



Social support, loneliness, eating, and activity among parent–adolescent dyads

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Abstract We examined associations of social support and loneliness with eating and activity among parent–adolescent dyads ($N = 2968$) using actor–partner interdependence modeling. Loneliness had several actor associations with health behaviors (adolescents: less physical activity [PA], $p < .001$, more sedentariness, $p < .001$; parents: less fruit/vegetable consumption [FVC], $p = .029$, more hedonic food consumption [HFC], $p = .002$, and sedentariness, $p < .001$), but only one dyadic association (adolescent loneliness with less parent FVC, $p = .039$). Visible support was associated with less HFC, $p < .001$, and sedentariness, $p < .001$, but less FVC, $p = .008$, among adolescents. Invisible support was associated with less HFC, $p = .003$, but also less PA, $p = .028$, among adolescents. Both support types were associated with less HFC among parents, $p < .001$, but invisible support was also associated with less FVC, $p = .029$, and PA, $p = .012$, and more sedentariness, $p = .013$, among parents. When examining health behavior among parents and adolescents, it may be important to consider social support (but perhaps not loneliness) at a dyadic level.

Keywords Social support · Loneliness · Eating behavior · Activity behavior · Parent–adolescent relationship · Actor–partner interdependence modeling

Introduction

In the U.S., 20.5% of adolescents and 36.5% of adults are obese (Ogden et al., 2015), which increases risk of cancer, cardiovascular disease, stroke, and premature mortality (Calle et al., 2003; Dauchet et al., 2006). Healthy eating and activity (which includes both physical activity [PA] and sedentary behavior) are associated with achieving and maintaining healthy weight, as well as with improved health (Rock & Demark-Wahnefried, 2002; US Department of Health and Human Services, 2017). Although healthy eating (Doyle et al., 2006; World Health Organization, 2017; Rock & Demark-Wahnefried, 2002; US Department of Health and Human Services, 2017) and activity (US Department of Health and Human Services, 2017) are broadly promoted, few adolescents and adults meet the recommended guidelines for eating fruits and vegetables, limiting low nutrient high calorie foods, engaging in physical activity, and limiting sedentariness (Casagrande et al., 2007; Centers for Disease & Prevention, 2007; Whitlock et al., 2010). Importantly, adolescence is a critical juncture for the formation of lifelong health habits (Lawrence et al., 2009). Thus, it is important to identify and intervene upon determinants of unhealthy eating and activity behaviors among adolescents and adults to improve population health.

Eating and activity are inherently social behaviors in that they often take place in the presence of or with the support of others (Anderson et al., 2007; Duncan et al., 2005). Accordingly, emerging evidence suggests that social factors, such as modeling, instrumental support, and loneliness, may influence these health behaviors among dyads (Baiocchi-Wagner & Talley, 2013; Dwyer et al., 2017; Ferrer et al., 2017; Howland et al., 2016; Lopez et al., 2012; Nansel et al., 2013; Orehek & Ferrer, 2019; Rut-

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kowski & Connelly, 2012; Segrin et al., 2015). The present research investigates two related but distinct correlates of eating and activity in parent–adolescent dyads: support and loneliness.

Social support and loneliness unfold within social networks and among dyads (Cacioppo et al., 2009; Kim et al., 2012), and are related (Sorkin et al., 2002; Stephens et al., 2011; Stroebe et al., 1996; Winningham & Pike, 2007). These processes may be particularly interrelated within parent–adolescent dyads, due to the inherent proximal and emotional closeness of this relationship (Al-Yagon et al., 2016). Given the social nature of eating and activity behaviors, and the importance of and associations among social support and loneliness within parent–adolescent dyads, these may be particularly important factors to examine together as potential correlates of parent and adolescent eating and activity behaviors.

Social support

Social support is defined as care or assistance, exchanged through social relationships and interpersonal interactions (Thoits, 1986). Here, we focus on social support aimed at solving problems or alleviating stressors experienced by the support recipient (i.e., problem-focused support), which are important because these help the recipient cope and can improve relationship quality and the well-being of both the recipient and provider (Bowlby, 1982; Feeney & Collins, 2003, 2015; Gleason et al., 2008; Inagaki & Orehek, 2017; Liang et al., 2001; Mikulincer & Shaver, 2009). Problem-focused support can be characterized as emotional support (support aimed at meeting the emotional or social needs of the recipient (Heaney & Israel, 2008) or instrumental/practical support (tangible help provided to help the recipient to solve problems (Heaney & Israel, 2008). Critically, social support can also improve the health of recipients regardless of whether the support is perceived as support by the recipient (i.e., visible support) or received absent of that perception (i.e., invisible support, which is not noticed or is not perceived or defined as support by recipient) (Bolger & Amarel, 2007; Bolger et al., 2000). Of note, however, receiving support can also be detrimental to its recipient when the support is not responsive to the recipient's support needs (Feeney, 2004; Feeney & Collins, 2015). Providing support can also be detrimental to providers when the burden of care outweighs the benefits of providing it (Ohaeri, 2003; Pinquart & Sorensen, 2001; Wilkinson et al., 2017).

In addition to improving relationship quality and well-being (Brown et al., 2003; LaRocco et al., 1980; Thoits, 1995), provided and received support may also be important in facilitating healthy behaviors, such as healthy dietary behavior (Hagler et al., 2007; Jackson, 2006; Steptoe et al., 2004), PA (T. E. Duncan & McAuley, 1993;

Eyler et al., 1999), and successful weight loss (Verheijden et al., 2005; Wing & Jeffery, 1999). Similarly, low levels of received visible support have been associated with lower PA, more smoking and heavy drinking, and an increased risk of obesity (Strine et al., 2008). Importantly, these studies have examined the health consequences of support at the individual-level, even though support is a dyadic phenomenon (Bowlby, 1982; Collins & Feeney, 2000). Thus, the role of support in health behaviors may be better understood when examined in the context of the dyad (Collins & Feeney, 2000).

Social support is more asymmetrically provided in the parent–child relationship than in many other relationships because there is a natural hierarchy of care and support (Al-Yagon et al., 2016; Bretherton, 2010; Rapini et al., 1990), and children benefit in many ways from adequate parental support. For example, when adolescents perceive their parents are providing sufficient visible support, they may be more effective in regulating their emotions and coping with stress, resulting in better overall mental health (Forehand et al., 1991; Hosley, 1999; Rueger et al., 2016). However, little is known about how providing both visible and invisible support to adolescents influences the parental support provider. One dyadic study found that parental empathy, which is often positively correlated with support provision, was associated with higher parental self-esteem and sense of purpose, but also higher biomarkers of inflammation among the parental support providers (Manczak et al., 2016). This is consistent with a broader literature on (non-parent–child) caregiving dyads, which suggests that providing visible and invisible support in caregiving can have both positive and negative consequences for the caregiver (Cohen et al., 2002; Feeney & Collins, 2003; Inagaki & Orehek, 2017; Schulz & Beach, 1999; Vitaliano et al., 2003). For example, caregivers may have poorer dietary and exercise behaviors (Acton, 2002; Burton et al., 1997; Castro et al., 2007). Moreover, one longitudinal study of the “sandwich generation” found that multigenerational caregivers were less likely to check food labels, choose food based on health values, and exercise regularly (Chassin et al., 2010). Thus, support in the parent–adolescent relationship may be more beneficial to adolescent health behaviors, and less beneficial to parent health behaviors, compared to what might be expected in more symmetrical relationships.

Loneliness

Loneliness, or perceived social isolation, also has many negative consequences for mental and physical health (Hawkey & Cacioppo, 2010). Loneliness is a painful and emotional experience that is threatening to the self (Rook, 1984; Weiss, 1973), and accompanies the perception that

one's social needs are not being met by social relationships (Pinquart & Sorensen, 2001). Loneliness has a predicted trajectory of peaking in adolescence, and although it wanes in adulthood (before increasing again in old age) (Heinrich & Gullone, 2006), the effects of adolescent loneliness on health may extend into adulthood (Caspi et al., 2006). For example, loneliness reduces self-efficacy for engaging in healthy behaviors (Hawkley & Cacioppo, 2010; Qualter et al., 2013). Among adults, loneliness has been linked to less PA, more sedentariness, and more emotional eating (Ford et al., 2017; Hawkley et al., 2009; Newall et al., 2013; Shankar et al., 2011). Among adolescents, it is associated with less fruit and vegetable consumption (FVC) (Conklin et al., 2014) and more hedonic food consumption (HFC) (e.g., sweetened beverages and salty snacks) (Grenard et al., 2013).

Loneliness is often conceptualized as an individual experience; however, some studies have evaluated the role of loneliness within relationships. An individual's loneliness is observable by others within their social network (Luhmann et al., 2016). Moreover, consistent with research on emotional contagion (Fowler & Christakis, 2008), loneliness may be transmitted among social networks and in close dyads (Cacioppo et al., 2009; Segrin et al., 2003). Given the effects of loneliness on one's own physical health and its ability to be observed and transmitted within networks, loneliness may also have dyadic consequences for physical health (Segrin et al., 2015). Indeed, one study suggests that loneliness can be detrimental for sleeping behavior among both the person experiencing loneliness and their close dyadic partner (Segrin et al., 2015). However, no known research has examined the consequences of loneliness within dyads for eating and activity behaviors.

The relationship between social support and loneliness

As stated, social support and perceived loneliness are two social processes that unfold within relationships and dyads (Cacioppo et al., 2009; Kim et al., 2012). These processes are related (Rook, 1984), and thus important to examine together (Sorkin et al., 2002; Stephens et al., 2011; Stroebe et al., 1996; Winningham & Pike, 2007). Importantly, loneliness and perceived support may be particularly intertwined within the parent–adolescent dyad; research suggests that being able to rely on a parent reduces adolescent-reported loneliness independent of the adolescent's peer connections (Al-Yagon et al., 2016). Similarly, other studies have demonstrated that children and adolescents in families with less parental support and attachment report greater loneliness (Al-Yagon et al., 2016; Dubow & Ullman, 1989; Mounts, Valentiner, Anderson, & Boswell, 2006). Moreover, when lack of support contributes to

loneliness among adolescents, it may also have implications for general loneliness; adolescents who report loneliness in their relationships with their parents are also more likely to report loneliness in their relationships with their peers (Marcoen & Brumagne, 1985). Moreover, it is possible that lonelier parents may be less able to provide adequate social support (Curran, 2018). As such, examining how support and loneliness are concurrently associated with eating and activity behavior within dyads provides a novel window into social processes and health behaviors at the individual- and dyadic- levels.

The current study

Here, we examined how social support and loneliness were independently associated with eating and activity behavior in parent–adolescent dyads using cross-sectional data from the National Cancer Institute's Family Life, Activity, Sun, Health, and Eating (FLASHE) study. We focused specifically on practical and emotional stress-related or problem-focused support and examined the associations of both visible and invisible support with health behaviors. To appropriately probe the dyadic associations among loneliness and support with eating and activity behaviors, we used actor–partner interdependence modeling (APIM) (Campbell & Kashy, 2002; Cook & Kenny, 2005), which allows for the examination of how each individual's own social processes are associated with his or her own behavior (i.e., actor associations), as well as how that individual's dyadic partner's social processes are associated with the individual's own behavior (i.e., partner associations). Given the relation among support and loneliness noted above, we included both support and loneliness in the same model. Of note, both adolescents' and parents' perceptions of how much support the parent provided (adolescent-perceived and parent-perceived support, respectively) were entered as predictors in the same model. Thus, parent-perceived support represented invisible support, or the support parents reported providing beyond what was perceived by the adolescent, which was statistically parceled out with the inclusion of the adolescent-perceived support (i.e., visible support) variable (see Orehek & Ferrer, 2019). This operationalization is consistent with the classic definition of invisible support—support that is reported as offered by the provider, but is not reported by the recipient either because the recipient did not notice the support provision or did not register it explicitly as provided support (Bolger et al., 2000).

We hypothesized that greater adolescent loneliness would be associated with less healthy behaviors among adolescents in actor associations, and among parents in partner associations. We also hypothesized that greater parent loneliness would be associated with less healthy

behaviors among parents in actor associations, and among adolescents in partner associations.

We hypothesized that *receiving* both visible and invisible support would be associated with healthier adolescent eating and activity behaviors. Some studies have found more negative health behaviors among support recipients as a function of invisible support within romantic dyads (Lüscher et al., 2015); therefore, we acknowledge the possibility that invisible support may not always be beneficial to the adolescent. Because there can be both benefits and adverse effects of *providing* support, we did not have specific hypotheses concerning the direction of the associations of visible and invisible support with parents' eating and activity behaviors.

Method

Participants and procedures

Data for these analyses are from the National Cancer Institute's FLASHE study. This study was a web-based, cross-sectional study of psychosocial, generational, and environmental correlates of cancer-preventive behaviors among parent–adolescent dyads. The study was administered by Westat, Inc, and data were collected between April and October 2014. U.S. adults were recruited through the Ipsos Consumer Opinion Panel using sample balance methods aimed at recruiting a sample that was demographically representative of the U.S. population in terms of gender, census division, household income, household size, and race/ethnicity (Oh et al., 2017). Adult participants were eligible if they were at least 18 years old and lived with at least one adolescent child aged 12–17 years for at least 50% of the time. Each dyad member (i.e., adult parent and adolescent child) completed two surveys, one that solicited responses on PA, smoking, and sun safety behaviors, as well as psychosocial correlates, and another about eating behaviors and psychosocial correlates. See <http://cancercontrol.cancer.gov/brp/hbrb/flashe.html> for more information on survey instruments and the study protocol, and Nebeling et al. (2017) for full methodology of FLASHE item development. This study was approved by the National Cancer Institute Special Studies IRB and the Westat, Inc. IRB. Parent participants provided informed consent for both the parent and adolescent and assent was obtained from adolescent participants.

For these analyses, participants were the 1484 parent–adolescent dyads ($N = 2968$) who completed all necessary measures (i.e., both the parent and adolescent completed the two independent variables and reported all necessary sociodemographic factors). Three-hundred and forty-eight dyads were excluded because one or both members of the

dyad did not complete all necessary measures.¹ The mean age of parents was 43.90 years ($SD = 7.58$ years), and adolescents' mean age was 14.46 years ($SD = 1.60$ years). Women made up 63% of the sample (75% among parents and 50% among adolescents). Full participant sociodemographic characteristics can be found in Table 1.

Measures

Correlations among all study constructs are found in Table 2.

Loneliness

Both adolescents and parents answered the same two items regarding feelings of loneliness: “I feel isolated from others,” and “I feel left out,” using five response options ranging from (1) *never* to (5) *always*. These two items were selected because they had high factor loadings onto the revised UCLA Loneliness Scale (Russell et al., 1980). The correlation among these items was high, $r = 0.83$, $p < .0001$.

Stress-related social support

Adolescents rated visible support (support they perceived their parents provided) using two items: “I can count on my parent if I have a problem,” and “My parent(s) don't like me to tell them my troubles,” (reverse-scored) using five response options ranging from (1) *never* to (5) *always*. Parents also rated the support they perceived they provided to their adolescents using two parallel items, “My teenager can count on me if he/she has a problem,” and “I don't like my teenager to tell me his/her troubles” (reverse-scored). These two items were validated as part of a published scale, and were selected because of their high factor loadings (Bastais et al., 2012; Darlington & Toyokawa, 1997; Kim et al., 2015; Mlynarczyk, 2013). The correlation between these two items was moderate, $r = 0.41$, $p < .0001$. Parent reported support was used to represent invisible support (i.e., support the adolescent reported receiving), as controlling for variance predicted by visible support in the model renders the remaining variance explained by parent-perceived support a measure of invisible support (i.e., parent-perceived support controlling for adolescent-perceived support).

¹ The majority of missingness was due to missing data on sociodemographic variables; few participants were excluded for missingness on loneliness (parents $n = 30$, adolescents $n = 92$) or support (parents $n = 22$, adolescents $n = 60$). We ran 22 regression analyses; of these, only three were significant. Specifically, missingness on parent-perceived support was predicted by greater age, $p = .032$, and college education, $p = 0.43$. Missingness on parent loneliness was predicted by non-white race, $p = .018$. Missingness on adolescent loneliness and adolescent-perceived support was not predicted by any sociodemographic variables.

Table 1 Sociodemographic characteristics

Variable	Full sample	Parent <i>M (SD)</i>	Adolescent <i>M (SD)</i>
Age	<i>n (%)</i>	43.90 SD = 7.58 <i>n (%)</i>	14.46 SD = 1.60 <i>n (%)</i>
Percent female	1855 (62.5%)	1111 (74.9%)	744 (50.1%)
Race			
White	2316 (78.0%)	1153 (77.7%)	1163 (78.4%)
Ethnicity			
Hispanic/Latino(a)	253 (8.5%)	106 (7.1%)	147 (9.9%)
Not Hispanic/Latino(a)	2715 (91.5%)	1378 (92.9%)	1337 (90.1%)
Employment status			
Employed	–	972 (65.5%)	–
Unemployed	–	512 (34.5%)	–
Marital status			
Married	–	1081 (72.8%)	–
Unmarried	–	403 (27.2%)	–
Parent education			
College degree	–	705 (47.5%)	–
Below college degree	–	779 (52.5%)	–
	<i>M (SD)</i>	<i>M (SD)</i>	
Loneliness	–	2.12 (1.00)	2.10 (1.01)
Social support	–	4.65 (0.86)	4.30 (1.11)
Physical Activity	–	177.64 (176.25)	111.89 (18.02)
Sedentariness	–	379.64 (220.80)	58.00 (2.72)
Fruit and vegetable consumption	–	3.11 (2.18)	2.84 (2.28)
Hedonic food consumption	–	3.73 (3.63)	5.05 (4.14)

Table 2 Correlations among study constructs

	1	2	3	4	5	6	7	8	9	10	11
1 Adolescent loneliness											
2 Parent loneliness	.37										
3 Adolescent-perceived support	– .20	– .12									
4 Parent-perceived support	– .09	– .07	.33								
5 Adolescent FVC	– .02	– .03	– .08	– .06							
6 Parent FVC	– .09	– .08	> – .01	– .04	.53						
7 Adolescent HFC	.07	.06	– .19	– .11	.45	.24					
8 Parent HFC	.07	.10	– .18	– .18	.35	.34	.69				
9 Adolescent exercise	– .09	< .01	– .02	– .04	.21	.14	.07	.11			
10 Parent exercise	< .01	– .07	– .06	– .08	.10	.03	.16	.23	– .12		
11 Adolescent sedentariness	.10	.04	– .12	– .06	– .03	– .02	.24	.19	– .36	.12	
12 Parent sedentariness	.04	.14	.01	.06	– .11	– .13	.02	.05	– .07	< .01	.08

Bolded values indicate significance at $p < .05$

Fruit and vegetable consumption (FVC) and hedonic food consumption (HFC)

A 27-item dietary screener was used to assess frequency of consumption of key foods, beverages, and food groups in the past 7 days. This screener was adapted from the

National Health and Nutrition Examination Survey, 2009–2010 Dietary Screener (<http://epi.grants.cancer.gov/nhanes/dietscreen/>) and the 2010 National Youth Physical Activity and Nutrition Survey (20 items; Brener et al. (2011); http://www.cdc.gov/healthyYouth/yrbs/pdf/nypans/2010nypans_questionnaire.pdf). Seven new items

were also added (Smith et al., 2017). The screener contained questions about FV and HFC.

Parent and adolescent FVC were queried with three items that assessed consumption of green salad, nonfried vegetables, and fruit over the past 7 days. Each item used the following format and provided examples of each food type: “During the past 7 days, how many times did you eat [food]?” Answer options were: (1) *I did not eat [food] during the past 7 days*; (2) *1–3 times in the past 7 days*; (3) *4–6 times in the past 7 days*; (4) *1 time per day*; (5) *2 times per day*; and (6) *3 or more times per day*. Responses were converted to daily frequencies (never = 0; 1 to 3 times during the past 7 days = 0.29; 4–6 times during the past 7 days = 0.71; 1 time per day = 1; etc.). FVC was computed as the sum of the 3 items.

Parent and adolescent HFC were queried with eight seven-day recall items that assessed consumption of sugary cereal, candy and chocolate, fried potatoes, chips, processed meat, cookies and cake, frozen desserts, and fast food. Responses were converted to daily frequencies and HFC was computed as the sum of these eight items.

Adolescent PA and sedentariness

Adolescent PA and sedentariness were recorded as the number of minutes spent engaging in each activity using the Youth Activity Profile (YAP). The YAP is a 15-item self-administered 7-day recall that assessed adolescent activity during school (e.g., recess, gym, transportation to and from school), right after school (e.g., sports practices), in the evening, and on weekends (Saint-Maurice et al., 2017). Sedentariness was captured by assessing time spent watching television, playing video games, and using personal technology devices (e.g., computer, tablets, phones, etc.). To enhance the accuracy of the YAP, a subsample of 119 adolescents wore ActiGraph GT3X + accelerometers on their wrists for 2 weeks following completion of the questionnaire. The minutes of PA and sedentariness generated from the accelerometer data were compared to the activities reported on the YAP for questionnaire calibration. An algorithm was created to improve the accuracy of self-reports by aligning the data from the self-report scores to the accelerometer data. This algorithm was then applied to all adolescent PA and sedentariness behavior YAP scores to generate a new outcome variable representing the number of minutes of PA and sedentariness per week. These YAP-refined scores are used in the present analyses. A detailed description of these processes can be found elsewhere (Saint-Maurice et al., 2017).

Parent PA and sedentariness

Parent PA behavior was recorded as the number of minutes of PA and sedentariness per week and was assessed via direct recall of the past 7 days. Parents were asked six questions regarding their weekly PA, including vigorous activity, moderate activity, and walking. Vigorous activity was assessed with the item, “During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobic, or fast bicycling?” Vigorous activity was described as activities that “take hard physical effort, make you breathe much harder than normal, and were completed for at least ten minutes at a time.” Moderate activity was assessed by, “During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.” Moderate activity was described as “activities that make you breathe somewhat harder than normal and were completed for at least 10 min at a time.” Walking was assessed separately in that parent participants were asked to consider the time spent walking in the past 7 days, including at home, at work, walking to travel from place to place, and any other walking done for recreation, sport, exercise, or leisure with the item, “During the last 7 days, on how many days did you walk for at least 10 min at a time?” A “No vigorous/moderate physical activity/walking” option was provided for each activity item.

A “Don’t know/Not sure” option was also available for all PA items. Activity items were summed to calculate minutes of PA per week. Parents who selected “don’t know” on one or two items were included using a score derived as the sum of the item(s) for which they provided a valid estimate and a score of zero for item(s) they reported as “don’t know.” Sixteen parents selected the “don’t know” option for all three items and were excluded from analyses involving PA.

Parental sedentariness was asked as a single item measure: “During the last 7 days, how much time did you spend sitting on a week day?” Hours per day and minutes per day were collected. A “Don’t know/Not sure” option was available; 300 participants selected “don’t know” on this item and were excluded from analyses of sedentary behavior. Both parent and adolescent activity behaviors were calculated as minutes of PA and sedentariness per week.

Sociodemographic covariates

Race, ethnicity, age, gender, marital status, work status, and educational attainment were recoded (i.e., dummy coded) as dichotomous variables. Race was coded as White

Table 3 Actor partner interdependence models predicting adolescent and parent activity behaviors with adolescent and parent loneliness and support

	Adolescent PA			Parent PA			Adolescent sedentariness			Parent sedentariness		
	β	95% CI	<i>p</i>	β	95% CI	<i>p</i>	β	95% CI	<i>p</i>	β	95% CI	<i>p</i>
Adolescent loneliness	– 0.11	– 0.14 , – 0.08	< . 001	0.03	– 0.03, 0.10	.390	0.10	0.06 , 0.15	< . 001	– 0.01	– 0.06, 0.04	.717
Parent loneliness	0.02	– 0.01, 0.05	.229	– 0.07	– 0.13, 0.00	.082	0.01	– 0.03, 0.06	.597	0.15	0.10 , 0.20	< . 001
Visible parent support (adolescent-perceived)	– 0.01	– 0.04, 0.01	.361	– 0.03	– 0.09, 0.03	.347	– 0.10	– 0.14 , – 0.05	< . 001	0.00	– 0.05, 0.05	.991
Invisible parent support (parent-perceived)	– 0.04	– 0.06 , – 0.01	.028	– 0.09	– 0.14 , – 0.03	.012	– 0.01	– 0.06, 0.03	.633	0.07	0.03 , 0.12	.013

Bold values indicate statistical significance at *p* < .05

(1) and non-White (0). Ethnicity was coded as Hispanic or Latino (1) and not Hispanic or Latino (0). Parental marital status was coded as married (1) and unmarried (0). Parent education was coded as college educated (1) and less than college educated (0). Parent working status was coded as currently employed for pay or self-employed (1) and not currently employed (0). Gender was coded as female (1) and male (0).

Data analysis

The four outcomes of interest (FVC, HFC, PA, and sedentariness) were analyzed separately using a series of actor–partner interdependence models (APIM) with regression models in SAS 9.3 (Campbell & Kashy, 2002; Cook & Kenny, 2005). This approach simultaneously examines hypothesized actor and partner effects while accounting for the nonindependence among dyads. Each model involved entering parent loneliness, adolescent loneliness, and stress-related support with both adolescent-perceived (visible) support and parent-perceived (invisible) support as simultaneous predictors of each outcome. Dyads were included in analyses if both parent and adolescent completed corresponding behavioral outcome measures within each set of analyses (cases with missing data were removed with Listwise deletion). Sociodemographic factors at both the individual level (each individual’s age, gender, race, and ethnicity) and dyadic level (parent education, work status, and marital status because they apply to parents only, as teens were all full-time students, and none was married) were controlled for in all analyses.²

² The pattern and significance of findings remained unchanged when sociodemographic control variables were omitted.

Results

Full results for the APIM paths are found in Tables 3 and 4 and Figs. 1 and 2

Loneliness

Adolescent loneliness was associated with less adolescent PA, $\beta = -0.11$, 95% CI [– 0.14, – 0.08], *p* < .001, and more adolescent sedentariness, $\beta = 0.10$, 95% CI [0.06, 0.15], *p* < .001 (and was unassociated with adolescent FVC and HFC). Parent loneliness was negatively associated with parent FVC, $\beta = -0.06$, 95% CI [– 0.11, – 0.02], *p* = .029, and positively associated with parent HFC, $\beta = 0.09$, 95% CI [0.04, 0.14], *p* = .002, and parent sedentariness, $\beta = 0.15$, 95% CI [0.10, 0.20], *p* < .001. Adolescent loneliness was negatively associated with parent FVC, $\beta = -0.06$, 95% CI [– 0.11, – 0.01], *p* = .039. No other partner associations emerged for loneliness.

Receiving stress-related support

Receiving visible support was associated with less HFC, $\beta = -0.14$, 95% CI [– 0.19, – 0.09], *p* < .001, and less sedentariness, $\beta = -0.10$, 95% CI [– 0.14, – 0.05], *p* < .001, among adolescents. However, receiving visible support was also associated with less adolescent FVC, $\beta = -0.08$, 95% CI [– 0.12, – 0.03], *p* = .008. Receiving invisible support was associated with less adolescent HFC, $\beta = -0.08$, 95% CI [– 0.13, – 0.04], *p* = .003. However, receiving invisible support was also associated with less adolescent PA, $\beta = -0.04$, 95% CI [– 0.06, – 0.01], *p* = .028.

Providing stress-related support

Providing visible support was associated with less parent HFC, $\beta = -0.11$, 95% CI [– 0.16, – 0.07], *p* < .001, as

Table 4 Actor partner interdependence models predicting adolescent and parent eating behaviors with adolescent and parent loneliness and support

	Adolescent FVC			Parent FVC			Adolescent HFC			Parent HFC		
	β	95% CI	<i>p</i>	β	95% CI	<i>p</i>	β	95% CI	<i>p</i>	β	95% CI	<i>p</i>
Adolescent loneliness	-0.02	-0.07, 0.03	.471	-0.06	-0.11, -0.01	.039	0.04	-0.00, 0.09	.132	0.02	-0.03, 0.06	.567
Parent loneliness	-0.00	-0.05, 0.05	.933	-0.06	-0.11, -0.02	.029	0.05	-0.00, 0.10	.104	0.09	0.04, 0.14	.002
Visible parent support (adolescent-perceived)	-0.08	-0.12, -0.03	.008	-0.01	-0.06, 0.03	.632	-0.14	-0.19, -0.09	< .001	-0.11	-0.16, -0.07	< .001
Invisible parent support (parent-perceived)	-0.05	-0.09, 0.00	.100	-0.06	-0.11, -0.02	.029	-0.08	-0.13, -0.04	.003	-0.10	-0.14, -0.05	< .001

Bold values indicate statistical significance at $p < .05$

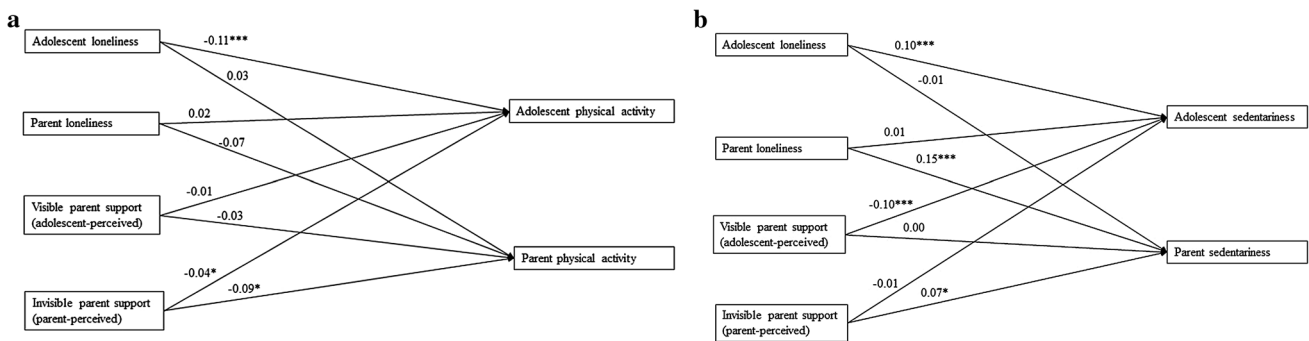


Fig. 1 APIM presenting associations of parent and adolescent support, perceived support, and loneliness with parents and adolescent physical activity (a) and sedentariness (b). Note. * $p < .05$, ** $p < .01$, *** $p < .001$

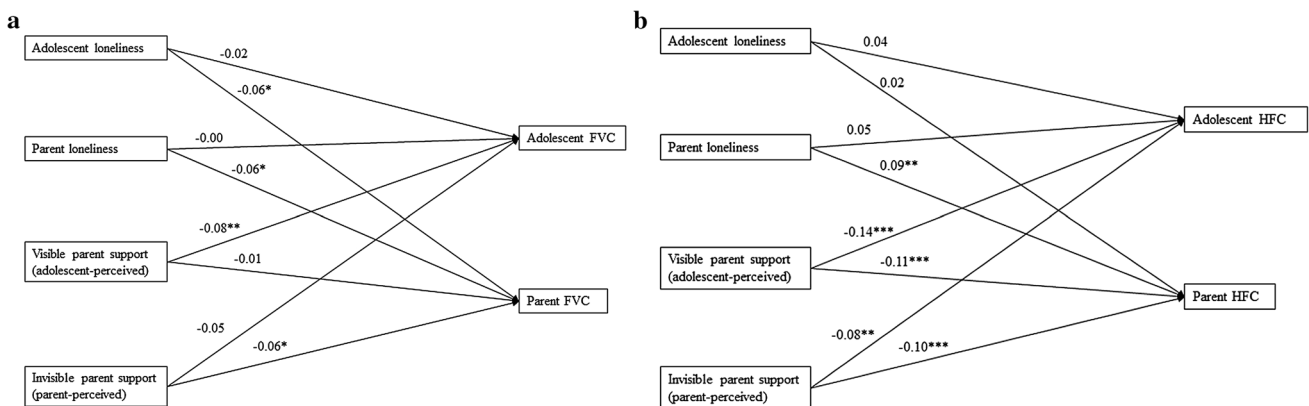


Fig. 2 APIM presenting associations of parent and adolescent support, perceived support, and loneliness with parents and adolescent fruit and vegetable consumption (FVC) (a) and hedonic food consumption (HFC) (b). Note. * $p < .05$, ** $p < .01$, *** $p < .001$

was providing invisible support, $\beta = -0.10$, 95% CI [-0.14, -0.05], $p < .001$. However, providing invisible support was also associated with less FVC, $\beta = -0.06$, 95% CI [-0.11, -0.02], $p = .029$, and PA, $\beta = -0.09$,

95% CI [-0.14, -0.03], $p = .012$, and more sedentariness, $\beta = 0.07$, 95% CI [0.03, 0.12], $p = .013$, among parents.

Discussion

This is the first known study to examine potential dyadic consequences of low stress-related visible and invisible emotional and practical support and loneliness for eating and activity behavior among parent–adolescent dyads. For loneliness, we uncovered many of the hypothesized actor associations (i.e., where parent loneliness was associated with less healthy parent behavior, and adolescent loneliness was associated with less healthy adolescent behavior), but only one partner association (i.e., where adolescent loneliness was associated with less parent FVC). Parental support provided to the adolescent had a more complex dyadic dynamic. Both visible (i.e., adolescent-perceived) and invisible (i.e., parent-perceived, controlling for adolescent-perceived) support were associated with healthier behaviors among adolescents, as expected. Among parents, both visible and invisible support were associated with less parent HFC. However, invisible support was associated with less parent FVC and PA, and more parent sedentariness. These findings highlight the importance of examining support (and to some extent, loneliness) as co-occurring individual- and dyadic-level correlates of eating and activity behaviors among parent–adolescent dyads.

Specifically, adolescent loneliness was associated with less healthy adolescent activity behaviors (i.e., more sedentariness and less PA) but was not associated with adolescent eating behaviors. Parental loneliness was also associated with more parent sedentariness (but not less PA), less parent FVC, and more HFC. Although not significant across all outcomes, this overall pattern of findings is consistent with research showing that loneliness has negative individual-level consequences for health behaviors (Ford et al., 2017; Grenard et al., 2013; Hawkey et al., 2009). Moreover, loneliness may be detrimental to health behaviors at any age and not just during adolescence when loneliness peaks (Heinrich & Gullone, 2006). The finding that adolescent eating behaviors were unassociated with adolescent loneliness may be, in part, due to the fact that adolescent eating may have social or environmental determinants (such as self-efficacy, intentions, parent purchasing and cooking behavior) (Chansukree & Rungjindarat, 2017; Orehek & Ferrer, 2019; Patrick & Nicklas, 2005; Savage et al., 2007) that supersede individual-level influences like loneliness. Because there was only one partner association with respect to loneliness, we did not interpret this finding further. However, future research should examine whether loneliness has dyadic consequences for eating and activity behavior within other relationships (e.g., romantic relationships and/or co-habiting partnerships among adults).

Receiving visible support from their parents was associated with less adolescent HFC and sedentariness. This finding is consistent with evidence suggesting that the perception of sufficient social support predicts healthier behaviors (Hagler et al., 2007; Jackson, 2006). However, inconsistent with these findings (and with predictions), receiving visible support was also associated with less FVC among adolescents. Findings with respect to receiving invisible support were similarly equivocal: receiving invisible support was associated with less HFC, but also less PA and more sedentariness, among adolescents. Findings related to the potential benefit of receiving invisible support are consistent with other work on the benefits of invisible social support (Howland & Simpson, 2010), such that invisible support among couples facilitates goal achievement (Girme et al., 2013) and reduces negative affect (Lüscher et al., 2015). However, the finding that invisible support was potentially detrimental to adolescents is consistent with work showing invisible support to be associated with more daily cigarettes smoked by the support recipient (Lüscher et al., 2015). It is possible that some of the unexpected negative associations of receiving support are due to parents providing more support to adolescents who they believe need that support. In other words, parents may be providing more support to adolescents who are engaging in less healthy behaviors, creating a confound that cannot be fully disentangled with cross-sectional data. There may also be individual- or relationship-level factors, such as relationship satisfaction, that determine whether support is beneficial (Biehle & Mickelson, 2012; König et al., 2016). It is also possible that these findings are due to inaccuracies in parental reporting—where they report providing more support than is objectively provided. Future research should examine moderators of the benefits (and detriments) of visible and invisible support for adolescents' health behaviors, ideally using longitudinal approaches.

Findings regarding the association of *providing* visible and invisible support with parent behaviors suggest that visible support may have some benefits for the parent providing it, but invisible support may have less benefit (and potentially, in some instances, be detrimental). Specifically, visible support was associated with less parent HFC. Invisible support was also associated with less parent FVC and PA, but *also* with *less* parent PA and more parent sedentariness. Findings that providing invisible support was negatively associated with healthy behaviors are consistent with research on the negative effects of caregiving (in relationships other than parent–adolescent dyads) (Aneshensel et al., 1995; Schulz & Beach, 1999), as well as research suggesting that providing invisible support may come at a cost to the invisible support provider (Bolger & Amarel, 2007; Girme et al., 2013; Howland & Simpson,

2010). Findings regarding the negative associations of invisible support with healthy behaviors may also be explained by the fact that parents who report providing more support may be doing so because their children have a greater need for support; literature suggests that parents have worse outcomes when they believe their children are faring poorly and need more support (Fingerman et al., 2012). Relatedly, it is possible that parents who provide more support to their adolescents have less time or resources to enact healthy behaviors for themselves. Future research should investigate this as a possible mechanism.

Limitations and future directions

These findings should not be considered without limitations. First, the cross-sectional design limits causal inferences. This is important not only because we cannot infer that loneliness and social support actually contribute to eating and activity behaviors, but also because it precludes any examination of the potential bidirectional influences of loneliness and support on one another. Given that social support can alleviate loneliness (Rook, 1984; Stephens et al., 2011; Winningham & Pike, 2007), it is possible that the associations of these with behavior are not independent, but rather that loneliness mediates the association of social support with behavior. Conversely, given that lonely people may perceive deficiencies within their social network that result in perceptions of inadequate availability of support (Sorkin et al., 2002; Stroebe et al., 1996), it is possible that support mediates the association of loneliness with behavior. Future longitudinal and experimental work should examine these possibilities.

Second, loneliness and perceived support were each assessed with two-item scales. Shorter scales are commonly employed in public survey data collection, and these scales were developed by selecting items that loaded highly onto previously validated scales (Darling & Toyokawa, 1997; Russell et al., 1980). Indeed, the two support items, despite only moderate correlation to one another in this study, have been validated as part of the parental support component of published scale in previous work (Bastaitis et al., 2012; Darling & Toyokawa, 1997; Kim et al., 2015; Mlynarczyk, 2013). Moreover, another study using these data demonstrated that these items loaded together on one factor, separate from the two other factors of the parenting styles scale employed in FLASHE (Lenne et al., 2018). Nonetheless, shorter scales can be less reliable than longer scales, and can attenuate findings related to relationships with other variables (Luttrel et al., 2017). As such, future research should examine these hypotheses with longer loneliness and support scales. Similarly, parental sedentariness was captured using only one item, and a longer scale may more comprehensively evaluate sedentariness.

Relatedly, measures were largely self-report. Even though the subjective self-report measures of eating and activity behavior have been validated (Andersen et al., 2002; Block et al., 2000; Nelson & Lytle, 2009), they may not have captured consumption or activity as accurately as objective recordings might have. The self-report limitations are off-set by the measure of adolescent PA, which was validated against accelerometer data, and use of a validated dietary screener (Subar et al., 2015). Of note, however, despite that adolescent activity was adjusted with this algorithm, the adjusted estimate may not be reflective of all adolescents and may have resulted in over-estimation for some adolescents and under-estimation for others.

In the current study, support was assessed as asymmetrical—where the adolescent was the recipient for both reports. In some ways, this is a strength given that the relationships themselves are asymmetrical with respect to support provision and receipt, but future research might consider provision to parents by adolescents as well. There may also be factors that moderate the associations observed in the current study. For example, gender may have played a role in some of these associations, but this study was not powered to detect moderation by parent–adolescent gender patterns (in that there were only 199 father–daughter and 228 father–son dyads, numbers that are underpowered for the complex structural equation models necessary to examine the study hypotheses; see Kline, 2004). However, given that there are gender differences in loneliness and social support among adults and adolescents (Adamczyk, 2016; Marcoen & Brumagne, 1985), future work should examine whether the associations observed here depend on the gender makeup of the parent–adolescent dyad. In addition, although visible and invisible support was captured, neither how or exactly what type of support were provided nor interpersonal closeness between the parent and adolescent were assessed. Effectiveness of social support can be altered based on relationship satisfaction (König et al., 2016) and thus, interpersonal closeness or other markers of relationship quality and satisfaction may modify these findings. Additionally, high levels of loneliness and low levels of perceived social support are associated with depression (e.g., Hagerty & Williams, 1999), and unfortunately this study did not assess depression; future research should consider the role of depression along with support and loneliness to fill this gap. Lastly, analyses did not consider the role of the built environment in eating and activity behavior. Features of the built environment, including the location, density, and accessibility of restaurants, parks, sidewalks, and transportation systems (Handy et al., 2002) can influence patterns of eating and activity, and may moderate the associations observed in this study. Future research is needed to elucidate the extent

to which the associations observed in the current study are consistent across levels of these potential moderators.

Conclusion

These findings add to growing literature on social factors that may contribute to eating and activity behavior among dyads. Results suggest that support and loneliness are associated with eating and activity behaviors at the individual level. Moreover, they suggest that both invisible and visible support may be important in facilitating the support recipient's health behaviors but may have some negative consequences for the provider's health behaviors. Taken together, our findings suggest promise for developing interventions aimed at decreasing loneliness in both parents and adolescents to facilitate individual participation in healthy eating and activity. Further, interventions that encourage support and decrease loneliness at the individual-level may be successful in increasing participation in healthy eating and activity behaviors among adolescents. However, since parents providing such support to their adolescents may have negative consequences for parental health behaviors, these efforts may need to be offset with efforts to support healthy behaviors among parents. Future experimental and intervention work is necessary to determine the clinical implications of specific combinations of support and loneliness for eating and activity behaviors among parent–adolescent dyads. In conclusion, social factors and their function within parent–adolescent dyads are important to investigate and consider when evaluating or promoting participation in eating and activity behaviors.

Compliance with ethical standards

Conflict of interest Jess Welch, Erin Ellis, Paige Green, and Rebecca Ferrer declares that they have no conflict of interest.

Human and animal rights and Informed Consent All procedures followed were in accordance with ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all individual participants included in the study.

References

- Acton, G. J. (2002). Health-promoting self-care in family caregivers. *Western Journal of Nursing Research*, *24*, 73–86.
- Adamczyk, K. (2016). An investigation of loneliness and perceived social support among single and partnered young adults. *Current Psychology*, *35*, 674–689.
- Al-Yagon, M., Kopelman-Rubin, D., Brunstein Klomek, A., & Mikulincer, M. (2016). Four-model approach to adolescent–parent attachment relationships and adolescents' loneliness, school belonging, and teacher appraisal. *Personal Relationships*, *23*, 141–158.
- Andersen, L. F., Johansson, L., & Solvoll, K. (2002). Usefulness of a short food frequency questionnaire for screening of low intake of fruit and vegetable and for intake of fat. *The European Journal of Public Health*, *12*, 208–213.
- Anderson, E. S., Winett, R. A., & Wojcik, J. R. (2007). Self-regulation, self-efficacy, outcome expectations, and social support: social cognitive theory and nutrition behavior. *Annals of Behavioral Medicine*, *34*, 304–312.
- Aneshensel, C. S., Pearlin, L. I., Mullan, J. T., Zarit, S. H., & Whitlatch, C. J. (1995). *Profiles in caregiving: The unexpected career*. Cambridge: Academic Press.
- Baiocchi-Wagner, E. A., & Talley, A. E. (2013). The role of family communication in individual health attitudes and behaviors concerning diet and physical activity. *Health Communication*, *28*, 193–205.
- Bastais, K., Ponnet, K., & Mortelmans, D. (2012). Parenting of divorced fathers and the association with children's self-esteem. *Journal of Youth and Adolescence*, *41*, 1643–1656.
- Biehle, S. N., & Mickelson, K. D. (2012). Provision and receipt of emotional spousal support: The impact of visibility on well-being. *Couple and Family Psychology: Research and Practice*, *1*, 244.
- Block, G., Gillespie, C., Rosenbaum, E. H., & Jenson, C. (2000). A rapid food screener to assess fat and fruit and vegetable intake. *American Journal of Preventive Medicine*, *18*, 284–288.
- Bolger, N., & Amarel, D. (2007). Effects of social support visibility on adjustment to stress: Experimental evidence. *Journal of Personality and Social Psychology*, *92*, 458–475. <https://doi.org/10.1037/0022-3514.92.3.458>
- Bolger, N., Zuckerman, A., & Kessler, R. C. (2000). Invisible support and adjustment to stress. *Journal of Personality and Social Psychology*, *79*, 953–961. <https://doi.org/10.1037/0022-3514.79.6.953>
- Bowlby, J. (1982). Attachment and loss: Retrospect and prospect. *American Journal of Orthopsychiatry*, *52*, 664.
- Brener, N. D., Merlo, C., Eaton, D., Kann, L., Park, S., & Blanck, H. M. (2011). Beverage consumption among high school students—United States, 2010. *MMWR. Morbidity and Mortality Weekly Report*, *60*, 778–780.
- Bretherton, I. (2010). Fathers in attachment theory and research: A review. *Early Child Development and Care*, *180*, 9–23.
- Brown, S. L., Nesse, R. M., Vinokur, A. D., & Smith, D. M. (2003). Providing social support may be more beneficial than receiving it: Results from a prospective study of mortality. *Psychological Science*, *14*, 320–327. <https://doi.org/10.1111/1467-9280.14461>
- Burton, L. C., Newsom, J. T., Schulz, R., Hirsch, C. H., & German, P. S. (1997). Preventive health behaviors among spousal caregivers. *Preventive Medicine*, *26*, 162–169.
- Cacioppo, J. T., Fowler, J. H., & Christakis, N. A. (2009). Alone in the crowd: The structure and spread of loneliness in a large social network. *Journal of Personality and Social Psychology*, *97*, 977.
- Calle, E. E., Rodriguez, C., Walker-Thurmond, K., & Thun, M. J. (2003). Overweight, obesity, and mortality from cancer in a prospectively studied cohort of US adults. *New England Journal of Medicine*, *348*, 1625–1638.
- Campbell, L., & Kashy, D. A. (2002). Estimating actor, partner, and interaction effects for dyadic data using PROC MIXED and HLM: A user-friendly guide. *Personal Relationships*, *9*, 327–342. <https://doi.org/10.1111/1475-6811.00023>
- Casagrande, S. S., Wang, Y., Anderson, C., & Gary, T. L. (2007). Have Americans increased their fruit and vegetable intake?: The trends between 1988 and 2002. *American Journal of Preventive Medicine*, *32*, 257–263. <https://doi.org/10.1016/j.amepre.2006.12.002>

- Caspi, A., Harrington, H., Moffitt, T. E., Milne, B. J., & Poulton, R. (2006). Socially isolated children 20 years later: Risk of cardiovascular disease. *Archives of Pediatrics and Adolescent Medicine*, *160*, 805–811.
- Castro, C. M., King, A. C., Housemann, R., Bacak, S. J., McMullen, K. M., & Brownson, R. C. (2007). Rural family caregivers and health behaviors: Results from an epidemiologic survey. *Journal of Aging and Health*, *19*, 87–105.
- Centers for Disease, C., & Prevention. (2007). Fruit and vegetable consumption among adults—United States, 2005. *MMWR. Morbidity and Mortality Weekly Report*, *56*, 213.
- Chansukree, P., & Rungjindarat, N. (2017). Social cognitive determinants of healthy eating behaviors in late adolescents: a gender perspective. *Journal of nutrition education and behavior*, *49*, 204–210.
- Chassin, L., Macy, J. T., Seo, D.-C., Presson, C. C., & Sherman, S. J. (2010). The association between membership in the sandwich generation and health behaviors: A longitudinal study. *Journal of Applied Developmental Psychology*, *31*, 38–46.
- Cohen, C. A., Colantonio, A., & Vernich, L. (2002). Positive aspects of caregiving: Rounding out the caregiver experience. *International Journal of Geriatric Psychiatry*, *17*, 184–188.
- Collins, N. L., & Feeney, B. C. (2000). A safe haven: An attachment theory perspective on support seeking and caregiving in intimate relationships. *Journal of Personality and Social Psychology*, *78*, 1053.
- Conklin, A. I., Forouhi, N. G., Surtees, P., Khaw, K.-T., Wareham, N. J., & Monsivais, P. (2014). Social relationships and healthful dietary behaviour: Evidence from over-50 s in the EPIC cohort, UK. *Social Science & Medicine*, *100*, 167–175. <https://doi.org/10.1016/j.socscimed.2013.08.018>
- Cook, W., & Kenny, D. (2005). The actor–partner interdependence model: A model of bidirectional effects in developmental studies. *International Journal of Behavioral Development*, *29*, 101–109. <https://doi.org/10.1080/01650250444000405>
- Curran, T. (2018). Intergenerational transmissions of mother-child loneliness: A moderated mediation model of familial social support and conflict avoidance. *Health Communication*. <https://doi.org/10.1080/10410236.2018.1466229>.
- Darling, N., & Toyokawa, T. (1997). Construction and validation of the parenting style inventory II (PSI-II). *Unpublished manuscript*.
- Dauchet, L., Amouyel, P., Hercberg, S., & Dallongeville, J. (2006). Fruit and vegetable consumption and risk of coronary heart disease: A meta-analysis of cohort studies. *The Journal of Nutrition*, *136*, 2588–2593.
- Doyle, C., Kushi, L. H., Byers, T., Courneya, K. S., Demark-Wahnefried, W., Grant, B., et al. (2006). Nutrition and physical activity during and after cancer treatment: An American Cancer Society Guide for informed choices. *CA: A Cancer Journal for Clinicians*, *56*, 323–353. <https://doi.org/10.3322/canjclin.56.6.323>
- Dubow, E. F., & Ullman, D. G. (1989). Assessing social support in elementary school children: The survey of children's social support. *Journal of Clinical Child Psychology*, *18*, 52–64.
- Duncan, S. C., Duncan, T. E., & Strycker, L. A. (2005). Sources and types of social support in youth physical activity. *Health Psychology*, *24*, 3.
- Duncan, T. E., & McAuley, E. (1993). Social support and efficacy cognitions in exercise adherence: A latent growth curve analysis. *Journal of Behavioral Medicine*, *16*, 199–218.
- Dwyer, L. A., Bolger, N., Laurenceau, J.-P., Patrick, H., Oh, A. Y., Nebeling, L. C., et al. (2017). Autonomous motivation and fruit/vegetable intake in parent-adolescent dyads. *American Journal of Preventive Medicine*, *52*, 863–871. <https://doi.org/10.1016/j.amepre.2017.01.011>
- Eyler, A. A., Brownson, R. C., Donatelle, R. J., King, A. C., Brown, D., & Sallis, J. F. (1999). Physical activity social support and middle-and older-aged minority women: results from a US survey. *Social Science and Medicine*, *49*, 781–789.
- Feeney, B. C. (2004). A secure base: Responsive support of goal strivings and exploration in adult intimate relationships. *Journal of Personality and Social Psychology*, *87*, 631.
- Feeney, B. C., & Collins, N. L. (2003). Motivations for caregiving in adult intimate relationships: Influences on caregiving behavior and relationship functioning. *Personality and Social Psychology Bulletin*, *29*, 950–968.
- Feeney, B. C., & Collins, N. L. (2015). A new look at social support: A theoretical perspective on thriving through relationships. *Personality and Social Psychology Review*, *19*, 113–147.
- Ferrer, R. A., Green, P. A., Oh, A. Y., Hennessy, E., & Dwyer, L. A. (2017). Emotion suppression, emotional eating, and eating behavior among parent-adolescent dyads. *Emotion*, *17*, 1052.
- Fingerman, K. L., Cheng, Y.-P., Wesselmann, E. D., Zarit, S., Furstenberg, F., & Birditt, K. S. (2012). Helicopter parents and landing pad kids: Intense parental support of grown children. *Journal of Marriage and Family*, *74*, 880–896. <https://doi.org/10.1111/j.1741-3737.2012.00987.x>
- Ford, T., Lee, H., & Jeon, M. (2017). The emotional eating and negative food relationship experiences of obese and overweight adults. *Social Work in Health Care*, *56*, 488–504. <https://doi.org/10.1080/00981389.2017.1301620>
- Forehand, R., Wierson, M., Thomas, A. M., Armistead, L., Kempton, T., & Neighbors, B. (1991). The role of family stressors and parent relationships on adolescent functioning. *Journal of the American Academy of Child and Adolescent Psychiatry*, *30*, 316–322.
- Fowler, J. H., & Christakis, N. A. (2008). Dynamic spread of happiness in a large social network: Longitudinal analysis over 20 years in the Framingham Heart Study. *BMJ*, *337*, a2338.
- Girme, Y. U., Overall, N. C., & Simpson, J. A. (2013). When visibility matters: Short-term versus long-term costs and benefits of visible and invisible support. *Personality and Social Psychology Bulletin*, *39*, 1441–1454.
- Gleason, M. E., Iida, M., Shrout, P. E., & Bolger, N. (2008). Receiving support as a mixed blessing: Evidence for dual effects of support on psychological outcomes. *Journal of Personality and Social Psychology*, *94*, 824.
- Grenard, J. L., Stacy, A. W., Shiffman, S., Baraldi, A. N., MacKinnon, D. P., Lockhart, G., et al. (2013). Sweetened drink and snacking cues in adolescents. A study using ecological momentary assessment. *Appetite*, *67*, 61–73. <https://doi.org/10.1016/j.appet.2013.03.016>
- Hagerty, B. M., & Williams, A. (1999). The effects of sense of belonging, social support, conflict, and loneliness on depression. *Nursing Research*, *48*, 215–219.
- Hagler, A. S., Norman, G. J., Zabinski, M. F., Sallis, J. F., Calfas, K. J., & Patrick, K. (2007). Psychosocial correlates of dietary intake among overweight and obese men. *American Journal of Health Behavior*, *31*, 3–12.
- Handy, S. L., Boarnet, M. G., Ewing, R., & Killingsworth, R. E. (2002). How the built environment affects physical activity. *American Journal of Preventive Medicine*, *23*, 64–73.
- Hawkey, L. C., & Cacioppo, J. T. (2010). Loneliness matters: A theoretical and empirical review of consequences and mechanisms. *Annals of Behavioral Medicine*, *40*, 218–227.
- Hawkey, L. C., Thisted, R. A., & Cacioppo, J. T. (2009). Loneliness predicts reduced physical activity: Cross-sectional & longitudinal analyses. *Health Psychology*, *28*, 354.
- Heaney, C. A., & Israel, B. A. (2008). Social networks and social support. *Health Behavior and Health Education: Theory, Research, and Practice*, *4*, 189–210.

- Heinrich, L. M., & Gullone, E. (2006). The clinical significance of loneliness: A literature review. *Clinical Psychology Review, 26*, 695–718.
- Hosley, C. A. (1999). *Social support in parent-adolescent relationships: Variation in support provision and the impact of support on adolescent psychological health*. Columbus: The Ohio State University.
- Howland, M., Farrell, A. K., Simpson, J. A., Rothman, A. J., Burns, R. J., Fillo, J., et al. (2016). Relational effects on physical activity: A dyadic approach to the theory of planned behavior. *Health Psychology, 35*, 733.
- Howland, M., & Simpson, J. A. (2010). Getting in under the radar: A dyadic view of invisible support. *Psychological Science, 21*, 1878–1885.
- Inagaki, T. K., & Orehek, E. (2017). On the benefits of giving social support: When, why, and how support providers gain by caring for others. *Current Directions in Psychological Science, 26*, 109–113.
- Jackson, T. (2006). Relationships between perceived close social support and health practices within community samples of American women and men. *The Journal of Psychology, 140*, 229–246.
- Kim, Y., Carver, C. S., Spillers, R. L., Love-Ghaffari, M., & Kaw, C.-K. (2012). Dyadic effects of fear of recurrence on the quality of life of cancer survivors and their caregivers. *Quality of Life Research, 21*, 517–525.
- Kim, C., Yang, Z., & Lee, H. (2015). Parental style, parental practices, and socialization outcomes: An investigation of their linkages in the consumer socialization context. *Journal of Economic Psychology, 49*, 15–33.
- Kline, R. B. (2004). *Principles and practice of structural equation modeling (methodology in the social sciences)*. New York: Guilford.
- König, C., Stadler, G., Knoll, N., Ochsner, S., Hornung, R., & Scholz, U. (2016). Invisible support: Effects on the provider's positive and negative affect. *Applied Psychology: Health and Well-Being, 8*, 172–191. <https://doi.org/10.1111/aphw.12067>
- LaRocco, J. M., House, J. S., & French Jr, J. R. (1980). Social support, occupational stress, and health. *Journal of Health and Social Behavior, 21*, 202–218.
- Lawrence, R. S., Gootman, J. A., Sim, L. J., & Council, N. R. (2009). Improving systems of adolescent health services. In R. S. Lawrence, J. Appleton Gootman, & L. J. Sim (Eds.), *Adolescent health services: Missing opportunities*. National Academies Press.
- Lenne, R. L., Joyal-Desmarais, K., Jones, R. E., Huelsnitz, C. O., Panos, M. E., Auster-Gussman, L. A., et al. (2018). Parenting styles moderate how parent and adolescent beliefs shape each other's eating and physical activity: Dyadic evidence from a cross-sectional, US National Survey. *Journal of Experimental Social Psychology, 81*, 76–84.
- Liang, J., Krause, N. M., & Bennett, J. M. (2001). Social exchange and well-being: Is giving better than receiving? *Psychology and Aging, 16*, 511.
- Lopez, N. V., Ayala, G. X., Corder, K., Eisenberg, C. M., Zive, M. M., Wood, C., et al. (2012). Parent support and parent-mediated behaviors are associated with children's sugary beverage consumption. *Journal of the Academy of Nutrition and Dietetics, 112*, 541–547.
- Luhmann, M., Bohn, J., Holtmann, J., Koch, T., & Eid, M. (2016). I'm lonely, can't you tell? Convergent validity of self- and informant ratings of loneliness. *Journal of Research in Personality, 61*, 50–60. <https://doi.org/10.1016/j.jrp.2016.02.002>
- Lüscher, J., Stadler, G., Ochsner, S., Rackow, P., Knoll, N., Hornung, R., et al. (2015). Daily negative affect and smoking after a self-quit attempt: The role of dyadic invisible social support in a daily diary study. *British Journal of Health Psychology, 20*, 708–723.
- Luttrell, A., Petty, R. E., & Xu, M. (2017). Replicating and fixing failed replications: The case of need for cognition and argument quality. *Journal of Experimental Social Psychology, 69*, 178–183.
- Manczak, E. M., DeLongis, A., & Chen, E. (2016). Does empathy have a cost? Diverging psychological and physiological effects within families. *Health Psychology, 35*, 211.
- Marcoen, A., & Brumagne, M. (1985). Loneliness among children and young adolescents. *Developmental Psychology, 21*, 1025.
- Mikulincer, M., & Shaver, P. R. (2009). An attachment and behavioral systems perspective on social support. *Journal of Social and Personal Relationships, 26*, 7–19.
- Mlynarczyk, S. M. (2013). Adolescents' perspectives of parental practices influence diabetic adherence and quality of life. *Pediatric Nursing, 39*, 181–189.
- Mounts, N. S., Valentiner, D. P., Anderson, K. L., & Boswell, M. K. (2006). Shyness, sociability, and parental support for the college transition: Relation to adolescents' adjustment. *Journal of Youth and Adolescence, 35*, 68–77.
- Nansel, T. R., Haynie, D. L., Lipsky, L. M., Wang, J., Mehta, S. N., & Laffel, L. M. (2013). Relationships among parent and youth healthful eating attitudes and youth dietary intake in a cross-sectional study of youth with type 1 diabetes. *International Journal of Behavioral Nutrition and Physical Activity, 10*, 125.
- Nebeling, L. C., Hennessy, E., Oh, A. Y., Dwyer, L. A., Patrick, H., Blanck, H. M., et al. (2017). The FLASHE study: Survey development, dyadic perspectives, and participant characteristics. *American Journal of Preventive Medicine, 52*, 839–848. <https://doi.org/10.1016/j.amepre.2017.01.028>
- Nelson, M. C., & Lytle, L. A. (2009). Development and evaluation of a brief screener to estimate fast-food and beverage consumption among adolescents. *Journal of the American Dietetic Association, 109*, 730–734.
- Newall, N. E., Chipperfield, J. G., Bailis, D. S., & Stewart, T. L. (2013). Consequences of loneliness on physical activity and mortality in older adults and the power of positive emotions. *Health Psychology, 32*, 921.
- Ogden, C. L., Carroll, M. D., Fryar, C. D., & Flegal, K. M. (2015). *Prevalence of obesity among adults and youth: United States, 2011–2014*. Hyattsville: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.
- Oh, A. Y., Davis, T., Dwyer, L. A., Hennessy, E., Li, T., Yaroch, A. L., et al. (2017). Recruitment, enrollment, and response of parent-adolescent dyads in the FLASHE study. *American Journal of Preventive Medicine, 52*, 849–855. <https://doi.org/10.1016/j.amepre.2016.11.028>
- Ohaeri, J. U. (2003). The burden of caregiving in families with a mental illness: A review of 2002. *Current Opinion in Psychiatry, 16*, 457–465.
- Orehek, E., & Ferrer, R. (2019). Parent instrumentality for adolescent eating and activity. *Annals of Behavioral Medicine. https://doi.org/10.1093/abm/kay074*.
- Patrick, H., & Nicklas, T. A. (2005). A review of family and social determinants of children's eating patterns and diet quality. *Journal of the American College of Nutrition, 24*, 83–92.
- Pinquart, M., & Sorensen, S. (2001). Influences on loneliness in older adults: A meta-analysis. *Basic and Applied Social Psychology, 23*, 245–266. https://doi.org/10.1207/s15324834basp2304_2
- Qualter, P., Brown, S. L., Rotenberg, K., Vanhalst, J., Harris, R., Goossens, L., et al. (2013). Trajectories of loneliness during childhood and adolescence: Predictors and health outcomes. *Journal of Adolescence, 36*, 1283–1293.

- Rapini, D. R., Farmer, F. F., Clark, S. M., Micka, J. C., & Barnett, J. K. (1990). Early adolescent age and gender differences in patterns of emotional self-disclosure to parents and friends. *Adolescence*, 25, 959.
- Rock, C. L., & Demark-Wahnefried, W. (2002). Nutrition and survival after the diagnosis of breast cancer: A review of the evidence. *Journal of Clinical Oncology*, 20, 3302–3316. <https://doi.org/10.1200/jco.2002.03.008>
- Rook, K. S. (1984). Research on social support, loneliness, and social isolation: Toward an integration. *Review of Personality & Social Psychology*, 5, 239–264.
- Rueger, S. Y., Malecki, C. K., Pyun, Y., Aycocock, C., & Coyle, S. (2016). A meta-analytic review of the association between perceived social support and depression in childhood and adolescence. *Psychological Bulletin*, 142, 1017.
- Russell, D., Peplau, L. A., & Cutrona, C. E. (1980). The revised UCLA loneliness scale: Concurrent and discriminant validity evidence. *Journal of Personality and Social Psychology*, 39, 472–480.
- Rutkowski, E. M., & Connelly, C. D. (2012). Self-efficacy and physical activity in adolescent and parent dyads. *Journal for Specialists in Pediatric Nursing*, 17, 51–60.
- Saint-Maurice, P. F., Kim, Y., Hibbing, P., Oh, A. Y., Perna, F. M., & Welk, G. J. (2017). Calibration and validation of the youth activity profile: The FLASHE study. *American Journal of Preventive Medicine*, 52, 880–887. <https://doi.org/10.1016/j.amepre.2016.12.010>
- Savage, J. S., Fisher, J. O., & Birch, L. L. (2007). Parental influence on eating behavior: Conception to adolescence. *The Journal of Law, Medicine & Ethics*, 35, 22–34.
- Schulz, R., & Beach, S. R. (1999). Caregiving as a risk factor for mortality: The caregiver health effects study. *JAMA*, 282, 2215–2219.
- Segrin, C., Badger, T., & Pasvogel, A. (2015). Loneliness and emotional support predict physical and psychological distress in latinas with breast cancer and their supportive partners. *The Open Psychology Journal*, 8, 105–112.
- Segrin, C., Powell, H. L., Givertz, M., & Brackin, A. (2003). Symptoms of depression, relational quality, and loneliness in dating relationships. *Personal Relationships*, 10, 25–36.
- Services, U. D. o. H. H. (2017). *Dietary guidelines for Americans 2015–2020*. New York City: Skyhorse Publishing Inc.
- Shankar, A., McMunn, A., Banks, J., & Steptoe, A. (2011). Loneliness, social isolation, and behavioral and biological health indicators in older adults. *Health Psychology*, 30, 377.
- Smith, T. M., Calloway, E. E., Pinard, C. A., Hennessy, E., Oh, A. Y., Nebeling, L. C., et al. (2017). Using secondary 24-hour dietary recall data to estimate daily dietary factor intake from the FLASHE study dietary screener. *American Journal of Preventive Medicine*, 52, 856–862. <https://doi.org/10.1016/j.amepre.2017.01.015>
- Sorkin, D., Rook, K. S., & Lu, J. L. (2002). Loneliness, lack of emotional support, lack of companionship, and the likelihood of having a heart condition in an elderly sample. *Annals of Behavioral Medicine*, 24, 290–298. https://doi.org/10.1207/s15324796abm2404_05
- Stephens, C., Alpass, F., Towers, A., & Stevenson, B. (2011). The effects of types of social networks, perceived social support, and loneliness on the health of older people: Accounting for the social context. *Journal of Aging and Health*, 23, 887–911.
- Steptoe, A., Perkins-Porras, L., Rink, E., Hilton, S., & Cappuccio, F. P. (2004). Psychological and social predictors of changes in fruit and vegetable consumption over 12 months following behavioral and nutrition education counseling. *Health Psychology*, 23, 574.
- Strine, T. W., Chapman, D. P., Balluz, L., & Mokdad, A. H. (2008). Health-related quality of life and health behaviors by social and emotional support. *Social Psychiatry and Psychiatric Epidemiology*, 43, 151–159.
- Stroebe, W., Stroebe, M., Abakoumkin, G., & Schut, H. (1996). The role of loneliness and social support in adjustment to loss: A test of attachment versus stress theory. *Journal of Personality and Social Psychology*, 70, 1241–1249. <https://doi.org/10.1037/0022-3514.70.6.1241>
- Subar, A. F., Freedman, L. S., Tooze, J. A., Kirkpatrick, S. I., Boushey, C., Neuhauser, M. L., et al. (2015). Addressing current criticism regarding the value of self-report dietary data. *The Journal of Nutrition*, 145, 2639–2645.
- Thoits, P. A. (1986). Social support as coping assistance. *Journal of Consulting and Clinical Psychology*, 54, 416.
- Thoits, P. A. (1995). Stress, coping, and social support processes: Where are we? What next? *Journal of Health and Social Behavior*, 35, 53–79.
- Verheijden, M., Bakx, J., Van Weel, C., Koelen, M., & Van Staveren, W. (2005). Role of social support in lifestyle-focused weight management interventions. *European Journal of Clinical Nutrition*, 59, S179–S186.
- Vitaliano, P. P., Zhang, J., & Scanlan, J. M. (2003). Is caregiving hazardous to one's physical health? A meta-analysis. *Psychological Bulletin*, 129, 946.
- Weiss, R. S. (1973). *Loneliness: The experience of emotional and social isolation*. Cambridge, MA: The MIT Press.
- Whitlock, E. P., O'Conner, E. A., Williams, S. B., Beil, T. L., & Lutz, K. W. (2010). *Effectiveness of primary care interventions for weight management in children and adolescents: An updated, targeted systematic review for the USPSTF*. U.S. Preventive Services Task Force Evidence Synthesis No. 76. Rockville, MD: Agency for Healthcare Research and Quality.
- Wilkinson, H., Whittington, R., Perry, L., & Eames, C. (2017). Examining the relationship between burnout and empathy in healthcare professionals: A systematic review. *Burnout Research*, 6, 18–29.
- Wing, R. R., & Jeffery, R. W. (1999). Benefits of recruiting participants with friends and increasing social support for weight loss and maintenance. *Journal of Consulting and Clinical Psychology*, 67, 132.
- Winningham, R. G., & Pike, N. L. (2007). A cognitive intervention to enhance institutionalized older adults' social support networks and decrease loneliness. *Aging & Mental Health*, 11, 716–721.
- World Health Organization. (2017). Obesity and overweight fact sheet. 2016. <http://www.thehealthwell.info/node/82914>.

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