

Does Virtual Communication with Parents Help Students Recover from Daily Stressors?:

Daily and Experimental Tests with First Year College Students

by

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Dissertation submitted in partial fulfillment of
the requirements for the degree of Doctor
of Philosophy in the Department of
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ABSTRACT

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Abstract

Emerging adulthood, specifically the transition to college, is often marked by changing social networks, increased responsibility, and separation from the parental home environment. Educators, researchers, and those dedicated to the healthy development of young people are invested in understating how and why social support is important for students' adjustment, wellbeing, and their ability to cope with the daily stressors that accompany this notable transition. In particular, parents are believed to be a key source of both perceived (stable) and enacted (immediate) support. Strong parental relationships predict students' overall achievement and adjustment in the first year of college. Less is known about how parental relationships may impact students' daily wellbeing and whether parents can provide helpful enacted support through daily communication. With the rapid ubiquitous rise in mobile technologies, students and their parents are now communicating more frequently during this transition; however, very little is known about whether daily virtual parental communication can help students cope with daily stressors. This study contributes to the existing literature by 1) describing students' daily in-person and virtual communication with parents during the beginning of college, 2) examining whether students' daily virtual parental communication is associated with their same-day wellbeing, 3) testing whether daily virtual communication (i.e., enacted support) buffers daily responses to stressors, 4) examining the specificity of parental support (versus other sources of support), and 5) exploring whether the strength of students' parental relationships (i.e., perceived support) is associated with students' 'reactivity' to daily stressors. This dissertation consists of three studies that used daily assessments (i.e., ecological momentary assessments: EMA) and experimental manipulation to understand the momentary interplay between exposure to stressors, parent-child virtual communication, and students' wellbeing during the transition to college.

Study 1, a 7-day EMA study of 136 first and second year college students, found that texting with a parent moderated the same-day associations between daily stressors and affect. Although daily parental virtual communication was not directly associated with same-day affect, on days when students reported a stressor and texted with a parent, they had lower negative and higher positive affect compared to stressor days when they did not text with a parent. Extending research by Gross (2009), Study 2 used an experimental paradigm in which 101 first year college students completed a virtual social exclusion stressor task (i.e., Cyberball) and then were assigned to text a parent, text a stranger, or play a solitary computer game. Students who ‘reached out’ via text message to parents or strangers demonstrated faster recovery in self-esteem following the experimentally induced stressor compared to students assigned to the no contact control. Study 3 followed the same 101 first year students with a 10-day EMA study. On days when students reported a stressor and called/texted with their parents (versus days without virtual parental contact), they reported lower negative affect and slept longer that night, as monitored objectively with a wearable wristband. Analyses testing for specificity across the three studies found that only virtual communication with parents or romantic partners, but not other texting patterns (number of texts or contacts) or partners (texting with acquaintances, siblings, roommates, or friends), moderated the daily associations between stressors and wellbeing. In addition, students with higher reported maternal relationship quality were less ‘reactive’ to stressors, such that in both experimental and naturalistic settings students with lower (versus higher) maternal relationship quality had steeper increases in negative affect when they experienced a stressor. Overall, the three studies found converging evidence that daily virtual communications with parents may aid students in dealing with daily stressors, especially for reducing negative affect. Possible explanations, ideas for future research, and implications are discussed.

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1. Introduction

Although the majority of undergraduate students report that they are enjoying college (Ruiz, Sharkness, Kelly, DeAngelo, & Pryor, 2010), many students appear to be struggling with the new challenges of the college environment. Over the past few decades, there have been marked increases in the number of college students reporting and seeking services for mental health problems (Pryor, Hurtado, DeAngelo, Palucki Blake, & Tran, 2010). In a survey of over 26,000 students from a representative sample of US colleges and universities, a large proportion reported frequently feeling ‘overwhelmed by the amount of work they have to do’ (41%) and/or ‘depressed’ (11%), during their first year in college (Ruiz et al., 2010). Nearly 16% of first year students reported seeking professional services for mental health related problems during their first year (Ruiz et al., 2010). Annual surveys of counseling centers from over 90 US institutions (Locke et al., 2015) showed that the growth in the numbers of students seeking counseling or mental health services in the last 5 years (30%) is more than five times the growth in enrollment (6%). Students most sought assistance for anxiety and depressive symptoms.

Students’ mental health problems can have serious implications for their academic achievement and/or persistence in college (American College Health Association, 2013; Gruttadaro & Crudo, 2012; Storrie, Ahern, & Tuckett, 2010). A survey of the general college student population (i.e., sample of 123,000 students), nearly 30% of students reported that within the last year ‘stress’ (in academic, social, financial domains) affected their academic performance through lower grades, disruption in coursework, and/or dropping a course (American College Health Association, 2013). Students the most ‘at risk’ for poor adjustment during the first year of college are those with preexisting mental health symptoms and/or who’ve experience the greatest amount of stressful life events, vulnerabilities which are exaggerated for those without strong

social support networks (Compas, Wagner, Slavin, & Vannatta, 1986). In addition, research has shown that across adult populations, experiences of *daily* stressors are strongly linked to poor mental and physical health outcomes (e.g., Almeida, 2005; Rook, 2001; van Eck, Berkof, Nicolson, & Sulon, 1996). For example, a community sample of adults found that on days with interpersonal conflict, a daily social stressor, participants were more likely to report higher same-day negative affect, lower positive affect, and poorer same-night sleep (Brissette & Cohen, 2002). Identifying students' daily behaviors and experiences that may alleviate (or aggravate) students' mental health problems may help students, parents, and educators to improve students' wellbeing and overall health.

Strong social support networks are often a defining characteristic of individuals who are able to cope with daily stressors. Individuals with unsupportive social support networks are particularly vulnerable to increased psychological and physiological problems associated with daily stressors (DeLongis, Folkman, & Lazarus, 1988), including first year college students (Zaleski, Levey-Thors, & Schiaffino, 1998). Social support, or the quality of, and interactions with, one's social network, has been shown to have both direct and buffering effects on young people's overall and daily mental and physical health (for reviews see, for example, Cohen, 2004; Hostinar, Sullivan, & Gunnar, 2014; Thoits, 2011). In particular, strong supportive relationships with parents predict better health and wellbeing during the transition to college (Laible, Carlo, & Roeshe, 2004; Larose & Boivin, 1998) and may buffer against the effects of new stressors as they occur (Friedlander, Reid, Shupak, & Cribbie, 2007; Sy, Fong, Carter, Boehme, & Alpert, 2011). Although parental support is typically studied as a stable characteristic, parents can also support their children on a daily basis via enacted support. Due to the emergence of mobile technologies, parents and their children are communicating more frequently during this transition, regardless of

any physical distances separating them. In fact, virtual communication is often a main, if not only, form of daily communication between students and parents during college (Golonka, 2013; Hofer, 2008). Young people's frequent mobile technology usage can offer students the ability to receive daily support from their parents and can offer researchers new opportunities to study students' daily experiences, communications, and wellbeing.

This dissertation focuses on daily parental communication during the beginning of college and tests whether daily virtual communication with parents, like in-person support, may confer benefits for students' wellbeing, especially as in terms of students' recovery from daily stressors. This introduction first describes emerging adulthood and the transition to college. It reviews the prior research on the linkages between students' experiences of daily stressors, social support (particularly parental relationship quality and communication) and wellbeing during this period. For first perceived then enacted support, the theoretical literature is used to predict how perceived and enacted support may play a role in students' responses to daily stressors and their daily wellbeing. Specifically, the literature is used to understand whether perceived and/or enacted support from parents during the college transition can mitigate the negative effects of daily stressor on students' wellbeing. I then explain why measuring students' virtual parental communication is essential for understanding students' daily support and wellbeing. Finally, I briefly introduce the current studies and the specific aims tested in this dissertation. The study aims fall under five main types of queries: 1) describing students' daily virtual communication with parents, 2) examining the associations between daily parental communication and students' wellbeing, 3) testing whether students' virtual communication with parents may buffer responses to stressors, 4) examining the specificity of parental support in buffering against daily stressors

compared to other sources of support, and 4) exploring whether students with higher (versus lower) parent-child relationship quality are less reactive to daily stressors.

1.1 Daily Stressors and Social Support during Emerging Adulthood

Emerging adulthood is a relatively new, mainly Western, developmental stage between adolescence and adulthood. Emerging adulthood is a developmental period where young adults (ages 18 to 25) begin engaging in a number of adult tasks, such as leaving home or gaining independence and responsibilities, (Arnett, 2000), but have not yet matured into many of the adult roles and responsibilities, such as marital relationships or child rearing. As such, most college students don't consider themselves as fully 'adult' (Arnett, 2000) and neither do their parents (Nelson, Padilla-Walker, Carroll, & Madsen, 2007). It is not a universal stage, but does include most college students in the United States, and this stage is characterized by exploration of self and gains in independence. The transition to college, in particular, often leads to separation from home environments, greater student autonomy, academic and financial responsibilities. Although the changes that accompany the first year of college often represent important and positive developmental milestones, this transition also introduces a number of new stressors and challenges for young people, which may impact their overall and daily wellbeing.

1.1.1 Daily Stressors and Students' Wellbeing

The stressors described by students during this transition are often minor and ongoing and resemble what researchers have identified as "daily stressors". Daily stressors are often defined as 'micro-stressors' that are normative, relatively small events or experiences that cause stress, such as misplacing keys or tension with a coworker/ roommate (Almeida, 2005; Kanner, Coyne, Schaefer, & Lazarus, 1981). In adult populations, daily stressors have been shown to

predict to immediate and long-term problems for health and wellbeing (e.g., Almeida, 2005; DeLongis et al., 1988). In fact, in some studies, exposure to daily stressors have been shown to be as, if not more, predictive of mental and physical health symptoms as compared to major life events, such as the death of a family member or breakup of a romantic relationship (DeLongis et al., 1988; Kanner et al., 1981). It's been theorized that daily stressors may have a greater cumulative impact on health and wellbeing, in part, because individuals seek and receive less social support from others when they experience daily stressors compared to major life events (Flett, Blankstein, Hicken, & Watson, 1995).

Daily stressors are also thought to have stronger impacts on adjustment and health during transition periods, such as entry to college, and at younger ages, such as during adolescence or young adulthood, when emotion regulation is still developing (Birditt, Fingerman, & Almeida, 2005; Hay & Diehl, 2010). During college, students' reported amount of perceived daily stress and the frequency of daily stressors are associated with lower educational achievement (Pritchard & Wilson, 2003), poorer psycho-social adjustment (Brooks & DuBois, 1995), physical health symptoms (Edwards, Hershberger, Russell, & Markert, 2001) and, across the first year of college, increases in social, academic and mental health problems (Friedlander et al., 2007). Daily diary studies with college students have linked higher reports of daily stressors to greater negative affect and alcohol use (Butler, Dodge, & Faurote, 2010; Park, Armeli, & Tennen, 2004). For example, a set of daily studies with young college students found that daily stressors, especially those related to sexism (women) and belonging (men and women), were associated with increased same-day feelings of negative affect and decreased self-esteem (Swim, Hyers, Cohen, & Ferguson, 2001). Thus, understanding students' everyday experiences of stressors, their daily

behaviors and feelings, and their perceived and enacted supports may help in improving students' immediate and long-term mental health and well-being.

1.1.2 Social Support and Parent-Child Relationships

Social support is defined as individuals' social, emotional, and structural resources and/or functions that they can receive from their social network, or their 'social funds' (Thoits, 1995). Social support is often studied as a stable characteristic of individuals who can cope with stress and/or as an adaptive coping strategy in dealing with daily stressors. Strong social relationships and support networks have been robustly linked to mental and physical health and can buffer against the effects of stressful events (for reviews see for example, Berkman, Glass, Brissette, & Seeman, 2000; Thoits, 2011; Uchino, Bowen, Carlisle, & Birmingham, 2012). Focusing on students' daily health and wellbeing, there are two main forms of social support that may help students cope with daily stressors. *Perceived social support* involves the quality of ones' social network and the perceived ability of friends and family to provide emotional (e.g., expressing sympathy), instructional (e.g., giving advice), and/or instrumental (e.g., lending money) support. *Enacted social support* includes the actual interactions that provide immediate support, often through solicited, responsive exchanges with friends and family. Both perceived and enacted forms of support are important for understanding students' responses to daily stressors and daily wellbeing as, though related, they are likely to relate to students' health through separate processes.

During the transition from adolescence to adulthood, parents remain key figures in students' social support networks. Despite changing social networks and environments, the quality of parent-child relationships remains relatively stable and perceived parental support predicts students' adjustment (e.g., Kenny & Rice, 1995; Sy et al., 2011). Parental support may be

especially important during emerging adulthood and the first year of college (Laible et al., 2004; O'Connor, Allen, Bell, & Hauser, 1996), as parents can provide a stable emotional base for their children to explore their new environments. During adolescence, individuals who have higher quality parental relationships, or whose parents are more warm and responsive, tend to have greater autonomy and adjustment compared adolescents whose parental relationships are more harsh or full of conflict (Fuhrman & Holmbeck, 1995; McElhaney, Allen, Stephenson, & Hare, 2009). In college, parental relationship quality predicts students' adjustment to college, such that students with higher relationship quality had greater academic success and adjustment during their first year of college (Hickman, Bartholomae, & McKenry, 2000). The role that parental support plays in students' daily well-being much less studied, but it is vital to understanding the concrete, everyday ways that parents may help students thrive within their new environments.

The following sections review the literature on social support and students' parent-child relationships to explain 1) how social support may relate to daily wellbeing and buffer against daily stressors and, 2) how parents may provide social support through strong relationship quality and positive daily interactions. Perceived and enacted forms of support are explained separately. Examples from the social support literature are used to illustrate the nature of daily social support and to connect the broader, existing literature with the extensions made in the current studies.

1.2 Perceived Parental Support in Students' Daily Lives

1.2.1 Perceived Support

Perceived social support is an individuals' perception of the strength of their relationships and the capacity of their social network to provide them with assistance. Typical measures of perceived social support assess individuals' social integration, relationship quality with friends and family members, and/or estimated (or potential) amount of emotional, instrumental, or

instructional assistance from their social network (Chu, Saucier, & Hafner, 2010; Haber, Cohen, Lucas, & Baltes, 2007). Broadly, perceived social support has been studied as a determinant for overall health across development and in a variety of populations (e.g., Siedlecki, Salthouse, Oishi, & Jeswani, 2014). Perceived support is also thought to influence students' daily health and wellbeing in response to daily stressors in two main ways.

First, students with higher perceived support may appraise daily stressors as more manageable or less stressful because they have greater faith that they can rely on their networks to provide responsive enacted support. For example, a study of young adult caregivers found that young people with stronger perceived social support also appraised the stress of caring for a parent as less intense (Pakenham, Chiu, Bursnall, & Cannon, 2007). In the transition to college, students with greater perceived social support may see stressful situations as less threatening and, in turn, be able to more effectively cope with daily stressors. In an experimental intervention study of first year students, African American students who were assigned to a social belonging intervention (i.e., assigned to write and discuss how social integration or exclusion problems in college are 'shared and short-lived') compared to a control group had lower immediate reactivity to daily stressors and better achievement and health three years later (Walton & Cohen, 2011). Similarly, a daily study of women in STEM found that women who were assigned to the social belonging intervention, compared to control conditions, reported higher daily self-esteem, saw daily stressors as more manageable, and were more confident in their ability to cope with the stressors (Walton, Logel, Peach, Spencer, & Zanna, 2015).

Second, students with high perceived support may also be more likely to disclose problems and seek enacted support. For example, adolescents with high perceived support engage in more help-seeking behaviors and positive coping strategies than adolescents with less robust

support networks (Sawyer et al., 2012). A cross-sectional study of college students found that participants who were more reluctant in expressing emotion and intimacy were less likely to seek support, as measured by self, other and daily reports, and had lower average wellbeing compared to students who were more comfortable with others (Johnson, Gans, Kerr, & LaValle, 2010). A daily study of 170 college students found that students' perception of the availability of support was associated with the number of individuals from whom they sought support daily (Armstrong & Kammrath, 2015). Students with higher (versus lower) perceived social support may actually have more supportive social networks, benefit more from enacted support (discussed in greater details below in the enacted support section), and/or have certain characteristics that lead to both higher support and higher wellbeing.

1.2.2 Perceived Parental Support and Daily Wellbeing

Perceived parental support is a key component of students' stable social support network. Parent-child relationship quality has been associated with students' health and well-being throughout adolescence and emerging adulthood (Hair, Moore, Garrett, Ling, & Cleveland, 2008; Kenny & Rice, 1995; Larose & Boivin, 1998), but strong parental relationships may be especially critical for students' perceived social support during the transition to college when their social networks are often in flux. A study of the transition to college found that the quality of students' parental relationships before college predicted more positive social adjustment and less loneliness in college (Larose & Boivin, 1998). Students with supportive parental relationships may also feel more competent in dealing with new challenges. Parental relationships may help protect against perceived stress during college, as a longitudinal study found that perceived parental support predicted students' concurrent and subsequent symptoms of anxiety and depression during the first year in college (Taylor, Doane, & Eisenberg, 2014). As discussed in the previous section,

students may view stressful situations as more manageable if they perceive their parents as more capable to support them. For example, a study examining 178 students' daily stress responses in the first year of college found that students with higher reported maternal relationship quality, especially those characterized by greater warmth, had lower overall cortisol levels and produced less cortisol in response to daily stressors (Lucas-Thompson, 2013).

1.2.3 Connections with the Current Studies

In sum, students' level of perceived social support, and their perceived parental relationship quality and support in particular, predicts their adjustment and success in college, which may be due, in part, to students' responses to daily stressors. Students with stronger parent-child relationships may be less reactive to daily stressors and/or may engage in more support seeking when faced with daily stressors compared to students with weaker parental relationships. These current studies specifically test the overall correlations between students' perceived parental support (i.e., relationship quality) and their average daily health (Studies 1 and 3) and test whether students with higher perceived parental support are less reactive to daily stressors (Studies 1 and 3) and experimentally-induced social exclusion (Study 2).

1.3 Enacted Support via Daily Parent-Child Communication

1.3.1 Enacted Support

Enacted support refers to immediate, everyday interactions with others, usually those with whom the individual has a close relationship, that are intended to help promote wellbeing and provide assistance in coping with daily stressors (Haber et al., 2007). Enacted support involves everyday activities like sharing hugs, listening to problems, providing advice, and lending money. Enacted support is thought to affect individuals' daily wellbeing by dampening their cognitive, emotional behavioral, and/or physiological responses to stressors (Cohen,

Gottlieb, & Underwood, 2001). For example, a 7-day study of romantic couples suggested that the amount of time couples spent being affectionate buffered the association between chronic work stressors and daily cortisol levels (Ditzen, Hoppmann, & Klumb, 2008). Immediate enacted support may help individuals to regulate their responses by, for example, solving or lessening the severity of problems, facilitating emotion regulation, promoting healthful or self-care behaviors (e.g., good exercise or sleep habits), and/or reasserting self-esteem and belonging. Enacted support has been linked to immediate benefits (e.g., lower negative affect and distress, higher positive affect) and long-term benefits (e.g., higher quality relationships, fewer mental health problems) in willing recipients (for a review see Uchino, 2009). However, the dynamic nature of social interactions means that receiving support is a variable process that may or may not predict benefits for wellbeing or reductions in stress.

The most effective forms of enacted support are immediate, responsive, and/or ‘invisible’ (i.e., without the individual knowing or without cost to their self-esteem) support from close partners (Bolger, Zuckerman, & Kessler, 2000; Maisel & Gable, 2009). For example, in a daily diary study of married couples, highly ‘visible’ support (i.e., when a stressed individual knew they were receiving ‘comfort’ from their partner) was positively associated with same-day reports of feelings of anxiety and depression (Bolger et al., 2000). Overtly ‘supported’ individuals may have felt greater distress because the ‘help’ they received was unsolicited, unhelpful, and/or came with an emotional cost of feeling needy (MacGeorge, Feng, & Thompson, 2008; McClure et al., 2013). Thus, the effectiveness of enacted support may depend upon a number of individual, relationship, and contextual factors.

The Dual Process Approach described by Burleson (2009) is a theoretical model that outlines the processes and factors that predict the efficacy of supportive daily interactions.

Essentially, people can show immediate and long-term benefits from supportive interactions if (1) the context is appropriate for recipients to be able (and willing) to process their partners' messages, (2) the relationships between the recipients and their partners are of high quality, and (3) the interactions between the pair are responsive or helpful for the situation. As an example, let's say that Isabelle receives a poor grade on a writing assignment (daily stressor) and feels unhappy and anxious (daily wellbeing outcomes). Upon receiving a text message "Hope school is going well!" (daily interaction or enacted support) from her mother, Isabelle may indeed feel appropriately supported resulting in reductions in negative affect and increases in positive affect. However, Isabelle may not perceive the message as supportive, if she sees it, for example, as intrusive or overly pressuring her to succeed academically, leading to increases anxiety and unhappiness rather than declines. There are a number of factors that may determine if and when Isabelle may feel supported by her mother. Using the past research and theoretical predictions made by the Dual Process Approach, three factors are described below to generate hypotheses about the ways that enacted social support via virtual communication may influence students' 'reactivity' to daily stressors in the current studies.

First, students may benefit more from support in contexts that are viewed as appropriate and allow for helpful communication. The more a context can allow for personal, intimate communications, the more individuals may feel comfortable seeking and receiving support. There is little research on how the context affects students' receptiveness to support (Burlison, 2009), but there is some broader research showing that individuals use situational cues (e.g., problem severity) to gauge the appropriateness of seeking or receiving support (Bodie, 2012; Holmstrom et al., 2015). In terms of the virtual context, young people are readily using mobile technologies to send and receive personal messages from their friends and family (Lenhart, 2012; Smith,

McGeeney, Duggan, Rainie, & Keeter, 2015), often to engage in intimate exchanges (for more detailed discussion see the virtual communication below). One correlational study of college students found that though students prefer seeking face-to-face support from their friends, they prefer seeking support from their instructors via email and rated the interpersonal costs of online supports as lower than in-person supports (Lim, Teo, & Zhao, 2013). Research studies have yet to compare online and in-person contexts on their appropriateness and helpfulness for daily support. As described below, the present studies describe and compare the characteristics of daily in-person and virtual communication (via mobile technologies) with parents (Studies 1 and 3).

Second, enacted support from ‘high quality’ partners (versus weaker relationship partners) may have greatest impacts because recipients may view the interactions appropriate for the relationship (Gleason, Iida, Bolger, & Shrout, 2003) and/or because higher quality partners may engage in more positive, responsive interactions (Iida, Seidman, Shrout, Fujita, & Bolger, 2008; Uno, Uchino, & Smith, 2002). For example, a study of college friend dyads, found that the stronger the relationship quality between the friends, the lower the rise in their blood pressures in response to discussions of negative events (Holt-Lunstad, Uchino, Smith, & Hicks, 2007). Thus, due to the connection between the parent-child dyad, as compared to weaker relationships (e.g., acquaintances or strangers), parental support may be more helpful and be associated with faster recovery from stressors. Across the present studies (Studies 1, 2, and 3), I test the specificity of daily parent-child virtual interactions in buffering the associations between daily stressors and wellbeing, as compared to interactions with other communication partners (e.g., strangers, acquaintances, roommates) who may have weaker relationships than parents with the students.

Third, the effectiveness of support depends on how responsive the interactions are to the needs of the recipient and/or to the nature of the stressor. Positive, ‘person-centered’ messages, or

messages that validate and normalize experiences or promote feelings of belonging, have been shown to increase feelings of support compared to less helpful messages (Holmstrom et al., 2015). For example, in an observational study of romantic couples discussing a personal issue or conflict, individuals had lower negative affect if their partner used affiliative humor to diffuse the problem as compared to partners who used aggressive humor or solely problem-focused support (Howland & Simpson, 2014). In an experimental study, young adults that received a positive message from a friend after a stressor task had lower blood pressure than young adults who received a negative or ambivalent message (Holt-Lunstad & Clark, 2014). Students may also be more receptive to daily support in interactions when they initiate contact or seek support and in interactions where their partner focuses on validating, rather ignoring or challenging, their feelings (Bodie, 2012). In Study 3, I describe the characteristics of students' daily interactions with parents, including the reported helpfulness and initiator of virtual contact, and test whether these characteristics are similar to daily in-person interactions.

Using Isabelle (support recipient) and her mother (support partner) again as an example, Isabelle is most likely to benefit from an interaction with her mother, (1) if she is able to receive and read the message in an appropriate context, (2) if she has a strong, supportive relationship with her mother, and (3) if the messages she receives are timely and responsive to her needs. The model for effective enacted support has interesting implications for the types of daily interactions and support partners that may help college students cope with daily stressors, which point to the need for research that focuses on students' daily virtual interactions with their parents.

1.3.2 Enacted Parental Support and Daily Wellbeing

Daily communication with parents may be a medium for students to receive enacted support, which may have implications for their daily wellbeing outcomes. The majority of

students have frequent contact their parents. For example, a survey study of 180 Duke University undergraduate students found that students communicate with their primary parent, on average, 34 times per week (average of 7 calls, 30 texts, 3 emails) via mobile technologies (Golonka, 2013). Daily communication with parents may reflect the parental relationship quality and be a source of support during the transition to college. In surveys of first year college students, the majority said that they frequently (58%) or occasionally (31%) felt that they've received advice or encouragement from their families during the past year (Rios-Aguilar, Eagan, & Stolzenberg, 2015). Cross-sectional studies show that the frequency of communication with parents has been associated with higher relationship quality and well-being in college students (Gentzler, Oberhauser, Westerman, & Nardorff, 2011).

Longitudinal and diary studies have also begun to show that daily virtual parental communication is related to students' daily health and wellbeing. In an parent intervention study, first year students whose parents who were given guides on how to discuss drinking with their children, compared to those given facts about college wellness, reported less alcohol use and binge drinking at the end of the semester (Ichiyama et al., 2009). This change, though untested, was thought to be due to greater and/or more helpful daily communication during the transition to college. Daily diary studies of college students have also shown associations between parent-child communication and students' self-care. On days when students talked to their parents on the phone, they were more likely to exercise and eat healthy than on days when they did not talk to their parents (Small, Morgan, Bailey-Davis, & Maggs, 2013). Similarly, students were less likely to binge drink on the weekends when they had been in contact with their parents compared to no-contact weekends (Small, Morgan, Abar, & Maggs, 2011).

This prior research appears to suggest a positive linear relation between daily contact with parents and students' well-being; however, daily communication with parents may not always confer benefits. As discussed above in the section on enacted support, highly 'visible' parental support may be associated with lower self-esteem (Bolger et al., 2000) as it can remind the receiver that need help as they cannot handle the stress alone (MacGeorge et al., 2008). In the literature on early adolescence, the initiator of daily interactions may determine the valence of child outcomes. Self-disclosure by adolescents predicts greater parental knowledge and closeness whereas solicitation of information by parents is associated with less adolescent truthfulness and poorer relationship quality (Kerr, Stattin, & Burk, 2010; Weisskirch, 2009). Perhaps, students and adolescents are more likely to perceive interactions as helpful if they initiate contact versus when their parents initiate contact. For example, in a study of adolescent phone communications, adolescents who initiated contact (i.e., support seeking), compared to adolescents whose parents initiated contact (i.e., parental monitoring), had closer relationships with their parents and higher self-esteem (Weisskirch, 2011). Of course, this is only one factor that may predict the valence or outcomes of daily parent-child communication (for a larger discussion on child and parent factors of parental monitoring and communication see Kerr, Stattin & Burk, 2010)

Additionally, when parent-initiated contact occurs in excess, parental initiation may devolve into 'over-involvement' or helicopter parenting. Parental over-involvement occurs when parents offer excessive 'aid' and exert too much control over their children's lives, such as scheduling daily activities, discouraging students' decision making, or contacting professors about assignments. Parents who are overly involved in their children's lives may thwart important developmental processes as students may be unable to fully gain autonomy in their responsibilities, independence in their decisions or experiences, and confidence in their abilities.

Parental over-involvement has been associated with more negative student outcomes, such as lower well-being, less autonomy, and higher psychological health problems (LeMoyne & Buchanan, 2011; Padilla-Walker & Nelson, 2012; Schiffrin et al., 2014). Some research has suggested that over-involvement may be linked to higher daily communication with parents and poorer well-being and adjustment to college (Hofer, 2008). In this study of undergraduate phone conversations with parents, students who communicated with parents more frequently had poorer adjustment and lower feelings of autonomy than students who communicated with their parents less often (Hofer, 2008)

1.3.3 Connections with the Current Studies

In sum, students are most likely to benefit from daily enacted support interactions in appropriate contexts, with partners with whom they have strong relationships, and from conversations that are positive, helpful, or that they themselves initiated. The most effective forms of daily parental communication are likely to stem from parents who have strong relationships with their children and engage in timely and student-centered (i.e., focus on student and normalize feelings) conversations. The current studies test whether daily parent-child virtual communications are directly associated with wellbeing and may buffer daily stressors. Specifically, the current test whether daily virtual communication with parents may moderate the daily associations between stressors and same day affect (Studies 1 and 3), self-esteem (Study 3), and sleep (Study 3). Furthermore, Study 2 experimentally tests whether reaching out via text message to a parent, versus strangers or no contact, leads to faster recovery from an experimentally induced stressor (Study 2). The current studies also describe the frequency and characteristics of daily virtual parental communication (Study3).

1.4 Daily Parental Communication in the Digital Age

It would be impossible to assess daily parent-child communications without acknowledging the fact that most of this daily communication occurs via mobile technologies. Mobile technologies are defined here as mobile devices or online platforms that allow for information gathering and sharing, entertainment and virtual communication (e.g., mobile phones, social media). Ownership and usage of mobile technologies have increased to nearly ubiquitous levels in the United States' general population since their initial introduction over 20 years ago (Fox & Rainie, 2014). For the current generation of young people, referred to as 'digital natives' or 'Generation M', mobile technologies have been a part of everyday life since birth (Palfrey & Gasser, 2008; Rideout, Foehr, & Roberts, 2010) with youth at the forefront of adoption and usage of new technologies. Most young people are using mobile technologies for virtual communication, as 91% of young adults aged 18-29 own or have access to a mobile phone and 89% of young adults are active on at least one social media site (Smith et al., 2015).

Mobile technologies have not only become integrated into young adults' daily routines, but have also become a key tool for maintaining social relationships and support systems. For many college students, virtual communication is a primary way (if not the only way) to interact with their parents (Golonka, 2013; Hofer, 2008). In order to understand if, and how, daily parental communication may provide students with access to social support and buffer the effects of daily stressors, mobile technologies must be considered as a main channel for communication. The question remains, though, whether support received through virtual mediums is capable of being as effective as in-person support. Research on communication via mobile devices is still largely in its infancy; however, it appears that daily virtual communication may mirror in-person

communication in a number of key ways (for a discussion see George & Odgers, 2015; Underwood & Ehrenreich, 2017).

1.4.1 Virtual Communication and Social Support

There are three main reasons why young peoples' daily virtual communication patterns may provide students with perceived and enacted social supports. First, young people are using mobile technologies to communicate with friends and family they know in 'real life' (Underwood, Ehrenreich, More, Solis, & Brinkley, 2015), and the amount of virtual communication among young people is positively associated with the perceived quality of their relationships (Valkenburg & Peter, 2007). A cross-sectional study of 1,200 adolescent friends found that more time spent online was positively associated with friendship quality, time spent together in-person, and adolescents' wellbeing (Valkenburg & Peter, 2007). A longitudinal study of over 1,000 US adolescents (12-18 year olds) found that the amount of time adolescents spent online, as measured through 2-day time diaries of the number of minutes online, was associated with less time spent in-person with their parents but not with lower parent-child relationship quality (Lee, 2009). Furthermore, in a survey study of parents of adolescents, a greater amount of technology use that involved familial communication or joint usage was associated with higher perceived family connectedness (Williams & Merten, 2011). Mobile technologies allow for frequent virtual communication between parents and children, which may foster relationship closeness despite distance. As many first year college students are newly separated from their parents, mobile technologies may provide a medium for students to maintain daily contact with their parents.

Second, young people often use mobile technologies to engage in intimate conversations and seek support from friends and family. In a qualitative study by Davis (2012), adolescents

indicated in interviews that young people use social media as a tool to set up meetings with friends and as a platform for intimate self-disclosure. Cross-sectional research indicates that though adolescents prefer offline to online self-disclosure, they nonetheless rate online settings as appropriate for intimate exchange (Schouten, Valkenburg, & Peter, 2007). In a study of Duke students' virtual communication with their parents, the majority were satisfied with the frequency (68%) and quality (81%) of daily virtual parental communications and the frequency of this communication was associated with greater parent-child closeness and social adjustment in college (Golonka, 2013). In addition, the majority of students reported using mobile technologies to seek advice from their parents on their health (70%), financial (55%), academic (50%), and/or social (36%) problems (Golonka, 2013). Thus, students are likely using virtual communication to seek immediate advice and disclose personal information with their parents.

Third, virtual communication has been shown to buffer the negative effects of a stressor among young people. An experimental study of 123 young adults and adolescents (aged 11-23 years) tested the impacts of virtual communication compared to playing a computer game following an experimentally-induced stressor (Gross, 2009). Participants engaged in a social stressor task known as 'Cyberball' (Williams & Jarvis, 2006), which involves throwing a virtual ball with two computer-generated characters who either pass the ball to the participant throughout the experiment (social inclusion) or exclude from playing for most of the game (social exclusion). After this experimental stressor, participants were randomly assigned to either play a computer game (solitary control) or Instant Message with a stranger (virtual communication). For participants that were included (i.e., did not experience a stressor), there were no differences in well-being between those that communicated or played online. However, in comparing adolescents and college students that were excluded (i.e., experienced a stressor), those who

engaged in virtual communication recovered to their baseline levels of self-esteem and affect faster than those that played on the computer alone. Thus, virtual communication may help students recover from social stressors, but the effectiveness of parent-child virtual communication to moderate the effects of daily stressors has not yet been tested.

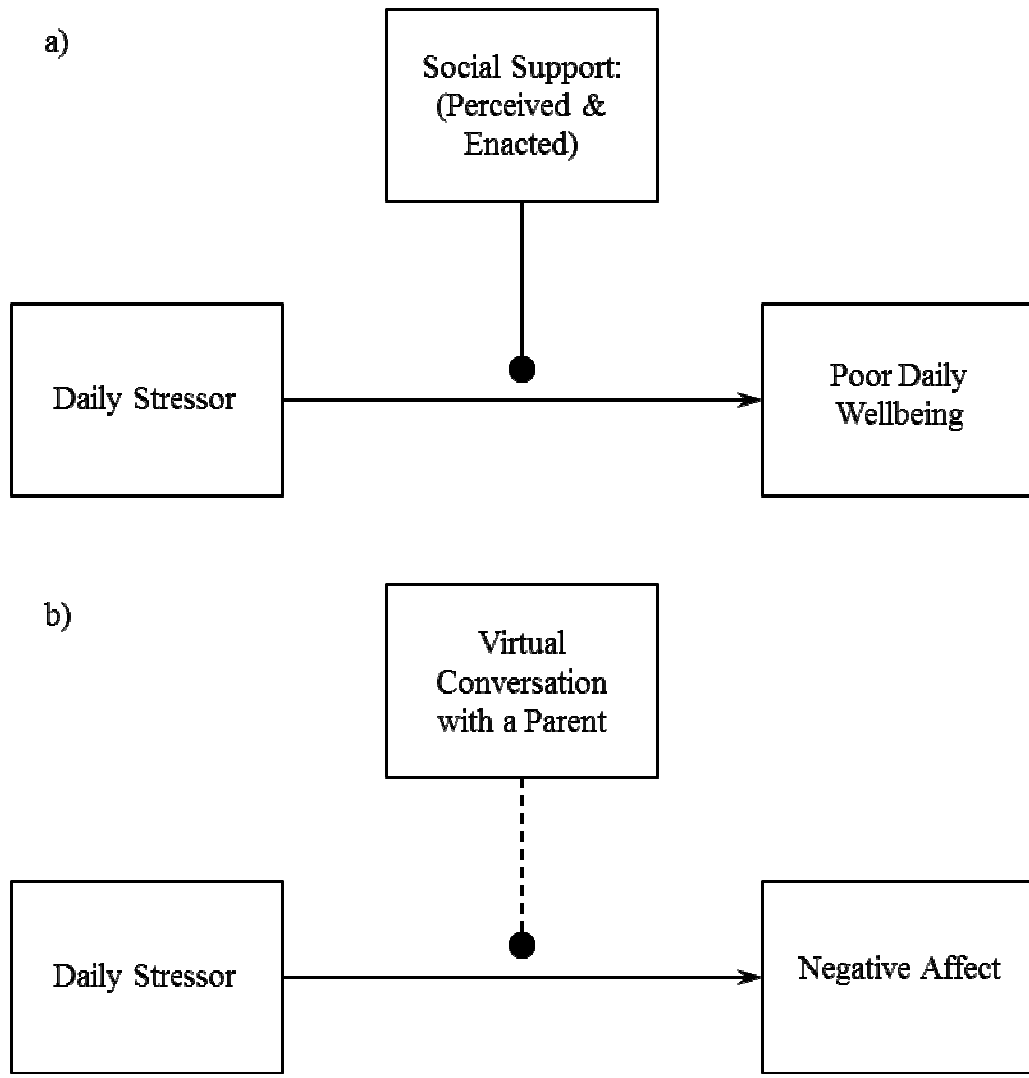
1.4.2 Connections with Current Studies

Overall, this research suggests that young people are using mobile technologies to communicate with, strengthen, and seek support from their existing social networks. Although there are features of virtual interactions that are different from in-person interactions (e.g., giving hugs), there are also similarities that may allow virtual communication to become an effective medium enacted support. Specifically, virtual daily communication may present an easy, immediate avenue for college students to seek and receive daily social support from their parents. The present studies describe and compare students' reports of in-person and virtual daily communication with parents (Studies 1 and 3). They also test whether virtual conversations may buffer the associations between stressors and wellbeing in the daily context (Studies 1 and 3) and using an extension of Gross' (2009) experimental paradigm (Study 2).

1.5 Gaps in Literature and Overview of Current Studies

Research is needed to fully describe first year college students' daily parent-child communication and test whether this communication is associated with their daily affect and well-being. No studies to date have tested whether daily virtual parental communication can reduce, or buffer, the impacts of daily stressors on well-being. **Figure 1** depicts the hypothesized daily associations between students' daily stressors, parental social support, and students' daily wellbeing (adapted from Cohen, Janicki-Deverts, Turner, & Doyle, 2014). The first diagram (1a) illustrates the associations previously reported in the social support literature. Students' daily

stressors negatively predict their same-day health and wellbeing outcomes, but social support can buffer this association. The link between daily stressors and wellbeing may be weakened by parental support in the form of daily communication (enacted support) and relationship quality (perceived support). There is no main effect of daily communication on wellbeing as the literature for this effect is still mixed (see discussion above on enacted support). The second diagram depicts a specific example of how these associations are tested in the current studies. Specifically, students' reports of daily stressors predict higher same-day negative affect, but virtual conversations with a parent (i.e., text or call) are hypothesized to buffer (or reduce) this daily association. In this figure, the relations for daily communication are dotted to reflect the dependence of the daily moderation by key features of the parental interaction (i.e., if it is helpful versus unwanted). The figures don't depict all feedback loops and other factors or pathways, including other aspects of social support (e.g., differences in appraisal), health (e.g., illness buffering), and daily events (e.g., positive events or uplifts), but are used here to simplify and illustrate the basic associations of interest in this dissertation. More specifically, the set of studies presented here test, through daily and experimental methods, whether these parental perceived and enacted supports buffer the relation between daily/experimentally-induced stressors and wellbeing.



Figures 1a & 1b: The hypothesized associations between daily stressors, wellbeing, and social support for students (adapted from Cohen et al., 2014).

Note: Figure 1a shows the established theoretical relations in which social support, both stable perceived forms and daily enacted forms, buffers the daily association between stressors and poor daily wellbeing. Figure 1b then illustrates a specific example tested in this study, showing that a virtual conversation with a parent (texting/calling) may buffer the daily association between daily stressors and daily negative affect.

Past research on parental relationships and support during emerging adulthood has largely studied 1) parental support only as a stable characteristic (i.e., perceived support), and 2) used cross-sectional designs to study its associations with overall wellbeing (with some exceptions, for example, Lucas-Thompson, 2013). Though informative for establishing general associations and testing individual differences, such studies miss enacted forms of parental support and within individual associations. Daily ‘diary’ designs, known as ecological momentary assessment (EMA; Shiffman, Stone, & Hufford, 2008) or experience sampling methodologies (ESM; Csikszentmihalyi, Larson, & Prescott, 1977), allow for repeated ‘in the moment’ assessments of individuals’ experiences, behaviors, and feelings in their natural environments. By shortening recall time to a few hours, these designs can help to minimize retrospective recall biases and produce more accurate self-reported estimates compared to those in cross-sectional survey studies (see for example Shiffman, 2009). As the dynamic nature of social support processes are difficult to capture via retrospective one-time assessments, the studies leverage daily diary methods to provide a more accurate descriptive look at students’ daily interactions and to test for between and within-individual differences in the associations between daily parental communications and wellbeing. The studies presented here add to the literature on parental social support by assessing both perceived and enacted forms of parental support and by testing whether perceived or enacted parental supports may buffer the associations between daily stressors and same-day wellbeing using EMA and experimental designs. The set of studies in this dissertation specifically address the following aims.

Aim 1: Describe students’ daily communication with their parents, including in-person and virtual (i.e., calling and texting) communication (Studies 1 and 3).

Aim 2: Describe the associations between perceived parental support and daily wellbeing, including a) the overall correlations between parent-child relationship quality (perceived support), daily virtual communication (enacted support), daily stressors, and daily wellbeing and b) the direct daily within-individual associations between parental virtual communication and wellbeing (Studies 1 and 3).

Aim 3: Test whether virtual parent-child interactions moderate (level 1 moderator) the associations between daily stressors and students' wellbeing (Studies 1 and 3) and experimentally test whether sending virtual messages to parents, compared to no virtual contact, predicts students' recovery from a social exclusion stressor task (Study 2).

Aim 4: Examine whether parental virtual communication is unique in moderating the associations between daily stressors and wellbeing or whether other forms of virtual communication (i.e., reaching out to a stranger in Study 2 or texting with other individuals in Studies 1 and 3) can show similar moderated associations (level 1 moderators) between stressors and wellbeing.

Aim 5: Examine whether perceived parental support (i.e., parental relationship quality) may moderate (level-2 moderator) students' responses to daily (Studies 1 and 3) and experimentally-induced (Study 2) stressors.

The aims above are addressed in three separate, but related studies. First, Study 1 uses an Ecological Momentary Assessment (EMA) design to describe parental communications (i.e., texting with a parent and hanging out in-person) and examine the associations with negative and positive affect in daily life. This study also tests whether texting with a parent moderates the associations between same-day stressors and positive and negative affect. Study 2 further targets this 'buffering' ability of parental contact in an experimental paradigm and tests whether enacted

(sending messages) and perceived (parental relationship quality) support may help students in dealing with an experimentally-induced social exclusion stressor task. It tests whether sending a text message, either to parents or strangers, can help students recover from social exclusion and whether parental relationship quality, including maternal and paternal, predicts students' 'reactivity' to or recovery from a social stressor. Study 3 further explored associations and individual differences in daily parent-child interactions with a 10-day EMA design. Study 3 described the presence, quantity, and nature of daily parent-student virtual communication. It further explored whether the characteristics students' daily experiences (i.e., types of stressors or virtual communication) and perceived parental support (i.e., the quality of students' maternal and paternal relationships) may be associated with students' responses to daily stressors as related to their daily wellbeing. Study 3 also included multiple daily measures of wellbeing, including same-day positive and negative affect, self-esteem, and an objective measure of same-night sleep duration (via a wearable activity monitor).

This set of studies contributes to the existing literature by providing valuable descriptive information about students' daily parental communication and early college experiences, as well as providing strong tests of whether parental virtual communication can influence students' response to daily stressors and well-being. All three studies focus on emerging adulthood, with Studies 2 and 3 narrowing the assessment window to the first year of the college experience to capture students during a key period during emerging adulthood. All three studies also focus on parental relationship quality, with Studies 2 and 3 further separating maternal and paternal relationships, and the unique role that parents (as opposed to other family members or friends) may play in students' daily lives. The inclusion of both EMA and experimental paradigms allow for strong, ecologically valid tests of the interplay between exposure to daily stressors, parental

virtual interactions, and student's emotional health. These studies are also positioned to inform future intervention efforts directed at students making the transition to college.

2. Study 1: Texting with a parent reduces the associations between daily stressors and negative affect

Study 1 uses an Ecological Momentary Assessment design to capture the coupling of daily parental communication, stressors, and wellbeing in students' daily lives. The purpose of this 7-day EMA study is threefold. First, this study aims to describe how frequently students communicate with their parents by examining the percentage of days they interact with their parents face-to-face and via mobile technologies (i.e., text messaging). To compare with measures used in cross-sectional studies, I correlate students' parental relationship quality and the frequency of daily virtual parental communication and person-level average wellbeing from across the EMA period. I also test within-individuals whether students' reported positive or negative affect differs on days when they communicate, versus do not communicate, with their parents via text message. Second, this study tests whether the daily associations between reported stressors and affect may be moderated by parent virtual communication on that same day. To test the specificity of this effect, I compare the strength of the moderation when students communicate with parents versus other texting patterns, including texting with other close friends and siblings, number of online contacts, and amount of texting. Third, this study asks whether overall parent-child relationship quality can 'buffer' against the effects of daily stressors by examining the overall correlations between relationship quality and daily well-being outcomes, testing whether students with stronger relationships have reduced reactivity to daily stressors by testing whether students with higher quality parental relationships have weaker daily associations between daily stressors and affect.

2.1 Study 1 Methods

2.1.1 Participants

Students from a larger longitudinal cohort study about resilience ($N = 1,128$) at an elite university were recruited via email and agreed to participate in this study ($N = 140$). Students completed this study in the last week of the spring semester. Approximately half the students were in their first year ($n = 78$) and half were in their second year ($n = 62$). Nearly all of the students reported on demographic information (97%; $n = 136$) and most of the students reported on their relationship with at least one parent (74%; $n = 103$) as a part of the larger study. Four participants did not complete any of the daily surveys; therefore, the final sample consisted of 136 students (66% women; 9% first generation; 42% White, 30% Asian or Asian American, 14% Black or African American, and 14% Other).

2.1.2 Procedure

In the summer before their first year in college, all students completed surveys that assessed the quality of their parental relationships as a part of the larger longitudinal college resilience study. A small subset of students was then recruited to complete one week of experience sampling surveys in the spring semester of their first or second year in college. For about seven days, participants received email or text message alerts six times daily: once in the morning as they woke up (after 6:30am), four times during the daytime (11:30am, 2:30pm, 5:30pm, and 8:30pm), and once in the evening before they went to sleep (after 10:30pm). Each morning survey asked about their sleep the previous night. Each daytime survey asked them to report on their experiences and activities, including stressors, texting patterns, and affect. Each evening participants provided a summary of their activities across the day. **Table 1** provides a brief snapshot of the measures that were administered at each survey signal time (see also

Appendix A for a full description of measures). The total completion rate of the daily surveys from this sample was about 75% (~900 person days, ~4,000 surveys).

Table 1: EMA measures for Study 1.

The main EMA measures collected at each survey signal of daily stressors, texting with parent, other texting partners and patterns, and negative and positive affect for Study 1.

	Morning (last night)	11:30am (last 3hrs)	2:30pm (last 3hrs)	5:30pm (last 3hrs)	8:30pm (last 3hrs)	Evening (total day)
Stressor	-	Y/N	Y/N	Y/N	Y/N	-
Text with parent	-	Y/N	Y/N	Y/N	Y/N	Y/N
Other texting partners (Y/N)	-	sibling, friend	sibling, friend	sibling, friend	sibling, friend	sibling, friend
Other texting patterns	-	number of contacts, total texts	number of contacts, total texts	number of contacts, total texts	number of contacts, total texts	number of contacts, total texts
Negative affect (0-10 rating)	-	anxious, angry, sad, irritable	anxious, angry, sad, irritable	anxious, angry, sad, irritable	anxious, angry, sad, irritable	anxious, angry, sad, irritable
Positive affect (0-10 rating)	-	happy, calm, excited	happy, calm, excited	happy, calm, excited	happy, calm, excited	happy, calm, excited

2.1.3 Measures

Parental Relationship Quality was measured using an adapted version of the Network of Relationship Inventory- Behavioral Systems Version (Furman & Buhrmester, 2009). This 16 item measure asked students to rate their relationships with their primary parent ($n = 103$) and

secondary parent ($n = 96$) on a number of facets including, warmth (1 item; How much is your [parent] warm and caring with you?), seeks a secure base (3 items; e.g., How much does your [parent] encourage you to pursue your goals and future plans?), seeks a safe haven (3 items; e.g., How much do you seek out your [parent] when you're upset?), antagonism (3 items; e.g., How much does your [parent] get on your nerves?), criticism (3 items; e.g., How much does your [parent] criticize you?), and conflict (e.g., How often do you and your [parent] argue with each other?), on a scale from 1 (not at all) to 5 (very much). Negative features were reverse coded and all items were averaged together to form a total score for each parent. An average of both parents was then created, while allowing for single parents, which ranged from 2 (rated of 1 on every item) to 10 (rated 5 on every item). Students reported, on average, relatively high relationship quality with their parents ($M = 6.87$, $SD = 1.39$, Range = 3.13- 9.56).

Parental Over-involvement was measured using an adapted 4-item measure from a 'helicopter parenting' scale (Padilla-Walker & Nelson, 2012). As with parent-child relationship quality, students reported on the perceived intrusiveness of their primary and secondary parents ($n = 105$). The scores were then averaged to create a composite measure for both parents that ranged from low (2) to high (10) parental 'over-involvement' ($M = 5.87$, $SD = 1.75$).

Daily Stressors were assessed four times per day in each of the daytime surveys. Students checked all the stressful experiences that had occurred in the last 3 hours (adapted from the Hassles and Uplifts Scale; Kanner et al, 1981) from a list of 5 items (e.g., I didn't do well in school; I ran into an unexpected problem), including an open-ended item where students briefly described the stressful experience. A daily marker was created by dichotomizing these items into 0 (day without a stressor) or 1 (days with a stressor) over the day. On average, students reported at least one stressor on 55% of study days ($M = 0.55$, $SD = 0.30$). The intraclass correlation

coefficient (ICC) for the daily reports of stressors was calculated in the multilevel modeling framework to assess the within versus between-person variance (Raudenbush & Bryk, 2002). The ICC for daily stressors was 0.16, which shows that 16% of the variance in daily stressors was between participants, whereas the remaining 84% of the variance was within participants over time.

Virtual and In-person Communications with a Parent were assessed at each daytime survey and in the evening survey. Students indicated with whom they'd text messaged in the last three hours (i.e., check all the people that you texted with), including their parents. To create a daily marker for virtual communication with a parent, or texting with a parent, these surveys were collapsed across the day into 0 (i.e., days without parent virtual contact) and 1 (i.e., days texted with parent). Students messaged their parents on 58% of all person days ($n = 468$), which was on average, about 57% of study days for each student ($M = 0.57$, $SD = 0.38$). Students also indicated with whom they'd seen and 'hung out' with in-person, including their parents. Similarly, to create a binary daily marker for hanging out with a parent, or in-person communication with a parent, surveys were collapsed across the day into 0 (i.e., days without parent in-person contact) and 1 (i.e., days with in-person parent conversation). Students saw their parents face-to-face on an average of about 5% of study days ($M = 0.05$, $SD = 0.15$). ICCs were calculated for texting (0.45) and for in-person contact (0.32) with a parent, which shows that 45% of the variance in texting with parents was between participants, whereas the remaining 55% of the variance was within participants over time.

Other Virtual Communication Partners and Texting Patterns were assessed at each daytime survey and in the evening survey. First, students listed with whom they'd text messaged in the last three hours (i.e., check all the people that you texted with), including their parents,

siblings, extended family, roommates, close friends, and others. As with parents, binary daily markers were created for texting with a sibling ($M = 0.30$, $SD = 0.37$) and with a close friend ($M = 0.74$, $SD = 0.35$). Second, students reported the number of separate individuals they text messaged in each daytime survey and overall in the evening survey. They reported contacting, on average, 2 individuals every 3 hours ($M = 2.20$, $SD = 2.69$) or 7 different individuals across the day ($M = 7.00$, $SD = 4.99$). Third, students estimated the number of text messages they'd sent in each daytime survey and across the day in the evening surveys. Students reported sending, on average, about 9 messages every 3 hours ($M = 9.37$, $SD = 9.59$) or 48 messages per day ($M = 47.83$, $SD = 49.09$). ICCs were calculated for texting with a sibling (0.53), texting with a close friend (0.52), the number of virtual contacts (0.75), and the number of texts sent (0.66).

Positive and Negative Affect were measured at each of the daytime surveys and the evening survey. Students rated how they felt on a scale from 0 (not at all) to 10 (extremely) for 7 adjectives including, 'happy', 'excited', 'calm', 'anxious', 'angry', 'irritated' and 'sad', that were adapted from the Positive and Negative Affect Schedule (PANAS; Watson et al 1988) with items from Schimmack (2003). For each affect item, a daily total was created by averaging ratings across the entire day. Composite negative and positive affect scores were created by averaging across the negative items (i.e., anxious, angry, irritated, sad) or positive items (i.e., happy, excited, calm) across the entire day. On average, students reported low daily negative affect ($M = 2.22$, $SD = 1.77$) and moderate daily positive affect ($M = 4.72$, $SD = 1.59$). The ICCs were calculated for daily negative affect (0.79) and positive affect (0.70).

2.1.4 Analytic Strategy

For all the between-individual, 'person-level' associations, a person mean was calculated for each individual for their average reports across the 7-day EMA and used in simple correlation

or ordinary least squares regression analyses ($N = 136$). For all within-individual tests, multilevel regression models were used to account for the nesting of days within participants and to estimate within-person associations between stressors, texting patterns, and affect. The daily models controlled for between-person level variance by person mean-centering the daily variables (i.e., centered by the proportion of days with stressors or days with parental virtual communication). Three different multi-level model equations were used for each type of analysis, direct within-individual associations, level-1 interactions, and cross-level interactions.

First, to test the direct within-individual associations, Equation 1 shows the multilevel model testing the same-day within-person association between daily stressors (Stressor) and negative affect (NA).

$$(NA_{ij}) = \beta_0 + \beta_1(\text{Stressor}_{ij}) + \beta_2(m\text{Stressor}_j) + u_{0j} \quad (1)$$

β_0 is the sample average intercept representing the average negative affect on days without a reported stressor. $\beta_1(\text{Stressor}_{ij})$ is the within-person associations describing the change (from each students' mean) in negative affect across stressor versus non-stressor days. $\beta_2(m\text{Stressor}_j)$ is the between-person associations testing whether students who more frequently reported stressors also reported higher average negative affect across the 7-day assessment. The random intercept [u_{0j}] captures the between-person variation in students' average negative affect. This modeling strategy was repeated for positive affect and for daily virtual communication with parents.

Second, to test whether there was a level-1 interaction between stressors and texting with a parent on affect, Equation 2 shows the multilevel model testing the same-day within-individual association between daily stressors (Stressor) and negative affect (NA) as moderated by virtual communication with a parent (VCP), a level 1 moderator.

$$(NA_{ij}) = \beta_0 + \beta_1(\text{Stressor}_{ij}) + \beta_2(m\text{Stressor}_j) + \beta_3(\text{VCP}_{ij}) + \beta_4(m\text{VCP}_j) + \beta_5(\text{Stressor}_{ij} * \text{VCP}_{ij}) + u_{0j} \quad (2)$$

As in Equation 1, this model predicts negative affect based on the within [$\beta_1(\text{Stressor}_{ij})$] and between-person associations [$\beta_2(m\text{Stressor}_j)$] with daily stressors, the students' average intercept [β_0], and the random intercept [u_{0j}]. It also adds the within [$\beta_3(\text{VCP}_{ij})$] and between-person associations [$\beta_4(m\text{VCP}_j)$] between virtual communication with a parent and negative affect. $\beta_5(\text{Stressor}_{ij} * \text{VCP}_{ij})$ is the within-individual association testing whether there is a difference (i.e., moderation) in the within-person association between stressors and negative affect by parental contact (i.e., virtual versus no parental communication days). This modeling strategy was repeated for positive affect and for all other daily virtual communication patterns and partners.

Third, multilevel models were also used to test the cross-level interaction between daily stressors and parental relationship quality. Equation 3 shows the multilevel model testing for same-day associations between daily stressors and negative affect as moderated by parental relationship quality (PRQ), a level 2 moderator.

$$(NA_{ij}) = \beta_0 + \beta_1(\text{Stressor}_{ij}) + \beta_2(m\text{Stressor}_j) + \beta_3(\text{PRQ}_j) + \beta_4(\text{Stressor}_{ij} * \text{PRQ}_{ij}) + u_{0j} \quad (3)$$

As in Equation 1, this model includes the within [$\beta_1(\text{Stressor}_{ij})$] and between-person associations [$\beta_2(m\text{Stressor}_j)$] for daily stressors and negative affect, the students' average intercept [β_0], and the random intercept [u_{0j}]. This model adds $\beta_3(\text{PRQ}_j)$, which tests the between person-association of whether students who report higher relationship quality with parents also report higher average negative affect. $\beta_4(\text{Stressor}_{ij} * \text{PRQ}_{ij})$ represents the cross-level interaction testing whether there is a difference (i.e., moderation) in the within-person association between stressors and negative affect by students' parental relationship quality. This model was repeated for positive affect and parental over-involvement.

Separate follow-up multilevel models were used to explore the nature of all the interactions; analyzing the moderated associations between stressors and affect separately by days with and without parental virtual communication and separately using a median split (i.e., above or below 7.13) of parental relationship quality.

2.2 Study 1 Results

2.2.1 Compliance

Across the sample and all signals, there was an overall completion rate of 76.79% ($N = 4,386$ total completed surveys out of a possible 5712). The completion rate was also calculated separately for each type of survey signals: morning signal (one per day), daytime signals (four per day), and evening signal (one per day). For the morning signals, the completion rate was 82.45% ($N = 785$ out of a possible 952 occasions). A completion rate of 76.65% was observed across all four target signals ($N = 2919$ out of a possible 3808 occasions). The completion rate was lowest for the evening signals at 71.64% ($N = 682$ out of a possible 952 occasions).

2.2.2 Aims 1 and 2: Person-level Descriptive Statistics and Correlations between Average Daily Wellbeing and Virtual Parental Communication

Table 2 shows the means and standard deviations for the full sample (i.e., person-level averages across the study period) and the averages at each survey signals (i.e., average for surveys at that signal time) for reported stressors, texting with parents, and negative and positive affect. There were no differences by survey signal for the frequency of texting with a parent ($F(3, 2242) = 1.17, p = 0.32$). Students were more likely to report a stressor in the morning than during the other occasions in the day ($F(3, 2827) = 4.57, p = 0.003$) and students reported higher positive and negative affect in the evening compared to the surveys in the daytime ($F(4, 2869) = 4.43, p < 0.001$; $F(4, 3328) = 9.23, p < 0.001$).

Table 2: Means and standard deviations for Study 1.

Means, standard deviations across all survey signals and participants' daily averages across the EMA period.

	Total <i>M (SD)</i> <i>N</i> = 136	11:30am <i>M (SD)</i> <i>N</i> = 720	2:30pm <i>M (SD)</i> <i>N</i> = 725	5:30pm <i>M (SD)</i> <i>N</i> = 700	8:30pm <i>M (SD)</i> <i>N</i> = 774	Evening <i>M (SD)</i> <i>N</i> = 682
Stressor days (%)	0.55 (0.30)	0.34 _a (0.47)	0.27 _b (0.44)	0.27 _b (0.44)	0.27 _b (0.44)	-
Text with parent days (%)	0.57 (0.38)	0.27 (0.45)	0.23 (0.42)	0.23 (0.42)	0.24 (0.42)	-
Average negative affect	2.22 (1.77)	2.03 _a (1.90)	1.98 _a (1.87)	1.91 _a (1.91)	2.01 _a (1.98)	2.37 _b (2.21)
Average positive affect	4.72 (1.59)	4.54 _a (2.04)	4.57 _a (2.08)	4.53 _a (2.15)	4.59 _a (2.09)	5.12 _b (2.14)

Note: *a* and *b* refer to significant t-test differences by group at the $p < 0.05$ level.

In order to show the traditional person-level correlations between parental communication and wellbeing, **Table 3** shows the correlations between overall parental relationship quality and the proportions of days students reported stressors, proportions of days students texted with a parent, and average daily negative and positive affect across the EMA period. This table shows that students who reported texting with a parent on a greater proportion of days, did not report more stressor days ($r = 0.02, p = 0.84$) nor higher negative or positive affect ($r = 0.05, p = 0.63, r = -0.04, p = 0.68$), but they reported slightly higher relationship quality with their parents ($r = 0.17, p = 0.09$). Students who reported a greater proportion of

stressor days also had higher average negative affect and lower average positive affect ($r = 0.32$, $p < 0.001$, $r = -0.17$, $p = 0.048$) and students with higher parental relationship quality had lower average negative affect ($r = -0.32$, $p = 0.002$).

Table 3: Correlations of person-level measures for Study 1.

Correlations between of proportion of days with stressors, texting with parent, and person-level averages negative and positive affect, and overall parental relationship quality.

	1	2	3	4	5
1. Text with parent days (%)	1				
2. Stressor days (%)	0.02	1			
3. Average negative affect	0.05	0.32***	1		
4. Average positive affect	-0.04	-0.17*	-0.18†	1	
5. Parent- child relationship quality	0.17†	-0.04	-0.32**	0.19†	1

Note: † $p < .10$ * $p < .05$, ** $p < .01$, *** $p < .001$

2.2.3 Aims 2 and 3: Daily Within-Individual Associations and Moderations

To test the within-person daily associations, **Table 4** illustrates three main findings from the results of the multilevel models examining the within-individual coupling of daily stressors, texting with a parent, and affect. First, experiencing a stressor was consistently associated with higher negative affect ($b = 0.45$, $p < 0.001$) and lower positive affect ($b = -0.35$, $p < 0.001$) at the

daily level. Second, texting with a parent was not significantly associated with daily negative affect ($b = 0.17, p = 0.08$) or positive affect ($b = -0.35, p = 0.06$). Third, there was a significant interaction between stressors and texting with a parent on daily negative ($b = -0.62, p = 0.02$) and positive ($b = 0.57, p = 0.048$) affect. In other words, on days when students reported a stressors, they had lower negative affect and higher positive affect if they texted with their parents, than on stressor days when they did not text with their parents. **Figure 2** compares the associations between daily stressors and negative and positive affect on days when students texted with their parents and on no virtual parental contact days. This figure shows that on days in which students texted with a parent, the associations between stressors for negative and positive affect were weaker than on days when students did not text with a parent.

Table 4: Daily associations and interactions for Study 1.

Multilevel coefficients and 95% confidence intervals showing the daily associations and level-1 interactions between stressors, texting with a parent, and same-day affect (controlling for person means).

	Same-Day Affect	
	Negative affect <i>b</i> [95% <i>CI</i>]	Positive affect <i>b</i> [95% <i>CI</i>]
Stressor	0.45*** [0.28, 0.61]	-0.35*** [-0.52, -0.18]
Text with parent	0.17† [-0.03, 0.38]	-0.19† [-0.41, 0.03]
Interaction (Stressor*Text parent)	-0.62* [-1.15, -0.10]	0.57* [0.01, 1.14]

Note: † $p < .10$ * $p < .05$, ** $p < .01$, *** $p < .001$

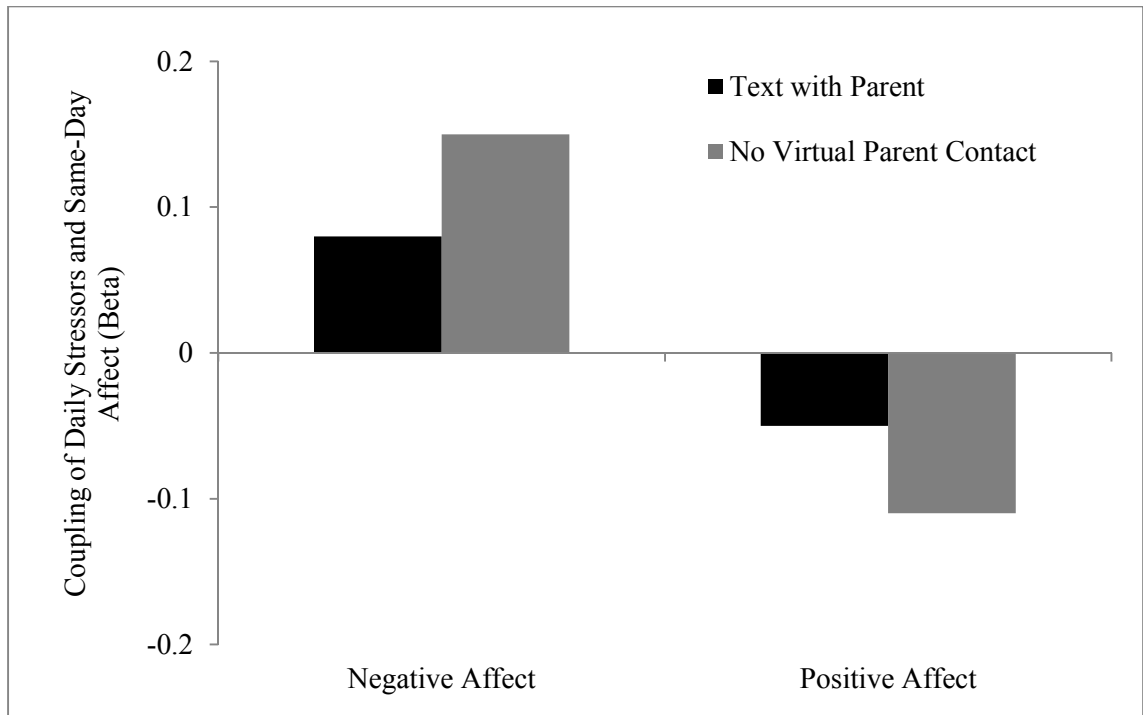


Figure 2: The interactions between daily stressors and texting with a parent for daily affect in Study 1.

Note: Figure 2 shows the standardized regression coefficients $((b_x - GM_x)/SD_x)$ comparing the strength of the daily associations between stressors and negative and positive affect on days when students did or did not text with their parents.

Similar tests of the within-individual associations were conducted for the coupling of in-person parent communication and affect. These analyses did not show direct associations between in-person contact with parents and negative ($b = -0.03, p = 0.90$) or positive ($b = -0.33, p = 0.17$) affect nor did these tests show evidence for moderation by in-person parental contact of the association between stressors and same-day negative ($b = 0.80, p = 0.46$) and positive ($b = 0.42, p = 0.60$) affect.

An exploratory set of analyses also examined whether the moderation of texting with a parent varied based on the timing of the stressors and texting throughout the day. Specifically, this test compared 1) days where the stressor and texting with a parent were reported in the same survey signal, 2) days where the reported stressor preceded texting with a parent, and 3) days where texting with a parent preceded the stressor. Simple ANOVA models comparing these person-days showed no differences by timing for associations with daily negative ($F(2,235) = 0.20, p = 0.82$) or positive affect ($F(2, 235) = 2.11, p = 0.12$).

2.2.4 Aim 4: Daily Associations for Other Daily Virtual Communication Patterns and Partners

To test the specificity of the moderating effect of parent-child virtual communication, similar multilevel analyses of the moderation of the association between stressors and affect were conducted using other daily texting patterns and partners, including texting with siblings and close friends, the number of virtual contacts (i.e., number of individuals texted), and the total number of texts sent. The model results for the interactions between texting patterns and stressors on affect are presented in **Table 5**. This table shows that none of the other texting patterns or partners significantly moderated the association between stressors and affect ($ps > 0.05$). Specifically, the associations between stressors and negative and positive affect were not moderated by texting with a sibling, texting with a close friend, the number of virtual contacts, or the number of texts sent.

Table 5: Daily interactions using other texting partners and patterns in Study 1.

Multilevel coefficients and 95% confidence intervals showing the daily associations and interactions between stressors, different texting partners or patterns, and same-day affect.

	Same Day Affect	
	Negative affect <i>b</i> [95% <i>CI</i>]	Positive affect <i>b</i> [95% <i>CI</i>]
Stressor	0.45*** [0.28, 0.61]	-0.35*** [-0.52, -0.18]
Stressor*Text sibling	-0.10 [-0.73, 0.53]	-0.04 [-0.68, 0.60]
Stressor*Text friend	-0.54† [-1.16, 0.09]	0.50 [-0.21, 1.21]
Stressor*Number of virtual contacts	-0.05 [-0.11, 0.02]	0.06† [-0.01, 0.13]
Stressor*Number of texts sent	-0.002 [-0.01, 0.01]	0.003 [-0.01, 0.01]

Note: † $p < .10$ * $p < .05$, ** $p < .01$, *** $p < .001$

2.2.5 Aim 5: Parental Relationship Quality Moderation of Daily Associations

To explore how parent-child relationship quality may relate to students' daily well-being, parental relationship quality measures (i.e., parent-child relationship quality, parental over-involvement) were used as person-level moderators (Level 2) of the association between daily stressors and affect. Parental relationship quality did not moderate association between daily stressors on negative ($b = -0.10, p = 0.21$) or positive ($b = -0.10, p = 0.24$) affect nor did parental over-involvement ($b = 0.03, p = 0.61$; $b = 0.01, p = 0.80$). **Table 6** shows the daily associations

conducted separately by higher or lower relationship quality using a median split (i.e., relationship quality score greater or less than 7.13) of the overall parent relationship quality measure. This table shows, though not statistically significant, that students with lower, versus higher parental relationship quality, had stronger associations between stressor and wellbeing outcomes (compare coefficients in stressor rows).

Table 6: Daily associations split by parental relationship quality in Study 1.

Multilevel coefficients and 95% confidence intervals showing the daily associations and interactions between stressors, texting with a parent, and same-day affect using a median split of parent-child relationship quality.

	Same Day Affect (Lower Relationship Quality)	
	Negative affect <i>b</i> [95% <i>CI</i>]	Positive affect <i>b</i> [95% <i>CI</i>]
Stressor	0.53** [0.22, 0.84]	-0.40* [-0.70, 0.10]
Text with parent	0.20 [-0.14, 0.55]	-0.35† [-0.73, 0.03]
Interaction (Stressor*Text parent)	-0.69† [-1.47, 0.09]	0.95* [0.09, 1.81]

	Same Day Affect (Higher Relationship Quality)	
	Negative affect <i>b</i> [95% <i>CI</i>]	Positive affect <i>b</i> [95% <i>CI</i>]
Stressor	0.42*** [0.22, 0.61]	-0.33** [-0.53, -0.13]
Text with parent	0.15 [-0.11, 0.40]	-0.11 [-0.38, 0.16]
Interaction (Stressor*Text parent)	-0.57 [-1.26, 0.13]	0.32 [-0.42, 1.06]

Note: † $p < .10$ * $p < .05$, ** $p < .01$, *** $p < .001$

2.3 Study 1 Discussion

This study had five key findings. First, students communicated with their parents in some way on the majority of days (53% of total study days), which was almost exclusively through virtual communication in this study. In-person contact was minimal, with only a small percentage of students (15%) having any in-person contact with their parents during the week, which was limited to a few study days (n= 35 total person days with in-person parental contact across all participants). Virtual communication was frequent with most students reporting communicating via text message with their parents on one or more days (82%) during the study and, on average, texting with their parents on the majority of study days (57%). The amount of in-person communication is likely to vary based on the characteristics of the student population and the timing of the study relative to holidays and student activities. As this study was conducted in a sample at a private university just before semester exams, in-person contact was severely restricted, so future studies should be conducted that directly target the daily associations between in-person versus virtual parental contact and wellbeing.

Second, in efforts to reproduce findings from cross-sectional studies of college students (Gentzler et al., 2011; Golonka, 2013), the amount of virtual communication was associated with parent-child relationship quality and well-being. A strength of this study, as compared to those prior cross-sectional studies, was that the daily methodology allowed for greater accuracy in the measurement of daily parental communication and it allowed for within-person tests of the associations between virtual parental communication and students' wellbeing. Whereas, there was a trend-level correlation between the frequency of texting with a parent and relationships quality, there were no direct associations between virtual parental communication and daily wellbeing. In other words, neither comparing students who text messaged with their parents more frequently,

nor comparing days in which students texted more with their parents, were directly associated with increased negative or positive affect.

Third, texting with a parent moderated the same-day associations between daily stressors and affect. As has been shown in previous studies (Kanner et al., 1981), this study found that daily reports of stressors are strongly associated with same-day positive and negative affect, but that same-day contact with parents reduced the strength of the associations between stressors and wellbeing. This finding, although correlational, suggests that texting with a parent may lessen the impact of daily stressor on affect. The interaction showed that, by itself, texting with a parent may not relate to better mood, but that texting with parent on days with a stressor may temper the associations between daily stressors and well-being. Further research is required on the timing of virtual interactions in relation to the stressor, though preliminary analyses comparing differential timing of the stressors and texting did not reveal any significant differences. Because this study was correlational, it is impossible to test whether communication with a parent *following* a stressor leads to reductions in negative affect or whether negative interactions with parents could be a source or exacerbate feelings of daily stress. Furthermore, this daily study may have inflated associations due to the shared method variance of the daily self-reports (i.e., all reports from the same individual). Experimental studies that can manipulate stressors and communication patterns are needed to disentangle the specific effects and causality (see Study 2) and studies that use objective measures of students' daily wellbeing can augment the validity of self-report studies (see Study 3 for integration of wearable activity data). More research is also needed to test whether the amount or type of parental virtual contact modifies how beneficial or potentially harmful the communication is for students' daily wellbeing (see Study 3).

Third, texting with a parent uniquely moderated the association between stressors and affect, as shown when specificity tests of the daily models were conducted using the other texting patterns and partners. These tests found that none of the other texting patterns or partners, including texting with a sibling or close friend, the number of texts, and the number of texting contacts, moderated the daily associations between stressors and affect. This finding points to the unique role that parents may play in students' support networks with respect to daily enacted social support. Research is needed exploring under which conditions parents may be most appropriate or helpful. For instance, in comparing daily moderation by virtual parental communication across different types of stressors (e.g., academic, social) and wellbeing may begin to suggest whether parents are more helpful in helping students cope with some stressful situations (e.g., social stressors) compared to others (e.g., time management stressors) (see Study 3). In addition, future research is needed examining the content of daily communications and direct comparisons of online versus in-person support activities and partners (e.g., text conversations with parents versus hugs from friends) to understand what types of enacted virtual support are most effective in mitigating the negative effects of daily stressors.

Fourth, students with stronger parental relationship quality had higher overall well-being, but they did not differ significantly in their daily responses to stressors or daily virtual contact with their parents compared to students with lower relationships quality. Similar to previous cross-sectional studies (e.g., Laible et al., 2004), parental relationship quality was associated with higher average positive affect (small effect) and lower average negative affect (medium effect). The cross-level interactions between relationship quality and the daily associations did not reveal any significant moderation of the associations between daily stressors and affect. These findings are in contrast to previous research showing that higher maternal relationship quality may reduce

students' responses to stressors (Lucas-Thompson, 2013). A clear limitation of this study was that all the participants were undergraduate university students, meaning the sample was a selective group of students with, for the most part, very highly educated, involved parents. Future research among more representative groups of young adults and adolescents is required to make broader generalizations. This study may also have limited in its ability to replicate these findings as maternal and paternal relationship quality could not be separated (see Study 3) and parental relationships were assessed prior to beginning college, so some features of the relationships may have changed.

This study provides initial evidence about the important role parents may play for college students as they transition to adulthood, especially in communicating with students on days in which they experience stressors. Causal claims cannot be made about the effects of texting a parent as stressors were not randomly assigned and student's reported on both their perceived daily stressors and wellbeing. Study 2 uses an experimental paradigm to test whether being randomly assigned to text with a parent after being subjected to a social exclusion task can aid students more immediate recovery or "bounce back" from a stressor. Study 3 expands upon this study by extending the types of daily within-individual analyses (i.e., differentiating between the types of stressors, increased specificity of virtual communication partners and perceived parental support) and by using an objective measure of daily wellbeing, which helps to address threats to the interpretation of these associations due to shared method variance.

3. Study 2: Sending a Text Message to a Parent Expedites Students' Recovery from an Experimentally-Induced Stressor

Study 1 provided evidence that virtual communication with a parent can moderate the associations between stressors and affect in young peoples' daily lives. Results showed that if students texted with a parent on stressful days they had lower negative affect and higher positive affect as compared to themselves on stressful days when they did not text their parents, which was not the case for other texting patterns or partners. This study was limited in its ability to make causal statements about the effects of texting with a parent due to the correlational design and shared method variance as students reported on both the perceived daily stressor and their daily wellbeing. Nonetheless, these findings suggest that parents may play a unique role in helping young people cope with daily stressors. In prior research, Gross (2009) created an experimental paradigm for testing whether virtual activities can help young people recover from a stressor. Gross (2009) found that online communication helped students recover more quickly than solitary online activities from an experimentally-induced social exclusion task, similar to participants' accelerated recovery after forms of in-person communication and support (Teng & Chen, 2012). Cyberball exclusion has been widely shown to result in significant, but short lived, reductions in self-esteem and increases in negative affect, which may be analogous to some of the daily stressors experienced by college students. Furthermore, social stressors, such as social exclusion and belonging concerns, are typical among first year students (Walton & Cohen, 2011) and interpersonal conflicts are thought to be frequent salient everyday events (Rook, 2001). This task is an approximate simulation of daily stressor in an experimental laboratory setting (Scheithauer, Alsaker, Wolfer, & Ruggieri, 2013); however, as with all laboratory-based

experimental paradigms, ecological validity is compromised in an attempt to exert greater control over the exposure to the stressor and students' virtual patterns of coping.

The current study thus uses the basic Gross (2009) design to experimentally test whether virtual communication with a parent (versus with a stranger or no one) can help students recover from an experimental stressor. This study has two major purposes. First, it aims to experimentally test if randomly assigned enacted support, or reaching out 'for support' via a text message, compared to playing a solitary online game, can result in faster recovery in self-esteem and well-being after social exclusion. Compared to Gross (2009), who used a longer Instant Message conversation, this is a more stringent test of the effects of virtual support seeking. This study also compares the recovery for students assigned to send a message to a parent versus a stranger, whereas Gross (2009) only assigned students to virtually communicate with stranger. Second, this study aims to test if the reported strength of students' parental relationships is associated with students' response to the experimental stressor. This study extends upon Gross' (2009) design by not only assessing if immediate enacted support (i.e., virtual communication with a parent) can aid in students' recovery from stressors, but also testing whether students' perceived parental support may help buffer students' response to the experimental stressor task.

3.1 Study 2 Methods

3.1.1 Participants

Undergraduate students were recruited from a southeastern university via flyers, the Psychology Department undergraduate research subject pool, and emails to first year students. All participants who agreed to participate (N = 106) were compensated with a small monetary payment or research credit. Five participants were excluded from the study, including one individual did not complete the experimental task and four who reported that they were not in

their first year of college, resulting in a final sample of 101 first year college students (70% women; 51% White, 25% Asian or Asian American, 14% Latino (a) or Hispanic, 8% Black or African American, and 2% Other). Most students had highly educated parents (68% of had a professional degree), but there was a small group of first generation students (11% of sample) with parents without a bachelor degree.

3.1.2 Procedure

The experiment had four assessment time points: a baseline affect assessment (T1), the social exclusion stressor task and affect assessment (T2), random assignment to a virtual coping activity and affect assessment (T3), and the questionnaire and final affect assessment (T4).

Students arrived at a small testing room with their mobile phone were told that they would be completing a questionnaire, engaging in three different virtual activities, and reporting multiple times on their current mood and well-being.

First in the baseline affect assessment (T1), all participants reported on their baseline self-esteem. Half of the sample ($n = 60$) also completed a short subset of the wellbeing items, which included ratings of 6 items (anxious, irritated, sad, happy, calm, and independent) at this time (affect assessment 1).

Second (T2), students played an online ‘game’ (i.e., Cyberball) that was used to induce brief feelings of social rejection and negative affect (see Williams & Jarvis, 2006). Cyberball involves throwing a virtual ball with 2 other computer programed ‘players’ who, after a few seconds of play, exclude the participant by only throwing to each other (see **Appendix B** for a diagram). The task lasted approximately 4 minutes and was immediately followed by the assessment of the participants’ self-esteem and well-being (affect assessment 2).

Third (T3), participants were randomly assigned to one of three conditions: 1) reaching out to a parent (ROP), 2) reaching out to a stranger (ROS), 3) no communication (NC). Participants in the ROP condition were instructed to contact a parent using their phone with a short text, for which they were given an example (i.e., Hi mom/dad, I'm a part of a psych study where I was told to text someone that I'm close to. I thought about you and wanted to say hi!). Participants in the ROS condition were asked to text a stranger (i.e., a researcher/research assistant) and provided an example text (i.e., Hi! I'm part of a psych study where I was told to text someone and I was assigned to you!). Students in the NC condition were instructed only to play an online computer game (i.e., Tetris). All participants then played this solitary game on the research computer alone until a total of 10 minutes have elapsed since they completed the Cyberball game (i.e., social exclusion stressor task) and then they reported on their current self-esteem and well-being (affect assessment 3).

Fourth (T4), participants completed a brief questionnaire of their demographic characteristics and parent-child relationship quality and all participants then checked their mobile phones for any incoming text messages. Students reported from whom they'd received any texts from during the course of the study, including any messages from their parents for which they reported on the valence and helpfulness of these messages. They also completed a final assessment of their self-esteem and well-being, which was approximately 20 minutes following the social exclusion task (affect assessment 4).

3.1.3 Measures

Self-esteem was assessed at each affect assessment (T1-T4) for all participants with single item (i.e., How do you feel about yourself right now? 1- really bad to 5- really good). This item was used as a holistic measure of the participants' overall wellbeing.

Dimensions of Well-being were also measured at each affect assessment (T1-T4). Students rated how they felt on a scale from 1 (not at all) to 5 (extremely) on a number of adjectives (adapted from the PANAS; Watson, Clark, & Tellegan, 1988; Gross, 2009; Schimmack, 2003). Negative aspects of wellbeing were measured using feelings of dysphoria (sad, down, upset, and stupid), anger (irritated, frustrated, hostile, and angry), anxiety (anxious, tense, stressed), and shame (ashamed, betrayed, embarrassed). Positive aspects were assessed using feelings of positive affect (happy, excited, calm), competence (smart, confident, independent) and relational value (valued, accepted, respected). Individual subscales composites for each dimension of well-being and total for negative and positive affect composites were created for each assessment of the study.

Perceived Parent-Child Relationship Quality was assessed using 18 items adapted from the Network of Relationship Inventory- Behavioral Systems Version (Furman & Buhrmester, 2009) and the Helicopter Parenting Scale (Padilla-Walker & Nelson, 2012) for the students' primary and secondary parents. A large majority rated their maternal (n = 98) and paternal (n = 94) relationships. This measure asked students to rate each parental relationship on a set of positive and negative facets of the relationship. Positive features were assessed with 7 items including warmth (1 item; Is your parent warm and caring with you?), seeks a secure base (3 items; e.g., How much does your parent encourage you to pursue your goals and future plans?), and seeks a safe haven (3 items; e.g., How much do you seek out your parent when you're upset?). Negative features were assessed with 11 items including antagonism (3 items; e.g., How much does your parent get on your nerves?), criticism (3 items; e.g., How much does your parent criticize you?), conflict (3 items; e.g., How often do you and your parent argue with each other?) and intrusion or 'over-involvement' (2 items; e.g., How much does your parent make important

decisions for you?) on a scale from 1 (not at all) to 5 (very much). Averages were created by reverse coding negative features and summing items together to create separate composites for maternal ($M = 3.55$, $SD = 0.75$) and paternal ($M = 3.70$, $SD = 0.65$) relationship quality.

Perceived Network Support was assessed using a 12-item measure of the strength and perceived availability of support from students' social networks called the Interpersonal Support Evaluation List (ISEL; Cohen & Hoberman, 1983). Students rated how the ease from 1 (definitely false) to 5 (definitely true) for which they could find someone to spend time with them (e.g., If I wanted to have lunch with someone, I could easily find someone to join me), provide emotional support or advice (e.g., When I need suggestions on how to deal with a personal problem, I know someone to turn to), and help with mundane tasks or monetary issues (If I was stranded 10 miles from home, there is someone I could call who could help get me). Negative items were reverse coded and then all items were summed to form a total score of perceived network support ranging from 12 to 60 ($M = 45.24$, $SD = 8.09$).

3.1.4 Analytic Strategy

To test for basic differences between the randomly assigned groups, Analysis of Variance (ANOVA) tests were used at each affect assessment. These tests were used to establish that the groups did not differ at the beginning or end of the study (T1, T2, or T4) and were then used to test for differences by random assignment group just after the manipulation (T3). Ordinary Least Squares (OLS) regressions were used to compare the three groups on their recovery from the social exclusion stressor due to the manipulation assignment, meaning if group assignment predicted students' affect at T3 controlling for affect at T2. Regression analyses were also conducted to test whether perceived parental relationship quality predicted students' response to the social exclusion stressor (affect at T2 controlling for T1).

3.2 Study 2 Results

3.2.1 Initial Wellbeing and Manipulation Checks

Oneway ANOVAs were conducted to test for differences by group in terms of their baseline affect and wellbeing or overall social support to ensure that the random assignment process had generated equivalent groups. There were no differences by group in overall relationship quality with either parent ($F(2, 95) = 0.11, p = 0.90$; $F(2, 91) = 0.53, p = 0.59$), perceived social support ($F(2, 98) = 2.40, p = 0.10$), or by any of the 7 items of well-being at baseline ($ps > 0.05$).

Next, a manipulation check of the Cyberball experimental paradigm was conducted by performing a repeated-measures ANOVA of self-esteem by time. This showed that across the entire sample self-esteem differed across the affect assessments ($F(3, 400) = 9.24, p < 0.001$), specifically participants reported the highest self-esteem at baseline ($M = 3.90, SD = 0.73$) and lowest after the Cyberball ($M = 3.32, SD = 0.82$). Similar ANOVA models were conducted for the subset of wellbeing measures assessed at baseline for half of the sample ($n = 60$) across the study affect assessments. All measures followed the same pattern of change over time as self-esteem. For most of the measures there were significant differences by study assessment times, including the happy ($F(3, 354) = 3.09, p = 0.03$), irritated ($F(3, 354) = 12.17, p < 0.001$), sad ($F(3, 354) = 4.48, p = 0.004$), and independent ($F(3, 354) = 5.04, p = 0.002$) items. For two of the measures, calm ($F(3, 354) = 0.83, p = 0.48$) and anxious ($F(3, 354) = 2.36, p = 0.07$), this change over the study period was not significantly different from the baseline affect assessment.

3.2.2 Overall Group Differences

A repeated-measures ANOVA was conducted to test for differences in self-esteem by time and condition ($F(6, 400) = 6.11, p < .001$), showing that there was a main effect of time

($F(3, 400) = 3.53, p = 0.02$), but no main effect or interaction with condition ($F(2,400) = 1.51, p = 0.23$; $F(6,400) = 1.51, p = 0.17$). Examining the within time contrasts, this analysis showed that students' self-esteem did not differ by group at baseline, after the social exclusion task, or at the final affect assessment. The groups only differed in their self-esteem after the manipulation of the coping strategy, so a oneway ANOVA of self-esteem by group was conducted at this assessment (T3; $F(2,98) = 3.67, p = 0.03$). Participants who sent a text to their parents ($M = 3.74, SD = 0.79$) or to a stranger ($M = 3.74, SD = 0.79$) reported higher self-esteem than those in the no contact control group ($M = 3.28, SD = 0.81$). There was a medium effect size ($d = 0.6$) for the difference in self-esteem between the parent and no contact control groups after the manipulation (T3).

Figure 3 shows the change in self-esteem by group across the four affect assessment in the study. This figure illustrates that self-esteem drops after to the exclusion task for all groups (T1 to T2), students in the parent and stranger groups have higher self-esteem than the no contact group just after the manipulation (T3), and then all groups converge again at the end of the study (T4).

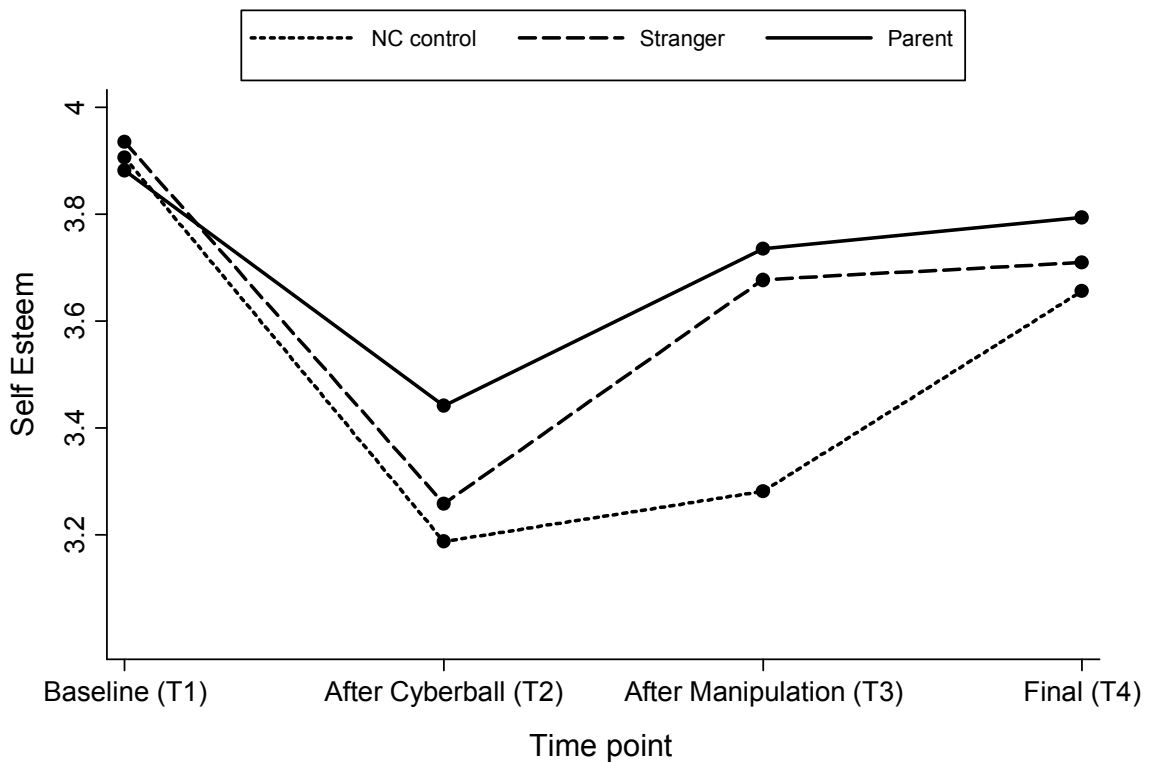


Figure 3: Self-esteem by group at each time point in Study 2.

Note: Figure 3 shows the mean self-esteem ratings at each of the assessment time points across the study session (T1 to T4) separately by each the three randomly assigned groups (NC- no contact control, ROS- texting a stranger, and ROP- texting a parent).

Table 7 presents the means by group after the manipulation for each dimension of well-being. Oneway ANOVAs were conducted for total negative and positive wellbeing as well as for each dimensional composite. These analyses tested for differences between the groups at (T3) on the total positive ($F(2,97) = 2.64, p = 0.08$) and negative ($F(2,97) = 1.95, p = 0.15$) dimensions of wellbeing as well as for each subtype. Post hoc analyses found that participants who sent a text to

a parent, had subsequently higher overall positive wellbeing, feelings of competence and lower feelings of shame compared to participants who had no contact.

Table 7: Means by group after manipulation of virtual coping in Study 2.

Means and standard deviations of each of the well-being dimensions across the three randomly assigned groups, no contact control (NC), reaching out to a stranger (ROS), and reaching out to a parent (ROP), after the manipulation (T3). The effect size shows the standardized difference score between the NC and the ROP group means.

	NC (control) (<i>n</i> =33) <i>M</i> (<i>SD</i>)	ROS (stranger) (<i>n</i> =32) <i>M</i> (<i>SD</i>)	ROP (parent) (<i>n</i> =36) <i>M</i> (<i>SD</i>)	Effect Size: ROP vs NC (Cohen's <i>d</i>)
Positive wellbeing (total)	2.93 (0.70) _a	3.08 (0.81) _{ab}	3.34 (0.74) _b	-0.57
Positive affect	2.92 (0.72)	2.99 (0.80)	3.23 (0.77)	-0.42
Competence	3.07 (0.86) _a	3.28 (1.00) _{ab}	3.57 (0.88) _b	-0.57
Relational value	2.80 (0.84) _a	2.97 (0.86) _{ab}	3.22 (0.86) _b	-0.49
Negative wellbeing (total)	1.97 (0.79)	1.73 (0.61)	1.64 (0.68)	0.45
Anxiety	2.53 (0.93)	2.39 (0.84)	2.33 (1.01)	0.21
Anger	1.90 (0.88)	1.68 (0.75)	1.56 (0.89)	0.38
Dysphoria	1.89 (0.89)	1.63 (0.72)	1.53 (0.72)	0.45
Shame	1.61 (0.76) _a	1.32 (0.52) _{ab}	1.21 (0.50) _b	0.63

Note: *a* and *b* refer Tukeys HSD post hoc differences at the $p < 0.05$ level.

3.2.3 Aims 3 and 4: Group Differences in the Recovery from Cyberball

To test whether the groups differed in their *recovery* from the social exclusion stressor, a regression analysis was performed by group on reported self-esteem after the coping manipulation (T3) accounting for self-esteem after the social exclusion stressor task (T2). This showed that, as compared to participants in the no contact control group, participants who texted a stranger had faster recovery of their self-esteem after the stressor ($b = 0.36, p = 0.045, \beta = 0.20$). The difference in the recovery of self-esteem between the no contact control and those who texted their parents was only significant at the $p = 0.06$ level, but had a comparable standardized coefficient and effect size as the stranger condition ($b = 0.33, p = 0.06, \beta = 0.19$).

A series of regression analyses to explore students' recovery in all the dimensions of wellbeing (T3 controlling for T2) were performed. First, analyses using overall positive and negative wellbeing totals were conducted and both revealed marginal differences between the parent contact and no contact groups ($b = 0.21, p = 0.09, \beta = 0.14$; $b = -0.21, p = 0.09, \beta = -0.14$ respectively). Students who sent a text to a stranger also had lower negative wellbeing ($b = -0.26, p = 0.04, \beta = -0.17$), and slightly higher positive wellbeing ($b = 0.11, p = 0.38, \beta = 0.07$) than the no contact control students. There were no differences in in positive or negative affective wellbeing between the parent and stranger groups. Second, analyses were conducted for each sub-dimension of wellbeing. A figure showing the standardized change coefficients for all wellbeing composites is depicted in **Figure 4**. This figure shows that there were there were no significant differences in the recovery between any of the groups in terms of positive affect, relational value, annoyance, or anxiety ($p > 0.05$); however, there were differences by group for feelings of competence, shame, and dysphoria. Compared to participants with no contact, participants who texted their parents had higher feelings of competence ($b = 0.39, p = 0.02, \beta = 0.20$) and lower

shame ($b = -0.29, p = 0.02, \beta = -0.23$), whereas strangers had lower feelings of dysphoria ($b = -0.36, p = 0.02, \beta = -0.21$) and shame ($b = -0.29, p = 0.02, \beta = -0.23$). There were no significant differences between the parent and stranger groups in any of these dimensions ($ps > 0.05$).

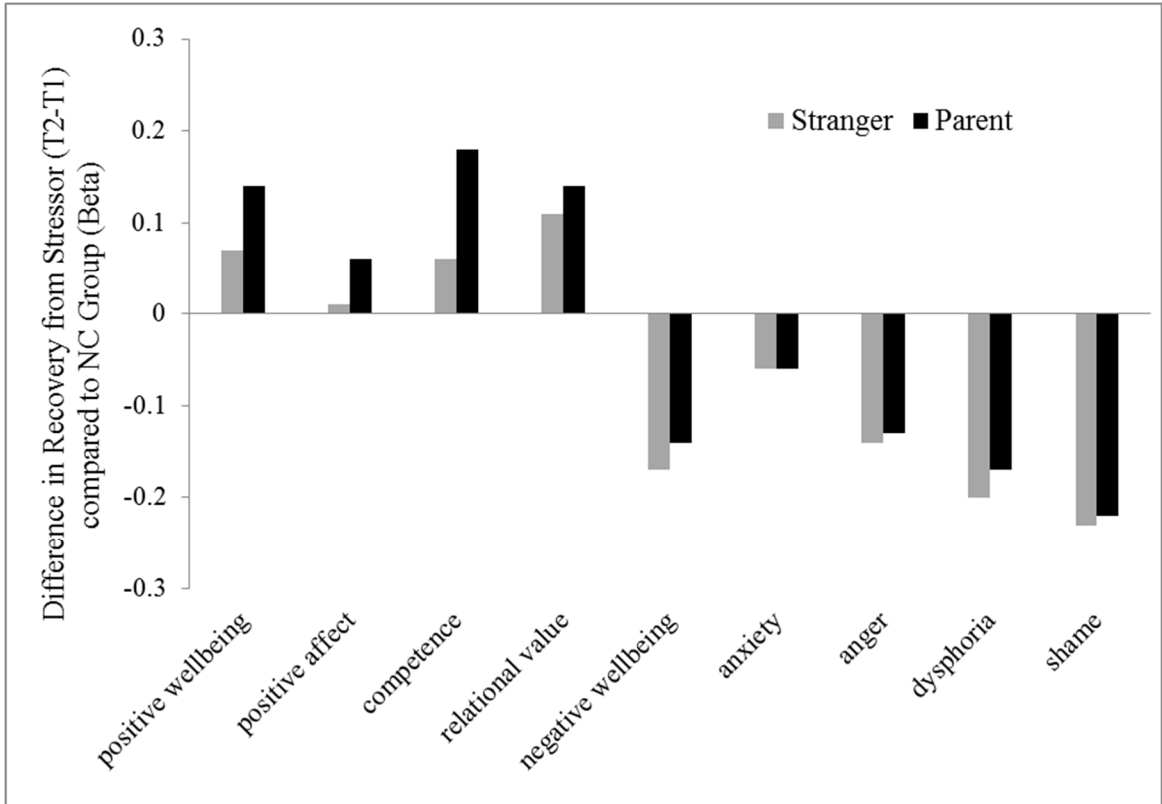


Figure 4: Standardized differences in recovery by manipulation group after the social exclusion stressor in Study 2.

Note: Figure 4 shows the standardized regression coefficients (β) for the ROS (stranger) and ROP (parent) groups compared to the NC (no contact) groups showing the change in wellbeing from the social exclusion task (T2) to the manipulation assessment (T3) for positive and negative dimensions of wellbeing.

3.2.4 Aim 5: Perceived Parental Relationship Quality

Next, I tested whether the strength of the students' perceived parental support predicted their response, or 'reactivity', to the stressor task. Controlling for baseline self-esteem (T1), maternal relationship quality ($b = 0.23, p = 0.01, \beta = 0.21$) predicted a higher self-esteem after the exclusion task (T2). In other words, students with stronger maternal relationships did not have as sharp of a decline in self-esteem after being rejected in the social exclusion task. This reduced reactivity, or association with self-esteem, was not found for paternal relationship quality ($b = 0.15, p = 0.15, \beta = 0.12$) or general perceived network support ($b = 0.01, p = 0.49, \beta = 0.06$).

3.3 Study 2 Discussion

There are three main findings from this study. First, students assigned to send a text message to either a parent or stranger had better wellbeing and recovered faster from an experimentally induced social stressor (Cyberball) than students without virtual contact with others. Students assigned to send a text message to a parent reported higher wellbeing than students assigned to play a solitary computer game. Specifically, students who sent a text message to another individual (parent or stranger) demonstrated faster recovery in well-being, especially in terms of their self-esteem, competence, and feelings of shame, compared to the no contact control group. This result is consistent with Gross' (2009) finding that virtual communication (through Instant Messaging) with a stranger encourages faster recovery after a stressor compared to solitary computer play. This study further showed that recovery can also be expedited with only a short unrelated text message, which suggests that students may be highly attuned to efforts to 'reconnect' with other or regain a sense of belonging (Baumeister & Leary, 1995). Future research is required rule out the alternative explanation that the act of just engaging with a phone and/or simply writing about an event is sufficient to generate these types of 'bounce

back' effects. In adults, simply priming written thoughts of a supportive person dampens cardiovascular and affective responses to an experimental stressor compared to those without a supportive prime (Gramer & Reibauer, 2010). However, in experimental research, Reis et al. (2010) found that students assigned to simply write about a positive event had lower wellbeing compared to students who shared the positive event through a written message to another person, which suggests that the process of interacting with another person may be important for students' evaluations and responses to events.

Second, there were no differences between the stranger and parent messaging conditions with respect to the students' response or recovery from the social exclusion task. This indicates that any contact may be beneficial for wellbeing, even though theory posits that contact with those with closer relationships should be more helpful (Burlinson, 2009). Further tests are needed to see under what conditions parents may offer any unique benefits. It may be that two-way conversations, rather than simply reaching out, are necessary to fully benefit from engaging with a close individual compared to a stranger or acquaintance. It is possible that parental enacted support may be more effective than stranger support if future studies use more severe or intense stressors (e.g., Trier social stress test or placing hand in an ice bucket) than the Cyberball social exclusion task, which had consistent and significant, but relatively minor effects on self-esteem and wellbeing. Furthermore, it is also possible that a 'research assistant' is not a distant enough stranger to see robust differences in recovery due to virtual communication. A check of the contact logs of the researcher's phone that students sent text messages to indicated that all participants assigned to the stranger condition did indeed send a text message. However, only about half of the participants indicated they sent a text to a 'stranger' at the end of the study, whereas the others indicated that they'd sent a message to a 'friend'. Perhaps, students identified

with the undergraduate researcher conducting the study as a fellow student, which led to greater perceived closeness. As research on belonging would suggest (Maner, DeWall, Schaller, & Baumeister, 2007), participants are highly motivated to try to affiliate others, including through interactions with strangers, after social exclusion.

Third, maternal relationship quality was associated with a smaller decline in self-esteem after an experimentally-induced social exclusion task consistent with previous research related to relationships and responses to stressors (e.g., DeLongis et al., 1988; Lucas-Thompson, 2013). This finding suggests that students' perceived support, especially in terms of maternal support, may help regulate their 'reactivity' to stressors. As the sample was a select group of students from an elite university with strong parent-child relationship quality overall, future research is needed to test these associations in more diverse populations. Because of the small sample size, sufficient subgroup analyses could not be performed to test for differences in the recovery by parental relationship within the parental contact group (i.e., if students with stronger relationships benefited 'more' from sending a text to their parents) as has been suggested by the enacted support literature. Future studies are needed with larger, more diverse samples of students.

The findings from this study, consistent with Study 1, suggest that virtual communication can buffer the effects of an experimental social exclusion stressor. However, there were some discrepant findings between Studies 1 and 2 and limitations of Study 2 that need to be addressed by future studies. Whereas Study 1 found that texting with parents uniquely moderated the associations between daily stressors and wellbeing, Study 2 found buffering effects for both sending a text to a parent and a stranger. Study 1 did not find a moderation effect of combined parental relationship quality on students' reactions to stressors, but Study 2 showed that students with maternal relationship quality also had reduced reactions to stressors in terms of their

wellbeing. Finally, although Cyberball is a well-validated social exclusion stressor and a manipulation check performed in Study 2 showed a decline in participants' self-esteem, participants did not report declines in all wellbeing measures from baseline (T2 controlling for T1). Specifically, after the experimental stressor, students did not report a significant increase in feelings of anxiety, whereas anxiety was strongly coupled with same-day reported stressors in Study 1. The lack of induced anxiety in participants may reflect a failure of the Cyberball manipulation, which is unlikely given the declines in other wellbeing measures, or reduced effects compared to daily stressors as a result of the artificial setting of the experiment task. Thus, Study 3 uses another daily approach to further test whether daily virtual communication with parents may buffer the daily associations between stressors, specifically social stressors, and wellbeing. Furthermore, Study 3 targets the moderating ability of students' virtual conversations with parents versus peers, including acquaintances, and tests whether maternal or paternal relationship quality are differentially associated with students' reactions to and recovery from stressors.

4. Study 3: Virtual Conversations with Parents and Maternal Relationship Quality Moderate the Associations between Daily Stressors and Well-being

Study 3 uses a 10-day Ecological Momentary Assessment design to further advance the findings from Study 1 and 2 in four ways. First, this study aimed to more fully describe daily parental communication in first year college students by examining the amount, types, and specific features of virtual and in-person parental daily communication. Specifically, I assessed features of the daily communication that may be related to perceptions of message responsiveness, including the valence of the communication (i.e., positivity and helpfulness), the primary initiator of the contact (i.e., whom initiated the contact), and the general topics of the conversations (i.e., reported topics of conversations). Second, this study was designed to test whether the finding from Study 1, in which texting with a parent moderated the associations between daily stressors and wellbeing, replicated with a sample of only first year students. This study also extends these analyses by more precisely distinguishing between different forms of daily stressors, including social, academic, and time management, and wellbeing outcomes, including negative and positive affect, self-esteem, and objectively measured sleep duration. The inclusion of an objectively measured outcome is important given concerns about the role of shared method variance in prior EMA studies, including Study 1, where the individual typically reports on both perceived stressors and daily outcomes. Third, this study aimed to help resolve the seemingly divergent findings from Study 1 and 2 regarding the uniqueness of parents (versus other contacts) to help in recovery from stressors. Similar to Study 1, I compare daily virtual communication with parent to daily virtual contact with other individuals and specifically target virtual communications with other undergraduate peers (friends, significant others, roommates, acquaintances) on days with social stressors (similar to Study 2). Fourth, this study examined how

perceived social support may influence students daily responses to daily stressor (as tested with combined relationship quality in Study 1) by testing whether the quality of maternal and paternal relationship quality or perceived overall network support separately (as tested in Study 2) may differentially moderate the daily associations between social stressors and wellbeing outcomes. In other words, I tested whether students with higher or lower quality relationships were more reactive to daily stressors in terms of their daily wellbeing.

4.1 Study 3 Methods

4.1.1 Participants

Students were recruited from Study 2 (see S2 Participants section for a description of the sample) in which 106 students agreed to participate. Students completed the EMA surveys for 10 days for during the 2016-2017 academic year. All participants were compensated with a small monetary payment or research credit. Five participants were excluded from the study, one did not complete any of the daily surveys and four were not in their first year of college, resulting in a final sample of 101 first year undergraduate students (70% women; 11% first generation; 51% White, 25% Asian or Asian American, 14% Latino(a) or Hispanic, 8% Black or African American, and 2% Other).

4.1.2 Procedure

Students were recruited and consented to participate in this 10-day EMA study in conjunction with Study 2 and told that the studies focus on first year students' everyday online and offline experiences and activities. As previously discussed in Study 2 (see S2 Procedure Section), all students completed a social exclusion task, manipulation of virtual coping strategy, and online baseline questionnaire, which included measures of their maternal and paternal relationship quality, perceived network support, and demographic information. When students

finished Study 2, they downloaded a survey application (i.e., MetricWire) onto their own personal mobile phones so they could complete the daily surveys, which were scheduled to be completed about every 4 hours per day of the EMA period. Participants also were given a wearable wristband (i.e., Jawbone), with an accompanying application (i.e., UP) on their phone. This wristband passively monitored their steps and their sleep duration each day. Participants returned devices at the end of the study 10 days later. Each day, students completed 5 short 2-3 minute surveys every 4 hours- one in the morning (7am), three during the daytime (11am, 3pm, and 7pm), and one in the evening (11pm). In the morning students reported their current affect and wellbeing and the previous nights' sleep duration and quality. In each of the daytime and evening survey signals, students reported on experiences of stressors, whether they'd conversed virtually with their parents (i.e., texted with or called their parents), the amount and nature of parental communication (i.e., number of messages, initiation, helpfulness), and their current wellbeing (i.e., self-esteem, positive and negative affect) since the previous survey (see **Appendix C** for full list of items at each assessment signal). **Table 8** lists the relevant items that were collected at each survey signal for each of the main types of measures (stressors, parental communication and wellbeing) and shows the items that were analogous with Study 1 measures. The total completion rate of the daily surveys from this sample was about 85% (~1000 person days, ~4,000 surveys).

Table 8: EMA measures for Study 3.

The EMA items for Study 3 across each of the daily survey signals (i.e., in the last 4 hours) for the types of reported stressors, the description of parental communication, other types of virtual communication, negative and positive affect, and wellbeing. Bolded items indicate items that are comparable to Study 1.

	7am	11am	3pm	7pm	11pm
Stressors (Y/N)	-	social, time management, academic	social, academic, time management	social, academic, time management	social, academic, time management
Parental Communication	-	type, amount, valence, topic, initiation	type, amount, valence, topic, initiation	type, amount, valence, topic, initiation	type, amount, valence, topic, initiation
Other texting partners (Y/N)	-	acquaintance, romantic, roommate, sibling, friend	acquaintance, romantic, roommate, sibling, friend	acquaintance, romantic, roommate, sibling, friend	acquaintance, romantic, roommate, sibling, friend
Negative affect (1-5 rating)	embarrassed, stressed, anxious, angry, sad, irritable	embarrassed, stressed, anxious, angry, sad, irritable	embarrassed, stressed, anxious, angry, sad, irritable	embarrassed, stressed, anxious, angry, sad, irritable	embarrassed, stressed, anxious, angry, sad, irritable
Positive affect (1-5 rating)	independent, confident, valued, happy, calm, excited	independent, confident, valued, happy, calm, excited	independent, confident, valued, happy, calm, excited	independent, confident, valued, happy, calm, excited	independent, confident, valued, happy, calm, excited
Wellbeing	self-esteem, sleep	self-esteem	self-esteem	self-esteem	self-esteem

4.2.3 Measures

Perceived Parental Relationship Quality and Network Support were measured at the baseline assessment are described in more detail in Study 2 (see S2 Measures or **Appendix B**). These measures assessed students' relationship quality with their mothers and fathers and the perceived support availability of their entire social network

Daily Stressors were assessed during each of the daytime and evening surveys. Students reported the hassles they'd experienced in the last 4 hours (adapted from the Hassles and Uplifts Scale; Kanner et al, 1981) from a list of 5 items (e.g., I didn't do well in school; I ran into an unexpected problem). To create daily measures, the total number of hassles were summed across the day and then dichotomized into 0 (day without stressor) or 1 (day with stressor). On average, students reported about 2 hassles per day ($M = 2.26$, $SD = 1.41$) and one or more stressors on 74% of study days ($M = 0.74$, $SD = 0.21$). Markers for each of the types of stressor days were also created, including social (i.e., conflict with friend or family: $M = 0.30$, $SD = 0.36$), academic (i.e., poor performance: $M = 0.34$, $SD = 0.37$), and time management (lateness, unexpected problems: $M = 0.62$, $SD = 0.29$) stressor days. The ICC was calculated for the presence of one or more daily stressors (0.15), and separately for reported social (0.39), academic (0.40), and time management (0.25) stressors. This shows, for example, that 39% of the variance in daily social stressors was between participants, whereas the remaining 61% of the variance was within participants over time.

Daily Presence of Virtual and In-person Parent-Child Communications were assessed in two ways at each daytime survey and in the evening survey. First, at each survey, students indicated with whom they'd interacted online and whom they'd spent time with in person in the last four hours (i.e., check all the people that you called/texted with; check all the people you

hung out with in person), including their mom, dad, or other parent/guardian. Binary markers for virtual and in-person communication with parents were created to match those created in Study 1. Days were split into 0 (i.e., days without virtual/in-person parent contact) and 1 (i.e., days with virtual/in-person parent contact). Students spent time in-person with a parent on average of 15% of study days ($M = 0.15$, $SD = 0.23$) and called or texted with their parents on 60% of study days ($M = 0.60$, $SD = 0.26$). Virtual communication days were further separated into contact with mothers and fathers. Specifically, students texted/called their mothers on average of about 47% of study days ($M = 0.47$, $SD = 0.28$) and with their fathers on 28% of study days ($M = 0.28$, $SD = 0.25$). Second, the amount of daily virtual contact was assessed with 2 items, including phone conversations (i.e., How many times did you talk (i.e., call, video chat, Facetime) with your parents?) and sending texts (i.e., How many texts did you send your parents?). On average, students spoke on their phones with their parents about once per day ($M = 0.75$, $SD = 1.43$) and sent them about five text messages per day ($M = 5.30$, $SD = 5.86$). ICCs were calculated for daily communication with parents, including daily virtual conversations (0.20) and in-person conversations (0.34), separately for daily virtual conversations with mothers (0.23) and fathers (0.23), and for the amount of virtual parental communication through the number of conversations (0.58) and text messages sent (0.27).

Features of Daily Parent-Child Communication were measured during the daytime and evening surveys. When students reported any form of virtual or in-person contact with their parents, they also reported on three features of those interactions. First, students rated the positivity and helpfulness of the conversations with their parents (i.e., How positive/negative was the conversation(s)? How helpful was the conversation(s) to you?) on a scale from 1 (not at all) to 10 (extremely). Composites were then created by averaging across each day with any parental

contact. On days with parental contact, participants rated these daily communications as positive ($M = 7.83$, $SD = 1.79$) and helpful ($M = 7.09$, $SD = 2.10$). Second, students chose the primary initiator of the interactions (i.e., Who initiated communication? 1- mostly my parent, 2- mostly me, 3- both equally, 4- someone else, 5- don't know). When students had contact with their parents, the day was marked by the primary initiator of conversations across that day and were coded as parent initiated (1), child initiated (2), 'equal' parent and child initiated (3), or other (4). Days with multiple interactions were coded based on the most frequent initiator of contact (i.e., days with a greater proportion of parent to child initiated responses were coded as 1) or as equal initiation (i.e., days with an equal ratio of parent to child initiated responses). Across all days in which students communicated with their parents in some medium, parents initiated contact 29% of days ($n = 194$ days), students initiated contact on 34% of days ($n = 225$ days), and equal initiation on 29% of days ($n = 192$ days). Third, on days when students had contact with their parents, they indicated the general topics of their virtual and in-person interactions (i.e., What did you discuss with your parent? catching up, family, friends/social events, academics, finances, something good, something bad, other). Across all study days with any form of parental contact, students most frequently reported 'catching up' with their parent (57%; $n = 378$ days), followed by discussions about family or friends (44%; $n = 290$ days), academics (36%; $n = 234$ days), a good event (21%; $n = 136$ days), finances (14%; $n = 90$ days), and a bad event (14%; $n = 89$ days).

Other Virtual Communication Partners and Patterns were assessed at each daytime survey and in the evening survey. As described above, students listed with whom they'd text messaged in the last 4 hours (i.e., check all the people that you texted with), including their significant other, close friends, roommates and acquaintances. As with parents, binary daily markers were created for texting/calling with different peers, including how often students had a

virtual conversation with a sibling ($M = 0.24$, $SD = 0.30$), a friend ($M = 0.88$, $SD = 0.20$), an acquaintance ($M = 0.17$, $SD = 0.21$), a roommate ($M = 0.29$, $SD = 0.33$), or a romantic partner ($M = 0.26$, $SD = 0.39$). ICCs were calculated for daily virtual conversations with a sibling (0.40), friend (0.28), acquaintance (0.23), roommate (0.47), and romantic partner (0.74).

Dimensions of Daily Wellbeing for each day were assessed in four ways. First, negative dimensions of affect and wellbeing were assessed at each survey. Students rated how they feel on a scale from 1 (not at all) to 5 (extremely) on six adjectives including ‘anxious’, ‘stressed’, ‘angry’, ‘irritated’, ‘sad’, and ‘embarrassed’ (adapted from PANAS; Watson, 1988; Gross 2009; Schimmack, 2003). Second, positive dimensions of affect and wellbeing were assessed at each survey with ratings of six adjectives including ‘happy’, ‘excited’, ‘calm’, ‘valued’, ‘independent’, and ‘confident’. Third, participants reported on their state self-esteem (i.e., how do you feel about yourself right now? 1- really bad to 5- really good) at each survey signal. For these three types of dimensions, individual items and total composites were created by averaging ratings across the entire day. Based on these 5-point scales, students, on average, reported low daily negative affect ($M = 1.96$, $SD = 0.57$), moderate daily positive affect ($M = 3.42$, $SD = 0.66$) and moderate self-esteem ($M = 3.72$, $SD = 0.56$). Fourth, sleep duration was measured each morning both with a daily self-reported item (i.e., How many hours did you sleep last night?) and objectively with a wearable wristband that the student wore each night. Students reported an average of 6 hours of sleep per night ($M = 6.43$, $SD = 1.14$) and the devices also recorded similar sleep averages ($M = 6.30$, $SD = 1.15$). As the two measures of sleep duration were fairly well correlated ($r = 0.56$, $p < 0.001$) across days and in order to limit the number of analyses, only analyses using days with objectively collected sleep duration measure are reported here ($n = 728$). The ICCs were calculated for daily negative affect (0.67), positive affect (0.70), self-esteem (0.59) and objective

sleep duration (0.14), which showed that 67% of the variance in daily negative affect was between participants, whereas the remaining 33% of the variance was within participants over time.

4.1.4 Analytic Strategy

The analytic strategy for Study 3 closely paralleled the analyses in Study 1. For all the between-individual, ‘person-level’ associations, a person mean was calculated for each individual to create an average measure across the 10-day EMA and used in simple correlation or ordinary least squares regression analyses. For all within-individual tests, multilevel regression models were used to account for the nesting of days within participants and to estimate within-person associations between stressors, texting patterns, and affect. The daily models controlled for between-person level variance by person mean centering the daily variables (e.g., daily stressors centered by the proportion of days with stressors). Three different multi-level model equations were used for each type of analyses, direct within-individual associations (Equation 1), level 1 interactions (Equation 2), and cross-level interactions (Equation 3) and are described fully in Study 1 (Section 2.1.4 Analytic Strategy for Study 1)

First, multilevel models were used to test the same-day within-person associations between stressors and negative affect (Equation 1). Analyses were repeated for all direct associations between the predictors in the models, including all the specific types of daily stressors and virtual communication with parents, and the four daily wellbeing outcomes, including negative and positive affect, self-esteem, and objectively assessed sleep duration. Second, multilevel model tested the moderation by virtual communication with a parent (a level-1 moderator) of the same-day association between daily stressors and negative affect (Equation 2).

This modeling strategy was used for all four measures of daily wellbeing and all forms of virtual communication patterns and partners. Third, multilevel models tested for moderation by perceived parental relationship quality (a level-2 moderator) of the same-day associations between daily stressors and negative affect (Equation 3). These cross-level interaction models were used to test whether the measures of perceived support (i.e., maternal, paternal and perceived network support) moderated the same-day associations between the presence of social stressors and all four measures of daily wellbeing.

As in Study 1, separate follow-up multilevel models were used to explore the nature of all the interactions; analyzing the moderated associations between stressors and affect separately by days with and without parental virtual communication and separately using median splits of parental relationship quality.

4.2 Study 3 Results

4.2.1 Compliance

Across the sample and all signals, there was an overall completion rate of 84.4% ($N = 4,263$ total completed signals out of a possible 5,050). The completion rate was calculated separately for each survey signal. The completion rate was the lowest for the 7am signal, 73.2% ($N = 739$ out of a possible 1010 occasions). The completion rate was 86.4% ($N = 873$) at the 11am signal, 88.0% ($N = 889$) at 3pm, and 85.1% ($N = 860$) at 7pm. The completion rate was the highest for the evening 11pm signals and reached nearly 90% compliance, (89.2%; $N = 902$ out of a possible 1010 occasions). ‘Compliance’ for the wearable devices was calculated based on the number of days with sleep duration data compared to total possible days (63.3%; $N = 639$ out of 1010 possible days) and the number of study days for participants with usable data ($n = 92$),

meaning students who wore the device for at least 2 days without device problems (69.5%; N = 639 out of 920 possible days)

4.2.2 Aim 1: Descriptions of Daily Parental Virtual and In-Person Communication

To describe daily communication between students and their parents, I compared characteristics of both virtual and in-person communications across the study days where students reported contact with their parents. Students reported any form of contact with their parents (conversed online or in person, sent a single message, talked with their parent in any medium) on an average of 71% of days ($M = 0.71$, $SD = 0.25$), of which most of the conversations occurred via mobile technologies (60% of study days) versus in-person (15% of study days). **Table 9** shows the person-level means (split by gender) and ranges for combined parental relationship quality and the proportion of days with virtual and in-person communication, proportion of days with stressors, and average wellbeing measures from across the EMA period.

Table 9: Person-level means and standard deviations by gender for Study 3.

Means, standard deviations, and ranges for person-level proportions of days with stressors, parent in-person and virtual communication, and person-level averages for wellbeing (negative and positive affect, self-esteem, and sleep) and parental relationship quality as split by gender.

	Total <i>M (SD)</i> (<i>N</i> =101)	Males <i>M (SD)</i> (<i>n</i> =30)	Females <i>M (SD)</i> (<i>n</i> =71)	Range
Virtual conversation with parent days (%)	0.60 (0.26)	0.50 (0.24) _a	0.64 (0.26) _b	0.08 – 1
In-person conversation with parent days (%)	0.15 (0.24)	0.18 (0.25)	0.14 (0.23)	0 – 1
Stressor days (%)	0.74 (0.21)	0.70 (0.24)	0.76 (0.20)	0.18 – 1
Average negative affect	1.96 (0.56)	1.97 (0.49)	1.95 (0.59)	1.05 – 3.37
Average positive affect	3.42 (0.68)	3.48 (0.65)	3.39 (0.69)	1.25 – 4.98
Average self-esteem	3.73 (0.56)	3.78 (0.59)	3.72 (0.55)	2.42 – 5
Average sleep duration (objective hrs)	6.28 (1.14)	6.00 (1.21)	6.41 (1.10)	2.84 – 8.63
Parent- child relationship quality (both)	3.64 (0.62)	3.57 (0.62)	3.67 (0.62)	1.86 – 4.75

Note: *a* and *b* refer to significant *t*-test differences by group at the $p < 0.05$ level.

Table 10 compares days with parental communication, where contact consisted of virtual only conversations, in person only conversations, both virtual and in-person conversations, and

other minor contact (sent a text but not reported as a virtual conversation), on three different types of communication features. First, students reported on the positivity and helpfulness of the day's contact with their parents. Comparing study days with virtual versus in-person parental conversations, virtual conversation days were rated as positive ($M = 7.98$, $SD = 1.75$) and as helpful ($M = 7.20$, $SD = 2.07$) as days with in-person conversations ($M = 8.14$, $SD = 1.64$; $M = 7.22$, $SD = 2.34$).

Second, the relative frequency of communication initiator (parent, student, both equally, or other) were calculated for each type of contact days. Examining the relative proportions of parent to child initiation days, for both virtual and in-person parental communication days, there was fairly even distribution of who initiated contact. When students reported virtual conversations with their parents, parents initiated contact on 29% of days ($n = 138$ days), students initiated contact on 39% of days ($n = 185$ days), whereas when students had in-person conversations with their parents they reported more equal initiation. When students reported virtual conversations with their parents, students most frequently reported catching up with their parent on 62% of days ($n = 289$ days), discussing family or friends on 43% ($n = 201$), academics on 40% ($n = 189$), finances on 14% ($n = 67$), something good on 21% ($n = 96$), and something bad on 13% ($n = 62$) of days. A similar pattern for the topics discussed parental in-person conversations was found. The main descriptive finding that can be drawn from this table is that there were almost no significant differences in the features of virtual and in-person contact days, except that students initiated contact on a greater proportion of virtual conversation days compared to in-person conversation days.

Table 10: Day means and standard deviations by type of parental communication in Study 3.

Means and standard deviations comparing the three features (valence, initiation, topic of communication) of daily parental communication across the four types of days with parental communication: virtual conversations only, in-person conversations only, both virtual and in-person conversations, and other minor parental contact.

	Virtual Conversation (<i>n</i> =468) <i>M</i> (<i>SD</i>)	In Person Conversation (<i>n</i> =53) <i>M</i> (<i>SD</i>)	Both Conversations (<i>n</i> =80) <i>M</i> (<i>SD</i>)	Minor Contact (sent text only) (<i>n</i> =58) <i>M</i> (<i>SD</i>)
Positivity (0-10)	7.98 (1.75) _a	8.14 (1.64) _{ab}	7.25 (1.86) _{bc}	7.01 (1.85) _c
Helpfulness (0-10)	7.20 (2.07) _a	7.22 (2.34) _{ab}	6.83 (2.02) _{ab}	6.30 (2.24) _b
Parent initiation (%)	0.29 (0.45) _{ab}	0.13 (0.34) _a	0.32 (0.47) _{ab}	0.38 (0.49) _b
Child initiation (%)	0.39 (0.49) _a	0.13 (0.34) _b	0.25 (0.43) _{ab}	0.22 (0.42) _b
Topic: Catching up (%)	0.62 (0.49) _a	0.45 (0.50) _{ab}	0.56 (0.50) _{ab}	0.34 (0.48) _b
Topic: People or social activities (%)	0.43 (0.50) _a	0.45 (0.50) _{abc}	0.64 (0.48) _b	0.24 (0.43) _c
Topic: Academics (%)	0.40 (0.49) _a	0.26 (0.45) _{ab}	0.33 (0.47) _a	0.09 (0.28) _b
Topic: Finances (%)	0.14 (0.35)	0.11 (0.32)	0.16 (0.37)	0.07 (0.26)
Topic: Something good (%)	0.21 (0.40)	0.21 (0.41)	0.24 (0.43)	0.17 (0.38)
Topic: Something bad (%)	0.13 (0.34) _{ab}	0.11 (0.32) _{ab}	0.23 (0.42) _a	0.05 (0.26) _b

Note: *a*, *b*, *c* refer to Scheffe post hoc differences at the $p < 0.05$ level.

4.2.3 Aim 2: Person-Level Correlations between Daily Parental Communication and Well-being

Table 11 shows the correlations between the person-level averages across the EMA period, including the proportions of days with virtual or in-person conversations with a parent, proportion of days with stressors, and average wellbeing dimensions (positive affect, negative affect, self-esteem, and objective sleep duration) and baseline parental relationship quality (combined for both parents). This table shows students who conversed more frequently with their parents via mobile technologies also slept more hours per night ($r = 0.23, p = 0.02$) and had higher relationship quality with their parents ($r = 0.41, p < 0.001$). In other words, students who reported texting/calling with their parents every day (100% of days) were expected to sleep 1.04 hours longer per night, on average, compared to students who never communicated virtually with their parents. Students who reported a greater proportion of stressor days also had higher average negative affect ($r = 0.47, p < 0.001$), lower average positive affect ($r = -0.23, p = 0.02$), lower self-esteem ($r = -0.23, p = 0.02$) and marginally lower relationship quality with their parents ($r = -0.18, p = 0.06$). In addition, students with higher parental relationship quality also reported lower average negative affect ($r = -0.31, p < 0.001$), higher positive affect ($r = 0.36, p < 0.001$) and self-esteem ($r = 0.28, p = 0.004$), and slept slightly more hours per night ($r = 0.19, p = 0.06$). There were no significant correlations between the frequency of in-person contact and any of the wellbeing measures.

Table 11: Correlations between person-level measures in Study 3.

Correlations between person-level proportions of days with reported stressors and virtual parental communication, and person-level averages for the four measures of daily wellbeing and perceived parental relationship quality.

	1	2	3	4	5	6	7
1. Virtual conversation with parent days (%)	1						
2. Stressor days (%)	0.10	1					
3. Average daily negative affect	0.002	0.24*	1				
4. Average daily positive affect	0.07	-0.23*	-0.26*	1			
5. Average daily self esteem	0.001	-0.23*	-0.34**	0.77***	1		
6. Average sleep duration (objective hrs)	0.23*	-0.11	-0.14	0.07	0.08	1	
7. Parent-child relationship quality (both)	0.40***	-0.18†	-0.31**	0.36***	0.28**	0.19†	1

Note: † $p < .10$ * $p < .05$, ** $p < .01$, *** $p < .001$

4.2.4 Aims 3 and 4: Daily Within-person Associations

To test the within-individual associations between daily communication and wellbeing, **Table 12** shows the results for multilevel models examining the coupling of daily stressors, daily virtual and in-person conversations with a parent, and measures of daily wellbeing. This table illustrates three main findings. First, reported stressors were associated with lower same-day wellbeing, including higher negative affect ($b = 0.22, p < 0.001$), lower positive affect ($b = -0.18, p < 0.001$), and lower self-esteem ($b = 0.28, p < 0.001$) at the daily level. Stressors were not associated with the amount of objectively measured sleep the next morning ($b = -0.10, p = 0.48$). Second, neither virtual nor in-person conversations with parents were not significantly associated with any measure of same-day well-being ($ps > 0.05$), except that on days with in-person conversations, students slept for longer duration that night ($b = -0.68, p = 0.008$). Third, the interactions between stressors and virtual conversations with parents were not significantly associated with same-day positive affect ($b = 0.04, p = 0.87$), or self-esteem ($b = -0.04, p = 0.91$), but there were associations at the $p = 0.06$ level with lower same-day negative affect ($b = -0.14, p = 0.06$) and with longer objective sleep duration ($b = 1.02, p = 0.03$). In other words, on days in which students reported a stressor, if they also had a virtual conversation with a parent, they slept for more hours that night than on stressor days when students did not converse virtually with a parent. There were no significant interactions between stressors, in-person parental communications, and daily wellbeing.

Table 12: Daily associations for virtual and in-person parental conversations and wellbeing in Study 3

Multilevel coefficients and 95% confidence intervals showing the daily associations and interactions between the presence of stressors, virtual conversation with parents (VCP) or in-person conversations with parents (ICP), and the four measures of same or next day wellbeing.

Same-Day Wellbeing and Next-Day Sleep				
	Negative affect <i>b</i> [95% <i>CI</i>]	Positive affect <i>b</i> [95% <i>CI</i>]	Self-esteem <i>b</i> [95% <i>CI</i>]	Sleep duration (objective hrs) <i>b</i> [95% <i>CI</i>]
Stressor	0.22*** [0.16, 0.29]	-0.18*** [-0.24, -0.11]	-0.28*** [-0.35, -0.21]	-0.03 [-0.37, 0.30]
Virtual conversation with parent	0.02 [-0.04, 0.07]	-0.01 [-0.08, 0.05]	-0.04 [-0.11, 0.03]	-0.08 [-0.39, 0.24]
Interaction (Stressor*VCP)	-0.14† [-0.29, 0.01]	0.04 [-0.12, 0.21]	-0.04 [-0.21, 0.14]	1.02* [0.22, 1.82]
In person conversation with parent	-0.03 [-0.12, 0.06]	0.02 [-0.08, 0.12]	0.06 [-0.04, 0.17]	0.68** [-0.39, 0.24]
Interaction (Stressor*ICP)	-0.07 [-0.29, 0.16]	0.05 [-0.20, 0.31]	0.10 [-0.17, 0.36]	0.05 [1.32, 1.41]

Note: † $p < .10$ * $p < .05$, ** $p < .01$, *** $p < .001$

Daily analyses were conducted separately for specific types of stressors. **Table 13** shows the tests of the daily associations between the different types of stressors (i.e., social, academic, and time management) and daily wellbeing, along with the daily moderation for each type of stressor by virtual conversations with a parent. This table shows that all types of stressors were significantly associated with same-day negative and positive affect and self-esteem, but not sleep

duration. In addition, virtual parent conversations moderated the daily associations between social ($b = 0.36, p = 0.02$), academic ($b = -0.37, p = 0.03$), but not time management ($b = -0.11, p = 0.25$) stressors and daily negative affect. The main take home point of this table is that social and academic stressors were more strongly coupled than time management stressors with daily wellbeing, and were more frequently moderated by daily virtual conversations with parents.

Table 13: Daily associations by type of stressor and interactions with virtual parental communication in Study 3

Multilevel coefficients and 95% confidence intervals showing the direct associations (top half) between the presence of different types of daily stressors and the four measures of same or next day wellbeing and the daily interactive associations (bottom half) between these different stressors and virtual conversation with parents (VCP) for wellbeing.

	Same-Day Wellbeing and Next-Day Sleep			
	Negative affect <i>b</i> [95% <i>CI</i>]	Positive affect <i>b</i> [95% <i>CI</i>]	Self-esteem <i>b</i> [95% <i>CI</i>]	Sleep duration (objective hrs) <i>b</i> [95% <i>CI</i>]
Social stressor	0.35*** [0.24, 0.47]	-0.26*** [-0.39, -0.17]	-0.43*** [-0.56, -0.30]	0.08 [-0.61, 0.76]
Academic stressor	0.39*** [0.27, 0.51]	-0.28*** [-0.40, -0.15]	-0.41*** [-0.53, -0.28]	-0.48 [-1.10, 0.13]
Time management stressor	0.22*** [0.14, 0.30]	-0.13** [-0.22, -0.05]	-0.21*** [-0.29, -0.12]	-0.35† [-0.74, 0.05]
Social stressor*VCP	-0.36* [-0.63, -0.10]	0.28† [-0.03, 0.60]	0.15 [-0.16, 0.46]	1.05 [-0.52, 2.62]
Academic stressor*VCP	-0.37* [-0.67, -0.08]	0.10 [-0.21, 0.41]	-0.007 [-0.32, 0.31]	0.65 [-0.79, 2.10]
Time management stressor*VCP	-0.11 [-0.30, 0.08]	0.11 [-0.09, 0.31]	0.006 [-0.20, 0.22]	0.97* [0.06, 1.88]

Note: † $p < .10$ * $p < .05$, ** $p < .01$, *** $p < .001$

4.2.5 Aim 6: Moderation by other Texting Partners

To test the specificity of the moderating effect of parent-child virtual communication, similar multilevel analyses were conducted for other virtual communication patterns, including the amount of phone conversations and number of texts sent to a parent, and other virtual communication partners, including texting/calling with acquaintances, roommates, friends, sibling, and significant others. First, there were no consistent direct associations between texting patterns or partners and same-day wellbeing ($ps < 0.05$). Second, only virtual conversations with parents (specifically fathers) and significant others moderated the associations between stressors and wellbeing. These moderation analyses focused on daily reports of social stressors, as they had the strongest direct associations with same-day wellbeing and paralleled tests from Study 2. The model results for the interactions between texting with different individuals and social stressors on daily wellbeing are presented in **Table 14**. This table shows that none of the other texting patterns significantly moderated the association between stressors and wellbeing ($ps > 0.05$), except for texting with a significant other. Here, as with texting with a parent, on days in which students experienced a social stressor, if they also texted with a significant other, they reported lower negative affect than on stressor days where there was no parent virtual contact reported.

Table 14: Daily associations as moderated by other texting patterns in Study 3.

Multilevel coefficients and 95% confidence intervals showing the daily interactive associations between daily social stressors and virtual communication (VC) patterns and partners and the four measures of same or next day wellbeing.

	Same-Day Wellbeing and Next-Day Sleep			
	Negative affect <i>b</i> [95% <i>CI</i>]	Positive affect <i>b</i> [95% <i>CI</i>]	Self-esteem <i>b</i> [95% <i>CI</i>]	Sleep duration (objective hrs) <i>b</i> [95% <i>CI</i>]
Social stressor* Number of parent conversations	-0.10† [-0.22, 0.003]	0.11 [-0.02, 0.25]	-0.002 [-0.14, 0.13]	0.35 [-0.44, 1.15]
Social stressor* Number of texts sent to parents	-0.02 [-0.04, 0.01]	0.02 [-0.01, 0.05]	0.008 [-0.02, 0.04]	0.08 [-0.08, 0.24]
Social stressor* VC with mother	-0.22 [-0.50, 0.06]	0.26 [-0.06, 0.59]	0.15 [-0.17, 0.48]	1.16 [-0.47, 2.80]
Social stressor* VC with father	-0.45* [-0.86, -0.03]	0.18 [-0.31, 0.67]	0.09 [-0.39, 0.57]	0.54 [-2.00, 3.08]
Social stressor* VC with sibling	-0.08 [-0.50, 0.34]	0.22 [-0.27, 0.71]	0.01 [-0.48, 0.50]	-0.02 [-2.31, 2.27]
Social stressor* VC with friend	-0.06 [-0.54, 0.42]	-0.22 [-0.78, 0.34]	0.16 [-0.38, 0.71]	0.82 [-1.77, 3.40]
Social stressor* VC with acquaintance	0.35 [-0.07, 0.77]	-0.21 [-0.71, 0.28]	-0.21 [-0.70, 0.28]	1.55 [-1.15, 4.26]
Social stressor* VC with roommate	-0.06 [-0.48, 0.37]	0.30 [-0.80, 0.21]	0.006 [-0.49, 0.50]	0.41 [-1.91, 2.74]
Social stressor* VC with significant other	-0.22* [-0.42, -0.02]	0.22† [-0.01, 0.45]	0.11 [-0.12, 0.34]	-0.54 [-4.51, 3.43]

Note: † $p < .10$ * $p < .05$, ** $p < .01$, *** $p < .001$

4.2.6 Aim 7: Parental Relationship Quality Moderation of Daily Associations

To explore how parent relationship quality may relate to students' daily well-being and reactivity to stressors, cross-level interaction analyses were conducted and results for these analyses can be seen in **Table 15**. In these tests, perceived parental support measures were used as person-level moderators of same-day associations between the experience of stressors and wellbeing. Maternal relationship quality moderated the daily associations between daily social stressors and negative ($b = -0.22, p = 0.008$) and positive ($b = 0.23, p = 0.007$) affect, such that those with higher perceived maternal relationship quality had weaker associations between daily social stressors and wellbeing. Neither paternal relationship quality nor overall perceived network support moderated the daily associations for any of the measures of wellbeing ($ps > 0.05$).

Table 15: Daily associations for daily stressors and virtual parental communication as moderated by perceived support in Study 3.

Multilevel coefficients and 95% confidence intervals showing the daily associations between social stressors and same day wellbeing using perceived maternal, paternal, or network support as level 2 moderators.

	Same Day Wellbeing			
	Negative affect <i>b</i> [95% <i>CI</i>]	Positive affect <i>b</i> [95% <i>CI</i>]	Self-esteem <i>b</i> [95% <i>CI</i>]	Sleep duration (objective hrs) <i>b</i> [95% <i>CI</i>]
Social stressor* maternal RQ	-0.22** [-0.36, -0.08]	0.23** [0.07, 0.40]	0.14 [-0.03, 0.31]	-0.18 [-1.13, 0.76]
Social Stressor* paternal RQ	0.01 [-0.17, 0.18]	-0.02 [-0.23, 0.18]	-0.10 [-0.30, 0.10]	0.83 [-0.28, 1.95]
Social stressor* network support	-0.01 [-0.02, 0.01]	-0.01 [-0.02, 0.01]	-0.002 [-0.02, 0.01]	0.08† [-0.01, 0.17]

Note: † $p < .10$ * $p < .05$, ** $p < .01$, *** $p < .001$

To illustrate this finding, **Figure 5** compares the coupling (using standardized regression coefficients) of the daily associations between social stressors and negative and positive affect for students with higher versus lower perceived maternal relationship quality (median split). Students with higher maternal relationship quality had weaker associations between daily social stressors and same-day negative and positive affect than those with lower relationship quality.

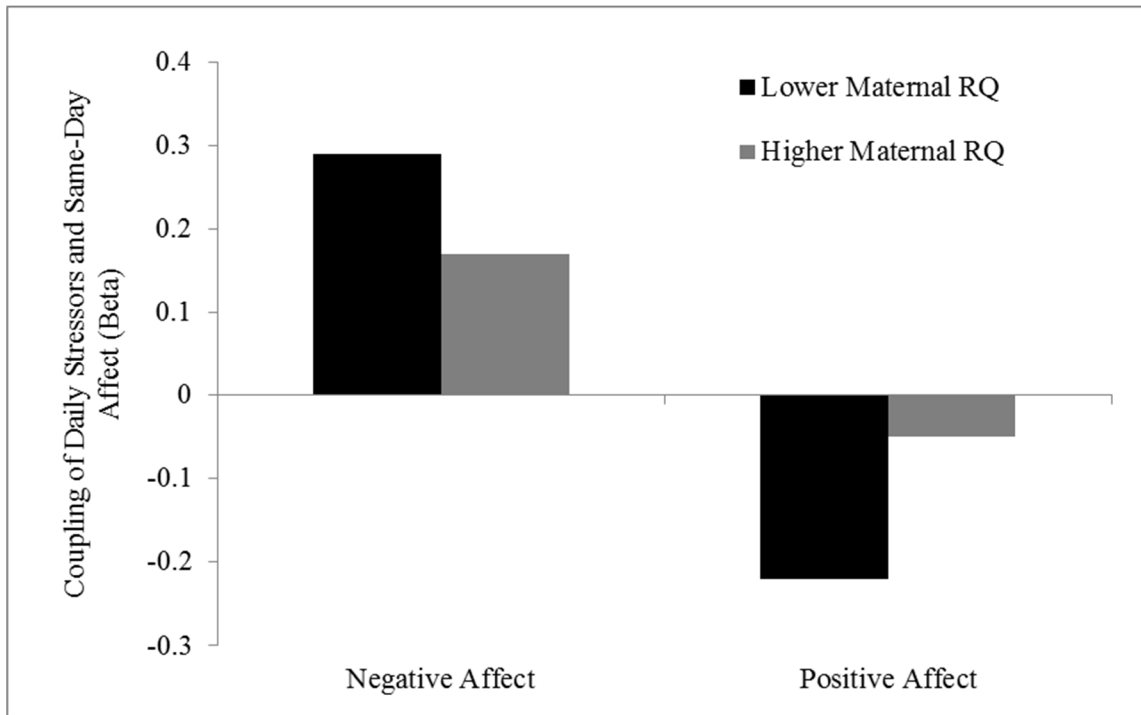


Figure 5: The cross-level interactions between daily social stressors and affect by perceived maternal support in Study 3.

Note: Figure 5 depicts the standardized regression coefficients $((b_x - GM_x)/SD_x)$ comparing the strength of the associations between daily social stressors and negative and positive affect between students with lower and higher perceived maternal relationship quality (RQ) using a median split of perceived maternal relationship quality .

4.3 Study 3 Discussion

This study had four main findings. First, as in Study 1, daily parental communication was frequent, with students reporting parental in-person or virtual contact on the majority of days (on average, over 70% of days). Overall, this parent-child communication was reported as being positive and helpful. In-person contact, though more frequent than Study 1, was still much less common than virtual communication (15% versus 60% of days on average). Initial comparisons

between virtual and in-person conversation days, revealed few differences. Days with either virtual or in-person conversations with parents were rated as similarly positive, helpful, and were comprised of similar discussion topics (most frequently social or academic topics). These findings are consistent with past research on adolescent virtual communication patterns suggesting that virtual interactions often mirror in-person ones (George & Odgers, 2015). The only difference between virtual and in-person communications was that a larger proportion of virtual conversations than in-person conversations that were initiated by students. Future studies are required to explore student-evoked versus parent-elicited support and whether differences in initiation between in-person and virtual contact days are linked with the amount that students' disclosure with their parents and/or with their daily wellbeing. Additional studies are needed to directly compare the similar (and dissimilar) features of in-person and virtual communication in relation to student outcomes (e.g., using experimental or diary methods).

Second, the between and within-person associations between virtual parental communication and wellbeing in Study 3 were consistent with findings from Study 1. Overall, students who communicated more frequently via mobile technologies with their parents had higher perceived parent-child relationship quality and average well-being, but there were no direct daily associations between virtual communication and wellbeing. As in Study 1, daily virtual conversations with parents moderated the association between reported stressors and wellbeing, including objectively measured sleep duration. This study moved beyond typical cross-sectional self-reports of stress, communication, and wellbeing, by studying these associations in daily life and by using an objective measure of daily wellbeing to combat shared method variance issues. To more closely compare findings with both Study 1 and Study 2, daily analyses focused on students' reports of social stressors. These daily models showed that on

days when students reported a social stressor, if they texted or talked on the phone with their parent, they had lower negative affect. It should be noted that the moderation of social stressors and wellbeing by virtual parental conversations was not found for all measures of wellbeing, including self-esteem, whose effect was strong in Study 2, or sleep duration as with overall stressors, though this test may have been underpowered as the direction mirrored the analyses using all daily stressors. Future research is needed among larger, more representative populations of students to generalize findings about the daily associations between virtual parental communication and wellbeing. Future research is also required to understand how the characteristics of daily stressors (e.g., intensity, severity) may impact students' daily coping strategies and wellbeing.

Third, this study suggested that virtual communication parents may be fairly unique in its ability to buffer daily stressors. As in Study 1 and Study 2, this study tested the specificity of virtual parental conversations to moderate the daily association between social stressors and wellbeing compared to other virtual communication patterns and partners. There were no significant daily interactions for either the amount of virtual parental interactions (i.e., phone conversations, text messages sent) or peer virtual communication (i.e., conversations with siblings, friends, acquaintances, roommates), except for with virtual conversations with significant others. This indicates that outside of the laboratory, and unlike in Study 2, generic forms of virtual communication may not aid in the recovery from social stressors. Instead, it appears that virtual communication in the context of close relationships, such as parental or romantic relationships, may offer the greatest support. This finding fits with developmental theories that suggest that burgeoning romantic relationships become increasingly important during adolescence and emerging adulthood (Arnett, 2000; Collins, Welsh, & Furman, 2008). As

this study was limited in its ability to target communication with specific friends, with whom students also have close relationships, future research is required to more carefully map students' daily communication patterns to their social support networks, for example, through an examination of records or social media profiles.

Fourth, this study found significant associations between parental relationship quality and daily wellbeing, at both the person and daily levels. Correlational results indicated that, as in Study 1, those with higher perceived parental relationship quality also tended to have higher daily wellbeing on average, including, higher positive affect and self-esteem, lower negative affect and slept longer each night as measured objectively. As in Study 2, maternal relationship quality, but not other forms of overall perceived support (paternal or network support), was related to students' reactions to daily stressors. Specifically, students with higher maternal relationship quality had weaker associations between daily social stressor and negative and positive affect, suggesting that they may be less reactive to daily stressors. Interestingly, these results contrasted finding from the daily enacted maternal and paternal support analyses. When comparing daily parental virtual communications, conversations with fathers appeared to have a stronger moderating effect on the daily association between daily stressors and negative affect compared virtual conversations to mothers. Additional studies are needed that directly compare the features of paternal and maternal relationship quality, distinguish between differences in virtual communication patterns with mothers and fathers, and that specifically code the content of virtual parental communications. These studies would be helpful in determining whether there are consistent differences in the perceived support derived from students' maternal or paternal relationships and whether mothers and fathers truly offer different forms of daily enacted support.

To fully address these points, future studies should sample more representative groups of young adults or adolescents with more variability in their parental enacted and perceived support.

This study provides new research insights by describing and testing the daily role of parents' perceived and enacted support in students' daily lives. It builds off of the work of Studies 1 and 2 by more specifically measuring the features of daily communication, types of daily stressors, and assessing broader daily health and wellbeing outcomes. Although more research is needed (e.g., on the timing of the stressors), findings from this study suggest that strong parental relationships and daily parental virtual conversations during the first year of college may help students cope with daily stressors.

5. General Discussion

5.1 Key Findings across Studies

The three studies presented in this dissertation convey five sets of key findings, which map onto the five main aims of the studies. First, Studies 1 and 3 described daily parental communication as frequent, primarily occurring via mobile technologies, and generally positive and helpful (**Aim 1**). On average, students in the studies interacted via mobile technologies with their parents of one or more times on over half of study days, indicating that students texted or called their parents 3-4 times per week. In comparing days with virtual and in-person conversations between students and their parents on a number of dimensions (i.e., positivity, helpfulness, initiator of contact, and topic of discussions), there were few differences. Such findings suggest that daily virtual communication and support between parents and students during the college transition may have great potential for educators and mental health professionals to leverage in interventions. For example, previous research has shown that when parents were given information on how to converse with their child about maladaptive alcohol usage (i.e., using alcohol as a means of coping with daily stressors), compared to parents who were given general information about alcohol use on campus, students' reported lower alcohol usage at the end of the semester (Ichiyama et al., 2009). This study suggests that these 'light touch' virtual interventions may be effective in helping parents to support their children to navigate the new challenges and stressors of the college environment.

Second, although the average amount of virtual daily communication between parents and students was positively associated with students' overall wellbeing (**Aim 2a**), Studies 1 and 3 did not find any evidence of daily, within-individual associations between virtual parental communication and wellbeing (**Aim 2b**). Previous cross-sectional research has shown that

students who interact more frequently or intensely with their parents also report better academic and social adjustment to college (Kerns & Stevens, 1996); however, much less is known about whether the key features and content of daily virtual parental interactions are related to daily wellbeing. A set of daily studies with undergraduate students found that the number of parent phone conversations was positively coupled with higher wellbeing and self-care, through greater reported exercise and lower alcohol use (Small et al., 2011; Small et al., 2013). Future research should examine specific support processes (like the social support buffering process tested here) through which daily parental communications may relate directly to daily wellbeing. For example, daily communication with parents may relate to reduced same-day alcohol use (i.e., greater self-care), lower confidence (i.e., cost to autonomy), and reduced loneliness (i.e., reminder of belonging).

Third, all three studies suggest that virtual parental communication may aid students ‘bounce back’ after daily stressors. Studies 1 and 3 found that daily virtual communication with parents (via phone calls or text message conversations) moderated the same-day associations between reported stressors and wellbeing (**Aim 3**). The inclusion of both daily self-reported affect and nightly objective sleep duration in the EMA studies, begin to combat issues of recall bias and shared method variance issues found in traditional cross-sectional studies. Study 2 found that sending a text message to a parent resulted in faster recovery (in terms of self-esteem and affect) after an experimentally-induced social exclusion stressor compared to a no contact control group (**Aim 3**). Although significant daily moderation was not found for every measure of wellbeing, the results across studies were fairly consistent. **Table 16** displays the direction and significance of comparable tests across the three studies of the buffering by virtual parental communication of the daily associations of stressors and wellbeing (Studies 1 and 3) or recovery

from the experimental stressor of students assigned to reach out to their parents compared to those in the no contact control group (Study 2). This table shows that, across individual wellbeing measures, (1) the direction of the moderation by virtual parental communication was consistent (contact predicted lower negative affect and higher positive affect) and (2) the moderation of the effect may be stronger for negative compared to positive affect outcomes. This research implies that daily virtual communication with parents may help students to ‘bounce back’ more quickly from daily stressors, especially in terms of reducing their feelings of anxiety and irritability. Additional studies are needed that test the timing (lagged effects) and causality of the associations between daily stressors, virtual parental communication, and wellbeing.

Table 16: Direction and significance of the comparable tests across the three studies.

The direction and significance of the coefficients across all three studies showing the ability for virtual parental communication (VPC)- daily texting with parents (Study 1), reaching out via text to a parent (Study 2) or virtual conversations with parents (Study 3)- to moderate the associations between stressors and negative and positive wellbeing outcomes.

Negative Wellbeing Outcomes					
	Negative affect (composite)	Anxious	Anger	Irritable	Sad
Study 1: Stressor*VPC	- *	- *	- *	- *	-
Study 2: Social Exclusion*VPC	- †	+	-	-	-
Study 3: Social Stressor*VPC	- *	- *	-	- *	- *

Positive Wellbeing Outcomes					
	Positive affect (composite)	Happy	Excited	Calm	Self-Esteem
Study 1: Stressor*VPC	+ *	+	+ *	+	n/a
Study 2: Social Exclusion*VPC	+ †	+ †	+	+	+ †
Study 3: Social Stressor*VPC	+ †	+	+	+ *	+

Note: + and - indicate positive or negative coefficients († if $p < 0.1$, * if $p < 0.05$)

Fourth, findings across Studies 1 and 3 suggest that virtual communication with parents may be unique in its ability to buffer the negative effects of daily stressors (**Aim 4**). Studies 1 and Study 3 tested the specificity of daily virtual parental conversations to significantly moderate the daily association between same-day stressors and wellbeing compared to other virtual communication patterns and partners. Across these two studies, only daily virtual communication with parents and romantic partners reduced the same-day associations between daily stressors and wellbeing outcomes. There were no significant daily moderating effects for the amount of technology usage (i.e., number of texts sent, number of contacts), the amount of virtual parental interactions (i.e., phone conversations, text messages sent), or peer virtual communication partners (i.e., conversations with siblings, friends, acquaintances, roommates). These findings fit with the literature that parents remain key members of students' social networks during college, but that romantic partners and close friends begin to take on a greater role (Arnett, 2000). Future daily research is needed that tests whether communication with specific peers (i.e., conversations with a best friend compared to new college friend) may also buffer the associations between daily stressors and wellbeing. Future research on support given by a specific peer may also begin to explain the discrepant findings in the EMA studies compared to the experiment in Study 2 showing that in both communication with parents and peers aided in the recovery from the experimentally-induced stressor. Study 2 found that participants assigned to text a stranger had comparable recovery to those assigned to text a parent, both of which recovered faster from the experimentally-induced stressor than the no contact control group. Additional studies are needed to assess describe the quantity and content of daily virtual parental and peer communications and longitudinally track whether there are any changes in daily parent to peer communication patterns across the transition to college.

Fifth, this set of findings also support the idea that stable perceived support, in terms of maternal relationship quality, is associated with students' "reactivity" to daily and experimentally induced stressors (**Aim 5**). Studies 2 and 3 found that students with higher maternal relationship quality had weaker reactions to both experimentally-induced and daily social stressors. Specifically, maternal relationship quality, but not other forms of overall perceived support (paternal or network support), predicted higher positive affect and lower negative affect after an experimentally-induced stressor, or on days with a daily social stressor. This finding is consistent with previous research showing that students with warmer maternal relationships have decreased cortisol production following daily stressors compared to students with less warm mothers (Lucas-Thompson, 2013). These studies extended previous cross-sectional research showing that parent-child relationship quality is correlated with students' overall wellbeing (Compas et al., 1986; Taylor et al., 2014), which this study also consistently found, by demonstrating that perceived parental support was associated with daily wellbeing outcomes measured with higher resolution via the EMA studies. Future research should examine how aspects of parental relationships, for example attachment styles or specific features (e.g., over-involvement), may play a role in students' coping styles and stress reactivity.

5.2 Limitations and Strengths

An important limitation of these studies was their reliance on a select student population from a private, elite university, who may have marked differences in daily experiences and communication patterns compared with other populations of emerging adults. These students tended to have highly educated, involved parents with financial resources. In addition, the majority of the students in the sample did not live in close proximity with their parents, which relates to their ability to engage in certain daily virtual and in-person communication patterns.

Future studies with more representative groups of young adults are needed to fully generalize the findings from these studies and to examine additional features of parent-child relationships.

Second, although sleep duration was assessed via wearable monitors in Study 3, these studies relied heavily on single informant self-reports of daily stressors, virtual communication, and wellbeing, which can lead to shared method problems. Future research is needed on dyads that simultaneously assess both parents and students on their support provisions and receipts (as has been done with marital couples by Bolger et al., 2000). Furthermore, additional studies are greatly needed that use objective measures to more accurately measure the quantity (e.g., the recorded number of texts sent or minutes spent talking to a parent) and quality (e.g., logs of the content of text conversations) of daily virtual parental communication as well as daily wellbeing outcomes (e.g., sleep duration as tested in Study 3).

Third, although these studies employed multiple methodological designs (daily and experimental methods), these studies are limited in their ability to make causal claims about the effects of daily virtual parent-student interactions. There are tradeoffs between the ecological validity of daily reports of virtual parental communication and the experimental validity of randomly assigning coping behaviors after inducing a social exclusion stressor. Neither of these designs can fully capture if and how communicating with parents ‘in real life’ can *cause* students to feel better after a daily stressor. Ideally, future research could design more ecologically valid stressor tasks and parent-child text communications for the lab and/or experimentally induce stressors in students’ daily lives.

The studies presented in this dissertation also had a number of strengths. Past research on parental support during emerging adulthood has largely studied 1) parental support only as a stable characteristic (i.e., perceived support) and 2) used cross-sectional designs. These studies

presented here used 1) daily reports to measure students' daily virtual communication with parents, 2) both daily and experimental methods to assess whether perceived and enacted parental support may buffer the effects of daily stressors, and 3) included both self-reported and objective daily measures of key wellbeing outcomes. EMA methods, compared to one-time cross-sectional surveys, can reduce the recall bias and enhance the ecological validity of self-reports (Bolger, Davis, & Rafaeli, 2003; Bradburn, Rips, & Shevell, 1987; Shiffman et al., 2008). The studies presented here add to the literature on parental communication by providing more accurate 'in the moment' estimates, of virtual communication patterns and wellbeing. In addition, Study 3 began to combat shared method variance issues by incorporating an objective measure of daily sleep duration. Ultimately to make stronger causal conclusions, future research is needed using additional objective measures of students' communication (e.g., text message logs, content), stressors (e.g., experimentally induced) and daily wellbeing (e.g., cortisol production, heart rate), in both experimental and daily studies with more representative samples of students.

5.3 Conclusion

As the ubiquity of mobile technologies and the frequency of virtual communication continue to grow in our society (Fox & Rainie, 2014; Smith et al., 2015), research is needed to test its negative and positive effects. Much of the research to date focuses on the how technology may be harming young peoples' development and relationships (George & Odgers, 2015; Underwood & Ehrenreich, 2017; Valkenburg & Peter, 2009). The studies presented here, along with previous work by Gross (2009), have shown that virtual communication may buffer against daily stressors by offering a new avenue for young people to seek social support. These studies provide daily and experimental evidence that parent-child communication via mobile technologies can help young adults recover from stressors in terms of their daily health and

wellbeing. Findings also suggest that virtual parent-child communication may serve as an effective focus or component of interventions aiming to improve the wellbeing of contemporary college students and young adults.

Appendix A: Study 1 Baseline and EMA Measures

Subset of Pre-Matriculation Measures (You@Duke Wave A)

Parent-Child Relationship Quality (adapted from Furman & Buhrmester, 2009)

This next set of questions asks about your relationships with your parents, guardians, or other important adults in your life. You will be asked to respond to questions about two different parents, guardians, or other important adults. When responding to the questions, please think of the parents, guardians, or other adults who you are closest to and who are most important in your day-to-day life. Think about a parent, guardian, or another important person in your life. Please enter his or her name (e.g., mom, dad, Tiffany, John) in the space below. (open-ended) This next set of questions asks about your relationship with [parent/guardian #1]. Please read each question carefully and respond based on your relationship with [parent/guardian #1]. (1 = Not at all, 5 = Very much)

1. How much does [parent/guardian #1] show support for your activities? (SSB)
2. How much do you and [parent/guardian #1] get upset with or mad at each other? (CON)
3. How much do you seek out [parent/guardian #1] when you're upset? (SSH)
4. How much does [parent/guardian #1] get on your nerves? (ANT)
5. How often does [parent/guardian #1] point out each your faults or put you down? (CRI)
6. How much does [parent/guardian #1] encourage you to try new things that you'd like to do but are nervous about? (SSB)
7. How often do you and [parent/guardian #1] disagree and quarrel with each other? (CON)
8. How much do you turn to [parent/guardian #1] for comfort and support when you are troubled about something? (SSH)
9. How much do you get annoyed with [parent/guardian #1]'s behavior? (ANT)
10. How much does [parent/guardian #1] criticize you? (CRI)
11. How much does [parent/guardian #1] encourage you to pursue your goals and future plans? (SSB)
12. How often do you and [parent/guardian #1] argue with each other? (CON)
13. How much do you turn to [parent/guardian #1] when you're worried about something? (SSH)
14. How much does [parent/guardian #1] hassle or nag you? (ANT)
15. How much does [parent/guardian #1] say mean or harsh things to you? (CRI)
16. How much is [parent/guardian #1] warm and caring with you? (WARM)

Baseline Measures

Social Support –ISEL (Cohen, S., & Hoberman, H. M., 1983).

For each statement check “definitely true” if you are sure it is true about you and “probably true” if you think it is true but are not absolutely certain. Similarly, you should check “definitely false” if you are sure the statement is false and “probably false” if you think it is false but are not absolutely certain.

___definitely true (3) ___probably true (2) ___probably false (1) ___definitely false (0)

1. If I wanted to go on a trip for a day (e.g., to the mountains, beach, or country), I would have a hard time finding someone to go with me.
2. I feel that there is no one I can share my most private worries and fears with
3. If I were sick, I could easily find someone to help me with my daily chores
4. There is someone I can turn to for advice about handling problems with my family
5. If I decide one afternoon that I would like to go to a movie that evening, I could easily find someone to go with me
6. When I need suggestions on how to deal with a personal problem, I know someone I can turn to
7. I don't often get invited to do things with others
8. If I wanted to have lunch with someone, I could easily find someone to join me.
9. If I was stranded 10 miles from home, there is someone I could call who could help get me
10. If a family crisis arose, it would be difficult to find someone who could give me good advice about how to handle it
11. If I needed some help in moving (e.g., new dorm or apartment), I would have hard time finding someone to help me
12. If I needed help in fixing something (e.g., appliance, car), there is someone who would help me

Network Size (adapted from Stokes, 1983)

List the people that you feel closest to (up to 10). These can be your parents, siblings, roommates, friends, etc. Please do not write their names, only their initials or general descriptors (e.g., mom). (enter initials in text box)

1. How many family members did you include?
2. How many friends did you include?

Everyday Behaviors Scale (own measure)

For some behaviors, some people find that they have to resist the temptation to engage in that behavior. For each of the behaviors listed below, please rate how much you have to resist the temptation to do that activity/behavior. (Scale will be 1, *not at all*, to 5, *a lot*).

Note: Participants may feel no temptation to engage in some of the activities and were added as comparisons or fillers.

- Take a nap
- Eat junk food
- Study or read for class
- Exercise
- Go to class or work
- Skip class
- Take a break for lunch or dinner
- Complete chores (e.g., clean room, do laundry)
- Pay attention in class
- Talk to or text my family/friends on my phone (e.g., text, Snapchat)
- Post something on social media (e.g., Facebook, Instagram, Yik Yak, etc)

- Browse social media (e.g., Facebook, Instagram, Yik Yak, etc)
- Play games on my phone
- Listen to music
- Surf the Internet
- Watch videos/movies on my phone
- Check my phone for the time or just to see if I missed any notifications
- Procrastinate or avoid doing work
- Online Shopping

For some behaviors, some people find that they have to force themselves to engage in that behavior. For each of the behaviors listed below, please rate how much you have to force yourself to engage in that activity/behavior. (Scale will be 1, *not at all*, to 5, *a lot*).

Note: Participants may feel no pressure to engage in some of the activities and were added as comparisons or fillers.

- Take a nap
- Eat junk food
- Study or read for class
- Exercise
- Go to class or work
- Skip class
- Take a break for lunch or dinner
- Complete chores (e.g., clean room, do laundry)
- Pay attention in class
- Talk to or text my family/friends on my phone (e.g., text, Snapchat)
- Post something on social media (e.g., Facebook, Instagram, Yik Yak, etc)
- Browse social media (e.g., Facebook, Instagram, Yik Yak, etc)
- Play games on my phone
- Listen to music
- Surf the Internet
- Watch videos/movies on my phone
- Check my phone for the time or just to see if I missed any notifications
- Procrastinate or avoid doing work
- Online Shopping

Self-Regulation of Smartphone Use (own measure)

- When it comes to using your smartphone, what about your phone do you find most tempting?
- Do you have any goals related to your smartphone usage?

- How tempting do you find your smartphone in these different situations? (Scale: 1, *not at all tempted to use my phone in this situation*, to 5, *very tempted to use my phone in this situation*)
 1. While driving
 2. During class
 3. In a social situation (e.g., out with friends)
 4. During meals
 5. While having an in-person conversation with someone
 6. While studying or doing classwork (e.g., at the library, in my dorm)
 7. Waiting in line (e.g., at a restaurant, the grocery store)
 8. Before I go to bed at night
 9. If I wake up in the middle of the night
 10. First thing when I wake up in the morning.

EMA Measures

Morning Surveys (start of the day)

Sleep, Last Night and Current Day Items (own measure)

Please respond to the following questions about last night and this morning:

1. How many hours did you sleep last night? (enter number)
2. What time did you wake up today? (enter time)
3. How well did you sleep last night? (1= very poorly; 5= very well)
4. Last night, did you have trouble falling asleep? (Y, N)
5. Last night, did you use your phone or other device late last night when you should have been sleeping? (Y, N)
6. Last night, did you stay up later than you planned on your phone or other device? (Y, N)
7. How many classes do you have today? (enter number)
8. Please list any major school assignments you have to complete today (e.g., tests, papers, or presentations) (enter text box)
9. How do you feel today? (1- poor, 2- fair, 3- good, 4- very good, 5- excellent)

Daytime Surveys (11:30am, 2:30pm, 5:30pm, 8:30pm)

Usage Items (own measure)

Please respond the following questions about your behaviors since the last signal (or in the last 3 hours):

1. How much time did you spend on your phone since the last signal (or in the last 3 hours)? (enter number minutes)
2. How frequently did you check your phone since the last signal (or in the last 3 hours)? (not at all, every few minutes, about every 10 minutes, about every 20 min, every 30 min)

- or more)
3. How many text messages did you send since the last signal (or in the last 3 hours)? (enter number)
 4. How many different people did you text with since the last signal (or in the last 3 hours)? (enter number)
 5. Who did you text with since the last signal (or in the last 3 hours)? Check all that apply:
 1. Parent
 2. Sibling
 3. Extended family
 4. Roommate
 5. Significant other
 6. Close friend
 7. Acquaintance
 8. Other (open entry)

Functions of Mobile Phone Use Checklist (own measure)

Please check as all that apply about how and why you used your phone since the last signal (or in the last 3 hours):

- Communication
 1. Keep in touch with my family
 2. Keep in touch with friends from high school
 3. Check in or Talk with college friends (e.g., text, Snapchat)
 4. Post something on social media (e.g., Facebook, Instagram, Yik Yak, etc)
- Entertainment
 5. Browse social media (e.g., Facebook, Instagram, Yik Yak, etc)
 6. Play games
 7. Watch videos/movies
 8. Listen to music
- Regulate emotions or distractions
 9. Distract myself from a problem
 10. Check the time or just to see if I missed any notifications
 11. Procrastinate or avoid doing work
 12. Avoid boredom
 13. Feel less worried/anxious
 14. Share something good that happened via text or social media
 15. Share something bad that happened via text or social media
- Other
 16. Relax
 17. Look up something for school
 18. Online Shopping
 19. Other (open entry)

Offline Experiences and Behaviors (adapted from Kanner et al, 1981 and RAISE protocol)

Please respond the following questions about your behaviors and experiences since the last signal (or in the last 3 hours):

- Where are you completing this survey (please fill in)?
- Did any of the following things happen to you since the last signal (or in the last 3 hours):
 1. Argued or had problems with a family member or friend
 2. Didn't do well in school
 3. Was running late
 4. Ran into an unexpected problem
 5. Something else stressful (open entry)
 6. Nothing bad happened to me
- Did any of the following things happen to you since the last signal (or in the last 3 hours):
 1. Received a compliment from someone
 2. Had a good time
 3. Did well in school
 4. Got all my chores/assignments done on time
 5. Something else good (open entry)
 6. Nothing good happened to me
- How many people did you hang with since the last signal (or in the last 3 hours)? (enter number)
- Who did you hang out in-person with since the last signal (or in the last 3 hours)? Check all that apply:
 1. Parent
 2. Sibling
 3. Extended family
 4. Roommate
 5. Significant other
 6. Close friend
 7. Acquaintance
 8. Other (open entry)

Positive and Negative Affect (adapted from PANAS; Laurent et al, 1999)

On a scale from 0 (definitely do not feel) to 10 (definitely feel), how well do the following adjectives describe your current mood: (sliding scale)

1. Happy
2. Excited
3. Calm
4. Irritable
5. Angry
6. Sad
7. Anxious

Evening Surveys (end of the day)

Daily Summary of Online Behaviors (own measure)

Please respond to the following questions about your activities across the entire day today:

- Estimate the total number of hours or minutes you spent on your phone today? (enter number minutes)

- How frequently did you check your phone today? (not at all, every few minutes, about every 10 minutes, about every 20 min, every 30 min or more)
- What was the main reason you used your phone today? (enter response)
- Count up the total number of text messages you sent today(enter number)
- How many different people did you text with today? (enter number)
- Who did you text with today? Check all that apply:
 1. Parent
 2. Sibling
 3. Extended family
 4. Roommate
 5. Significant other
 6. Close friend
 7. Acquaintance
 8. Other (open entry)

Daily Social Support and Network Size (own measure)

Did any of the following things happen today? :

- I had a good time with someone (Y, N)
- I received help or advice from someone (Y, N)
- Someone helped me with daily chores, errands, or homework (Y, N)

How many people did you hang out with in-person today? (enter number)

Positive and Negative Affect (adapted from PANAS; Laurent et al, 1999)

On a scale from 0 (definitely do not feel) to 10 (definitely feel), how well do the following adjectives describe your current mood: (sliding scale)

- Happy
- Excited
- Calm
- Irritable
- Angry
- Sad
- Anxious

Appendix B: Study 2 Experimental Manipulation Materials

Baseline Measures (Studies 2 and 3)

Demographic Information

1. What is your sex? M, F, Other
2. What is your age? (text)
3. What is your racial/ethnic background? (Can check multiple options: African American/Black, Asian American/Asian, Latino(a), Caucasian, Other)
4. International student? Y/N
5. What is the highest level of education obtained by your parent(s) or guardian(s)? (High school or less, Some college, College degree, Graduate/professional degree)

Parent-Child Relationship Quality (adapted from Furman & Buhrmester, 2009)

This next set of questions asks about your relationship with a parent, guardian, or other important adult in your life. Please enter his or her name (e.g., mom, dad, Tiffany, John) in the space below. (open-ended) Please read each question carefully and respond based on your relationship with [parent/guardian #1]. (1 = Not at all, 5 = Very much)

1. How much does [parent/guardian #1] show support for your activities? (SSB)
2. How much do you and [parent/guardian #1] get upset with or mad at each other? (CON)
3. How much do you seek out [parent/guardian #1] when you're upset? (SSH)
4. How much does [parent/guardian #1] get on your nerves? (ANT)
5. How often does [parent/guardian #1] point out each your faults or put you down? (CRI)
6. How much does [parent/guardian #1] encourage you to try new things that you'd like to do but are nervous about? (SSB)
7. How often do you and [parent/guardian #1] disagree and quarrel with each other? (CON)
8. How much do you turn to [parent/guardian #1] for comfort and support when you are troubled about something? (SSH)
9. How much do you get annoyed with [parent/guardian #1]'s behavior? (ANT)
10. How much does [parent/guardian #1] criticize you? (CRI)
11. How much does [parent/guardian #1] encourage you to pursue your goals and future plans? (SSB)
12. How often do you and [parent/guardian #1] argue with each other? (CON)
13. How much do you turn to [parent/guardian #1] when you're worried about something? (SSH)
14. How much does [parent/guardian #1] hassle or nag you? (ANT)
15. How much does [parent/guardian #1] say mean or harsh things to you? (CRI)
16. How much is [parent/guardian #1] warm and caring with you? (WARM)
17. How much does your parent intervene in solving problems you have? (OVER)
18. How much does your parent make important decisions for you (e.g., what classes to take)? (OVER)

Social Support –ISEL (Cohen & Hoberman, 1983).

For each statement check “definitely true” if you are sure it is true about you and “probably true” if you think it is true but are not absolutely certain. Similarly, you should check “definitely false”

if you are sure the statement is false and “probably false” is you think it is false but are not absolutely certain.

____definitely true (3) ____probably true (2) ____probably false (1) ____definitely false (0)

1. If I wanted to go on a trip for a day (e.g., to the mountains, beach, or country), I would have a hard time finding someone to go with me.
2. I feel that there is no one I can share my most private worries and fears with
3. If I were sick, I could easily find someone to help me with my daily chores
4. There is someone I can turn to for advice about handling problems with my family
5. If I decide one afternoon that I would like to go to a movie that evening, I could easily find someone to go with me
6. When I need suggestions on how to deal with a personal problem, I know someone I can turn to
7. I don't often get invited to do things with others
8. If I wanted to have lunch with someone, I could easily find someone to join me.
9. If I was stranded 10 miles from home, there is someone I could call who could help get me
10. If a family crisis arose, it would be difficult to find someone who could give me good advice about how to handle it
11. If I needed some help in moving (e.g., new dorm or apartment), I would have hard time finding someone to help me
12. If I needed help in fixing something (e.g., appliance, car), there is someone who would help me

Network Size (adapted from Stokes, 1983)

List the people that you feel closest to (up to 10). These can be your parents, siblings, roommates, friends, etc. Please do not write their names, only their initials or general descriptors (e.g., mom). (enter initials in text box)

1. How many family members did you include? (enter number)
2. How many friends did you include? (enter number)

Affect and State Measures (adapted from Gross, 2009)

On a scale from 1 (not at all) to 5 (extremely), how well do the following adjectives describe your current mood or state:

Positive Affect and Competence

1. Happy
2. Excited
3. Calm
4. Confident
5. Smart

Anxiety

6. Anxious

7. Tense
8. Stressed

Anger

9. Angry
10. Irritated
11. Frustrated
12. Hostile
13. Mad

Dysphoria

14. Sad
15. Down
16. Upset
17. Stupid

Perceived Relational Value

18. Respected
19. Valued
20. Accepted

Shame

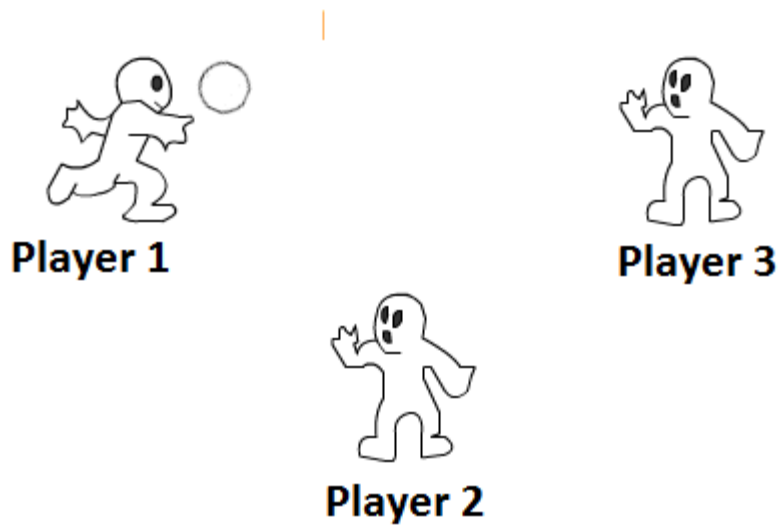
21. Betrayed
22. Ashamed
23. Embarrassed

State Self-Esteem

24. How do you feel about yourself right now? (1- really bad to 5- really good)

Cyberball Task (Williams & Stevens, 2006; figure from wikispaces)

Note: The participant is “Player 2”.



Parent Virtual Communication (own measure)

Please answer the following about your interactions during this study:

1. To whom did you send texts to during this study? (Mom, Dad, Guardian, Friend, Stranger, No one)
2. From whom did you receive texts during this study? (Mom, Dad, Guardian, Friend, Stranger, No one)
3. How helpful was this conversation to you? (1-not at all to 5 extremely)
4. How positive was this conversation to you? (1-not at all to 5 extremely)
5. How negative was this conversation to you? (1-not at all to 5 extremely)

Appendix C: Study 3 EMA Measures

EMA Measures

Morning Surveys (7am)

Sleep and Last Night Items (own measure)

Please respond to the following questions about last night and this morning:

1. How many hours did you sleep last night? (enter number)
2. What time did you wake up today? (enter time)
3. How well did you sleep last night? (1= very poorly; 5= very well)
4. Last night, did you have trouble falling asleep? (Y, N)
5. Last night, did you use your phone or other device late last night? (Y, N)
6. Last night, did you stay up later than you planned on your phone or other device? (Y, N)

State Self-Esteem (from RAISE protocol)

How do you feel about yourself right now? (1- really bad to 5- really good)

Positive and Negative Affect, Stress, and Current State (adapted from PANAS; Schimmack, 2003; Laurent et al, 1999, and Gross, 2009)

On a scale from 1 (not at all) to 5 (extremely), how well do the following adjectives describe your current mood or state:

1. Happy
2. Excited
3. Calm
4. Anxious
5. Angry
6. Irritated
7. Sad
8. Stressed
9. Embarrassed
10. Valued
11. Confident
12. Independent

EMA items (own measure)

1. How many classes do you have today? (enter number)
2. How much academic work do you have to do today? (scale, 1- little to no workload, 5- extremely heavy workload)

Daytime Surveys (11am, 3pm, 7pm)

Hassles and Uplifts (adapted from Kanner et al, 1981 and RAISE protocol)

Please respond the following questions about your behaviors and experiences in the last 4 hours:

- Did any of the following things happen to you since the last signal (or in the last 3 hours):
 1. Argued or had problems with a family member or friend
 2. Didn't do well in school
 3. Was running late
 4. Ran into an unexpected problem
 5. Something else stressful (open entry)
 6. Nothing bad happened to me
- Did any of the following things happen to you since the last signal (or in the last 3 hours):
 1. Received a compliment from someone
 2. Had a good time
 3. Did well in school
 4. Got all my chores/assignments done on time
 5. Something else good (open entry)
 6. Nothing good happened to me

Parent-Child Communication (own measure)

1. Did you talk to your parent in the last 4 hours? (Check all that apply: phone call, text message, face-to-face, did not talk)
2. How many texts did you send to your parents in the last 4 hours? (enter number)
3. How many conversations/interactions did you have with your parents in the last 4 hours? (enter number)
4. Who initiated communication? (mostly my parent, mostly me, both equally, someone else)
5. How helpful was this conversation (1-not at all helpful to 5-very helpful)
6. How positive was this conversation(s)? (1-not at all positive to 5- very positive)
7. How negative was this conversation(s)? (1- not at all negative to 5-very negative)

State Self-Esteem (adapted from RAISE protocol)

How do you feel about yourself right now? (1- really bad to 5- really good)

Positive and Negative Affect, Stress, and Current State (adapted from PANAS; Laurent et al, 1999, Schimmack, 2003; and Gross, 2009)

On a scale from 1 (not at all) to 5 (extremely), how well do the following adjectives describe your current mood or state:

1. Happy
2. Excited
3. Calm
4. Anxious
5. Angry
6. Irritated
7. Sad
8. Stressed
9. Embarrassed

10. Independent
11. Valued
12. Confident

Usage Items (own measure)

Please respond the following questions about your behaviors in the last 4 hours:

1. How much time did you spend on your phone in the last 4 hours? (enter number minutes)
2. How many text messages did you send in the last 4 hours? (enter number)
3. How many different people did you text in the last 4 hours? (enter number)
4. How many people did you hang with in the last 4 hours? (enter number)

Evening Surveys (11pm)

Hassles and Uplifts (adapted from Kanner et al, 1981 and RAISE protocol)

Please respond the following questions about your behaviors and experiences in the last 4 hours:

- Did any of the following things happen to you since the last signal (or in the last 3 hours):
 1. Argued or had problems with a family member or friend
 2. Didn't do well in school
 3. Was running late
 4. Ran into an unexpected problem
 5. Something else stressful (open entry)
 6. Nothing bad happened to me
- Did any of the following things happen to you since the last signal (or in the last 3 hours):
 1. Received a compliment from someone
 2. Had a good time
 3. Did well in school
 4. Got all my chores/assignments done on time
 5. Something else good (open entry)
 6. Nothing good happened to me

Parent-Child Communication (own measure)

1. Did you talk to your parent in the last 4 hours? (Check all that apply: phone call, text message, face-to-face, did not talk)
2. How many texts did you send to your parent in the last 4 hours? (enter number)
3. How many conversations/interactions did you have with your parent in the last 4 hours? (enter number)
4. Who initiated communication? (mostly my parent, mostly me, both equally, someone else)
5. How helpful was this conversation (1-not at all helpful to 5-very helpful)
6. How positive was this conversation(s)? (1-not at all positive to 5- very positive)
7. How negative was this conversation(s)? (1- not at all negative to 5-very negative)

State Self-Esteem (adapted from RAISE protocol)

How do you feel about yourself right now? (1- really bad to 5- really good)

Positive and Negative Affect, Stress, and Current State (adapted from PANAS; Schimmack, 2003; Laurent et al, 1999, and Gross, 2009)

On a scale from 1 (not at all) to 5 (extremely), how well do the following adjectives describe your current mood or state:

1. Happy
2. Excited
3. Calm
4. Anxious
5. Angry
6. Irritated
7. Sad
8. Stressed
9. Embarrassed
10. Valued
11. Confident
12. Independent

Usage Items (own measure)

Please respond the following questions about your behaviors in the last 4 hours:

1. How much time did you spend on your phone in the last 4 hours? (enter number minutes)
2. How many text messages did you send in the last 4 hours? (enter number)
3. How many different people did you text in the last 4 hours? (enter number)
4. How many people did you hang with in the last 4 hours? (enter number)

Daily Social Support and Network Size (own measure)

Did any of the following things happen today? :

1. I felt emotionally supported (Y, N)
2. I had a good time with someone (Y, N)
3. I received help or advice from someone (Y, N)
4. Someone helped me with daily chores, errands, or homework (Y, N)

Irritability and Emotion Dysregulation (adapted from the Affect Regulation Checklist; Moretti, 2003, and the Brief Self-Control Scale; Tangney et al, 2004):

1. Today, I had a hard time concentrating or focusing (Y, N)
2. Today, I've been doing or saying things without thinking first (Y, N)
3. I'm having a hard time controlling my emotions (Y, N)
4. Even little things are getting on my nerves (Y, N)

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Biography

Madeleine George was born in Chicago, IL and grew up in St. Paul, Minnesota. Madeleine majored in Psychology and Biology (Neurobiology Concentration) and graduated with Honors from the University of Wisconsin, Madison with a Bachelor of Science degree. She then taught English to primary school children at Cofradia Bilingual School in Honduras and to high school students at Lycee Bourdelle in France. Madeleine engaged in a year of graduate training and coursework at the University of California, Irvine before transferring to Duke University with her advisor Dr. Candice Odgers. She received a Master of Arts degree from Duke University in September 2015 for her thesis on adolescent friendships in the digital context. At Duke, she conducted research as part of Adaptlab research team in the Center for Child and Family Policy and has collaborated on the RAISE project, an intensive longitudinal study of NC adolescents, and the Duke Endowment funded Resilience (or You@Duke) project, a 4-year, 4-institution study about students' transition to and adjustment in college. In 2012 and 2013, she received one of Duke's Sulzberger and Levitan Fellowship Awards for her applied work on young people's technology usage and development. Madeleine is a member of the Society for Research on Child Development and the Association for Psychological Science.

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