

Emerging Adult-Sibling Relationships: Closeness, Communication, and Well-being

A Thesis

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Dedication

For Arthur Delaune.

Abstract

In the current study, we examined the relationships between well-being, sibling closeness, and sibling communication to address several gaps in the literature. Extending the concepts and assumptions of social exchange theory, the goal of this study was to determine if well-being moderates the relationship between communication and perceived sibling closeness. This study utilized a subsample ($n=236$) of participants from a larger sample of emerging adults. Surveys were collected through Amazon's Mechanical Turk and participants were compensated \$0.50 for their time. Hierarchical multiple regression was used and analyses were run using IBM SPSS Statistics 23. The dataset was evaluated for compliance with linear regression assumptions. Results found that neither emotional, psychological, nor social well-being moderated the relationship between sibling communication and sibling closeness. However, associations between sibling communication and sibling closeness were statistically significant in the full model. Male-female gender dyads, as well as the race Asian, were found to be statistically significant. Results suggested male-female gender dyads were more likely to be close and those who identified as Asian as less likely to be close to their siblings. Limitations and future research are considered.

Keywords: Emerging Adults, Siblings, Communication, Closeness, Well-being, Computer Mediated Communication

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Introduction

Sibling relationships have been described as one of the longest, most enduring relationships in an individual's life; outlasting relationships with parents, spouses, other relatives and even friends (Cicirelli, 1995). This lifelong quality of sibling relationships is not limited to full biological siblings but is also true of most step-, adopted, and half sibling relationships as well (Cicirelli, 1995). With close sibling relationships being characterized as a source of emotional support and warmth (Cicirelli, 1980) it is important to understand the unique sibling relationship throughout the life course.

In 1995, Victor Cicirelli argued that the largest gap of knowledge in regards to sibling relationships lies in young adult sibling relationships. Twenty-two years later, this sentiment remains true. Though more has been discovered about how sibling relationships change throughout the life course (e.g., Conger & Little, 2010; Riggio, 2006; Stocker, Lanthier, & Furman, 1997; White, 2001), studies focusing specifically on emerging adult-sibling relationships are rare (e.g., Scharf, Shulman, & Avigad-Spitz, 2005), and studies on how emerging adult-siblings communicate with one another are almost nonexistent (e.g., Lindell, Barr & Killoren, 2015). Emerging adulthood presents a unique opportunity for sibling research due to the many changes and transitions that siblings experience, both together and separately, during this time.

First proposed by Arnett (2000), emerging adulthood is the age period from 17 or 18 years old to the mid to late 20's (Wood et al., 2018) in which individuals are beginning to leave home, establish independence, and have new experiences before committing to full careers and marriage (Arnett, 2007). This transition from the home can cause sibling relationships to become voluntary once they are no longer living under the

same roof. As they leave home, the importance of certain relationships begin to shift and as a result, creates a need for siblings to work to maintain their relationships, which is usually accomplished through communication.

Previous studies of sibling communication were limited by the technological advances of their time and as a result, studies often only considered face-to-face conversations, emails, letters, and phone calls as the ways in which siblings communicated with one another. Technological developments, such as smartphones, have allowed individuals new avenues with which to communicate with one another. With 100% of Americans 18-29 years old now owning cell phones and 94% owning smartphones (Pew Research Center, 2018) communication with a sibling is now easier than ever before; it is important that we explore how siblings are using, or not using, these new technologies to communicate with each other and the variables that influence frequency of that communication.

Most previous sibling studies have described the importance of constellation variables (also called structural variables) such as birth order, family size, gender, and age spacing of siblings, for the quality of the sibling relationship (Cicirelli, 1995). These variables can influence the quality of satisfaction with sibling relationships and support received from the sibling relationship (Conger & Little, 2010). However, constellation variables do not fully account for relationship processes (Buhrmester & Furman, 1990) as other aspects of the sibling relationship such as sibling closeness and communication, as well as individual aspects such as well-being can also influence the sibling relationship. Therefore, this study examines constellation, sibling, and individual variables to help gain a more complete understanding of sibling relationships.

Social exchange theory emphasizes that individuals behave in a way that gets the most rewards from a given relationship at the lowest cost to the individual. In the current study, the emerging adult-sibling relationship was explored and how sibling closeness, communication, and well-being are associated with these rewards and costs.

Social Exchange Theory

Social exchange theory is a useful lens through which to explore the emerging adult- sibling relationship. The main proposition of social exchange theory is that humans make rational choices with the intention of maximizing their benefits or rewards and minimizing costs, in order to obtain the most profitable outcome (Thibaut & Kelley, 1959). Rewards received from exchanges in a social relationship are defined as the “pleasures, satisfactions, and gratifications the person enjoys” (Sabatelli & Shehan, 1993, p. 397). Rewards do not need to be solely monetary or economically based but can also be in the form of emotional support, closeness, warmth, and advice, with the individual deciding how important each of these rewards are to them. The rewards one might obtain from sibling relationships are companionship, emotional support, positive well-being, and closeness. For this research study we examined the reward of being close to ones sibling (sibling closeness). Costs on the other hand are “any factors that operate to inhibit or deter the performance of a sequence of behavior” (Sabatelli & Shehan, 1993, p. 398). Costs could be in the form of punishment; however, the costs associated with sibling relationships are more likely to be an internal conflict such as ambivalence about the relationship (Sabatelli & Shehan, 1993). For this study, frequent communication is conceptualized as the cost of maintaining the sibling relationship.

An evaluation of the exchanges of rewards and costs in the sibling relationship will lead each sibling to feel satisfied or unsatisfied in the relationship. For example (see Figure 1), in quadrant one an evaluation of the sibling relationship could lead the sibling to perceive high sibling closeness; however, it is at great cost to them (e.g., great mental effort or frequent communication) resulting in a potentially unsatisfying relationship. In quadrant two, the sibling could perceive there to be a low amount of sibling closeness and at a high cost to them resulting in a potentially unsatisfying relationship. In quadrant three, the sibling perceives the reward of sibling closeness as greater than the emotional costs or frequent communication required to maintain the relationship and is likely to be satisfied in their sibling relationship. In the fourth quadrant, the sibling perceives the reward of sibling closeness as low and at a low cost of maintaining the relationship, resulting in a potentially unsatisfying relationship. Evaluations of the rewards and costs in a sibling relationship allows emerging adult-siblings to choose how much contact they have and choose to communicate more or less frequently with their sibling to maximize their rewards and/or keep costs low. However, this is a circular pattern, with the possibility of increases or decreases in communication influencing a sibling's perceptions of the rewards gained from the relationship.

Literature Review

Development and Voluntary Contact

As emerging adults begin to leave home for school, work, or marriage, the relationships they previously held with their siblings begin to change. No longer is the nature of their interactions monitored by their parents or caused by sharing the same

home, but they now have the ability to choose how much contact they have with their siblings, or if they have any contact at all (Cicirelli, 1995; Conger & Little, 2010; Scharf, Shulman, & Avigad-Spitz, 2005; Stocker, Lanthier, & Furman, 1997). This freedom from daily contact might cause siblings to develop, “a renewed appreciation for one another” (Conger & Little, 2010, p. 2), which could have long-term, positive effects on the quality of their relationship (White, 2001). However, social exchange theory suggests that freedom to form a voluntary relationship could lead to a very different outcome. Instead of gaining a renewed appreciation for their sibling, an individual may instead gain rewards from not communicating with their sibling (such as less rivalry or jealousy) and as a result, realize that the costs of their relationship may outweigh the benefits of remaining close.

During this transition out of the home, parent and sibling relationships tend to lose importance, while peer and romantic relationships are becoming a priority for emerging adults (Conger & Little, 2010; Lindell, Barr, & Killoren, 2015). Despite this shift in relationship priorities, Scharf, Shulman, and Avigad-Spitz (2005) found that even though emerging adult-siblings spent less time together than during adolescence, they became a main source for support, advice, and intimacy for each other. Close sibling relationships have more “emotional exchanges, such as discussing personal matters, and feeling more warmth toward their siblings” (Scharf et al., 2005, p. 82) than siblings had at younger ages. Research findings suggest that perceived closeness between siblings in emerging adulthood is based on more than just time spent together.

Well-being

Research on sibling well-being in emerging adult relationships is limited; previous studies have primarily focused on childhood or later adulthood. In his 1989 study of sibling well-being in later life, Victor Cicirelli found that brothers' and sisters' perception of closeness to sisters was important for older adult's well-being, resulting in significantly fewer depressive symptoms. Milevsky (2005) made an attempt to close this research gap for emerging adults and found that emerging adult-siblings who reported high social support from siblings also reported less loneliness and depression as well as significantly higher self-esteem and life satisfaction than those who reported low sibling support. Further, sibling social support was able to partially or completely compensate for low levels of social support from other relationships including with mothers, fathers, and friends. Both of these previous studies examined the sibling relationship with sibling well-being as the outcome of the sibling relationship. However, it is possible that well-being could influence the relationship in other ways.

Humans are social creatures who have a need to develop and maintain social relationships. Humans maintain social relationships for a variety of rewards such as feelings of closeness and a positive well-being and previous research suggests that social relationships are linked to improvements in mental health (Thoits, 2011). To maintain these relationships individuals engage in 'relationship maintenance' by communicating with one another. As mentioned previously, this relationship maintenance becomes particularly important for the survival of sibling relationships during emerging adulthood, as these relationships begin to become voluntary and can become less important than romantic or peer relationships. Through an evaluation of the rewards and costs of maintaining a given relationship, the act of communicating may outweigh the rewards of

the given relationship such as the feelings of closeness. Individual well-being can also play a role in how we evaluate our relationships. Previous research tells us that our emotions can influence our perceptions of messages. For example, an individual experiencing depressive symptoms may interpret the message, “are you still in school” differently than someone not experiencing those symptoms. It is possible the individual could interpret the message as judgmental instead of the way intended by the sender. Using Keyes Mental Health Continuum, the current study was designed to explore how an individual's perceived, or subjective, well-being (measured through emotional, psychological, and social well-being) changes the relationship between frequency of sibling communication and sibling closeness.

Communication Technologies

With technologies such as smartphones and the growing popularity and prevalence of social media, it is important that the many ways siblings can communicate be explored to determine the impact these technologies may or may not be having on the sibling relationship. No longer living in the same home with their sibling, communication will be vital to the quality and closeness of the sibling relationship. With 88% of 18-29 year olds being social media users (Pew research center, 2018), and 100% of 18-29 year olds owning some type of cell phone (Pew research center, 2018), emerging adult-siblings no longer have to rely on face-to-face contact or phone calls to keep in touch with one another. Information and Communication Technologies (ICTs), such as texting and social networking sites, introduce new avenues for family members to communicate and interact with one another; ICTs may drastically impact the ways families maintain

relationships and thus the quality of family relationships (Lindell et al., 2015). For example, siblings describe ICTs as “paramount” for the maintenance of the sibling relationship, with less than 23% of respondents relying primarily on face-to-face communication with their siblings and instead turning to other technology-based methods for communication when one sibling left for college (Lindell et al., 2015). Research on the perceptions and uses of social networking sites has found that college students tended to view social networking sites such as Facebook as more appropriate for communicating with siblings than with parents; this may be due to the types of information that they share on Facebook (Goby, 2011).

Sibling Constellations

Sibling constellations (or structures) are the various “demographics” that identify a sibling’s position in the family relative to the other siblings in the family (Cicirelli, 1995). These positions are determined by the gender, spacing of siblings, number of siblings in a family, and birth order (Cicirelli, 1995) and each influences the sibling relationship in different, yet linked ways.

Gender constellations. Studies exploring the differences between sibling gender constellations have been around since the beginning of the 1950s; previous research has explored differences between gender constellations and feelings of warmth and closeness (Buhrmester & Furman, 1987, 1990; Cicirelli, 1982) as well as frequency of communication (Lindell et al., 2015). Findings suggest that same sex sibling dyads (female-female, male-male) tend to report closer and warmer relationships with one another than opposite sex sibling dyads (female-male; Cicirelli, 1989). Female siblings tend to communicate with their siblings more than male siblings. In fact, a study on

emerging adult-siblings found that even when female siblings were identified as “low communicators” they communicated more than males and were also higher “passive” communicators, checking in on their siblings through social networking sites (Lindell et al., 2015, p. 574).

Sibling spacing. Research on the effects of age spacing and sibling relationships have been limited and, of the studies available, results have been mixed. It has been suggested that a sibling age spacing of 2 to 4 years may be ideal, “for greater mental stimulation from one another while minimizing conflict” (Cicirelli, 1995, p. 74). Conger and Little (2010) argued that siblings who are close in age are able to have positive connections around their shared life experiences. However, Conger and Little (2010) also hypothesized that those same shared life experiences could promote negative comparisons between siblings and continue rivalries that were rooted in early childhood. This supports the findings of Stocker et al. (1997) that siblings who were farther apart in age perceived less conflict in their relationships than siblings who were closer in age. Further research is needed to address the mixed results found on the effects of age spacing on the quality of sibling relationships.

Purpose Statement

The purpose of the current study was to explore how frequently emerging adult-siblings are communicating with one another and how use of in person, phone, and ICTs are associated with perceived sibling closeness and well-being. Previous research shows that the sibling relationship begins to make a pivotal transition during emerging adulthood (Conger & Little, 2010). For the first time, siblings may not be living under the

same roof as one another and can therefore control for themselves how much, if any, contact they choose to have with one another (Cicirelli, 1995; Conger & Little, 2010; Scharf et al., 2005; Stocker et al., 1997). At the same time, friendships and romantic relationships are beginning to take precedence over familial relationships (Conger & Little, 2010; Lindell et al., 2015), making emerging adulthood a time of change and transition for siblings. The communication patterns and relationship maintenance behaviors established during emerging adulthood could dramatically influence the sibling relationship for years to come (White, 2001). With the emergence of technologies such as texting and social networking sites, maintaining the sibling relationship may be easier than ever before. The current study was designed to explore how these newer technologies, as well as previously studied technologies (such as telephone calls), influence emerging adult-sibling relationships. Extending the concepts and assumptions of social exchange theory, the goal of this study was to determine if well-being moderates the relationship between communication and perceived sibling closeness (see Figure 2). Four research questions are considered:

RQ1: Is frequency of sibling communication associated with perceived sibling closeness?

RQ2: Is frequency of sibling communication associated with well-being?

RQ3: Is perceived sibling closeness associated with well-being?

RQ4: Does well-being moderate the relationship between frequency of sibling communication and perceived sibling closeness?

Method

Participants

The present study used a subsample ($n= 236$) of emerging adults from a larger study who reported having at least one sibling. The average age of participants was 25.2 years and the average age of the siblings participants reported on was 26.0 years. The average age spacing between siblings was five years (range 1-32 years). Just under three-quarters of participants identified as White (73.4%), 8.4% identified as Black or African American, 7.6% as Asian, 7.6% as Hispanic or Latinx, 2.1% reported more than one race, and 0.4% identified as American Indian or Alaska Native. Participants included 88 males and 148 females; the siblings they reported on included 116 females and 120 males. Gender dyads consisted of 57 male participants reporting on a male sibling (male-male), 85 female participants reporting on a female sibling (female-female), 63 female participants reporting on a male sibling (female-male), and 31 male participants reporting on a female sibling (male-female). Thirty-three participants did not complete part or all of the sibling demographics or sibling communication sections of the survey. Detailed inspection of the data revealed that these participants did not have a sibling and therefore skipped this section of the survey; these 33 participants were deemed ineligible for the study and removed from the sample, leaving a final sample of 236 participants.

Procedures

Participants were recruited to take a 20-minute online survey through Amazon Mechanical Turk (MTurk), an online labor market. This labor market is designed to match temporary work from employers or “requesters” to employees (Dworkin, Hessel, Gliske & Rudi, 2016). Employers are able to post jobs to MTurk known as Human Intelligence Tasks (HITs). Workers can then browse existing jobs and complete them in

exchange for a monetary payment set by the employer. Since the launch of MTurk in 2005, research has shown MTurk to be an effective, low cost method for social science research, with samples from MTurk being characteristically diverse in terms of age, geography, and race (Dworkin et al., 2016). The current survey was advertised to employees on MTurk as a study that “focuses on young adult peer and family relationships and the ways that young adults use technologies in these relationships”. Respondents were compensated \$0.50 for their completion of the survey, a reasonable payment for MTurk workers for a task of this sort and an amount that would not lead participants to be coerced into completing the survey.

Measures

Participants responded to all survey questions about their closest sibling (see Table 1).

Perceived sibling closeness. Respondents reported their perceived sibling closeness to their closest sibling using a series of eight Likert-type scale questions designed to measure a participant’s relationship with family members (Vangelisti & Caughlin, 1997). One question, “how often do you talk about personal things with this family member [closest sibling]?” was removed from the analysis due to its strong conceptual overlap with the communication scale. Some example questions from the resulting 7-item scale are, “How close are you to this family member?” and “How important is your relationship with this family member?” The response scale ranged from 1 (not at all) to 7 (very much; $\alpha = .926$; $M = 5.55$, $SD = 1.47$).

Sibling communication. Participants reported how frequently they communicated with their closest sibling using various technologies using five Likert-type scale questions (Lenhart, Purcell, Smith, & Zickuhr, 2010). These five questions were selected from the larger scale of 15-items as the questions that focused specifically on communication; item skewness was also considered. For example questions such as, if siblings played online video games together, were not relevant to understanding the communication patterns in emerging adult-sibling relationships and were removed from analyses. For the complete list of questions used and questions removed see Table 1 and 2.

The five questions included in analyses ($\alpha=.778$) asked how often participants, “Talk to them in person?”, “Call them on the phone?”, “Send text messages to them (including apps like WhatsApp or Kik)?”, “Send private messages to them through social media?”, and “Reach out to them publicly on social media (share a link/photo with them, comment on or “like” their status updates, write on their timeline)?” The response scale ranged from 1 (*Never*) to 7 (*Several times a day*). Correlations between individual communication questions were computed to explore the relationships between the variables. Correlations between all variables were significant at the .01 level. Correlations ranged from $r=.187$ to $r=.617$. The correlation between “Send private messages to them through social media?”, and “Reach out to them publicly on social media (share a link/photo with them, comment on or “like” their status updates, write on their timeline)?” was highly correlated at $r=.617$. Correlations between items that are moderate to high, suggest that no additional information will be gained from using the individual

items (Leech, Barrett, & Morgan, 2015). Therefore, the mean score of the five questions was computed as one measure of sibling communication ($\alpha=.778$, $M=3.01$, $SD=1.26$).

Well-being. Participants responded to questions about their well-being using the Adolescent Mental Health Continuum-Short Form (Keyes, 2005). This scale contains 14 Likert-type questions that were used to create three subscales; emotional well-being (3 questions), for example, “During the past 30 days how often did you feel happy?” ($\alpha=.865$; $M=4.68$, $SD=1.00$); psychological well-being (6 questions), for example, “During the past 30 days how often did you feel that you liked most parts of your personality?” ($\alpha=.913$; $M=4.49$, $SD=1.12$); and social well-being (5 questions), for example, “How often did you feel that you had something important to contribute to society?” ($\alpha=.869$; $M=3.79$, $SD=1.19$). Response options included, 1 (*Never*) to 6 (*Every day*).

Control variables.

Internalizing and externalizing. Measures of internalizing and externalizing behaviors were included as control variables. A participant’s emotional state has been shown to bias their responses to survey items and in turn lead to an inflation of associations between variables (Rueter et al., 2015). For this study, these measures were used as controls to ensure that participants’ positive or negative affect did not account for the relationships that emerged. It is reasonable to assume that those participants who may have been experiencing externalizing behaviors such as aggression or internalizing symptoms such as depression, may have answered questions regarding how close they feel to their sibling differently than those who were not experiencing these behaviors. Internalizing and externalizing behaviors were measured using the Strengths and Difficulties Questionnaire-Adolescent report (SDQ; Goodman, 1997). This measure

consists of 25 questions separated into three scales: internalizing behaviors (10 questions) for example, “I would rather be alone than with other people,” ($\alpha=.709$; $M=1.74$, $SD=.370$), and externalizing behaviors, (10 questions) an example being, “I am restless, I find it hard to sit down for long”, ($\alpha= .704$; $M=1.51$, $SD=.316$). The five remaining questions assessed prosocial behaviors, however that scale was not utilized for this study. Participants responded using a Likert-type scale that ranged from 1 (*Not true*) to 3 (*Certainly true*). The computing of internalizing and externalizing scales is suggested for assessing broad constructs of internalizing and externalizing behaviors among low-risk samples (Goodman, Lamping, & Ploubidis, 2010). Scales were computed by combining several smaller scales. To broadly assess externalizing behaviors, the hyperactivity scale and conduct problems scales were combined and to assess internalizing behaviors, the emotional symptoms scale and peer problems scales are combined (Goodman, 1997).

Demographics. Participants reported their age as well as the age of their closest sibling. Based on previous literature, which suggests age is a constellation variable that can influence the sibling relationship, age of the participant and age of the sibling reported on were controlled for (see Table 3).

Participants reported their gender as well as the gender of their closest sibling. Four gender dyads were created (participant gender, sibling gender) dyad=1 (male-female), dyad=2 (male-male), dyad=3 (female-female), and dyad=4 (female-male). Four gender dyads were created, instead of combining the male-female and female-male groups, due to previous research that has shown that males and females tend to report and perceive their relationships differently (Lindell et al., 2015).

Participants reported whether they had resided with the sibling they were reporting on for the majority of the last 12 months (yes or no). Residing with a sibling for the past 12 months was controlled for due to the fact that communication with a sibling and sibling closeness would likely be influenced by sharing a residence.

Participants reported their race as either American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, Caucasian, Hispanic or Latin American, mixed race, don't know or prefer not to answer, or other. Participants also reported on marital status, if they had children, their parents marital status, the last grade they completed in school, their school status over the last twelve months (enrolled in school full time, enrolled in school part time, on leave, or not in school), what degree they were seeking to obtain, work status over the past twelve months (full time, part time, unemployed/looking, or unemployed/not looking), and annual gross income.

Data Analysis Plan

Missing Data

Missing data were found for all five communication variables. Little's Missing Completely at Random (MCAR) test was run first to test the hypothesis that the data were missing completely at random; this assumption must be met prior to replacing missing values with imputation techniques. Results from the MCAR test revealed that the data were missing completely at random ($\chi^2=7.09$, $df=8$, $p=.527$). Since the amount of missing data found was less than 2% for all five communication questions (0.4%, 0.4%, 0.4%, 0.8%, and 1.3%) expectation maximization (EM) was used to handle and explore the missing data. EM is a two-part procedure, in which the value of the missing data is

estimated based on other key variables and is replaced with the value that is most likely. EM imputations are better than other types of imputations because the relationship with other variables is preserved, which is vital for the later regression (Enders, 2003). EM was run with the five communication variables to replace the missing data with the most likely values. Missing data was also found for the internalizing (two people did not answer one question, 0.8% missing) and externalizing variables (three people did not answer one question and one person did not answer two questions, 1.7% missing), emotional well-being (one person did not answer one question, 0.4% missing), social well-being (three people did not answer one question, 1.3% missing), and sibling closeness (one person did not answer one question, 0.4% missing). Results from Little's MCAR test showed that the data missing from all variables was not missing completely at random ($\chi^2=35.5$, $df=20$, $p=.018$). Inspection of the data revealed very little missing data within each scale (see Table 4). A new variable was created in order to test if there were any statistically significant differences between participants with any missing data and those without missing data on variables of interest. T-tests and chi-square tests revealed no significant differences for any of the variables in the study. With so little missing data and no meaningful differences between participants with missing data and those with complete data, missing data was handled through EM procedures.

Preliminary Analyses

Preliminary analyses were first computed to examine the relationships between variables of interest. Descriptive statistics, including frequencies, were computed and the means and standard deviations of items and scales were computed. After inspection of the variables, intercorrelations of variables were computed (see Table 5).

Participants reported on marital status, if they had children, their parents marital status, the last grade they completed in school, their general school status over the last twelve months, what degree they were seeking to obtain, work status over the past twelve months, and current annual gross income. ANOVA's and independent samples T-tests were computed to determine relationships between these demographic variables and sibling closeness and communication. However, there were no significant differences for any of these demographic variables and sibling closeness and communication, so they were not included in the analyses.

Assumptions. Before testing for moderation, the data were evaluated to determine if the three assumptions of moderation were met. For this research study the predictor or independent variable was sibling communication and the dependent variable was perceived sibling closeness. The potential moderation variable was well-being (see Figure 2).

The first assumption of moderation is that there must be a linear relationship between the predictor or independent variable and the dependent variable (Baron & Kenny, 1986; Leech, Barrett, & Morgan, 2015); in the current study, there must be a relationship between sibling communication and sibling closeness. This can be tested through scatterplots, and looking at the arrangement of the points to be sure they form a linear shape (Leech et al., 2015). A scatterplot matrix was run and showed that the independent variable had a linear relationship with the dependent variable (the points on the scatterplot form a straight line instead of a curve); this assumption was met (see Figure 3). The second assumption is that the error, or residuals are normally distributed. This assumption can also be tested through the examination of a scatterplot of the error

terms. The scatterplot for normality was examined to make sure the points appeared evenly scattered (Leech et al., 2015). Results from the scatterplot matrix showed a fairly normal distribution of the dots with few or no outliers for the variables; this assumption was also met. The final assumption of moderation is that of multicollinearity, which occurs when there is a high intercorrelation between variables (Leech et al., 2015). This can create problems such as inaccurate or misleading results. In general, variables would be considered highly correlated with a correlation of .7 or higher. To ensure that the variables did not violate this assumption, correlations between variables were computed and examined. This assumption was also met.

Testing for Moderation

After testing the assumptions of moderation, analyses were run using IBM SPSS Statistics 23. First, since variables were not measured using the same scale the predictor variable, frequency of sibling communication, as well as each of the moderation variables (emotional, psychological, and social well-being) were standardized to allow comparison of measures on the same scale, and thus make results easier to understand. Next, the standardized frequency of communication was multiplied by each of the standardized well-being variables to form three interaction terms.

Next, three regressions were computed, one with each potential moderator of well-being (emotional, psychological, and social). In the first step, the regression models were fit with communication and well-being (either emotional, psychological, or social). In the second step, control variables were entered which included age, race, gender, living with a sibling, as well as internalizing and externalizing behaviors. This was done to see if these variables account for a significant amount of variable in sibling closeness.

Last, the interaction term between the frequency of communication and each of the well-being variables was added to the regression model. Examination of the proportion of variance in sibling closeness from these given results, along with the examination of an interaction plot determined if well-being moderated the relationship between sibling communication and closeness.

Results

Testing Associations

First, analyses were conducted to explore differences by gender dyads. Results from a one way ANOVA revealed that female-female and male-male dyads were statistically different than female-male gender dyads in relation to their frequency of communication, with female-female and male-male gender dyads communicating more frequently than female-male dyads (see Table 6). No statistical differences were found between gender dyads in sibling closeness, emotional well-being, psychological well-being, or social well-being (see Table 6). Next, to address the first three research questions, correlations were computed to test the associations between sibling communication, sibling closeness and emotional, psychological, and social well-being (see Table 5). Sibling communication and sibling closeness were significantly correlated, $r(236)=.529, p=.000$ (research question 1). Sibling communication was significantly correlated with all three measures of well-being: emotional well-being, $r(236)=.196, p=.000$, psychological well-being $r(236)=.238, p=.000$, and social well-being $r(236)=.203, p=.000$ (research question 2). Perceived sibling closeness was also significantly correlated with emotional well-being, $r(236)=.211, p=.001$ and

psychological well-being, $r(236)=.223$, $p=.001$ but was not significantly correlated with social well-being, $r(236)=.121$, $p=.064$ (research question 3).

Moderation

Emotional well-being. Emotional well-being was tested as a moderator of the relationship between frequency of sibling communication and perceived sibling closeness. The full model was statistically significant $F(15,220)= 8.12$, $p=.000$. Communication ($\beta=.525$, $t(236)= 8.40$, $p= .000$), male-female gender dyads ($\beta=.169$, $t(236)= 2.75$, $p= .006$) and Asian race ($\beta= -.197$, $t(236)= -1.97$, $p= .050$) were all significantly associated with sibling closeness in the full model (see Table 7). The interaction term between emotional well-being and communication was not significant ($\beta=-.034$, $p=.561$) and did not explain a significant increase in variance in perceived sibling closeness, $\Delta R^2 = .001$, $F(1, 220)= .339$, $p=.561$. Emotional well-being was not a significant moderator of the relationship between frequency of sibling communication and perceived sibling closeness.

Psychological well-being. Psychological well-being was tested as a moderator of the relationship between frequency of sibling communication and perceived sibling closeness. The full model was statistically significant $F(15,220)= 8.07$, $p=.000$. Communication ($\beta=.519$, $t(236)= 8.27$, $p= .000$), male-female gender dyads ($\beta=.166$, $t(236)= 2.71$, $p= .007$) and Asian race ($\beta= -.193$, $t(236)= -1.93$, $p= .055$) were all significantly associated with sibling closeness in the full model (see Table 8). The interaction term between psychological well-being and communication was not significant ($\beta= -.026$, $p=.655$) and did not explain a significant increase in variance in perceived sibling closeness, $\Delta R^2 = .001$, $F(1, 220)= .200$, $p=.655$. Psychological well-

being was not a significant moderator of the relationship between frequency of sibling communication and perceived sibling closeness.

Social well-being. Social well-being was tested as a moderator of the relationship between frequency of sibling communication and perceived sibling closeness. The full model was statistically significant $F(15,220)= 7.99, p=.000$. Communication ($\beta=.536, t(236)= 8.65, p= .000$) and male-female gender dyads ($\beta=.165, t(236)= 2.68, p= .008$) were both significantly associated with sibling closeness in the full model (see Table 9). The interaction term between social well-being and communication was not significant ($\beta= -.049, p=.414$) and did not explain a significant increase in variance in perceived sibling closeness, $\Delta R^2 = .002, F(1, 220)= .670, p=.414$. Social well-being was not a significant moderator of the relationship between frequency of sibling communication and perceived sibling closeness.

Discussion

Previous sibling research has mainly focused on young children, adolescents, and the elderly, creating a gap in the literature. The goal of this research was to explore the understudied area of emerging adult-sibling relationships: their closeness, frequency of communication, and emotional, psychological, and social well-being. Most previous studies did not include specific questions about sibling communication using social networking sites and the potential influence this may have on the sibling relationship.

Sibling Communication, Sibling Closeness, and Well-being

According to social exchange theory, closeness, emotional support, advice, and warmth would be some of the possible rewards of a sibling relationship during emerging

adulthood. Several studies (Cicirelli, 1980; Scharf et al., 2005) have found that, even though emerging adult siblings are spending less time together, close sibling relationships have more “emotional exchanges, such as discussing personal matters, and feeling more warmth toward their siblings” (Scharf et al., 2005, p. 82) than siblings at younger ages. Consistent with social exchange theory, results showed that sibling communication was associated with perceived sibling closeness. Participants communicated with their closest sibling relatively infrequently ($M=3.02$), only every few weeks, and still considered themselves as close ($M=5.55$) to their sibling. These findings suggest that despite less frequent daily interactions during emerging adulthood, siblings are still an important source of support and advice for each other. It is possible that the content of the messages may be more important to maintaining the sibling relationship than the amount of times siblings communicate with one another; future research should explore the content of sibling messages and how what is communicated is related to feelings of perceived sibling closeness.

Findings also revealed that sibling communication was positively associated with all three types of well-being. However, we do not know whether more communication causes increased well-being or if increased well-being causes siblings to communicate more. Social exchange theory suggest that either or even both could be true. During the evaluation of their sibling relationship, it is possible that the rewards or costs of the relationship impact well-being and as a result lead to increases or decreases in communication. In contrast, more frequent or less frequent communication could also impact well-being. In addition, participant reports of internalizing behaviors were negatively associated with sibling closeness. Results begin to further our understanding

of emerging adult-sibling relationships and suggest the need to further explore the ways in which sibling relationships are related to both positive well-being and poor mental health.

Previous studies on sibling communication (Furman & Buhrmester, 1992; Lindell et al., 2015; Whiteman, McHale, & Crouter, 2011) have found female siblings to report more warmth in their relationships, with some suggesting female siblings communicate more frequently. Results also showed that female-female and male-male dyads were statistically different from female-male gender dyads in relation to their frequency of communication, with female-female and male-male sibling pairs reporting significantly more frequent communication than female-male siblings. However, we found that male-female gender dyads were the only dyads significant in the full model but were not statistically different from other gender dyads in their closeness. These results provide preliminary evidence that the gender of the respondent and gender of their sibling matters in understanding sibling communication and closeness.

The relationship between sibling closeness and well-being was also examined. Results showed that both emotional and psychological well-being were associated with sibling closeness while social well-being was not found to be significantly associated with sibling closeness. Questions used to assess social well-being sought to examine how individuals saw themselves in their public, social lives based on five dimensions, social integration, social contribution, social coherence, social actualization, and social acceptance (Keys, 2005). Previous research has shown that during emerging adulthood, relationships begin to shift in importance, with family relationships taking the back seat to romantic and peer relationships. This could potentially explain why we did not see an

association between social well-being and sibling closeness. The social well-being scale was designed as a measure of positive functioning and it may be that when siblings are high in social well-being, they are receiving rewards such as closeness from other relationships, for example from friends or romantic relationships.

Race was also examined as a control variable and entered in the second step of each regression analysis. Examination of the results from the third step, full model, revealed the race Asian to be negatively associated with closeness in both the emotional and psychological well-being models. These results suggest that Asian siblings reported lower levels of sibling closeness than compared to White, African American, and Hispanic/ Latin American siblings.

Research on sibling relationships has predominately focused on white samples, with our own sample containing only 7.6% of respondents who identified as Asian. In their review of sibling literature, McHale, Updegraff, and Whiteman (2012) identified several studies on African American siblings (Brody et al., 2003; Brody, Kim, Murry, & Brown, 2003; East, Reyes, & Horn, 2007; McHale, Whiteman, Kim, & Crouter, 2007) and several on Mexican American families (Gamble & Modry- Mandell, 2008; Killoren, Thayer, & Updegraff, 2008; Updegraff, McHale, Whiteman, Thayer, & Delgado, 2005), concluding that cultural factors influence sibling relationships. No studies of Asian American siblings were identified. McHale and colleagues (2012) call for more cross-cultural research of sibling relationships; findings from the current study echo this call for more research examining cross-cultural sibling relationships. Cultural differences could not be explored in this study.

Well-being as a Moderator

Results revealed that neither emotional, psychological, nor social well-being were significant as moderators; well-being did not affect the direction or strength of the relationship between sibling communication and sibling closeness. However, all or most types of well-being were significantly associated with sibling communication and sibling closeness and it may be that there are other factors contributing to the emerging adult-sibling relationship that can further explain these relationships.

Limitations and Future Directions

Several limitations of the study need to be considered. First, this project utilized cross sectional data. Therefore, although results indicate associations between sibling communication, well-being, and closeness we cannot assume causation. Future studies may want to consider a longitudinal approach to understanding changes in sibling communication and closeness over time. Second, surveys were completed by only one member of the sibling dyad. There is much to learn from reports of all siblings in a given family in order to see if reports of closeness and communication match between siblings as well as to provide researchers the opportunity to explore as many constellation variables as possible in a single study.

An extensive amount of research has been conducted on sibling birth order. These studies have focused on characteristics of each birth position and differential treatment of siblings by parents (McHale et al., 2012). It is suggested that differential treatment of siblings stems from the first-born child receiving more attention and resources from parents than subsequent children (McHale et al., 2012). Previous findings from sibling research is mixed when it comes to sibling age and gender dyads. Some studies have found that both age and gender were significant in influencing various aspects of the

sibling relationship, other studies have found only one or neither to be significant. In the current study, neither sibling nor participant age were significantly associated with sibling closeness. This demonstrates a need for further exploration of the sibling relationships and the variables that may influence these life-long relationships. Finally, as mentioned previously, future research should examine the content of messages. Different technologies are used to send different types of messages. For example the content of messages posted publicly on SNS sites may be very different from what it said in a private message between siblings. Therefore, investigating various forms of communication could help determine if it is content of the messages that may be creating feelings of closeness as well as the impact technology is playing on these relationships.

The current study was designed to further understand the intricate nature of the life-long sibling relationship. Findings add to previous sibling literature by including ICTs such as social networking sites as possible modes of sibling communication, and exploring well-being as a moderator rather than an outcome of the sibling relationship. Though not a significant moderator, findings suggests a relationship between well-being and sibling closeness and communication, demonstrating the power sibling relationships have and concluding that emerging adult-sibling relationships have their own place in the sibling developmental life-span.

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Appendix

Table 1

<i>Full List of Questions</i>
Psychological Well-Being
During the past 30 Days,
1. How often did you feel that you liked most parts of your personality?
2. How often did you feel good at managing the responsibilities of your daily life?
3. How often did you feel that you had warm and trusting relationships with others?
4. How often did you feel that you had experiences that challenged you to grow and become a better person?
5. How often did you feel confident to think or express your own ideas and opinions?
6. How often did you feel that your life has a sense of direction or meaning to it?
Emotional Well-Being
During the past 30 Days,
1. How often did you feel happy?
2. How often did you feel interested in life?
3. How often did you feel satisfied with life?
Social Well-Being
During the past 30 Days,
1. How often did you feel that you had something important to contribute to society?
2. How often did you feel that you belonged to a community (like a social group, your school, or your neighborhood)?
3. How often did you feel that our society is a good place, or is becoming a better place, for all people?
4. How often did you feel that people are basically good?
5. How often did you feel that the way our society works made sense to you?
Internalizing
For each item, please mark the box for Not True, Somewhat True, or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain. Please give your answers on the basis of how things have been for you over the last six months.
1. I get a lot of headaches, stomach-aches or sickness.
2. I would rather be alone than with other people.
3. I worry a lot.
4. I have at least one good friend.
5. I am often unhappy, depressed or tearful.
6. I am nervous in new situations. I easily lose confidence.
7. Other people pick on me or bully me.

8. I get along better with older people than with people my own age.
9. I have many fears, I am easily scared.
10. Other people generally like me.

Externalizing

For each item, please mark the box for Not True, Somewhat True, or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain. Please give your answers on the basis of how things have been for you over the last six months.

1. I am restless, I am restless, I find it hard to sit down for long
 2. I get very angry and often lose my temper.
 3. I am generally willing to do what other people want.
 4. I am constantly fidgeting or squirming.
 5. I fight a lot. I can make other people do what I want.
 6. I am easily distracted, I find it difficult to concentrate.
 7. I am often accused of lying or cheating.
 8. I think before I do things.
 9. I take things that are not mine from home, work or elsewhere.
 10. I finish the work I'm doing. My attention is good.
-

Closeness

Answer the following questions using a scale from 1 (Not at all) to 7 (Very much)

1. How close are you to this family member?
 2. How satisfied are you with your relationship with this family member?
 3. How important is your relationship with this family member?
 4. How much do you like this family member?
 5. How important is this family members opinion to you?
 6. How much do you enjoy spending time with this family member?
-

Communication

Thinking about all the different ways you have communicated with different family members and friends over the past 12 months, how often do you...

1. Talk to them in person
2. Call them on the phone
3. Receive a call from them on the phone but not answer it?
4. Receive a call and accept a call from them on the phone?
5. Send text messages to them (including apps like WhatsApp or Kik)
6. Receive text messages to them (including apps like WhatsApp or Kik)?
7. Send emails to them?
8. Receive emails from them?
9. Send private messages to them through social media
10. Receive private messages from them through social media?
11. Reach out to them publicly on social media (share a link/photo with them, comment on or "like" their status updates, write on their timeline)

12. Do they reach out to them publicly on social media (share a link/photo with them, comment on or “like” their status updates, write on their timeline)?
 13. Play video games with them (online or in person)?
 14. Call them via Skype or other video conferencing?
 15. Respond to their calls via Skype or other video conferencing?
-

Table 2

Communication Descriptives

	N	Mean	SD	Skewness	Kurtosis
Talk to them in person	235	3.67	1.856	.528	-.850
Call them on the phone	235	2.95	1.616	.714	-.102
Send text messages to them (including apps like WhatsApp or Kik)	235	3.50	1.866	.405	-.925
Send private messages to them through social media	234	2.40	1.736	1.319	.783
Reach out to them publicly on social media (share a link/photo with them, comment on or "like" their status updates, write on their timeline)	233	2.57	1.642	.895	-.189

Table 3

Descriptive Statistics of Control Variables

	N	M	SD	%	Range
Participant age	236	25.13	2.84		
Sibling age	236	26.03	6.42		
Race	236				
Asian	18			7.6	
Black or African American	20			8.5	
White or Caucasian	173			73.3	
Hispanic or Latin American	18			7.6	
Participant gender	236				
Male	88			37.3	
Female	148			62.7	
Sibling gender	236				
Male	120			50.8	
Female	116			49.2	
Dyad=1 (M,F)	31				
Dyad=2 (F,F)	85				
Dyad=3 (M,M)	57				
Dyad=4 (F,M)	63				
I have lived with this person the majority of the time during the past 12 months	236				
Yes	57			24.2	
No	179			75.8	
Internalizing	236	1.49	.370		1-3

Externalizing	236	1.74	.316	1-3
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Note. Dyad= (Participant gender, sibling gender)

Table 4

Missing Data

Variable	N	Missing	
		Count	Percent
Internalizing	235	2	.8
Externalizing	233	4	1.7
Emotional Well-being	236	1	.4
Social Well-being	234	3	1.3
Sibling Closeness	236	1	.4

Table 5

Means, Standard Deviations, and Correlations of Model Variables

Variables	Mean	SD	Correlations											
			1	2	3	4	5	6	7	8	9			
1 Sibling Closeness	5.55	1.47	-											
2 Sibling Communication	3.01	1.26	.529**	-										
3 Psychological Well-being	4.49	1.12	.223**	.238**	-									
4 Social Well-being	3.79	1.19	.121	.203**	.740**	-								
5 Emotional Well-being	4.68	1.00	.211**	.196**	.826**	.667**	-							
6 Internalizing	1.74	.370	-.169**	-.168**	-.378**	-.377**	-.409**	-						
7 Externalizing	1.51	.316	-.115	-.070	-.244**	-.168**	-.302**	.477**	-					
8 Age of Participant	25.13	2.84	-.024	.013	.020	-.067	-.012	.029	-.006	-				
9 Age of Sibling	26.03	6.40	-.056	-.091	-.011	.033	-.073	-.059	-.40	.333**	-			

Note. * $p < .05$, ** $p < .001$.

Table 6

Means and Standard Deviations of Key Variables, by Gender Dyads

	Male, female (n=31)	Female, female (n=85)	Male, male (n=57)	Female, male (n=63)
Closeness	5.98 ^a (1.14)	5.55 ^a (1.37)	5.46 ^a (1.53)	5.40 ^a (1.67)
Communication	2.94 ^{ab} (1.01)	3.31 ^{a**} (1.42)	3.15 ^{a*} (1.25)	2.53 ^b (1.02)
Emotional Well-being	4.70 ^a (.980)	4.76 ^a (.972)	4.47 ^a (1.01)	4.79 ^a (1.05)
Psychological Well-being	4.58 ^a (1.05)	4.53 ^a (1.14)	4.37 ^a (1.07)	4.52 ^a (1.22)
Social Well-being	3.83 ^a (1.26)	3.75 ^a (1.24)	3.88 ^a (1.13)	3.65 ^a (1.16)

Note. Means shown. Standard deviations are in parentheses. Gender dyads= (participant gender, sibling gender). The difference between means is not statistically significant if letters are the same according to Tukey's Honestly Significant Difference. The difference between means is statistically significant if letters are different according to Tukey's Honestly Significant Difference.

* $p < .05$, ** $p < .001$.

Table 7

Summary of Regression Analysis for Emotional Well-being as a Moderator (N = 236)

Variable	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>p</i>	95% CI	
Communication	.611	.073	.525	8.395	.000**	.468	.754
Emotional Well-being	.107	.094	.073	1.135	.257	-.079	.293
Male, female	.733	.267	.169	2.748	.006*	.207	1.259
Female, female	.089	.223	.026	.399	.690	-.351	.529
Female, male	.306	.216	.092	1.419	.157	-.119	.732
Asian	-1.090	.553	-.197	-1.971	.050*	-2.180	.000
Black or African American	.050	.554	.009	.090	.928	-1.043	1.143
White/Caucasian	-.069	.483	-.021	-.143	.886	-1.021	.882
Hispanic/Latin American	.093	.558	.017	.168	.867	-1.006	1.192
Internalizing	-.031	.276	-.008	-.113	.910	-.574	.512
Externalizing	-.336	.303	-.072	-1.111	.268	-.933	.260
Lived with a Sibling	-.222	.203	-.065	-1.098	.273	-.622	.177
Age of Participant	.002	.014	.008	.139	.889	-.025	.029
Age of Sibling	-.017	.031	-.032	-.547	.585	-.077	.044
Communication x EWB	-.043	.073	-.034	-.582	.561	-.187	.101

Note. CI= confidence interval. EWB=Emotional Well-Being Male, male was used as the comparison group for gender dummy coded variables.

* $p < .05$, ** $p < .001$.

Table 8

Summary of Regression Analysis for Psychological Well-being as a Moderator (N = 236)

Variable	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>p</i>	95% CI	
Communication	.604	.073	.519	8.273	.000**	.460	.748
Psychological Well-being	.082	.082	.063	1.001	.318	-.079	.243
Male, female	.722	.267	.166	2.707	.007*	.196	1.247
Female, female	.070	.220	.020	.318	.751	-.363	.503
Female, male	.295	.216	.089	1.365	.174	-.131	.721
Asian	-1.068	.552	-.193	-1.933	.055*	-2.157	.021
Black or African American	.052	.555	.010	.093	.926	-1.043	1.146
White/Caucasian	-.054	.483	-.016	-.112	.911	-1.005	.897
Hispanic/Latin American	.117	.557	.021	.210	.834	-.980	1.213
Internalizing	-.049	.272	-.012	-.179	.858	-.585	.487
Externalizing	-.362	.303	-.078	-1.193	.234	-.960	.236
Lived with a Sibling	-.228	.202	-.066	-1.128	.261	-.627	.171
Age of Participant	.001	.014	.002	.039	.969	-.026	.027
Age of Sibling	-.017	.031	-.034	-.567	.572	-.078	.043
Communication x PWB	-.027	.060	-.026	-.447	.655	-.144	.091

Note. CI= confidence interval. PWB=Psychological Well-Being Male, male was used as the comparison group for gender dummy coded variables.

* $p < .05$, ** $p < .001$.

Table 9

Summary of Regression Analysis for Social Well-being as a Moderator (N = 236)

Variable	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>p</i>	95% CI	
Communication	.625	.072	.536	8.653	.000**	.482	.767
Social Well-being	-.029	.075	-.024	-.387	.699	-.177	.119
Male, female	.716	.267	.165	2.677	.008*	.189	1.242
Female, female	.045	.219	.013	.206	.837	-.386	.476
Female, male	.307	.216	.092	1.416	.158	-.120	.733
Asian	-1.016	.553	-.184	-1.839	.067	-2.106	.073
Black or African American	.138	.559	.026	.246	.806	-.964	1.240
White/Caucasian	.001	.482	.000	.001	.999	-.950	.951
Hispanic/Latin American	.116	.559	.021	.208	.835	-.986	1.218
Internalizing	-.175	.274	-.044	-.638	.524	-.716	.366
Externalizing	-.392	.302	-.085	-1.300	.195	-.987	.202
Lived with a Sibling	-.252	.205	-.073	-1.228	.221	-.656	.152
Age of Participant	.001	.014	.006	.099	.921	-.026	.028
Age of Sibling	-.018	.031	-.034	-.577	.565	-.078	.043
Communication x SWB	-.044	.054	-.049	-.818	.414	-.151	.062

Note. CI= confidence interval. SWB=Social Well-Being Male, male was used as the comparison group for gender dummy coded variables.

* $p < .05$, ** $p < .001$.

		Rewards	
		High	Low
Costs	High	<p>Quadrant I</p> <p>Balanced Exchange Relationship</p> <p>Sibling may be receiving a high amount of sibling closeness but at high personal cost</p> <p>Potentially Unsatisfying Relationship</p>	<p>Quadrant II</p> <p>Unbalanced Exchange Relationship</p> <p>Sibling may be receiving a low amount of sibling closeness but at high personal cost</p> <p>Potentially Unsatisfying Relationship</p>
	Low	<p>Quadrant III</p> <p>Ideal Exchange Relationship</p> <p>Sibling may be receiving a high amount of sibling closeness but at low personal cost</p> <p>Potentially Satisfying Relationship</p>	<p>Quadrant IV</p> <p>Unrewarding Exchange Relationship</p> <p>Sibling may be receiving a low amount of sibling closeness but at low personal cost</p> <p>Potentially Unsatisfying Relationship</p>

Figure 1. Costs and rewards diagram demonstrating the four possible social exchange sibling relationships.

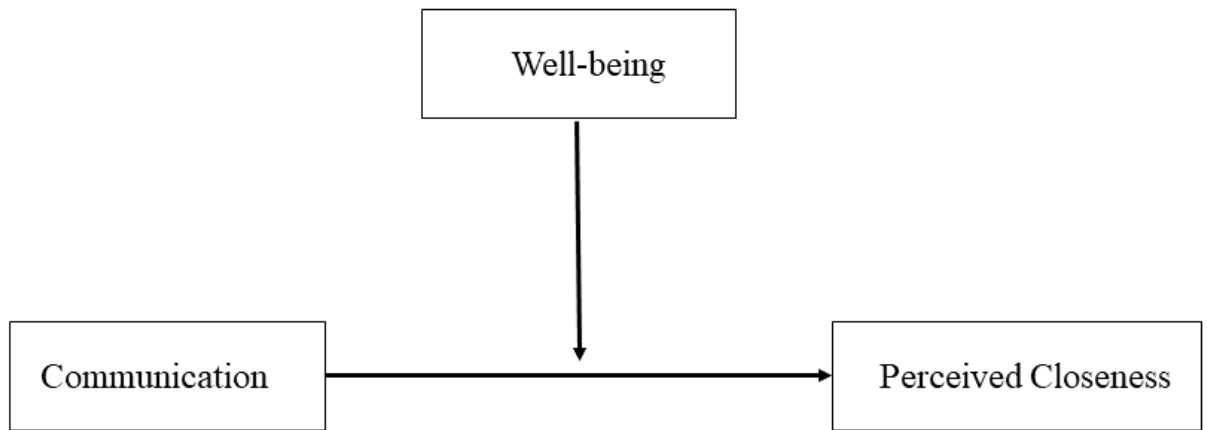


Figure 2. Conceptual model of well-being moderating the relationship between communication and perceived closeness.

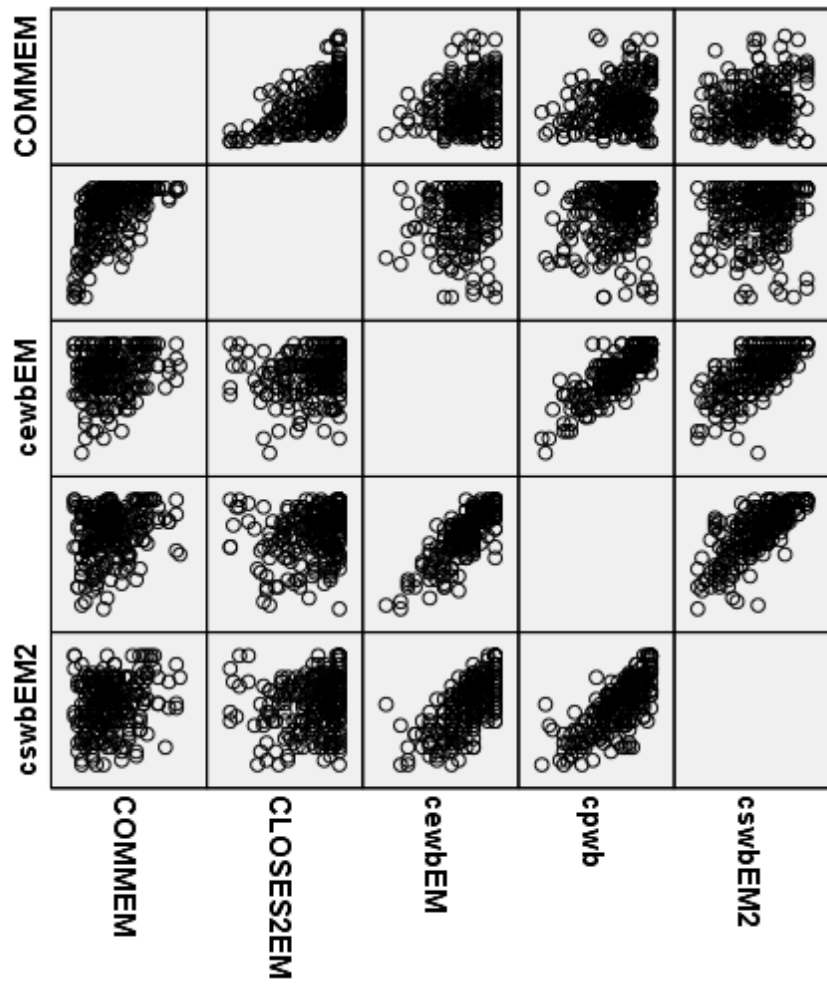


Figure 3. Scatter plot Matrix testing assumptions of moderation.