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Adolescent Caregiving Success as a Predictor of Social Functioning from Age 13 to 33

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Abstract

Adolescent success providing satisfying support in response to a close friend's call in a caregiving task was examined as a potentially fundamental developmental competence likely to predict future social functioning, adult caregiving security, and physical health. Adolescents (86 male, 98 female; 58% White, 29% African American, 8% mixed race/ethnicity, 5% other) were followed from age 13 to 33 (1998 to 2021) using multiple methods and reporters. Early caregiving success was found to predict greater self- and partner-reported caregiving security, lower negativity in adult relationships, and higher adult vagal tone. Results are interpreted as advancing our understanding beyond simply recognizing that adolescent friendships have long-term import, to now identifying specific capacities within friendships that are linked to longer-term outcomes.

Caregiving is a central element of close human social relationships and has been posited as an organized behavioral system fundamental to human adaptation (Bowlby, 1969/1982; Solomon & George, 1996). Although caregiving behavior receives the greatest attention with regard to behavior directed toward offspring and to partners in adult romantic relationships (Ainsworth, 1989; Finkel & Eastwick, 2015; Zeifman & Hazan, 2008), the ability to successfully respond to another's distress or request for help in a way that satisfies the person's needs has potentially far broader implications. To the extent that humans are 'pack animals,' the functional meaning of being in a pack is that its members have learned how to

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provide support to one another instrumentally and/or emotionally, as at least in evolutionary times such support could be crucial to the survival of the pack (Hrdy, 2009).

The capacity to provide satisfying caregiving likely first becomes manifest in adult-like form in early adolescence (e.g., ages 10 to 14). Although a capacity for empathy and prosocial behavior emerges early in development (Vaish, 2016), the perspective-taking, communication, and social skills needed to translate this empathy into effective support are most likely to come online in a meaningful way beginning in adolescence. These discrete skills must function together as part of a more complex, goal-corrected partnership in which success reflects both provision of care and its attunement to the specific needs of the care recipient (Bowlby, 1969/1982; Kobak & Duemmler, 1994). A behavioral systems perspective on adolescent relationships conceptualizes caregiving as one of three primary systems in adolescent social relationships (along with attachment and affiliative systems; (Furman & Buhrmester, 2009). The caregiving system is thought to be “activated” by need signals expressed by the care recipient, and “deactivated” when the need has been satisfied (Bowlby, 1969/1982). Each of these processes contributes to caregivers’ and care recipients’ representations of the relationship, including expectations of future interactions. From an organizational perspective (Cicchetti et al., 1990), although qualities such as empathy, emotion regulation and perspective taking are each of independent value, it is the *organization* of these into a successfully enacted relationship phenomena that is most important to overall functioning. Caregiving success is thus best considered not in terms of a specific behavior, but rather as an organizational construct involving multiple behaviors and capacities in the service of a larger organizational goal: the formation and maintenance of satisfying social relationships (Solomon & George, 1996). For all of these reasons, caregiving is an inherently dyadic construct and should be assessed as such (Furman & Rose, 2015; Lyons et al., 2002).

The close friendship in adolescence appears as a promising setting in which to examine the individuals’ developing caregiving capacity (Stern et al., 2021). Close friendship quality in adolescence is increasingly recognized as a predictor of future peer and romantic relationship qualities (Allen et al., 2022; Allen et al., 2020). Further, friendships provide the opportunity to practice critical social skills within a horizontal relationship. This context (in contrast to teens’ vertical relationship with parents) may be especially important for learning both sides of a goal-corrected relationship and learning to manage caregiving in adult-adult relationships (Sroufe & Fleeson, 1986). Relatively little research, however, has examined *which* skills and capacities within close friendships are most central to future relationship success. Several of the studies that do address this question, however, point to the potential importance of behaviors and skills linked to caregiving. For example, adolescents’ self-reported empathy has been linked to adult self-reported empathy and social success (Allemand et al., 2015). There is also evidence that difficulty *seeking and receiving* support in adolescent friendships is linked to negativity in adult romantic relationships.

Caregiving success is likely to have implications for both close friendships and romantic relationships, as the capacity to give and receive needed care and support is considered one of the fundamental drivers of the quality of adult relationships. Although adult friendships and romantic relationships clearly differ in many respects (e.g., presence vs. absence of

sexual interaction, potential for marital commitment, etc.), secure caregiving capacity—the ability to recognize and respond effectively to a partner's needs—is likely to be essential to establishing satisfying and secure relationships of both types (Collins & Ford, 2010). It has been proposed that adolescent-era relationships ultimately influence long-term romantic relationships by establishing expectations related to attachment and caregiving processes (Furman & Flanagan, 1997). As romantic relationships become increasingly salient in the transition from adolescence to adulthood, they are particularly likely to take on a mutually-reinforcing, dyadic quality. Thus, caregiving success on the part of one individual is likely to become linked not only to that individual's confidence in enacting caregiving behaviors but also to their relationship *partner's* confidence as a caregiver (Johnson, 2019; Mikulincer et al., 2003). Although research and theory linking adolescent friendships to adult close relationships suggests that there are likely continuities in caregiving success across this span (Allen et al., 2022; Furman & Shomaker, 2008; Oudekerk et al., 2015), such continuities have never been examined.

Caregiving success also appears likely to be linked to success handling the inevitable conflicts that occur in close relationships. A central premise of attachment-focused family and couples therapies (e.g., Diamond et al., 2016; Johnson, 2012) is that how well conflict in close relationships is handled will depend upon expectations that a partner will meet one's needs when appropriate. With a clear expectation of partner availability in times of stress, even challenging conflicts can be worked out as part of a goal-corrected partnership, in which maintaining the quality of the relationship is a central goal and occasional ruptures and repairs do not threaten the underlying relationship. Thus, caregiving ability might be expected to predict adolescents' longer-term success in handling conflict with peers and romantic partners in ways that maintain and strengthen relationships. Conversely, as noted above, inability to obtain support and care has been linked to future negativity in romantic relationships, suggesting a likely inverse relationship between caregiving and relationship negativity (Emily L. Loeb et al., 2020).

Ultimately, there is a case to be made that caregiving success, given its potentially fundamental role in human social functioning, will even be linked to markers of physical health. A large and rapidly growing body of evidence links social relationship qualities to a wide array of physical health indices, up to and including early mortality (Holt-Lunstad et al., 2010; Yang et al., 2016). Although relationship qualities and behaviors may at first appear to be on a different level from more physiogical factors, increasingly research is suggesting deep connections between these two domains (Uchino et al., 2007). One potential linking mechanism is the 'helper-therapy' effect—in which those providing help to others actually gain significantly in well-being (Weinstein & Ryan, 2010). Indeed, youth volunteer service has been shown to improve physiological measures of cardiac health in a randomized trial, including markers of functioning of the immune system such as levels of interleukin-6 circulating in the blood (Schreier et al., 2013). These effects are thought to be mediated by improvements to volunteers' mood and sense of self (Schreier et al., 2013). Similarly, the presence of positive friendships and positive social connections has been found to predict increased vagal tone—a marker of activity of the parasympathetic nervous system—both in short-term studies in adulthood and in longer-term studies from adolescence to adulthood (Allen et al., in press; Gouin et al., 2015; Holt-Lunstad et al., 2007; Kok & Fredrickson,

2010). Under conditions of perceived safety, such as is likely to exist in a secure caregiving relationship, higher vagal tone reflects greater activity in the parasympathetic nervous system, which serves to adaptively downregulate stress responses (Porges, 2007). Vagal tone in turn has been linked to concurrent levels of adolescent empathy in mother-adolescent interactions (Diamond et al., 2012). Whether the capacity to provide care successfully to others in adolescence actually has these sorts of longer-term physiological concomitants has not been previously examined, however.

It has been noted that a variety of different qualities of adolescent friendships can potentially affect longer-term outcomes; identifying *which* aspects are independently linked to which outcomes therefore becomes a central task (Wood et al., 2017). One key question is whether caregiving success adds anything in predicting outcomes beyond other existing measures of the qualities of adolescent friendships. For example, Furman (Furman, 1999) notes the importance of affiliative and attachment systems in addition to caregiving systems in relationships. Similarly, Wood and colleagues attach comparable importance to intimacy and security (Wood et al., 2017). To assess the unique contribution of caregiving success requires distinguishing caregiving success from these affiliative/intimate and attachment/security dimensions of friendships. Affiliative processes can be partly captured via ratings from a close friend of the degree of closeness/intimacy within the friendship (Shulman et al., 1997). Similarly, one indicator of the security of attachment processes in adolescent friendships has been identified as the capacity of the friendship to handle disagreements with behaviors maintaining both autonomy and relatedness in the friendship (Allen et al., 2007). If caregiving truly represents an independent system that contributes to explaining key outcomes, then it should contribute unique variance to those outcomes even after considering these factors.

Gender is also important to consider when assessing close relationships in adolescence and adulthood. A number of mostly cross-sectional studies suggest that in childhood and adolescence, girls report higher levels of intimacy, self-disclosure and affection in their friendships than do boys (Buhrmester & Furman, 1987; Lempers & Clark-Lempers, 1993; Sharabany et al., 1981). Further, some research has found that boys consistently perceived less support in their close friendships than girls across the entire adolescent period (De Goede et al., 2009). However, other researchers contend that gender differences in friendship skills have been overstated, or at minimum, that existing work in the field is inconclusive (Rose & Asher, 2017; Underwood, 2007; Way & Silverman, 2011), leaving the role of gender open for further exploration.

The current study examined adolescent caregiving success as a dyadic, organizational construct, following Furman and Rose's (2015) suggestion that the *relationship* be considered as the most appropriate unit of analysis. Success was reflected in a process by which a peer sought help, an adolescent provided it, and the critical end result was that the peer was *satisfied* with the interaction. Thus, caregiving success would be expected to be related to an adolescent's provision of support. This provision of support must be judged, however, in relation to the peer's calls for support, in keeping with the idea that the central function of the caregiving system is the satisfaction of specific needs of a partner within a goal-corrected partnership (Bowlby, 1969/1982; Solomon & George, 1998). And though we

observe this process in dyadic lab-based interactions, we would also expect it to be related to a peer's experience of support more generally within a friendship. Finally, to the extent that observed caregiving success is more than just a generic marker of friendship quality, we would expect it to account for *incremental* variance in outcomes over and above other facets of friendships, such as affiliative and attachment dimensions.

This study examined the short- and long-term implications of early adolescent caregiving success using a prospective, multimethod approach within a demographically diverse community sample of adolescents assessed repeatedly from age 13 to 33. Although the lack of prior research in this area renders this study as exploratory such that the following hypotheses were examined as part of a broader pattern of exploration of the available data, six specific hypotheses were assessed:

1. Observed caregiving success will display convergent validity with observations of support processes within a close friendship as well as with friend-reports of satisfaction with adolescents' provision of support in the friendship more broadly.
2. Greater caregiving success at age 13 will predict greater long-term security as a caregiver in romantic relationships at ages 21–27, as experienced by both participants and by their current romantic partners.
3. Greater caregiving success at age 13 will predict lower levels of negativity in romantic relationships at ages 21–27 and in close friendships at ages 24–33.
4. Greater caregiving success at age 13 will predict higher vagal tone and lower levels of a marker of inflammation (interleukin-6) at age 29.
5. Greater caregiving success at age 13 will demonstrate incremental validity, adding unique variance in predictions over and above two markers of friendship quality: observations of adolescent capacity to establish autonomy and maintain relatedness with a close friend during a disagreement and the friend's rating of the intimacy/closeness of the friendship.

Method

Participants

This report is drawn from a larger longitudinal investigation of adolescent social development in familial and peer contexts. Participants included 184 seventh and eighth graders (86 male and 98 female) followed over a 20-year period from ages 13 to 33, along with collateral data collected from close friends and romantic partners of these participants. The sample was racially/ethnically and socioeconomically diverse: 107 adolescents (58%) identified as Caucasian, 53 (29%) as African American, 15 (8%) as of mixed race/ethnicity and 9 (5%) as being from other minority groups. Adolescents' parents reported a median family income in the $40,000 - $59,999 range at the initial assessment.

Adolescents were recruited from the 7th and 8th grades of a public middle school drawing from suburban and urban populations in the Southeastern United States. Information about

the study was provided via an initial mailing to parents with follow-up presentations to students at school lunches. Formal recruitment took place via telephone contact with parents. Students who had already served as close peer informants in the study were not eligible to serve as primary participants. Of students eligible for participation, 63% of adolescents and parents agreed to participation when parents were contacted. Adolescents provided informed assent before each interview session, and parents and adult participants provided informed consent. Interviews took place in private offices within a university academic building.

Assessments in this study were obtained at mean participant ages 13.3 (*SD* = .64) and 15.1 (*SD* = .80) in adolescence and annually from ages 23.7 (*SD* = .97) to 33.3 (*SD* = .93) in adulthood. For the close friend reports, at each assessment wave, participants nominated their closest friend to be included in the study (not necessarily the same friend across ages). Close friends who participated in the adolescent-era assessments reported that they had known participants for an average of 4.3 to 5.7 years (*SD* = 3.1 to 3.8). Close friends in adulthood similarly reported that they knew participants for an average of 10.3 to 11.2 years (*SD*'s = 6.6 to 7.1). Romantic partner observations were obtained for participants who were in a relationship of at least three months duration and in which the romantic partner was willing to come into our offices for an observational assessment. Romantic relationship assessments were obtained when a participant was in such a relationship and willing to participate at some point in each of three assessment windows lasting 3 years each. The 3-year window was selected to maximize the likelihood that a sustained romantic relationship would exist during that period. The result was that romantic partner assessments were obtained at participant ages 21.0 (*SD* = 1.1), 23.8 (*SD* = 1.12), and 27.4 (*SD* = 1.43), although not all assessments were obtained at each age as noted below. Data were collected in Charlottesville, VA from 1998 to 2021.

Attrition Analyses

The primary measure of caregiving satisfaction was available for 168 out of 184 original participants. The 168 participants with this measure available did not differ from the 16 for whom it was missing on any measures at baseline. Beyond this, modest attrition, given the duration of time considered,was observed for the peer report of friendship conflict measure (*N* = 9), romantic partner report of caregiving security (*N* = 37), self-report of caregiver security (*N* = 6), vagal tone measure *(N* = 37), and interleukin-6 assessment (*N* = 40). However, other than modest effects of gender on attrition for the friend report of conflict in the friendship from 24–33 (8 boys vs. 1 girl attrited, $p < .01$), and the measure of vagal tone (23 boys vs. 14 girls attrited, $p = .02$), there were no other significant attrition effects.

To best address any potential biases due to attrition in longitudinal analyses, full information maximum likelihood (FIML) methods were used with analyses including all variables that were linked to future missing data (i.e., where data were not missing completely at random). Because these procedures have been found to yield the least biased estimates when all available data are used for longitudinal analyses (vs. listwise deletion of missing data; (Arbuckle, 1996; Mueller & Hancock, 2008), the entire original sample of 184 was utilized for these analyses. This full sample thus provides the best possible estimates of variances and covariances in measures of interest and was least likely to be biased by missing data.

Procedure

In the initial introduction and throughout all sessions, confidentiality was assured to all study participants and adolescents were told that their parents and friends would not be informed of any of the answers they provided. Participants' data were protected by a Confidentiality Certificate issued by the U.S. Department of Health and Human Services, which protected information from subpoena by federal, state, and local courts. Transportation and childcare were provided if necessary. Adolescent/adult participants and their romantic partners and peers were all paid for participation. Peer and self-report measures were administered prior to the observed interaction tasks so that reports would not be influenced by behavior in the task.

Measures

***Caregiving Success* (Age 13).—**Adolescents participated in a 6-minute interaction task with their closest friend, during which their friend was instructed to ask for help with a "problem they were having that they could use some advice or support about." Task length was specified after initial piloting so as to be long enough to allow significant discussion and at least some resolution of the vast majority of interactions, while minimizing awkward dead time for participants following conclusion of the substantive part of their discussion. Typical topics included problems with peers or siblings, raising money, potential dating issues, or deciding about joining sports teams (a more detailed listing of topics is presented in Supplemental Table A). These interactions were video-recorded and then coded by doctoral students in clinical psychology using the Supportive Behavior Coding System (Allen, Hall, et al., 2001), which was based on several related systems developed by Crowell and colleagues (Crowell et al., 1998; Julien et al., 1997). Caregiving success was assessed in terms of coders' judgments of the degree to which the recipient of support (the close friend of the participating adolescent) appeared satisfied with the interaction, based both on their behavioral response and the extent to which the interaction appeared to address the recipient's concern. Each interaction was reliably coded on a 4-point scale with half-point intervals, ranging from a '0' indicating the support seeker appeared to feel 'pretty bad' about the interaction to a rating of '4' which requires that, "Seeker feels that the interaction was clearly helpful and did a good job dealing with his/her problem, and/or feels safe and supported (i.e. interaction may not have been able to solve a very difficult problem, but did a very good job of addressing it). Conversation was easy." Coders were first trained in the system and then coded videos in pairs or larger groups until they were able to code reliably. Weekly or bi-weekly reliability check meetings were subsequently conducted in which all coders coded the same recorded interaction and discussed differences so as to minimize coder drift. Each interaction was coded by two trained coders blind to other data from the study, with an intraclass correlation of .70, which is considered well into the good range for this statistic (Cicchetti & Sparrow, 1981).

***Observed Peer Calls for Support* (Age 13).—**From the same observational task, coders rated the extent to which the peer made a clear and persistent call for support (either emotional or instrumental). Each interaction was reliably coded with a single code designed to capture the clarity, intensity, and persistence of the peer calls for support on a 4-point scale with half-point intervals, ranging from no call for advice or support to a

clear, strong, and persistent call for advice or support. For example, a score of '4' reflects an interaction in which "There is a clear call for emotional support/empathy, and three or more additional emotional support seeking statements or questions. The seeker directly and unambiguously expresses his/her concern and desire for emotional support." An average of the scores obtained by two trained raters unaware of other data from the study was used, with an intraclass correlation of .85, which is considered in the excellent range for this statistic (Cicchetti & Sparrow, 1981).

***Observed Participant Provision of Support* (Age 13).—**From the same observational task, coders rated the extent to which the participant provided the peer with emotional and/or instrumental support. Each interaction was coded using a 4-point scale with half-point intervals in terms of the participant's provision of support and efforts to make sure that support was attuned to the peer's needs. The scale ranged from "a complete lack of efforts at support" at the low end to "clear attempts to provide support while drawing the seeker out so as to ensure support was truly attuned and effective" for higher scores. For example, a score of '4' could reflect a situation in which "the supporter clearly recognizes seeker's emotional distress and makes clear attempts to draw the seeker out. He/she clearly expresses warmth, concern, sympathy toward other and his/her feelings. This persists throughout most of the interaction." An overall score was represented by an average of the scores generated by two trained raters, with an intraclass correlation of .87, which is considered in the excellent range for this statistic (Cicchetti & Sparrow, 1981).

Peer-reported support (Age 13).—The Friendship Quality Questionnaire (Parker & Asher, 1993) was used to assess a close friend's report about the participant's ability to provide support to the peer in their friendship. A series of statements from the validation and caring, help and guidance, and intimate exchange scales were rated for their applicability on a 5-point Likert scale. Responses to these 29 statements were averaged to yield an overall measure of peer-reported support. For example, statements included, "[Participant] cares about my feelings," (validation and caring scale), "[Participant] gives advice figuring things out" (help and guidance scale), and "We always tell each other our problems" (intimate exchange scale). Internal consistency was good (Cronbach's α =.95).

Secure Caregiving in Romantic Relationships (Romantic Partners: Ages 21, 24, 27; Participants: Ages 24, 27).—Secure caregiving was measured using the Behavioral Systems Questionnaire (Furman & Wehner, 1999), which uses a 5-point Likert scale ranging from strongly disagree to strongly agree, to assess attachment styles with a current partner. Both participants and their romantic partners completed this measure about themselves. The 5-item Secure Caregiving subscale includes behaviors such as "I feel comfortable with my [boyfriend/girlfriend] coming to me for help," and "It is relatively easy to respond to my [boyfriend/girlfriend's] needs." Thus, the participant's report reflects the participant's security in themselves as a caregiver, and the partner's report reflects the partner's security as a caregiver. Cronbach's α's ranged from .78 to .83. Scores were averaged across years to yield the final measure. Participant self-reports were not collected at the age 21 assessment.

Negativity in Close Peer Relationships (Annually from Ages 24 – 33).— Negativity in relationship to the closest (non-romantic) peer was rated by both participants and their peers each year from ages 24 to 33 using the Network of Relationships Inventory (Furman & Buhrmester, 1985). Items were rated on a 5-point Likert scale; the negativity score was created by summing scores from subscales assessing antagonism, criticism, and conflict comprising nine items in total. Internal consistency was good, with Cronbach's alphas ranging from .78 to .93.

Negativity in Romantic Relationships (Participants & Romantic Partners: Ages 21, 24, 27).—Participants and their romantic partners each completed items about the negative interactions in their relationship using the same items from the Network of Relationships Inventory as described above (Furman & Buhrmester, 1985). Internal consistency was good, with Cronbach's alphas ranging from .89 to .94.

Vagal Tone (Age 29).—Vagal tone was assessed in terms of heart interbeat intervals obtained from an electrocardiogram while participants were resting in a comfortable chair, watching a soothing nature video for ten minutes (Cacioppo et al., 1995; Kirschbaum et al., 1993). Heart rate was continuously monitored (with sampling at 1 kHz) using a Mindware 2000D module. Five-lead electrodes were placed according to standard ECG placement recommendations (Hoetink et al., 2002), and each waveform was verified or edited prior to analyses. Respiratory sinus arrhythmia (RSA) was calculated based on the digitized interbeat-intervals. Following linear detrending, the heart period time series was band-pass filtered from .12 to .40 Hz (Berntson et al., 1993; Litvack et al., 1995). The power spectrum of the heart period time series was calculated using a Fast Fourier Transform and scaled to $msec^2/Hz$. RSA was calculated as the natural log of the area under the heart period power spectrum within the corner frequencies of the band-pass filter (Litvack et al., 1995). RSA was calculated on a minute-by-minute basis and averaged across the last 3 minutes to increase measurement reliability (Berntson et al., 1997).

Interleukin-6 (IL-6, Age 29).—Approximately 20 cc of blood were collected and treated with EDTA, to prevent clotting, to determine circulating concentrations of IL-6. Plasma was separated via centrifugation, aliquoted and stored at −80C. IL-6 was measured by ELISA (limit of detection = 0.3 pg/ml; R&D Systems, San Diego, CA). Intra-assay and inter-assay coefficients of variation (% CV) are 3.6 and 8.6 for IL-6, respectively. Resulting scores were then log-transformed, as is typical with this measure to address skewness.

Covariates

Body Mass Index (BMI, Age 29).—BMI was assessed at the age 29 assessment to be used as a covariate in assessments of predictions to both vagal tone and levels of interleukin-6 given its established relations to both outcomes (Riva et al., 2001; Rodríguez-Hernández et al., 2013). Height (in meters) and weight (in kilograms) were assessed with light clothing and BMI was calculated using the standard formula BMI = weight / $height^2$, which was then log-transformed.

Autonomy & Relatedness While Disagreeing (Age 13).—Adolescent close peer dyads participated in an 8-minute videotaped task during which they first answered questions separately and then were brought together to discuss their disagreement in a revealed differences paradigm (Strodtbeck, 1951). Participants and their close peers were asked to decide which 7 out of a possible 12 fictional characters stranded on another planet should be selected for an emergency trip back to earth. Adolescents and their peers first chose their seven characters separately, and then came together to discuss disagreement and make a final recommendation. Using the Autonomy-Relatedness Coding Manual for Peer Interactions (Allen, Porter, et al., 2001), researchers coded participants' interaction style for behaviors establishing their autonomy while maintaining a sense of relatedness while disagreeing, a measure that has been related to numerous functional outcomes in adolescence (Emily L. Loeb et al., 2020; Oudekerk et al., 2015). Results were averaged across partners as a marker of ability to establish autonomy while maintaining relatedness. Two trained coders blind to other data in the study reliably coded each interaction with an intraclass correlation of .81, which is considered in the excellent range for this statistic (Cicchetti & Sparrow, 1981).

Close Friendship Intimacy **(Friend-rated: Age 13).—**Close friends rated participants on the intimacy of the friendship, using a version of the 4-item friendship competence scale from the Adolescent Self-Perception Profile modified to obtain ratings of one's friend (vs. oneself, as in the original scale; (Harter, 1988). Although the scale was originally labelled 'close friendship competence,' examination of the items suggests that it is better conceptualized as a measure of the intimacy of the friendship. Items focused, for example, on extent to which teen had "a close friend they share secrets with," "a friend close enough to share really personal thoughts with," and a "really close friend to share things with." Internal consistency was good (Cronbach's αs ranged from .65 to .74 within years).

Results

Analytic Plan

For all primary analyses, SAS PROC CALIS (version 9.4, SAS Institute, Cary, NC) was employed using full information maximum likelihood handling of missing data for assessment of key relations in hierarchical regression models. Power estimates indicate that 80% power would be obtained for standardized estimates equal to or greater than .21. Participant gender and baseline family income were entered in the first step followed by variables of interest for a given hypothesis. We also examined possible moderating effects of these factors on each of the relationships described in the primary analyses below. Moderating effects were assessed by creating interaction terms based on the product of the centered main effect variables and are reported below, where significant.

Means, standard deviations and intercorrelations for all substantive variables are presented in Table 1.

Primary Analyses

Hypothesis 1: Observed caregiving success will display convergent validity with observations and friend-reports of support from participants.—Analyses initially examined the simple relation of observed caregiving success to concurrent observations of participant and friend behavior in the caregiving task and to friends' reports of the degree to which they felt supported by the participant in their friendship. As seen in Table 2, observed peer satisfaction in the caregiving interaction—the primary measure of caregiving success in the study—was examined in relation to observations of support provided by the participant, as well as the strength and persistence of calls for support from the peer. Analyses indicated that observed support provided was positively related to peer satisfaction, and that this relationship was strengthened when it was examined in relation to the intensity of peers' calls for support: Peers' satisfaction was highest when *higher* levels of teen support were provided in the context of relatively *lower* levels of peers' calls for support.

In addition, as seen in Table 3, the satisfaction-based measure of participants' observed caregiving success with a close friend was positively related to that friend's overall report of the degree to which the participant was generally supportive in the friendship.

Hypothesis 2: Greater caregiving success at age 13 will predict greater security as a caregiver in romantic relationships at ages 21–27, as experienced by both participants and by their current romantic partners.—As shown in Table 4, significant positive effects of caregiving success in predicting secure caregiving were observed both for participants' self-reported security as caregivers at ages 24–27, as well as for partner reports of partners' own security as caregivers at ages 21–27.

Hypothesis 3: Greater caregiving success at age 13 will predict lower levels of negativity in romantic relationships at ages 21–30 and in close friendships at ages 24–33.—Mixed results were obtained regarding predictions from adolescent caregiving success to negativity in adult close relationships. Caregiving success at age 13 was predictive of lower self-reported negativity in close peer relationships across ages 24 to 33, as shown in the first columns of Table 5. However, caregiving success was unrelated to peer-reported negativity in these same relationships ($\beta = -.08$, $p = .28$; not depicted). Similarly, caregiving success at age 13 was predictive of lower romantic partner-reported negativity in the romantic relationship, as shown in the second set of columns in Table 5. However, caregiving success was unrelated to self-reports of negativity in those relationships ($\beta = .11$, $p = .11$; not depicted).

Hypothesis 4: Greater caregiving success at age 13 will predict higher vagal tone and lower levels of a marker of inflammation (interleukin-6) at age 29.—Mixed results were also obtained regarding predictions to future physiological outcomes. Predictions to adult vagal tone were assessed after considering not only gender and family income, but also adult BMI (a standard covariate in predictions to vagal tone). After accounting for these factors, caregiving success at 13 was predictive of greater adult vagal tone, as shown in Table 6. A similar approach controlling for BMI was used to assess

predictions to adult levels of interleukin-6. No significant prediction was observed ($\beta = .11$, $p = .11$; not depicted).

Hypothesis 5: Greater caregiving success at age 13 will demonstrate incremental validity adding unique variance in predictions over and above two markers of friendship quality: observations of adolescent capacity to establish autonomy and maintain relatedness with a close friend during a disagreement and the friend's rating of the intimacy/closeness of the friendship.—To assess whether observed caregiving success added unique variance beyond other friendship qualities in explaining key outcomes, analyses for Hypotheses 2 through 5 were repeated, but now models also added measures of baseline level of observed autonomy and relatedness with friends and friend ratings of close friendship intimacy as covariates. In these analyses (available in Supplemental Tables B – D), the significance of predictions from observed caregiving success did not change appreciably when these additional factors were included, with the exception of the prediction from caregiving success to romantic partner-reported negativity, which moved to the trend level of significance ($p = .06$).

Discussion

Success providing care to a close peer at age 13 predicted a range of hypothesized outcomes as much as two decades later. Caregiving success was assessed via an observational task in which participants were tasked with responding to a close peer's request for help or support. Success was viewed from a dyadic perspective and was rated in terms of observations of the peer's satisfaction in the task, a novel operationalization of caregiving success from a dyadic perspective. As hypothesized, this measure was linked to the degree to which the support provided by the participant was high relative to the level of the peer's call for support. Further evidence of construct validity was observed in links of observed caregiving success to the peer's independent report of the degree to which they actually felt supported by the participant in the friendship.

The most robust finding observed was the long-term prediction to caregiving security in romantic relationships in the twenties. The finding regarding participant self-reported caregiving security suggests long-term continuity across contexts and relationships from what was observed in adolescence to what the participant perceived of their own behavior in adult romantic relationships. This prediction was observed with respect to both the participant's self-report and to their romantic partner's report about their own caregiving security and is highly consistent with Furman's hypotheses regarding expected continuities from adolescent friendships to adult romantic relationships (Furman, 1999; Furman & Flanagan, 1997). Even more striking is the finding that early adolescent caregiving success was predictive of romantic partners' report of their *own* caregiving security. This suggests an important point about the dyadic nature of the caregiving process: Success likely reflects both caregiver capacity as well as recipient receptivity ((Furman & Rose, 2015). It may be that adolescents who are successful in providing support to a close friend are more likely to attract individuals, via a form of niche selection, who are themselves attuned to caregiving needs in relationships (Dijkstra et al., 2013). Alternatively, attachment theory would suggest

that individuals become increasingly attuned to one another's relational styles over time:. Thus individuals may not only select peers who are more likely to be satisfied with support they receive and able to reciprocate this support, they may *create* relationships in which this is likely to be the case (Mikulincer et al., 2003). If confirmed, either of these explanations potentially begins to explain how a process that is dyadic in nature may nevertheless give rise to long-term predictions not only for the individual but also for their new relationships.

Some evidence was also found linking caregiving success to reduced negativity in both adult close friendships and romantic relationships. This is in keeping with evidence from attachment-focused therapies that to the extent partners can meet one another's attachment needs, potential conflicts become far easier to resolve and negativity is less likely to persist (Greenman & Johnson, 2022). Links between caregiving success and lower future negativity were less consistent than other findings in this study, however. Caregiving success did not predict peer reports of negativity in close friendships, nor self-reports of negativity in adult romantic relationships. Although this lack of findings could reflect the relatively modest power of the study to test these longer-term predictions, it may also simply reflect the indirect nature of the hypothesized linkage, with caregiving success hypothesized to predict lower negativity only indirectly via qualities of support in adult relationships.

Evidence was also found linking caregiving success to higher levels of adult vagal tone, although not to levels of interleukin-6. The parasympathetic nervous system, which vagal tone reflects and influences, plays a key role in adaptively downregulating stress responses under conditions of perceived safety. High vagal tone has been linked both cross-sectionally and in short-term longitudinal studies to lower levels of perceived threat (Brosschot et al., 2016, 2017; Smith et al., 2020). One explanation for the present findings is that individuals who are successful caregivers may be able to establish social relationships that provide them with a more generalized sense of safety. This may also help explain why vagal tone, but not interleukin-6 was related to caregiving success: It may be that caregiving success predicts presence of not just benign relationships but of relationships that promote a sense of safety and security. This difference may well affect vagal tone, given the increased relaxation respose likely to result from such an effect; it may well not affect levels of interleukin-6, however, which have been primarily found sensitive to high levels of conflict, which are more likely to found at the opposite and far more disturbed end of a continuum of relationship functioning, where caregiving success may be less likely to be relevant. These findings are in line with prior research suggesting that broadly positive adolescent relationship qualities also predict greater adult vagal tone (Allen et al., in press). Given that vagal tone was not assessed at baseline, however, it also remains quite plausible that greater vagal tone in adolescence, which has been linked to greater physiological and emotion regulation capacity (Porges, 2007), gave rise to greater caregiving success and then simply remained stable into adulthood.

The finding that caregiving success predicted a range of outcomes over and above measures of the intimacy of a given friendship or the capacity of that friendship to handle disagreements with autonomy and relatedness suggests that it is not simply the presence of a good relationship or an artifact of performance in observational assessments that is being tapped by the caregiving measure. Together, these findings suggest that caregiving

success reflects a very specific relationship maintenance skill that can be observed in early adolescence and that displays continuity well into adulthood. These findings are also consistent with the emphasis within attachment theory on the importance of developing a goal-corrected partnership in which each partner's behavior is titrated to the needs and goals of the other (Bowlby, 1969/1982). Most importantly, these findings help advance the field from the understanding *that* adolescent close friendships are important, to beginning to identify *which* aspects of those friendships may be most important as markers of underlying developmental capacities.

One clear limit of this study is that the approach used relies upon a single observational assessment at a single point in time. It is possible that the early adolescent close friendship provided a particularly fortuitous vantage point from which to assess caregiving success. The early adolescent friendship is just beginning to take on attachment-like functions (Rosenthal & Kobak, 2010) and several lines of evidence suggest that such early attachment-like experiences may be uniquely impactful. Given both the plasticity of the social brain in adolescence (Blakemore & Mills, 2014), as well as the primacy effect from early experiences in newly intense friendships, the likelihood that early caregiving success would have longer-term implications increases. The observational approach employed demonstrated significant empirical advantages, however: The zero-order correlations in Table 1 make clear that the observational measure of caregiving success yielded predictions far stronger than a peer's simple report of feeling supported. One explanation is that the observational task was calling upon a skill which was only newly emerging and not yet frequently used. This skill thus might not necessarily be central to experiences in the *current* friendship but would become increasingly important as development progressed and friendship intensity increased.

Given that data from prior to age 13 were not available, it was not possible to assess the extent to which the present findings are capturing an existing capacity of the adolescent as opposed to a novel causal agent, although the former explanation seems most plausible. Thus, research examining what precedes the development of this adolescent capacity is now important to pursue. For example, empathy has been conceptualized as a core feature of the developing caregiving system that undergirds the ability to provide attuned, effective care that successfully meets others' needs (Decety et al., 2012) and may have played a critical role in these findings. Research linking high-quality relationships to the development of greater empathic abilities both in childhood and adolescence suggests that further exploration of the role of empathy in relation to caregiving ability is warranted (Stern et al., 2021) (Stern & Cassidy, 2018).

Several additional limits of this study should also be kept in mind. First, none of the findings are sufficient to support causal hypotheses. It is entirely possible, and indeed likely, that other unmeasured factors, such as empathic abilities, behavioral motivations, personality characteristics, and friendship selection, were the operative factors and that caregiving success simply serves as a marker of these capacities in operation. Even these other factors within adolescence may well have simply reflected pre-existing qualities from earlier in development that predicted both caregiving success with a peer at 13 as well as later outcomes. Further, although we obtained observations from both teens and their peers

in adolescence, we did not obtain the type of in-depth, parallel measures that would allow for more sophisticated dyadic analyses (e.g., actor-partner interaction models). In addition, this study took place over a 20-year period, which of necessity means that adolescent-era data were collected around the turn of the century in a different cultural context. Care must therefore be taken in generalizing results to adolescents currently.

Nonetheless, what these findings suggest is that as we increasingly recognize the importance of adolescent close friendships (Allen et al., 2022), we may now also begin to productively consider just what it is about those friendships that is most important going forward. It should also be noted that although this study was framed in terms of caregiving success and what this success predicts, the converse also applies: Individuals who struggled to meet their peer's needs at age 13 went on to struggle with caregiving and relationship qualities from adolescence onward. Identifying specific skills, dyadic processes, and capacities related to future outcomes is essential to developing intervention approaches to address the needs of these individuals and to move the field beyond the vague prescription of 'develop good friendships.' The current findings suggest that developing an individual's caregiving behavior may be one such direction worth pursuing in future research and intervention efforts.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Univariate Statistics and Intercorrelations Among Primary Constructs

	Mean	SD	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
1. Caregiving Success (Obs.: 13)	3.32	.62	.05	.31***	.14	.26***	.29***	−.16*	−.09	−.10	−.21*	.19*	.13	.11	.03	.05	.12	−.06
2. Peer Call for Support (Obs.: 13)	3.01	1.69	--	.82***	.14	−.05	.05	−.20**	−.14	−.18*	−.12	.02	−.16	.10	.01	−.10	.01	.22*
3. Provision of Support (Obs.: 13)	2.27	1.56		--	.18*	.04	.12	−.24**	−.19*	−.17	−.17*	.12	−.11	.21**	.02	−.12	.05	.18*
4. Peer-reported Support (Peer-rep:13)	3.78	.79			--	.02	−.07	−.09	−.22**	.08	.01	.01	−.11	.09	.41***	−.04	.06	.17*
5. Secure Caregiving (Self-rep: 24–27)	20.5	2.81				--	−.13	−.26***	−.02	−.30***	−.13	.03	.10	.04	−.00	.06	.03	.17*
6. Secure Caregiving (Prtnr rep: 21–27)	20.9	2.33					--	−.04	−.07	−.08	−.15	.01	.12	.02	.05	.04	.09	−.10
7. Negativity in Close Peer Rels (Self-rep: 24–33)	13.3	4.35						--	.35***	.45***	.14	−.18*	.10	−.15	−.09	.06	−.04	.18*
8. Negativity in Close Peer Rels (Peer-rep: 24–33)	13.7	3.98							--	.06	.05	−.06	.04	−.22**	−.18*	.08	−.16*	−.15*
9. Negativity in Romantic Rels (Self-rep: 21,24, 27)	5.97	1.61								--	.47***	.01	.11	−.17*	−.04	−.04	−.08	.17*
10. Negativity in Romantic Rels (Prtnr-rep: 21,24,27)	6.33	1.80									--	−.06	.22*	−.19*	−.09	.11	−.28***	.10
11. Vagal Tone (Phys: 29)	6.18	1.25										--	−.31***	.22*	.12	−.32***	.08	−.04
12. Interleukin-6 (Phys: 29)	.212	.875											--	−.26**	−.11	.61***	−31***	−.18
13. Auton. & Relatedness while Disagreeing (Obs: 13)	2.36	.635												--	.13	−.18*	.28***	−.09
14. Close Friendship Intimacy (Peer-rep:13)	13.31	2.54													--	−.18*	.06	.96
15. Body Mass Index (Phys: 29)	3.27	.24														--	−.17*	.14

	Mean	SD	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
16. Adolescent Family Income (parent-rep:13–17)	45,170	214															--	−.12
17. Identified Gender (13)	--	--																--

Note:

*** $p < .001$.

** $p < .01$.

* $p < .05$. Age of assessment in parentheses; Obs = Observed, Peer-rep = Peer report, Prtner-rep = Romantic Partner report, Self-rep = Self-report, Rels = Relationships, Phys = Physiological Assessment, Parent-rep = Parent report

Table 2

Relation of Observed Caregiving Success to Participant Support Given and Peer Calls for Support

	Observed Caregiving Success (13)			
	β entry	β final	R^2	ΔR^2
Step I.				
Gender (1=M; 2=F)	−.04	−.06		
Adol. Family Income	.11	.08		
Statistics for Step			.016	.016
Step II.				
Support Given (13; Obsvd.)	.33***	.81***		
Statistics for Step			.119***	.103***
Step III.				
Peer Calls for Support (13; Obsvd.)	−.60***	−.60***		
Statistics for Step			.235***	.116***

Note:

*** $p < .001$.

** $p < .01$.

* $p < .05$. Adol. = Adolescent, Obsvd. = Observed.

Table 3

Regressions Predicting Peer-Reported Support in Friendship

	Peer-Reported Support in Friendship			
	β entry	β final	R^2	ΔR^2
Step I.				
Gender (1=M; 2=F)	.19**	.20**		
Adol. Family Income	.10	.08		
Statistics for Step			.041*	.041*
Step II.				
Caregiving Success (13; Obsvd.)	.15*	.15*		
Statistics for Step			.064**	.023*

Note:

*** $p < .001$.

** $p < .01$.

* $p < .05$. Adol. = Adolescent, Obsvd. = Observed

Table 4

Regressions Predicting Secure Caregiving in Adult Romantic Relationships

	Secure Caregiving							
	Self-Report (Ages 21–27)				Romantic Partner-Report (Ages 21–27)			
	β entry	β final	R^2	ΔR^2	β entry	β final	R^2	ΔR^2
Step I.								
Gender (1=M; 2=F)	.17*	.18*			−.09	−.08		
Adol. Family Income	.06	.02			.08	.05		
Statistics for Step			.031	.031			.017	.017
Step II.								
Caregiving Success (13; Obsvd.)	.26***	.26***			.27***	.27***		
Statistics for Step			.099***	.068***			.091**	.074***

Note:

*** $p < .001$.

** $p < .01$.

* $p < .05$. Adol. = Adolescent, Obsvd. = Observed

Table 5

Regressions Predicting Close Relationship Negativity

	Relationship Negativity							
	Close-Peer Relationship (age 24–33) (self-report)				Romantic Partner Relationship (age 21–30) (partner-report)			
	β entry	β final	R^2	ΔR^2	β entry	β final	R^2	ΔR^2
Step I.								
Gender (1=M; 2=F)	−.18*	−.19**			−.09	.06	.07	
Adol. Family Income	−.06	−.04			.08	−.25**	−.27***	
Statistics for Step			.035*	.035*			.080**	.080**
Step II.								
Caregiving Success (13; Obsvd.)	−.17*	−.17*			−.17*	−.17*		
Statistics for Step			.064*	.029*			.107***	.027*

Note:

*** $p < .001$.

** $p < .01$.

* $p < .05$. Adol. = Adolescent, Obsvd. = Observed

Table 6

Regressions Predicting Adult Vagal Tone

	Vagal Tone (Age 29)			
	β entry	β final	R^2	ΔR^2
Step I.				
Gender (1=M; 2=F)	−.03	.01		
Adol. Family Income	.08	.02		
Statistics for Step			.008	.008
Step II.				
Body Mass Index (29; Measured)	−.30***	−.31***		
Statistics for Step			.092**	.084***
Step II.				
Caregiving Success (13; Obsvd.)	.18*	.18*		
Statistics for Step			.123***	.039*

Note:

*** $p < .001$.

** $p < .01$.

* $p < .05$. Adol. = Adolescent, Obsvd. = Observed