compensate for a lack of peer acceptance. Ultimately, the sibling relationship is one of the most enduring relationships in one's life, with early qualities laying the groundwork for warmth and support received later in life (Goetting, 1986). The present study aimed to deepen our understanding of how sibling warmth captured during adolescence may offer compensatory effects by, (a) coding observations of younger and older sibling warmth during dyadic problem-solving tasks, (b) examining sibling warmth as a buffer against the association between adolescent social problems and the later development of internalizing and externalizing behaviors, and (c) investigating whether effects varied by birth order.

Internalizing and Externalizing Behaviors in Adolescence

Adolescence is characterized by a multitude of developmental changes in biological, psychological, and social domains (Cicchetti & Rogosch, 2002). Specifically, changes in an adolescent's social relationships occur as they begin to strive for increased independence and autonomy from their parents, while seeking closer and more intimate relationships with peers (Thompson et al., 2006). Though many individuals successfully navigate these transitions, the inherent state of flux and reorganization characteristic of adolescence increases the potential for internal (e.g., low self-esteem) and external conflict (e.g., peer difficulties), ultimately making this developmental transition a sensitive period for the development of psychosocial problems (Cicchetti & Rogosch, 2002).

Internalizing and externalizing symptoms are often examined to capture more broadband forms of maladjustment across

development (Achenbach et al., 2016). The internalizing domain encapsulates mood disruptions such as depression, anxiety, and withdrawal, and has been linked to ruminative cognitive patterns that exacerbate negative affect and depressed mood (Abela et al., 2004). These self-focused, ruminative thoughts may be triggered more often in individuals who experience frequent social problems, as adolescents often seek out social information during self-evaluation, ultimately increasing internalizing symptoms over time (Oland & Shaw, 2005). Externalizing behaviors encapsulate actions that are directed outward, including aggression, oppositional behaviors, and property and status violations (Frick et al., 1993). Status violations in particular—including truancy, swearing, running away from home, and drug and alcohol use—have been found to increase on average across adolescence (Bongers et al., 2004). This uptick may be linked to the increase in normative stressors associated with the transition to adolescence (e.g., interpersonal problems), as engagement in externalizing behaviors may bring about relief and serve as a dysfunctional coping mechanism (Daughters et al., 2009).

Social Problems and Maladjustment

Peers become increasingly salient, rewarding, and influential across the transition into adolescence (Blakemore, 2018; Telzer, van Hoorn, et al., 2018). As teens spend almost twice as many waking hours with peers in comparison to parents (Agnew, 2003), they also place greater attention on fitting-in to their evolving peer network and rely more heavily on peer input for social comparison, emotional support, and problem-solving (LaFontana & Cillessen, 2010). As these changes provide new types of relationships and associated increases in intimacy, adolescents must develop a more refined set of social skills (Brown & Larson, 2009). These skills extend beyond those developed in childhood, which center around play activities and group acceptance, as adolescents must develop more intimate interpersonal competencies including the initiation of conversation, the provision of emotional support, and the disclosure of personal information to peers (Buhrmester, 1990). Difficulties implementing these skills may hinder adolescents from establishing close peer relationships, which in turn limits future opportunities to practice and develop the social competencies necessary for positive development.

These social problems can cascade into later internalizing and externalizing symptoms (Bornstein et al., 2010). According to the competency-based model of depression, children actively seek out feedback from others regarding their performance in multiple domains of their life (e.g., social and academic; Cole, 1991). When aversive feedback is consistently received, children may internalize these appraisals and adopt global, negative self-perceptions. Previous research has evidenced that multi-informant ratings of low social competence predict longitudinal increases in depression at the transition to middle school (Cole et al., 1996). Furthermore, earlier symptoms of depression promote the erosion of later peer support (Stice et al., 2004), suggesting the potential for an escalating cycle of social problems and internalizing symptoms over time.

A large body of theory and research additionally supports the connection between heightened social problems and externalizing behaviors, as adolescents who struggle to appropriately engage with their peers may turn to more deviant peer groups for acceptance (Dishion & Patterson, 2006). This affiliation further promotes the escalation of externalizing problems during a developmental period

in which peers are particularly influential (Luciana, 2013), as antisocial friends often model, reinforce, and encourage problematic behaviors and attitudes (Laird et al., 1999). Delving deeper into social problems, experiences of chronic peer victimization have been linked to everyday antisocial behavior, as feelings of exclusion may trigger an increase in risk-taking behaviors as adolescents attempt to establish social connections and gain acceptance from their peer group (Telzer, Miernicki, et al., 2018). Given the associations between social problems and maladjustment, investigating alternative avenues of social support may be beneficial in promoting adolescent adjustment.

The Role of Sibling Relationships During Adolescence

Though adolescents' primary social network shifts away from the family and toward peer groups, adolescents also view siblings as more available and accessible over time in comparison to peers (Cicirelli, 1995). Further, adolescents tend to rate their siblings as an important source of intimacy and companionship (Lempers & Clark-Lempers, 1992) and report more frequent self-disclosure to their siblings than to their parents or friends (Howe et al., 2000). Siblings serve as a unique source of emotional and instrumental support, fostering interpersonal development through both positive (e.g., warm and supportive) and negative (e.g., conflictual) interactions (Feinberg et al., 2012). Specifically, siblings scaffold the learning of interpersonal problem-solving skills—for example, learning how to negotiate or compromise to arrive at a solution in the midst of conflict. These constructive, communication-based skills have been linked to higher levels of sibling warmth, and additionally foster the development of prosociality and empathy, which may be leveraged in intimate relationships outside of the family system (e.g., with peers; Lam et al., 2012; Rinaldi & Howe, 1998). Overall, siblings play an important role in preparing children for peer interactions and continue to serve as a sounding board for the practice of interpersonal skills throughout development (Cicirelli, 1995).

Accumulating evidence suggests that warm sibling relationships in adolescence are linked to both concurrent and longitudinal psychosocial outcomes (Hollifield & Conger, 2015; Yeh & Lempers, 2004), including reduced internalizing and externalizing problems (for a review, see Buist et al., 2013). For example, above and beyond parent–child relationship quality, longitudinal increases in sibling intimacy are linked to increases in peer competency and, for girls, decreases in depressive symptoms (Kim et al., 2007). Moreover, beyond direct effects, empirical evidence suggests that sibling support may play a compensatory role when peer support is lacking (e.g., East & Rook, 1992; Milevsky, 2005). These findings align with social provisions theory, which suggests that individuals seek out specific types of social support from specific relationships. If support is lacking in one relationship, an individual will turn to alternative sources to fill in the gap (Furman & Buhrmester, 1985; Weiss, 1974). As such, adolescents with heightened social problems who find it difficult to request support from peers may turn to their siblings for disclosure, support, and advice, which in turn may buffer against the development of internalizing or externalizing behaviors that could otherwise manifest. However, this theory is not fully supported in the literature, as other empirical investigations have failed to find compensatory effects of sibling relationships (e.g., van Aken & Asendorpf, 1997). Given these mixed findings, it would be beneficial to move beyond broad measures of sibling

support and investigate the specific behaviors and contexts in which warmth and support may be offered. The majority of past work has examined sibling interactions within general problem-solving contexts, including verbal discussions (e.g., Bullock & Dishion, 2002) and interactive tasks (e.g., Iturralde et al., 2013). However, despite the affective and dynamic nature of sibling relationships, very few studies have compared sibling behaviors across different types of contexts—for example, during collaborative, stressful, or conflictual interactions. The present study seeks to address this gap in the literature by investigating the provision of sibling warmth across varied problem-solving situations.

Finally, birth order and related age differences within sibling relationships can create an innate hierarchical dynamic that may qualify the effects of warmth and support provided within dyads (Feinberg et al., 2012). Younger siblings are more likely to view their older siblings as powerful and nurturant, and therefore may be more likely to seek them out for advice or support. Given these dynamics, most research has exclusively focused on unidirectional models of older-to-younger sibling influence (Whiteman et al., 2017). However, younger siblings are active agents within the sibling subsystem, with influence and support flowing in a bidirectional manner (Cox & Paley, 1997). Therefore, the present study included birth order as an additional moderator to test whether younger sibling warmth served as a protective factor against older sibling maladjustment, or if effects remained unidirectional.

Present Study

The present study utilized behavioral observations to examine if sibling warmth served as a buffer between social problems and later maladjustment in a sample of early and older adolescents. This work expands upon previous research that has predominantly relied upon questionnaires to measure sibling relationship quality (Buist et al., 2013). Though important for understanding an individual's own perceptions, these measures are often quite broad and fail to offer specificity with regards to the mechanisms and contexts by which sibling warmth and support may be offered. Thus, objective measures can better tap into discrete behaviors that are important for understanding how siblings interact with one another. In addition, research examining observations of sibling behaviors have seldom incorporated adolescent samples (Iturralde et al., 2013).

To address these gaps in the literature, we coded directional expressions of warmth between older and younger siblings within two videotaped interactive tasks: a cooperative task and a stress task. Additionally, to limit self-report bias across all questionnaire measures, we utilized multi-informant ratings to obtain both adolescent and parental perspectives on adolescent behavior. Specifically, adolescent self-report of internalizing symptoms and parental report of social and externalizing problems provided the most construct validity for the present study; internalizing symptoms are often more difficult for outsider observers to identify (De Los Reyes et al., 2015), and social desirability bias may make adolescents particularly hesitant to self-report delinquent behaviors and social problems in order to uphold a more positive self-presentation (e.g., DiBartolo et al., 1998). We hypothesized that, (a) across all participants, social problems would predict greater internalizing and externalizing behaviors 1 year later, (b) older sibling warmth would moderate this association, such that younger siblings with a warm older sibling would not display a significant association between social

problems and later maladjustment, and (c) effects would vary by birth order, such that younger sibling warmth would not moderate the association between social problems and later maladjustment in the older sibling group. Finally, we investigated the moderating effects of warmth in two tasks, exploring whether sibling warmth functioned in a context-specific manner to mitigate maladjustment.

Method

Participants and Procedure

Participants included 45 families, each with an adolescent younger sibling (M_{age} = 12.1 years, range = 10.5–14.3; 24 females), their closest-in-age older sibling (M_{age} = 14.5 years, range = 11.8–17.1; 21 females) within 4 years of age, and a participating parent (36 mothers). Birth order within the larger family was not included as a criterion for participation, though the majority of families consisted of only two siblings in total. 15.5% of families included other children living at home, ranging from one to five additional siblings. Of these initial 45 families, 75.6% of younger siblings (n = 34), 80% of older siblings (n = 36), and 86.7% of parents (n = 39) completed the full follow-up. The average sibling dyad age difference was 2.4 years (SD = .84). Families were recruited through community flyers and social media (Facebook, Craig's List). Inclusion criteria required both siblings to be free from psychiatric disorders (e.g., ADHD), developmental disorders, and learning disabilities, and additionally required siblings to have lived with one another for the younger sibling's entire life (excluding infancy for adoptive pairs). Screenings were conducted through parental reports. Full biological (n = 41), half biological (n = 2), and adoptive (n = 2) sibling dyads were included in the sample. See Table 1, for sample characteristics.

Prior to participation, all subjects provided written assent and parents provided written consent in accordance with the Institutional Review Board. Data were collected at two time points, spaced approximately 1 year apart. At the initial laboratory visit (Time 1), sibling pairs were brought into an observational room together while a participating parent remained in a separate waiting room. The dyads were asked to complete two videotaped tasks: a cooperative task and a stress task. In addition, both siblings and the parent completed questionnaires at Time 1 (T1) and at Time 2 (T2), which consisted of an online 12-month follow-up. Reasons for attrition at T2 included loss of interest to participate and failure to begin or complete the questionnaires. Across all participants, siblings included in the present sample did not significantly differ from those lost to attrition in age (t = −.72, p = .48), gender, $\chi^2(1)$ = .32, p = .57, or ethnicity, $\chi^2(4)$ = 1.18, p = .88. Videotape data for the stress task are missing for one dyad due to equipment malfunction.

Questionnaire Measures

Internalizing Symptoms

Younger and older siblings completed the Short Mood and Feelings Questionnaire at T1 and T2 to assess internalizing symptoms (SMFQ; Angold et al., 1995). Participants rated how truthfully each item reflected their feelings and actions in the past 2 weeks, from 0 (*not true*) to 2 (*true*). Example items include: "I felt miserable or unhappy" and "I found it hard to think properly or concentrate." Responses were summed for each participant, with a higher overall

Table 1
Demographics: Family and Dyad Characteristics

Variables	N (%)
Adolescent ethnicity ($N = 90$)	
African American/Black	5 (11.1%)
Caucasian/White	31 (68.9%)
Hispanic/Latino	5 (11.1%)
South Asian	1 (2.23%)
Multiethnic	3 (6.67%)
Dyad gender composition ($N = 45$)	
Younger sister/older sister	10 (22.2%)
Younger sister/older brother	14 (31.1%)
Younger brother/older sister	11 (24.5%)
Younger brother/older brother	10 (22.2%)
Family total income ($N = 45$)	
$45,000	3 (6.70%)
$45,000–$74,999	12 (26.7%)
$75,000–$99,999	13 (28.9%)
$100,000–$150,000	11 (24.4%)
>$150,000	6 (13.3%)
Parental education ($N = 45$)	
Some high school	1 (2.20%)
High school diploma	1 (2.20%)
Some college	6 (13.3%)
Associate's degree	6 (13.3%)
Bachelor's degree	13 (28.9%)
Some graduate school	3 (6.70%)
Master's degree (e.g., MA, MSW)	12 (26.7%)
Professional degree (e.g., PhD)	3 (6.70%)
Parental marital status ($N = 45$)	
Single	3 (6.70%)
Married to first spouse	35 (77.8%)
Divorced and remarried	7 (15.5%)

score indicating more severe internalizing symptoms (younger sibling: $\alpha_{T1} = .94$, $\alpha_{T2} = .98$; older sibling: $\alpha_{T1} = .92$. $\alpha_{T2} = .95$).

Externalizing Behaviors

Parents completed the externalizing subscale of the Child Behavior Checklist (CBCL; Achenbach, 1991) at T1 and T2 to assess each siblings' behavioral problems. Items were rated from 0 (*not true*) to 2 (*very true or often true*). Sample items include: "Breaks rules at home, school, or elsewhere" and "Drinks alcohol without parent's approval." Responses were summed together, with higher scores indicating heightened externalizing behaviors (younger sibling: $\alpha_{T1} = .93$, $\alpha_{T2} = .98$; older sibling: $\alpha_{T1} = .91$, $\alpha_{T2} = .82$).

Social Problems

Parents additionally completed the social problems subscale of the CBCL to assess each siblings' overall social functioning at both time points, though only data from T1 are utilized in the present study. Items (e.g., "Gets teased a lot" and "Doesn't get along with other kids") were rated from 0 (*not true*) to 2 (*very true or often true*). Responses were summed together, with higher scores indicating more social problems (younger sibling: $\alpha_{T1} = .82$; older sibling: $\alpha_{T1} = .77$).

Observational Coding

Cooperative Task

To examine sibling cooperation and problem-solving, each dyad completed the desert survival situation, a team-building task consisting of two parts. To begin, an experimenter read a description of the survival scenario out loud as the participants followed along (see Appendix; Lafferty & Pond, 1974). Briefly, the scenario described a plane crash that left the siblings stranded together in a desert with only 15 salvaged items (e.g., flashlight and jackknife). The younger and older siblings were then moved to separate tables, given a list of the 15 items, and instructed to independently rate each item according to its importance to their survival, from 1 (*least important*) to 15 (*most important*). This portion of the task was not videotaped. After 3 min, the siblings were brought back together with instructions to discuss their individual ratings and reach a final consensus for each item in 7 min. The experimenter placed one pen, one final rating sheet, and a timer on their table before leaving the room. This 7-min interaction was videotaped.

Stress Task

To examine sibling problem-solving under stress, dyads completed a puzzle task intended to be too difficult to complete in the time allotted. Challenging puzzles are often utilized during parent-child interactions to induce stress (e.g., Dittrich et al., 2017), though the present study adapted the puzzle to be more difficult for our older teen sample. Specifically, a 3-D chameleon puzzle consisting of 120 microblocks, step-by-step instructions, and a picture of the completed product were provided. Siblings were instructed to complete the entire puzzle in 15 min. The experimenter set a timer on the table, left the room, and returned at the end of the task. This 15-min puzzle-solving interaction was videotaped.

Coding Scheme

Task videos were coded for directional expressions of warmth from one individual to the other when siblings were actively completing each task (Iowa Family Interaction Rating Scales; Melby et al., 1998). Warmth codes utilized in the present study were defined as expressions of care, concern, support, or encouragement directed from one sibling to the other (separately coded as expressions of warmth from older to younger sibling, and from younger to older). Expressions of hostility and conflict within dyads were not utilized in the present study. Raters used a global coding scheme encompassing vocal tone, affect, and body language. Verbal content was only utilized to inform the intent of behaviors, if necessary. Example expressions of warmth included laughter, smiles, and nods directed toward the other. Warmth was rated according to frequency and intensity of behaviors across the entirety of each task video, from 1 (*not at all characteristic*) to 9 (*mainly characteristic*). Multiple independent coders rated a sample of 18 videos (21% of the data) to assess interrater reliability, with different coders for each task. Discrepancies were discussed and resolved, and a single rater coded the remainder of the videotapes. Intraclass correlations indicated high reliability for warmth in the cooperative task ($ICC(2,2) = .85$) and stress task ($ICC(2,2) = .91$; Landers, 2015).

Data Analysis

Multilevel modeling was utilized to accommodate the nested nature of the data (individuals nested within sibling dyads). Four two-level models were computed to explore, (a) how directional

expressions of sibling warmth moderated the association between social problems and later maladjustment across all siblings, and (b) whether effects varied between younger and older siblings. Two internalizing and two externalizing models were estimated, such that each included younger and older sibling warmth observed during the cooperative task or during the stress task. Prior to analyses, all continuous T1 independent variables (social problems, younger/older sibling warmth, internalizing symptoms, and externalizing symptoms) were mean centered, and birth order was dummy-coded (0 = younger sibling, 1 = older sibling). Each model was constructed in two steps: main effects and the two-way interaction (Social problems × Sibling warmth) were included in step one to test the global moderating effect of sibling warmth across the whole sample, followed by the inclusion of the three-way interaction (Social problems × Sibling warmth × Birth order) in step two to test whether effects varied by birth order. Models were estimated using the following form:

Level 1:

$$Int T2_{ij} = \beta_{0j} + \beta_{1j}(Gender_{ij}) + \beta_{2j}(Int T1_{ij}) + \beta_{3j}(Social_{ij})$$
$$+ \beta_{4j}(SibWarm_{ij}) + \beta_{5j}(BirthOrd_{ij})$$
$$+ \beta_{6j}(Social_{ij} \times SibWarm_{ij}) + \beta_{7j}(Social_{ij} \times BirthOrd_{ij})$$
$$+ \beta_{8j}(SibWarm_{ij} \times BirthOrd_{ij})$$
$$+ \beta_{9j}(Social_{ij} \times Sibwarm_{ij} \times BirthOrd_{ij}) + e_{ij}$$

Level 2:

$$\beta_{0j} = \gamma_{00} + u_{0j}$$
$$\beta_{1j} = \gamma_{10}$$
$$\beta_{2j} = \gamma_{20}$$
$$\beta_{3j} = \gamma_{30}$$
$$\beta_{4j} = \gamma_{40}$$
$$\beta_{5j} = \gamma_{50}$$
$$\beta_{6j} = \gamma_{60}$$
$$\beta_{7j} = \gamma_{70}$$
$$\beta_{8j} = \gamma_{80}$$
$$\beta_{9j} = \gamma_{90}$$

where Int_{ij} represents internalizing (or externalizing) symptoms for individual i in dyad j, modeled as a function of the intercept (β_{0j}), covariates (β_{1j}, β_{2j}), sibling warmth and social problems (β_{3j}, β_{4j}), categorical birth order (β_{5j}), interactions among main variables (β_{6j}, β_{7j}, β_{8j}, β_{9j}), and residual error (e_{ij}). γ parameters account for dyadic clusters, and intercepts (u_{0j}) were allowed to vary. Models were estimated using the R-package *lme4* (Bates et al., 2015).

Results

Descriptive Statistics

Bivariate correlations, means, and standard deviations of the study variables are presented in Table 2. Beginning with younger

siblings, externalizing behaviors at T1 and T2 were positively correlated with one another ($r = .54$, $p < .001$), as were internalizing symptoms at both time points ($r = .61$, $p < .001$). Externalizing behaviors at T1 were positively correlated with internalizing symptoms at T2 ($r = .36$, $p = .03$), though earlier internalizing symptoms were not associated with later externalizing behaviors. Additionally, social problems at T1 were significantly correlated with externalizing behaviors at both time points ($r_{T1} = .42$, $p = .005$; $r_{T2} = .57$, $p < .001$), but were not correlated with internalizing symptoms at either time point. The observational results indicated a positive correlation in older sibling warmth between the two tasks ($r = .75$, $p < .001$). Older sibling warmth in each task was not associated with younger adolescent social problems or internalizing symptoms, though there was a negative correlation between older sibling warmth during the stress task and adolescent externalizing problems at T2 ($r = -.37$, $p = .02$).

For older siblings, externalizing behaviors were correlated over time ($r = .51$, $p = .002$), as were internalizing symptoms ($r = .50$, $p = .001$). Early social problems were correlated with externalizing behaviors at T2 ($r = .62$, $p < .001$), but not with internalizing symptoms at either time point. Younger sibling warmth was positively correlated between tasks ($r = .68$, $p < .001$), but was not associated with older sibling adjustment.

Multilevel Analyses

Internalizing Symptoms

The first multilevel model examined the interactive effect of social problems and sibling warmth during the cooperative task on the development of internalizing symptoms (Table 3). Step one tested global moderation effects across all participants without accounting for birth order. Fixed effects indicated that greater levels of internalizing symptoms at T1 were associated with heightened symptoms at T2 ($\gamma = .68$, $p < .001$). However, the main effects of social problems and sibling warmth, as well as the interaction between the two parameters, were not significant when modeled across all participants ($ps > .16$). In step two of the model, birth order was included to test whether effects varied between younger and older siblings. The three-way interaction between social problems, sibling warmth, and birth order was not significant ($\gamma = .90$, $p = .13$), suggesting that the association between social problems and received warmth did not vary between younger and older siblings. However, it should be noted that the two-way interaction was trending toward significance ($\gamma = -.93$, $p = .07$), such that older sibling warmth during cooperation marginally moderated the association between early social problems and later internalizing symptoms specifically for younger siblings.

The second multilevel model examined sibling warmth during the stress task. All effects of interest were nonsignificant, such that warmth did not moderate the association between social problems and later internalizing symptoms for older or younger siblings.

Externalizing Behaviors

The third multilevel model examined the interactive effect of social problems and sibling warmth during the cooperative task on the later development of externalizing behaviors (Table 3). These results were not significant.

Table 2
Bivariate Correlations, Means, and Standard Deviations of Primary Variables

Measure	1	2	3	4	5	6	7
Younger sibling							
1. T1 internalizing symptoms	—						
2. T2 internalizing symptoms	.61***	—					
3. T1 externalizing behaviors	.25	.36*	—				
4. T2 externalizing behaviors	−.01	.09	.54***	—			
5. T1 social problems	.24	.25	.42**	.57***	—		
6. OS warmth (cooperative task)	−.01	.00	−.13	−.29	−.09	—	
7. OS warmth (stress task)	−.04	.11	−.19	−.37*	−.04	.75***	—
Mean	4.81	4.68	5.25	3.54	1.57	3.56	4.20
Standard deviation	5.56	6.88	5.34	4.33	2.00	2.11	2.29
Older sibling							
1. T1 internalizing symptoms	—						
2. T2 internalizing symptoms	.51**	—					
3. T1 externalizing behaviors	−.01	.22	—				
4. T2 externalizing behaviors	.09	.09	.50**	—			
5. T1 social problems	.07	.28	.62***	.25	—		
6. YS warmth (cooperative task)	−.03	.08	−.04	−.02	−.08	—	
7. YS warmth (stress task)	−.05	.02	−.04	−.19	−.20	.68***	—
Mean	6.02	8.22	6.45	4.45	2.18	4.51	4.30
Standard deviation	5.84	8.11	7.12	4.64	2.81	2.01	2.58

Note. Two-tailed significance. T1 = Time point 1; T2 = time point 2; OS warmth = older-to-younger sibling warmth during each task; YS warmth = younger-to-older sibling warmth.
* $p < .05$.   ** $p < .01$.   *** $p < .001$.

The fourth multilevel model included older sibling warmth during the stress task in predicting externalizing behaviors. In step one of this model, higher levels of externalizing behaviors at T1 predicted heightened externalizing behaviors at T2 across the whole sample ($\gamma = .36$, $p = .002$). The main and interaction effects of social problems and sibling warmth were not significant (ps > .16). In step two, greater social problems ($\gamma = .80, p = .02$) and lower older sibling warmth ($\gamma = -.70, p = .02$) each significantly predicted heightened externalizing behaviors in younger siblings. By reversing the reference group, we confirmed that these main effects were not significant for older siblings (ps > .51). Next, the two-way interaction between social problems and sibling warmth was significant for younger siblings ($\gamma = -.39, p = .02$), suggesting that older sibling warmth significantly moderated the association between social problems and later externalizing behavior. By reversing the reference group, we confirmed this two-way interaction as not significant for older siblings ($p = .62$). Finally, the three-way interaction was significant ($\gamma = .45$, $p = .03$), suggesting that moderation effects varied by birth order. To probe this significant interaction, regions of significance were explored and plotted for both younger and older siblings (Johnson & Neyman, 1936; Long, 2020). As displayed in Figure 1, when older sibling warmth was lower than .14 standard deviations away from the mean, the simple slope of younger sibling social problems on externalizing behavior was positive and significantly different from zero. This range includes 61% of observed older sibling warmth data. However, when older sibling warmth was above .14 standard deviations from the mean, the simple slope did not significantly differ from zero (39% of observed data). Finally, the simple slope of older sibling social problems on externalizing behavior was not significantly different from zero across the entire range of younger sibling warmth values. Altogether these findings suggest that, for younger siblings, receiving higher levels of sibling warmth during the stress task buffered the association between social problems and increases in externalizing behavior, but this buffering effect is not present in older siblings.

Discussion

Difficulties with social skills and engagement may be particularly distressing during the transition into adolescence, as peer input becomes especially salient and important for building one's self-image and self-esteem. These difficulties can cascade into later internalizing and externalizing problems when positive peer relationships and social skills are lacking (Bornstein et al., 2010). Although significant research has implicated social support as a protective factor against these negative outcomes, siblings often remain an overlooked source of warmth and support (Feinberg et al., 2012). Building upon this gap in the literature, findings from the present study highlight the importance of older sibling warmth for buffering against the association between social problems and later maladjustment in early adolescence. The development of heightened externalizing problems was moderated by older sibling warmth observed during a specific problem-solving task, suggesting that sibling relationships may function as a protective factor within particular contexts and exchanges. Younger sibling warmth did not similarly buffer against maladjustment in older siblings.

Younger Sibling Effects

First, we investigated whether early social problems predicted adolescent maladjustment 1 year later. Findings partially aligned with our hypotheses for the younger sibling group, corroborating that more social problems in early adolescence predicted later externalizing behaviors. This association is consistent with previous literature, suggesting that adolescents may cope with social

Table 3
Multilevel Models: Moderating Effects of Sibling Warmth and Birth Order

	Internalizing		Externalizing	
	Step 1	Step 2	Step 1	Step 2
Fixed effects	b (SE)	b (SE)	b (SE)	b (SE)
Cooperative task				
Intercept	2.60 (2.7)	1.41 (2.7)	5.59 (1.6)**	5.79 (1.6)***
Gender	2.07 (1.5)	1.94 (1.5)	−.94 (.91)	−.98 (.90)
Symptoms T1	.68 (.14)***	.64 (.14)***	.39 (.11)**	.38 (.11)**
Social problems	.50 (.35)	−.66 (.76)	.38 (.23)	.92 (.45)*
Warmth	.22 (.41)	−.83 (.74)	−.06 (.24)	−.25 (.43)
BO	1.87 (1.6)	3.21 (1.8)	.21 (.93)	−.00 (.99)
Social × Warmth	−.16 (.22)	−.93 (.50)†	−.06 (.13)	.03 (.29)
Social × BO		1.40 (.86)		−.79 (.51)
Warmth × BO		1.31 (.91)		.47 (.53)
Social × Warmth × BO		.90 (.57)		−.10 (.33)
Stress task				
Intercept	2.82 (2.8)	2.84 (2.9)	5.40 (1.6)**	5.03 (1.6)**
Gender	1.93 (1.6)	1.88 (1.7)	−.79 (.95)	−.49 (.91)
Symptoms T1	.69 (.14)***	.70 (.14)***	.36 (.11)**	.35 (.10)**
Social	.58 (.39)	.32 (.57)	.36 (.25)	.80 (.32)*
Warmth	.32 (.34)	.35 (.49)	−.26 (.20)	−.70 (.27)*
BO	1.83 (1.6)	2.00 (1.6)	.15 (.91)	.27 (.88)
Social × Warmth	−.03 (.16)	−.05 (.29)	−.02 (.09)	−.39 (.16)*
Social × BO		.53 (.80)		−.57 (.44)
Warmth × BO		.00 (.70)		.60 (.38)
Social × Warmth × BO		.09 (.36)		.45 (.20)*
Random effects	SD [95% CI]	SD [95% CI]	SD [95% CI]	SD [95% CI]
Cooperative task				
Intercept	.06 [.0, .0]	.06 [.0, .0]	.04 [.0, .0]	.04 [.0, .0]
Residual	6.21 [5.2, 7.4]	6.19 [5.2, 7.4]	3.85 [3.3, 4.5]	3.78 [3.2, 4.5]
Stress task				
Intercept	.06 [.0, .0]	.06 [.0, .0]	.04 [.0, .0]	.05 [.0, .0]
Residual	6.30 [5.3, 7.5]	6.43 [5.4, 7.7]	3.86 [3.3, 4.6]	3.61 [3.0, 4.3]

Note. Unstandardized estimates. SE = standard error; SD = standard deviation. T1 = Time point 1; Warmth = sibling warmth directed by other sibling; BO = birth order (coded: younger sibling = 0, older sibling = 1).
† p = .07. * p < . 05. ** p < .01. *** p < .001.

problems or interpersonal distress through problematic or antisocial behaviors, including substance use and delinquency (Daughters et al., 2009). However, contrary to our hypotheses, social problems were not directly associated with later internalizing symptoms. This discrepancy may be explained by the normative levels of social problems captured in our community sample. Difficulties with peers have been found to have a dose–response relationship with internalizing symptoms, such that chronic and stable social problems confer the greatest risk for emotional maladjustment in adolescence (Zwierzynska et al., 2013). Further, the link between social problems and internalizing symptoms tends to be strongest in girls, who are more likely to report both greater interpersonal stress within their peer relationships and higher levels of associated depressive symptoms in comparison to same-age boys (Rudolph, 2002). Therefore, future work may seek to investigate these processes across adolescence in a larger sample to allow for moderation by sex.
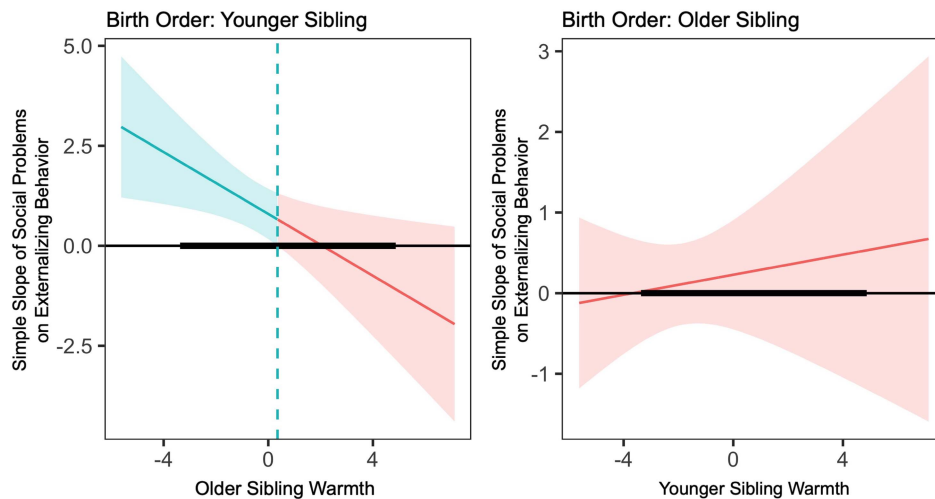
Next, the present study investigated the role of observed older sibling warmth in mitigating the association between social problems and later maladjustment. Moderation results partially supported our hypotheses, indicating that, for younger siblings who experienced heightened social problems, older sibling warmth during the stressful puzzle task moderated against the development of externalizing behaviors; similarly, warmth during cooperative

problem-solving displayed a marginally significant effect in buffering against internalizing symptoms. These findings align with Weiss' (1974) social provisions theory, suggesting that early adolescents who are unable to appropriately engage and derive support from their peers may turn to their sibling relationships to compensate. However, if both peer and sibling warmth are low, the lack of sufficient social support may confer risk for more problematic outcomes.

Beginning with the mitigation of externalizing behaviors, the effects of older sibling warmth were specific to only the stressful puzzle task. This task likely elicited feelings of frustration and pressure. The puzzle consisted of over 100 tiny microblocks, which required the siblings to not only work closely with one another to carefully place each piece, but to also simultaneously work quickly to complete the puzzle in the short time allotted. Warmth and support received within this type of stressful context may foster the use of more adaptive regulatory strategies, as the older sibling can provide encouragement and scaffolding around problem-solving approaches while the dyad works together. Relatedly, older siblings who are able to offer warmth, support, and encouragement to their younger siblings while under stress are likely to display adaptive regulatory skills themselves. Younger siblings may be able to learn from and emulate these behaviors in their own interpersonal

Figure 1

Older Sibling Warmth Buffers the Association Between Social Problems and Externalizing Behavior in Younger Siblings

Note. Left panel: Simple slope of younger sibling social problems on externalizing behavior plotted along the range of older sibling warmth values during the stress task. The shaded region represents the 95% confidence intervals. The solid black line represents the range of observed data. The vertical dotted line represents the region of significance, such that the slope $+.14$ *SD* away from the mean is not significant (pink; 39% of the observed data), representing the buffering effect of higher levels of older sibling warmth on the association between social problems and externalizing behaviors. Covariates include gender and previous levels of externalizing behaviors. Right panel: Non-significant slope of older sibling social problems on externalizing behaviors plotted along with the range of younger sibling warmth values. See the online article for the color version of this figure.

interactions (Whiteman et al., 2007). Previous work supports this explanation, such that sibling warmth and affection predicts later adolescent self-regulation, which in turn associates with lower externalizing behaviors (e.g., Padilla-Walker et al., 2010). Future work may seek to extend these findings into more real-life scenarios, investigating how sibling dyads work together to problem-solve and support one another while under stress (e.g., during family conflict).

Internalizing results indicated that the buffering effect of older sibling warmth during the cooperative task on the association between social problems and later internalizing trended toward significance. Although this effect should be interpreted with caution, warmth and support observed within the neutral, collaborative problem-solving context may reflect the dyad's ability to effectively listen, communicate, and exchange ideas—skills that can transfer into intimate self-disclosure. Prior research corroborates that sibling warmth is positively correlated with adolescent self-disclosure about personal issues (e.g., friendships and romantic relationships), which may allow older siblings to help their younger siblings identify instrumental problem-solving solutions for navigating interpersonal dilemmas (Campione-Barr et al., 2015; Howe et al., 2000, 2001). However, effects did not reach the standard significance threshold of $p < .05$, providing multiple avenues for future work to further investigate. First, the present task focused on a fictional collaborative scenario that does not reflect real-life interpersonal discussions or situations in which siblings would typically elicit or provide warmth and support. Observational work should seek to examine warmth offered during more realistic exchanges. Second, the present study only focused on internalizing symptoms within each sibling

separately. However, heightened internalizing in *both* members of the dyad could lead to corumination, qualifying the effects of a warm relationship. Corumination can generate increases in symptoms as siblings excessively discuss interpersonal problems and negative feelings (Dirks et al., 2015), offering an important moderator to consider in future work.

Older Sibling Effects

Older siblings' early social problems did not significantly predict internalizing or externalizing behaviors 1 year later, nor did younger sibling warmth moderate the association between social problems and maladjustment. In light of these findings, it is important to note potential developmental differences within our dyads. Specifically, the older sibling group in the present study ranged in age from 12 to 17, while the younger sibling group ranged from 10 to 14. Past work utilizing an emotion reappraisal task found that emotion regulation success increased linearly from age 10 to 16, suggesting progressive skill development with age (Silvers et al., 2012). Further, younger adolescents displayed greater deficits at regulating their emotional response to social stimuli in comparison to nonsocial stimuli, while older adolescents remained consistent. Therefore, the older siblings in our study may display lower social sensitivity and be better emotionally equipped to handle social problems than their younger siblings, and therefore rely upon their younger siblings less for advice and support. However, given the small sample size of the present study, bidirectional effects of sibling warmth should be explored further in future work.

Limitations and Future Directions

Several additional study limitations warrant attention and offer future directions for research. First, future work would benefit from recruiting a larger sample size to not only control for sibling dyad characteristics, but to also examine additional moderating factors specific to the sibling relationship. For example, the gender composition and age spacing of a dyad can associate with differences in sibling interactions, such that same-sex pairs (especially sister pairs) and dyads closer in age typically display higher-quality relationships (Buist et al., 2013). With a larger sample size, it would be beneficial to examine *which* sibling dyads are most likely to display and accept compensatory warmth within the context of heightened social problems. Second, the present study relied upon parent reports of adolescent social problems. Although this approach may circumvent social desirability issues on the part of the adolescent, parents may not be fully aware of how their child functions with peers outside of the home. Thus, future work should seek to leverage peer reports of acceptance and rejection as a more accurate and direct measurement of adolescent functioning within their own social network. Finally, it should be noted that the coding of sibling warmth in the present study did not take into account reciprocal engagement—for example, whether or not each adolescent responded in a positive or rejecting manner to warm behaviors from their sibling. This more in-depth approach should be considered in future work to better capture bidirectional engagement.

To conclude, the present study illustrated the salient role of warm older sibling behaviors in preventing heightened social problems from cascading into later maladjustment at the transition to adolescence. The observational data utilized in the present study were beneficial for measuring warm and supportive behaviors within unique problem-solving contexts, with interactive tasks that required the effective use of a range of interpersonal skills (e.g., communication and negotiation). Engaging with a warm older sibling on a regular basis may allow adolescents to garner support and help in working through their interpersonal problems, while also practicing their social and regulatory skills in the process. These findings contribute to previous work by specifying problem-solving domains (e.g., working together under stress) in which positive interactions with older siblings may be most beneficial for improving adolescent functioning, and further emphasize the importance of understanding transactional effects between different domains of an individual's social network, including both the peer and family systems.

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Appendix

Desert Survival Situation

It is approximately 10 a.m. in August and you have just crash-landed in a desert in the United States. The light twin-engine plane has completely burned and only the airplane frame remains. You and your sibling are not injured. The pilot was unable to notify anyone of your position before the crash. However, he had indicated before impact that you were 70 m southwest from a mining camp. The immediate area is quite flat and rather barren, except for an occasional barrel and cacti. The last weather report indicated that the temperature would reach 110 degrees that day, which means that the temperature at ground level will be 130 degrees. You are dressed in lightweight clothing—short-sleeved shirts, pants, socks, street shoes, and a handkerchief.

Before the plane caught fire, you and your sibling salvaged the 15 items listed on the sheet. Your task is to rank these items according to their *importance to your survival*, starting with "1" *being the most important* to "15" *the least important*. You may assume and all the items are in good working condition.

Item	My Ranking
Flashlight (4 battery size)	
Jackknife	
Sectional air map of the area	
Plastic raincoat (large size)	
Magnetic compass	
Compress kit with gauze	
.45 caliber pistol (loaded)	
Parachute (red and white)	
Bottle of 1,000 salt tablets	
A cosmetic mirror	
Book ("Edible Animals of the Desert")	
A pair of sunglasses per person	
2 quarts of 80 proof Vodka	
1 overcoat per person	