More Than Just Sex: Affection Mediates the Association Between Sexual Activity and Well-Being

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Abstract

Positive interpersonal interactions such as affection are central to well-being. Sex is associated with greater individual well-being, but little is known about why this occurs. We predicted that experienced affection would account for the association between sex and well-being. Cross-sectional results indicated that affection mediated the association between sex and both life satisfaction (Study 1) and positive emotions (however, among men only in Study 2). In Study 3, an experience sampling study with 106 dual-earner couples with children, affection mediated the association between sex and increased positive affect in daily life. Cross-lagged analyses in Study 3 to 4 supported the predicted direction of the associations. Moreover, the strength of the daily association between sex and positive affect predicted both partners' relationship satisfaction 6 months later. Our findings underscore the importance of affection and positive affect for understanding how sex promotes well-being and has long-term relational benefits.

> Only the united beat of sex and heart together can create ecstasy
>
> —Anaïs Nin

Decades of research indicate that social relationships are a basic human need (Baumeister & Leary, 1995), as they are crucial for health and well-being (e.g., Holt-Lunstad, Smith, Layton, & Brayne, 2010). Most studies linking close relationships to well-being have focused on social support, while neglecting the importance of nonverbal interactions, such as sex or touch (Gallace & Spence, 2010; Impett, Muise, & Peragine, 2014). Sexual activity in romantic relationships is a nonverbal interaction often experienced as highly intimate (e.g., Muise & Impett, 2016). Moreover, the literature suggests a robust positive association between sexual frequency and well-being (e.g., Blanchflower & Oswald, 2004; Muise, Schimmack, & Impett, 2016). However, little is known about what accounts for this association. Sexuality research has tended to neglect relational aspects of sexuality (Impett et al., 2014). As illustrated by Anaïs Nin's quote, sex should be the most rewarding when coupled with an affectionate connection to the partner. This article aims to merge research on sexuality with research on close relationships (Diamond, 2013) to test the hypothesis that sexual activity is associated with affectionate experiences with the partner, in turn promoting positive emotions and well-being.

Sexuality and Well-Being

The link between having an active and satisfying sexual life and individual well-being has received strong support. In a large nationally representative U.S. sample, sexual frequency was associated with greater general happiness (Blanchflower & Oswald, 2004). In a large international study, sexual frequency and sexual satisfaction were associated with greater life happiness in older adults (Laumann et al., 2006). In addition, Muise, Schimmack, et al. (2016) underscore the relevance of these basic findings: the size of the difference in well-being for people having sex once a week, compared with those having sex less than once a month, was greater than the size of the difference in well-being for those making US$75,000 compared with US$25,000 a year—a US$50,000 difference.

General well-being emerges from the accumulation of daily positive and negative events and emotions (Schwarz, Kahneman, & Xu, 2009), and experiencing daily positive

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emotions causes an increase in well-being over time (Cohn, Fredrickson, Brown, Mikels, & Conway, 2009). Moreover, interactions with a romantic partner are crucial determinants of emotions (Schoebi & Randall, 2015), and intimate exchanges are among the activities that are most highly linked with positive affect (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004). Thus, it seems important to examine the link between sexual activity and subsequent affective experiences.

Coinciding with a general lack of attention to positive processes in sex research (Impett, Muise, & Breines, 2013), little attention has been paid to how sex is associated with affective states. A few studies indicate nevertheless that sex is linked with positive affect. Donald, Lucke, Dunne, and Raphael (1995) showed that a fulfilling sexual life is associated with more positive and less negative emotions in adolescents. In experimental settings, sexual arousal has been linked to more positive and less negative affect in men (Meisler & Carey, 1991) and women (Heiman, 1980). Even subliminal sexual cues can increase positive affect (Gillath & Collins, 2016). However, it remains unclear whether these findings are ecologically valid, as they are either retrospective (Donald et al., 1995) or gathered in artificial lab settings (Gillath & Collins, 2016; Heiman, 1980; Meisler & Carey, 1991), and as such are subject to several biases, especially given the intensely private nature of sex in relationships (Janssen, 2002; Wiederman, 2004).

A promising approach to understanding the emotional dynamics associated with sex is to study couples naturalistically in their daily lives (Laurenceau & Bolger, 2012). Even if this method does not allow us to draw firm causal conclusions (Conner & Lehman, 2012), it has the advantage of informing about and generalizing to couples' daily lives. Only a few studies, based solely on female samples, have examined daily associations between sexual activity and affect. Burleson, Trevathan, and Todd (2007) found that when middle-aged women had sex, they experienced lower negative mood and stress on the next day. Moreover, Fortenberry and colleagues (2005) showed that adolescent girls experienced more positive and less negative affect on days when they engaged in sex. This suggests that sex may serve as a unique source of positive affect in daily life, but it remains unclear whether these results extend to both genders.

The Importance of Affectionate Experiences

People have a fundamental need to belong, and as such, strive to experience emotionally satisfying bonds with significant others (Baumeister & Leary, 1995). An important way to fulfill the need to belong is by experiencing affection, defined as "a feeling of fondness and intense positive regard" for another person, or perceived from another person (Floyd, 2008, p. 4). How are such affectionate experiences generated? Both verbal and nonverbal behaviors can convey affectionate feelings. Touch is the most common nonverbal form of affection (Floyd, 2008) and occurs frequently in romantic relationships (Debrot, Schoebi, Perrez, & Horn, 2013; van Anders, Edelstein, Wade, & Samples-Steele, 2013). Sex might be a nonverbal behavior that promotes affection in relationships. Indeed, experiencing affection or intimacy with the partner is one of the most frequent motivations for having sex (e.g., Muise, Impett, & Desmarais, 2013), and sexual activity on a given day predicts more affectionate behaviors the next day (Birnbaum, Reis, Mikulincer, Gillath, & Orpaz, 2006).

Affection, in turn, seems to enhance well-being (Jakubiak & Feeney, 2016). People experiencing more affection are at lower risk for psychological problems, such as depression and anxiety (e.g., Floyd, 2008; Jorm, Dear, Rodgers, & Christensen, 2003). Moreover, touch frequency in romantic couples' daily lives predicts psychological well-being longitudinally (Debrot et al., 2013). Affection is also linked with physical well-being (Cohen, Janicki-Deverts, Turner, & Doyle, 2014). For example, affectionate interactions are associated with stronger daily changes in cortisol levels, indicating a healthier stress response (Floyd & Riforgiate, 2008). Furthermore, people also reap benefits when providing affection (Debrot et al., 2013; Floyd et al., 2009). The rewarding quality of affection, as reflected by its association with positive affect (Debrot et al., 2013; Floyd et al., 2005), may be key to fostering well-being. Therefore, we expect affectionate experiences with a romantic partner to account for the association of sexual activity with general and emotional well-being.

Long-Term Benefits of the Mood-Enhancing Effects of Sex

Experiencing progress toward a desired goal or state is important for well-being (Carver, 2006). For example, perceived progress toward intimacy is associated with enhanced individual and relational well-being, more than the perception of intimacy itself (Laurenceau, Troy, & Carver, 2005). Moreover, engaging in activities that enhance positive affect with a romantic partner predicts heightened relationship satisfaction (e.g., Aron, Norman, Aron, McKenna, & Heyman, 2000). Because shared positive activities with a partner promote relational well-being and given that sex can be emotionally rewarding (Burleson et al., 2007), the emotional benefits associated with sex should predict relationship satisfaction in the long term. We thus expected that people showing stronger incremental positive affect associated with sexual activity in daily life will have higher relationship satisfaction over time.

Overview of the Current Studies

Past research shows that sex is robustly associated with well-being, but reasons about why this is the case are lacking. Given the importance of positive interpersonal interactions,

we postulate that one important explanation is that within romantic relationships, sex is coupled with the experience of affection between partners. Thus, we predicted that the association between sex and well-being (both general and emotional) would be accounted for by affection. We conducted four studies to test our predictions. Study 1 is a cross-sectional study of individuals in romantic relationships to initially test our prediction that affectionate touch would mediate the association between sexual frequency and life satisfaction, a general indicator of well-being. The research conducted on the association between sex and well-being mostly includes data from only one member of romantic couples. Thus, in Studies 2 to 4, we recruited both members of romantic couples to provide more accurate assessments of shared couple behaviors (Kenny, Kashy, & Cook, 2006). Study 2 was a cross-sectional study in which we sought to extend our results to an affective indicator of well-being: positive emotions. Finally, because of the potential biases of cross-sectional research, Study 3 relied on an experience sampling design to investigate how sexual activity on a given day is associated with momentary positive affect and to further test the prediction that daily affectionate experiences will account for this association. This also allowed us to test whether the direction of the associations postulated in our model was supported by cross-lagged analyses. In addition, we used the strength of the daily association between sexual activity and positive affect to predict relationship satisfaction at a 6-month follow-up assessment. As later results will reveal, the direction of the association between sex and affection could not be clearly sorted out in Study 3. Thus, in a fourth study, we used the same design as in Study 3 but with more frequent sampling occasions. In all studies, we tested for possible gender differences in the investigated paths, because previous research on sexuality has revealed important gender differences. For example, men tend to have a stronger and more consistent sex drive, as they both desire and report more frequent sex, whereas women's sexuality tends to be more easily influenced by social, cultural, and situational factors (e.g., Vohs, Catanese, & Baumeister, 2004).

Study 1

We first sought to provide evidence for the link between sexual frequency and well-being, assessed with evaluations of life satisfaction; we further expected that affectionate touch frequency would mediate this association.

Method

Participants and procedure. Participants were recruited through Amazon's Mechanical Turk. To participate in this online survey about sexuality in relationships, participants had to live in the United States, currently be in a romantic relationship, and pass an attention check embedded within the survey (see also Muise, Schimmack, et al., 2016). We recruited 395 participants, but 16 participants (4%) reported that they were not currently in a romantic relationship, and 44 participants (12%) did not pass the attention check, therefore their data were excluded. The final sample included 335 participants (138 men; 197 women). There is 80% power to detect a small effect ($R^2 = .03$) in a model with two predictors at an alpha level of .05. Participants ranged in age from 18 to 64 years ($M = 31.0$, $SD = 9.1$) and comprised diverse ethnic backgrounds: 65% Europeans, 10% African Americans, 9% Asians, 4.5% Latinos, 2% Native Americans, 1.5% Indians, and 8% self-identified as Other. Most participants (84%) were married or cohabitating, and 90% identified as heterosexual. Relationship length varied between 4 months and 30 years ($M = 7.5$ years, $SD = 8.4$ years). Each participant was paid US$ 0.60 for completing this 20-min online survey. We describe only the measures used in this study.

Measures

Sexual frequency. Participants indicated on average how frequently they engaged in sex with their partner[1] (1 = *less than once a month*, 2 = *about once a month*, 3 = *2-3 times per month*, 4 = *once a week*, 5 = *multiple times per week*, 6 = *daily; M = 4.03, SD = 1.37*).

Affectionate touch frequency. Participants indicated the general frequency of affectionate touch (e.g., cuddling, kissing, caressing) in their relationship (1 = *never*, 2 = *less than once a month*, 3 = *about once a month*, 4 = *2-3 times per month*, 5 = *about once a week*, 6 = *multiple times per week*, 7 = *daily; M = 5.74, SD = 1.67*).

Satisfaction with life. Participants completed the five-item Satisfaction With Life Scale (Diener, Emmons, Larsen, & Griffin, 1985), rating items on a 7-point scale ranging from 1 = *strongly disagree* to 7 = *strongly agree* (α = .90, $M = 4.49$, $SD = 1.46$).

Results

Data analytic strategy. We constructed a 95% confidence interval (CI) for the indirect effect using bootstrapping techniques with 5,000 resamples using the INDIRECT SPSS macro (Preacher & Hayes, 2008). We also tested whether our effects could be accounted for by gender, age, relationship status, or relationship duration.

Test of the Hypotheses

As predicted, participants who reported engaging in more frequent sex also reported higher life satisfaction (β = .26, $p < .001$, 95% CI = [0.15, 0.35])[2] and more frequent affectionate touch (β = .55, $p < .001$, 95% CI = [0.56, 0.79]). Affectionate touch frequency was also associated with greater life satisfaction (β = .30, $p < .001$, 95% CI = [0.16,

0.32]). Importantly, there was a significant indirect effect of sexual frequency on life satisfaction through affectionate touch frequency, 95% CI = [0.07, 0.19]; when affectionate touch frequency was included in the model, the association between sexual frequency and life satisfaction was significantly reduced (β = .14, $p < .05$, 95% CI = [0.01, 0.26]). All effects remained significant when controlling for gender, age, relationship duration, and relationship status, and were not moderated by these variables, suggesting that the findings are consistent across these factors.

Discussion

Study 1 replicated previous research showing that sex is associated with greater well-being (e.g., Blanchflower & Oswald, 2004), here operationalized by subjective ratings of life satisfaction. In addition, it provided initial evidence that affection plays an important role in understanding the association between sexual frequency and well-being.

Study 2

Building on Study 1, the goals of Study 2 were (a) to investigate whether sexual frequency predicts another critical indicator of well-being: positive emotions (Schwarz et al., 2009), (b) to assess affection more precisely by using a multiple-item measure, and (c) to use a dyadic sample to assess sexual and affectionate interactions at the couple level to determine how much partners' reports of sexual frequency and affectionate touch frequency converge.

Participants and Procedure

Participants were recruited from the San Francisco Bay Area in California, with online and paper flyers. Eighty-one couples agreed to participate to this larger multi-phase project on romantic relationships (e.g., see Impett et al., 2010). We only describe the measures from the cross-sectional background survey used here. We removed six homosexual couples from the dataset because, as later analyses will reveal, we found some significant gender differences, and therefore used gender as a distinguishing variable (Kenny & Kashy, 2011). Two additional couples were removed because one of the partners did not complete the survey.

The final sample included 74 couples. Participants' age ranged from 17 to 60 years ($M = 23.8$, $SD = 6.4$) and comprised a diverse range of ethnic backgrounds: 52% Europeans, 24.3% Asians, 8.1% Latinos, 7.4% African Americans, 3.4% Indian, 2% from the Middle East, and 0.7% Native Americans. Half (50.0%) of the participants were dating, 45.5% were cohabitating, and 4.5% were engaged or married. Relationship length varied between 6 months and 7 years 10 months ($M = 2.1$ years, $SD = 1.9$ years). Participants were paid US$10 each for completing the survey.

Measures

Sexual frequency. Participants indicated how frequently they had sex with their partner on a scale ranging from 1 = *never or almost never*, 2 = *at least once a month*, 3 = *at least once a week*, 4 = *at least 2 days a week*, 5 = *once a day*, to 6 = *more than once a day* ($M = 3.68$, $SD = 1.35$). Consistent with previous research (e.g., Muise et al., 2016), the correlation between partners' reports was high ($r = .82$, $p < .001$). Thus, similar to Muise et al. (2016), we used the mean of the two partners' reports to create a couple-level indicator of sexual frequency.

Affectionate touch frequency. Using five items from the Physical Affection Scale (Light, Grewen, & Amico, 2005, adapted from Diamond, 2000), participants indicated how frequently they engaged in different affectionate touching behaviors (e.g. hugging or kissing), on the same scale as the sexual frequency measure ($M = 5.46$, $SD = 0.64$). Because the correlation between both partners' reports was only moderate ($r = .48$, $p < .001$), we used both partners' scores separately in our analyses.

Positive emotions. The Dispositional Positive Emotion (DPES) Scale is a 38-item measure assessing the trait-like tendency to experience seven positive emotions (Shiota, Keltner, & John, 2006). Because the focus of the current investigation is on individual well-being, we created a composite of self-related emotions—joy, contentment, pride, amusement, and awe (27 items, α = .89)—and excluded love and compassion, because these emotions facilitate intimate bonds and might be conflated with affection.[3] The scale ranged from 1 = *strongly disagree* to 5 = *strongly agree* ($M = 3.63$, $SD = 0.45$).

Results

Data analytic strategy. Multilevel modeling was used to account for the non-independence in the data. Using the MLwiN software, Version 2.32 (Rabash, Steele, Brown, & Goldstein, 2009), we tested a two-level model where partners were nested within couples. Using the actor–partner interdependence mediation model (APIMeM; Ledermann & Bodenmann, 2006), we computed two sets of parameters per couple—one for each gender (Kenny et al., 2006). Intercepts were allowed to vary randomly across couples, and residual terms were allowed to be correlated between partners at the couple level.

We first tested a model with the direct effect of sexual frequency on positive emotions. In a second step, adding affectionate touch frequency, we computed a multivariate mediation model. We tested our mediation hypothesis using the Monte Carlo method for assessing multilevel mediation (MCMAM) with 20,000 resamples and 95% CIs; the indirect
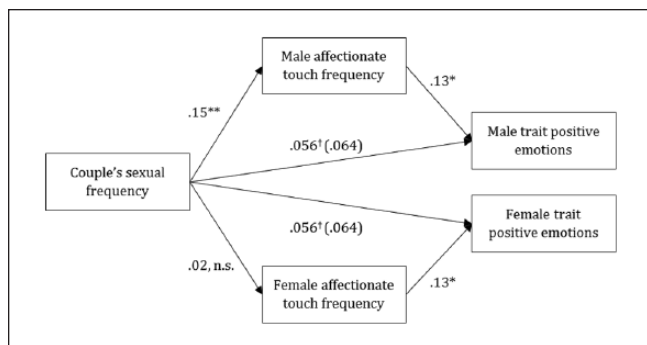
Figure 1. Results of the multivariate mediation model for Study 2. *p < .05, **p < .01.

effect is present when zero is not in the CI (Preacher & Selig, 2012). We tested separate intercepts and path coefficients for men and women and set them equal across gender when no significant difference was found.

Sex frequency and positive emotions. As expected, sexual frequency was associated with greater positive emotions, $b = .06$, $SE = .03$, $p < .05$, 95% CI = [0.005, 0.123], $r = .24$,[4] and there were no gender differences in this association, $\chi^2_{diff}(1) = 1.20$, $p = .27$. Hence, when partners reported more frequent sex, they reported higher emotional well-being.

The mediating role of affection. Next, we tested the prediction that affectionate touch would mediate the association between sexual frequency and positive emotions in a multivariate model. First, we tested whether the two dependent variables (affectionate touch frequency and positive emotions) differed by gender. Controlling for all parameters in the model, the intercept for affectionate touch frequency was significantly higher in women ($b = 5.39$, $SE = .22$) than in men ($b = 4.93$, $SE = .23$), $\chi^2_{diff}(1) = 4.11$, $p < .05$, indicating that women report experiencing more affectionate touch than men. Hence, we estimated separate intercepts for affectionate touch for each gender. The intercept for positive affect did not differ by gender, $\chi^2_{diff}(1) = 3.11$, $p = .08$, and was therefore estimated as equal across genders, $b = 2.71$, $SE = .32$.

Figure 1 shows the results of the mediation model. When including affectionate touch frequency in the analyses, the direct effect of sexual frequency on positive emotions dropped to marginal significance, $b = .06$, $SE = .03$, $p = .06$, 95% CI = [−0.003, 0.115], $r = .21$. As in the previous model without affection, the association between sexual frequency and positive emotions did not differ by gender, $\chi^2_{diff}(1) = 0.43$, $p = .51$. However, the association between sex frequency and affectionate touch frequency was significantly different for men and women, $\chi^2_{diff}(1) = 0.43$, $p < .05$; thus, we tested separate paths for each gender. When partners reported more frequent sex, men reported more affectionate touch, $b = .15$, $SE = .06$, $p < .01$, 95% CI = [0.034, 0.262], $r = .29$, but women did not, $b = .02$, $SE = .06$, $p = .78$. Next,

the association between affectionate touch and positive emotions was significant, $b = .13$, $SE = .06$, $p < .05$, 95% CI = [0.021, 0.241], $r = .26$, with no gender differences, $\chi^2_{diff}(1) = 1.49$, $p = .22$. The MCMAM (Preacher & Selig, 2012) revealed that affectionate touch significantly mediated the association between sex frequency and positive emotions for men (indirect effect: 95% CI = [0.001, 0.046]), but not for women (indirect effect: 95% CI = [−0.014, 0.020]). All associations remained significant when controlling for age, relationship duration, and relationship status. None of these variables moderated the results, except for relationship duration, which weakened the association between sexual frequency and affectionate touch.

Discussion

Study 2 demonstrated that sex is associated with emotional well-being. Moreover, as in Study 1, affection played an important role in explaining this association, however, only in men. This is surprising because women tend to emphasize more relational aspects of sexuality (e.g., Vohs et al., 2004). However, because men generally report higher sexual desire (Muise, Stanton, Kim, & Impett, 2016; Vohs et al., 2004), they might rely more on sex to experience affection. Indeed, affection frequency was more strongly associated with sexual and relationship satisfaction in men than in women (Heiman et al., 2011). Taken together, Studies 1 to 2 provide initial support for our model, but because cross-sectional studies based on global reports have several limitations (Bolger & Laurenceau, 2013), we turned to the use of an experience sampling method in Study 3 to address these concerns and model associations between sex, affection, and well-being as within-person processes.

Study 3

Building upon the results of the first two cross-sectional studies, Study 3 tested the hypothesis that engaging in sexual activity would be associated with greater positive affect and affection in daily life, using an experience sampling design with a sample potentially exposed to more daily challenges (dual-earner parents). Repeated momentary affect reports provide a more direct and less biased measure of affect than retrospective reports (Schwarz, 2012) and procure a more fine-grained assessment by allowing us to examine *changes* in positive affect. Moreover, this design allowed us to test for alternative directions of the associations to investigate the order of the studied processes (Conner & Lehman, 2012). We predicted that sexual activity would be associated with greater positive affect and that heightened affection would mediate this association. Finally, we expected that the positive effects of sex would extend beyond the day-to-day association, with people showing a stronger association between sex and positive

affect in daily life reporting greater relationship satisfaction 6 months later.

Method

Participants. Participants were recruited by ads and flyers in Switzerland. To participate in this study about relationship processes among working and parenting couples (see also, Schoebi, Perrez, & Bradbury, 2012), both partners had to (a) live together, (b) be professionally active for at least 12 hr per week and have a regular work schedule (no night shifts), and (c) have at least one child younger than 8 years. From the initially recruited 108 couples, 106 provided adequate data. No formal power analyses were computed given their complexity in multilevel designs. However, our sample size is far above the recommendations of sampling at least 50 observations at Level 2 to avoid biased standard errors estimates (Maas & Hox, 2005).

On average, participants were 36.58 years old (SD = 5.72). Relationship length ranged from 2 years 5 months to 12 years 11 months (M = 10.2 years, SD = 4.7). Most couples (87.8%) were married. Most participants (59.1%) had a university degree, and 40.4% a post-secondary school diploma. Many participants (38.3%) had a medium monthly income between US$3,000 to US$6,000[5]; 33.5% earned more than US$6,000 per month. Participants reported on average 29.58 hr (SD = 6.30) of paid work per week. The couples had between one and five children (M = 1.67, SD = 0.82), whose mean age was 4.54 years (SD = 4.17).

Procedure. First, a research assistant visited the couples in their homes where they completed several paper-and-pencil questionnaires. All materials were administrated in German; translations from the original English versions were validated through back-translation. Then, participants received detailed instructions about the use of the handheld devices and reporting plan. They received an instruction manual and completed some practice exercises.

During the 10-day experience sampling period, participants were instructed to complete a brief questionnaire ("diary") 4 times a day, according to their individual schedule: (a) in the morning before the workday, (b) at the end of the workday (i.e., during the last hour of work or on the way home), (c) during the first 45 min after reunion with their partner, and (d) during the last hour before going to bed at night. Sexual activity and affectionate feelings were assessed in the morning and concerned the last 24 hr. The hypotheses concerned the effects of sexual activity and affectionate feelings on morning positive affect, controlling for evening positive affect; thus, only the "morning" and "evening" diaries were used in the analyses (see Figure B1 of the supplemental materials). Partners were instructed not to complete any diaries retrospectively if forgotten, and not to discuss their responses with each other. On average, participants responded to 69.5% of the diaries.

Follow-up questionnaires were sent to them 6 months after the experience sampling period. Each participant received the equivalent of US$60 as compensation.

Baseline and follow-up measures

Relationship satisfaction. Relationship satisfaction was assessed initially in participants' homes and 6 months later, with five items from the quality of marriage index (QMI; Norton, 1983) rated on a scale ranging from 1 = *not at all* to 6 = *absolutely*. The wording was adapted to apply to non-married partners. Internal consistency was good (Cronbach's α at T1 = .88, and at T2 = .89), and participants had fairly high scores (T1: M = 5.06, SD = 0.78; T2: M = 5.01, SD = 0.83).

Daily diary measures

Positive affect. At each report, participants were asked, "How do you feel at this moment?" They rated their positive affect on a scale ranging from 1 = *not at all* to 6 = *extremely* with three items (*cheerful, happy*, and *confident*) adapted from the PANAS-X (Positive and Negative Affect Schedule-Expanded Form; Watson & Clark, 1994). These items were selected based on prior research on emotions in relationships (e.g., Schoebi, Way, Karney, & Bradbury, 2012). To validate the aggregation of these items in this sample (M = 4.26, SD = 0.88), a multilevel confirmatory factor analysis (CFA; Bolger & Laurenceau, 2013) was conducted using Mplus (Muthén & Muthén, 1998-2012). The estimate was ω = .71, indicating good composite reliability at the within-person level.

Sexual activity. At the morning report, participants indicated with a *yes/no* response whether, since yesterday morning, they engaged in "sex" or experienced "erotic moments" with their partner. The latter were defined as situations in which a sexual or erotic attraction was signaled verbally or non-verbally. The multilevel CFA revealed a moderate omega value of ω = .56.[6] The variable was scored 1 if participants indicated that they experienced having sex, erotic moments, or both. Over the 10-day experience sampling period, on average, participants reported engaging in sex 1.40 times (SD = 1.39), experiencing erotic moments 1.50 times (SD = 1.72), and experiencing either one of those 1.90 times (SD = 1.85); 24.1% reported no sexual activity, and the maximum frequency was 8 times.

Affectionate moments. At the morning report, participants indicated with a *yes/no* response whether they experienced "tender moments," "moments of love and security," and "affectionate or thoughtful signs from my partner." The multilevel CFA indicated satisfactory reliability, ω = .71. Thus, the mean of the three items was used as a measure of affectionate moments (M = 0.56, SD = 0.36). Higher scores on this variable indicate that more items reflecting affectionate moments were checked.
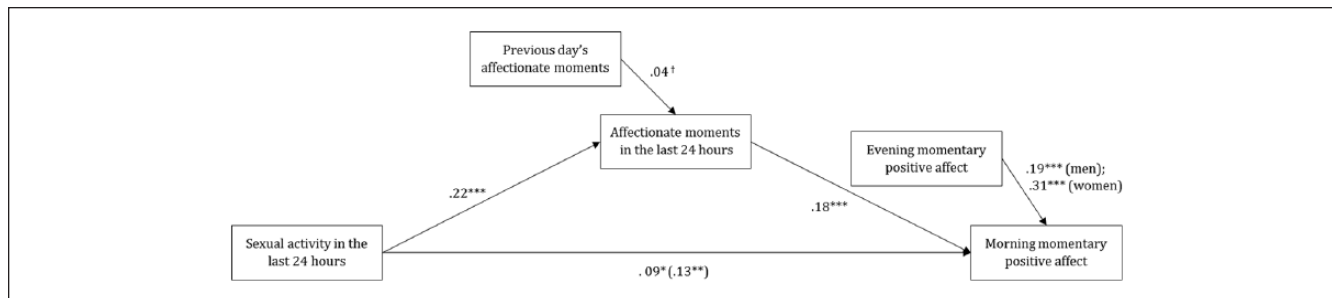
Figure 2. Results of the multilevel multivariate mediation model for Study 3. $^{†}p < .10$, $^*p < .05$, $^{***}p < .001$

Results

Daily diary associations

Data analytic strategy. To account for the non-independence in the data, we used multilevel modeling, whereby daily reports (Level 1) were considered as nested within couples (Level 2; Bolger & Laurenceau, 2013). To distinguish between individuals (male vs. female partners), we computed a two-level adaptation of the APIMeM (Ledermann & Bodenmann, 2006) with two sets of parameters per couple, one for the female and one for the male partner (Kenny et al., 2006) using MlwiN, Version 2.32 (Rabash et al., 2009). Intercepts were allowed to vary randomly across couples and reports, and residual terms were allowed to be correlated between partners at Levels 1 and 2. All predictors were centered at each person's mean to partial out general individual tendencies. Moreover, we adjusted for each participant's positive affect score from the previous evening, and in the mediation model, for previous day's affection. Thus, the outcome represents the residualized change in positive affect that occurred since the previous evening, and for the mediator, the change in affection since the previous day. Except for these autoregressive parameters, all predictors were allowed to vary at Level 2. The equations for the mediation model are reported in the Supplemental Material C.

Sex and positive affect. Our first hypothesis was that sexual activity would be associated with heightened positive affect. More specifically, we tested whether, when partners indicated in the morning that they had sex in the previous 24 hr, their morning positive affect would be heightened (i.e., an increase from the evening report). The results supported our prediction; sexual activity was associated with increases in positive affect, $b = .13$, $SE = .05$, $p < .01$, $r = .24$. This association did not differ by gender, $\chi^2_{diff}(1) = 1.30$, n.s.

The mediating role of affection. Our second hypothesis was that the link between daily sexual activity and increased positive affect would be mediated by experienced affection in the last 24 hr. All associations were equal across gender, all $\chi^2_{diff}(1)$ between 0.11 and 1.91, n.s., except for the association between evening positive affect and morning positive affect, which was stronger for women, $\chi^2_{diff}(1) = 6.53$, $p < .05$. Therefore, except for this particular parameter, all parameters were set equal across gender.

The results are depicted in Figure 2 (the detailed parameter estimates are provided in Table D1 of the supplemental material). When adding affectionate moments as a mediator, the association between daily sexual activity and positive affect dropped in size but remained significant, $b = .09$, $SE = .05$, $p < .05$, $r = .19$. Sexual activity also significantly predicted increases in affectionate moments, $b = .22$, $SE = .02$, $p < .001$, $r = .74$. Affection, in turn, predicted positive affect, $b = .18$, $SE = .06$, $p < .001$, $r = .27$. The model controlled for the effect of the two dependent variables (positive affect and affectionate moments) at the last time they were reported. The MCMAM (Preacher & Selig, 2012) confirmed that affectionate moments significantly mediated the association between sexual activity and increased positive affect, 95% CI = [0.024, 0.081]. All effects remained significant when controlling for age, relationship duration, and relationship satisfaction (measured at Level 2 with the QMI) showing that our model holds above and beyond these factors.

Testing the direction of the association. We conducted cross-lagged analyses to test whether the association of our mediation model would hold, not only when assessed at the same session but also over the next assessment time (see Supplemental Material E for more details). First, supporting our hypothesis that sex promotes well-being, sexual activity on one day predicted next day's positive affect, $b = .11$, $SE = .04$, $p < .05$. Conversely, previous morning's positive affect did not predict next day's sex, $b = .01$, $SE = .01$, $p = .16$. Second, we tested whether sexual activity would predict next day's affectionate moments. The cross-lagged association was not significant, $b = .03$, $SE = .03$, n.s.; moreover, affectionate moments did not predict next day's sexual activity, $b = -.02$, $SE = .03$, n.s. To further disentangle how sex and affection are associated, we examined how often they co-occurred. Cross-tabulation revealed that sex without affection was very rare (occurring on 4.2% of sexual activity reports), whereas affection was often experienced without sex (78.0% of affectionate moments occurrences). Thus, sexual activity is highly interconnected, however not redundant, with affection in committed long-term relationships.

Finally, concerning the association between affection and positive affect, cross-lagged analyses revealed that affectionate moments did not predict next day's positive affect, $b = .07$, $SE = .06$, n.s., and previous morning's positive affect did not predict following day's affection, $b = .02$, $SE = .01$, n.s. This shows that affection and positive affect occurred within the same time frame, but their association does not last over the next day.

Long-term relationship benefits

Data analytic strategy. Our third hypothesis was that the strength of the within-person association between sexual activity and positive affect would predict changes in relationship satisfaction over time. To test this longitudinal hypothesis, we estimated an Actor Partner Interdependence Model (APIM) in Mplus (Muthén & Muthén, 1998-2012). We saved each partner's association between daily sexual activity and positive affect from the first multilevel analysis (without mediation) and used this person-specific association as a predictor of relationship satisfaction at the 6-month follow-up. We adjusted for the main effects of positive affect (mean across all reports) and sexual frequency (combined partners' report of sexual activity). To predict *changes* in relationship satisfaction, we controlled for each partner's baseline relationship satisfaction. We found no significant gender differences for any of the actor effects, $\chi^2_{diff}(1) \leq 2.53$, $p \geq .11$, or partner effects, $\chi^2_{diff}(1) \leq 2.16$, $p \geq .14$. Thus, all effects were set equal across gender. The resulting APIM model showed a good fit: $\chi^2(7) = 10.59$, $p = .157$, comparative fit index (CFI) = .979, root mean square error of approximation (RMSEA) = .070, 95% CI = [.000-.149].

Long-term associations. Results showed that partners who had a stronger association between daily sexual activity and positive affect measured during the experience sampling period reported heightened relationship satisfaction 6 months later (actor effect: $b = .64$, $SE = .32$, $p = .044$, 95% CI = [0.017, 1.255]; $\beta = .13$ for men and .07 for women), controlling for their baseline satisfaction. Thus, the strength of the association between sex and positive affect predicted increased, or less decreased, relationship satisfaction from baseline to follow-up. The corresponding partner effect was marginally significant ($b = .52$, $SE = .29$, $p = .066$, 95% CI = [−0.035, 1.083]; $\beta = .05$ for men and .11 for women) suggesting that a stronger daily sex-positive affect association is associated with a marginal increase in the partner's relationship satisfaction over time. There were no significant main effects of sexual frequency or mean positive affect on relationship satisfaction 6 months later ($ps \geq .160$ for actor and partner effects). Subsequent analyses revealed that the actor and partner effects were not significantly different from each other ($ps \geq .786$). In sum, a stronger association between sexual activity and positive affect had a beneficial effect on relationship satisfaction 6 months after the initial measurement for both partners, over and above baseline satisfaction.

Discussion

Study 3 showed that daily sexual activity was associated with increased momentary positive affect and that increased daily affection with the partner accounted for a substantial part of this association. Sex was shown to predict subsequent positive emotions; however, the direction of the association between sex and affection could not definitively be teased apart. This is problematic regarding our postulated model. Indeed, if we can provide support for carryover effects, our mediational hypothesis would be more strongly supported in this non-experimental context (Bolger & Laurenceau, 2013). However, due to all the events that a person is likely to encounter in daily life (Kahneman et al., 2004), it is likely that the effect of sexual activity on experienced affection might last less time than 24 hr. It is, therefore, important to select a more appropriate time-lag between the investigated variables (Bolger & Laurenceau). In addition, Study 3 also showed that the extent to which daily sex was associated with mood predicted both partners' relationship satisfaction 6 months later, showing the importance of mood increases related to sexual activity.

Study 4

To provide stronger support for the mediational role of affection in the sex-positive affect link, it is important to show that sex predicts changes in affection over time. To this end, we examined prospective associations between sex and affection based on data from a dyadic experience sampling study with more frequent assessments of sex and affection.

Method

Participants. Participants were recruited as part of a larger study on romantic relationships through mailing lists at a Swiss university, announcements published on online forums, flyer distributions in different locations across the country, and word of mouth advertising. To participate, both partners had to live together and be in a committed relationship for at least 6 months. The sample is composed of 58 heterosexual couples. On average, participants were 25.07 years old ($SD = 7.75$), and 66.8% were students. Relationship length ranged from 2 years to 10 years 4 months ($M = 4.35$ years, $SD = 2.33$ years). Most couples (93.7%) were unmarried.

Procedure. Participants first completed a baseline online questionnaire that was followed by a smartphone-based (Samsung Galaxy Note II) ambulatory assessment 4 times per day (upon awakening, at 12:00 p.m., 6:00 p.m., and before going to bed) over 2 consecutive weeks. During an introduction session, a research assistant provided instructions on the use of the smartphones, administered the informed consent form, and introduced and explained the questions and items of the ambulatory assessment. The

participants completed a trial assessment and were asked questions to clarify uncertainties. Reporting was initiated by an acoustic signal and vibration, and only possible within a 1-hr time window. Participants received the equivalent of US$50 or course credit (if they were psychology students) for their participation.

Daily diary measures

Sexual activity. At each report, participants indicated with a *yes/no* response whether they engaged in "sex or erotic interactions" with their partner since the last report. The variable was scored 1 if sex was reported and 0 if no sex was reported.

Affectionate moments. At each report, participants indicated with a *yes/no* response whether, they engaged in "moments of love and affection" with their partner since the last report. The variable was scored 1 if affection was reported and 0 if no affectionate interactions were reported.

Results

Data analytic strategy. Similar to Study 3, we computed a multilevel model whereby daily reports (Level 1) were considered as nested within couples (Level 2), with two sets of parameters per couple, one for each gender. However, because the outcome was binary, we used a binary logistic model, using the software HLM (Raudenbush, Byrk, & Congdon, 2011). Intercepts were allowed to vary randomly across couples and reports, and residual terms were allowed to be correlated between partners. All predictors were centered at each person's mean. Moreover, we adjusted for each participant's outcome at the previous session. All predictors were allowed to vary at Level 2. We controlled for the overall occurrence of sex and of affection during the experience sampling period at Level 2. Effects were set equal across gender if not statistically different.

Prospective associations between sex and affection. We first tested whether sex predicted affection at the next session. Results support our model; when participants reported having had sex or erotic moments, they were more likely to report affection at the next session ($b = .37$, $SE = .11$, $p < .01$, odds ratio [OR] = 1.45), controlling for affection at the concurrent session. This effect did not differ between genders, $\chi^2_{\text{diff}}(1) = .48$, $p < .001$. The coefficients suggest that the likelihood of reports of affection was estimated at .67 in situations without sex at the prior time point, and it increased by .32 to a likelihood of .97 after reports of sex. The details of the model's parameters are reported in the Supplemental Material F. Similarly, affection also predicted the subsequent probability of having sex ($b = .78$, $SE = .21$, $p < .001$, OR = 2.18). Again, this effect did not differ across genders, $\chi^2_{\text{diff}}(1) = .44$, $p < .001$. The coefficients suggest that while the likelihood of reports of sex was estimated at .07 in situations

without affection at the prior time point, it increases by .09 to a likelihood of .16 after affection. Thus, while the OR for sex predicting affection was lower than that of affection predicting sex, it reflects an effect on a greater base probability of event occurrence (.67 vs. .07) and therefore corresponds to a more substantial difference in event occurrence than the effects of affection (.32 vs. .09).

Discussion

Study 4 shows that sex contributes over time to interactions marked by affection, supporting our hypothesis. Moreover, affectionate interactions heighten the probability of sex or erotic encounters, as has been suggested in previous literature (van Anders et al., 2013). Although the correlational data still do not allow us to make definitive causal conclusions, demonstrating that sex prospectively predicts affection further validates the assumption of an indirect path from sex via affection to positive affect, as tested in Study 3. Such evidence for the effects of sex is important (Wiederman, 2004), as it is based on reports of real-life experiences collected under ecologically valid conditions (Bolger & Laurenceau, 2013; Conner & Lehman, 2012).

General Discussion

The current investigation merges sexuality research with close relationships research to demonstrate the powerful role of affection in understanding how sexual activity in romantic relationships confers well-being benefits. Our hypothesis that sex promotes well-being because it promotes affection was supported not only in two cross-sectional studies (Studies 1 and 2) but also by the cross-lagged analyses of daily diary data (Studies 3 and 4).

Sexual Activity and Well-Being

Sexual activity was associated not only with general life satisfaction (Study 1) but also with positive affect, both generally (Study 2) and in daily life (Study 3). Our daily diary study is, to our knowledge, the first showing the association of sex with affect in daily life using a dyadic sample with both genders and to show that sex predicts positive affect. When partners reported having sex in the previous 24 hr, they experienced increased positive affect. Moreover, sexual activity also predicted next day's positive affect, whereas previous day's positive affect did not increase the probability of having sex. This provides initial evidence that sex actually promotes well-being and most probably does so by fostering positive emotions—experiences that predict well-being (Cohn et al., 2009). Because of the methodological challenges of conducting experiments investigating sex and their limited ecological validity and generalizability (Wiederman, 2004), daily diary studies are best suited to investigate sexual process in romantic relationships, by capturing naturally

occurring within-subject fluctuations in sexual and relational processes in romantic couples (see also, for example, Muise et al., 2013).

As we found that sexual experiences on one day (whenever they occured) predicted next morning positive affect, the improved mood associated with sex is unlikely merely due to pleasure experienced during sex itself (Georgiadis & Kortekaas, 2009). In addition, these results held when controlling for age, relationship length, relationship status, and relationship satisfaction, supporting the robustness of the associations.

Affection Mediates the Link Between Sex and Well-Being

Across three studies, results supported our main hypothesis that affection would account for the association between sex and well-being, except for women in Study 2. Moreover, Study 4 showed that sex predicted affection across a few hours, further supporting the notion that sex promotes the experience of affection (Bolger & Laurenceau, 2013; Preacher & Hayes, 2004). Affection was measured in different ways (affectionate touch in Studies 1 and 2 and general affection in Studies 3 and 4), providing a conceptual replication of our findings (Crandall & Sherman, 2016). Moreover, the results held across two different countries (US and Switzerland), lending converging support for the role of affection in understanding how sex promotes well-being.

When engaging in sex, people not only seek an intimate connection (e.g., Muise et al., 2013), but indeed experience more affection, both when having sex and in the next several hours. Hence, sex seems not only beneficial because of its physiological or hedonic effects (Georgiadis & Kortekaas, 2009), but because it promotes a stronger and more positive connection with the partner. Thus, sex within romantic relationships provides a meaningful way for people to experience a strong connection with their partner (Baumeister & Leary, 1995). These findings are in line with theories conceptualizing sexuality as a part of the attachment system in adult romantic relationships (i.e., Shaver, Hazan, & Bradshaw, 1988). Hence, affection theories could benefit from integrating sex within the scope of behaviors fostering affection (e.g., Floyd, 2008).

Long-Term Benefits of the Sex-Positive Affect Association

Our longitudinal analyses suggest that sex has benefits beyond momentary increases in mood. A stronger daily association between sexual activity and positive affect was associated with higher relationship satisfaction over time. Remarkably, mean sex frequency and positive affect were not associated with follow-up relationship satisfaction. This stresses the importance of *increases* in mood from sexual activity, consistent with the idea that progress toward a desired state predicts well-being (Carver, 2006). Relationship satisfaction often decreases over time (McNulty, Wenner, & Fisher, 2016). As our sample was composed of fairly satisfied long-term couples, our findings suggest that couples who draw positive feelings from engaging in sex are at lower risk for declines in relationship satisfaction. Thus, the emotional benefits reaped from sexual activity might explain why sex is such a crucial factor for relationship satisfaction (i.e., Karney & Bradbury, 1995; McNulty et al., 2016), stressing the importance of emotional dynamics within romantic relationships (Schoebi & Randall, 2015). Therefore, when investigating the association of sex with relationship satisfaction (e.g., McNulty et al., 2016), considering the role of positive emotion might be important.

Partner effects also emerged, suggesting that when one person draws emotional benefits from sex, their partner's relationship satisfaction is also promoted over time. This effect might be stronger for people highly motivated to meet their partner's sexual needs (Muise & Impett, 2015); future research should test this possibility.

Limitations and Future Directions

Our models suggest that sexual activity promotes affection, which in turn, promotes well-being. Because we did not conduct an experimental manipulation, firm causal conclusions cannot be drawn (Conner & Lehman, 2012). However, per some authors (Bolger & Laurenceau, 2013; Preacher & Hayes, 2004), temporal precedence can be used to make causal claims. Moreover, an experimental study where positive affect, affectionate feelings, or sexual arousal are induced in couples could be conducted, but such a design, regardless of its methodological difficulty to implement, would clearly dampen the results' ecological validity (Wiederman, 2004).

The results across the three studies paint a picture of striking similarity across gender, consistent with research showing that, within long-term relationships, sexual processes are highly similar across gender (e.g., Impett et al., 2014). Further research could investigate whether the gender difference found in Study 2 was due to some potential moderating factors, such as relationship length.

Future research could also investigate whether sex and affection might compensate for one another in maintaining well-being. Could affection potentially make up for diminished sexual activity? In some life stages, such as the postpartum period, or with diminished physical capacity, sex may be impaired (see review by Impett et al., 2014). In those times, affection could help maintain well-being, despite decreased sex frequency. Some research supports this idea: Among older men, touch and caresses were a stronger predictor of sexual satisfaction than sexual frequency (Heiman et al., 2011). Conversely, sexual activity might compensate for the diminished well-being in partners having difficulties adequately exchanging affection. Sexual frequency buffers against the negative association between attachment

insecurity and relationship quality (Little, McNulty, & Russell, 2010). Further research could investigate whether sexual frequency could also buffer the negative association of insecure attachment with individual well-being (Kafetsios & Sideridis, 2006).

Conclusion

Previous research has largely neglected to examine the role of affection in sexuality, and particularly in the association between sex and well-being. Our studies show that sexuality is associated with multiple conceptualizations of well-being, both within and between persons, and provides an important explanation for how this process occurs, namely, because of increased experiences of affection with the partner. Our data also suggest that drawing individual emotional benefits from sex is meaningful beyond the moments in which it occurs, as participants who showed a greater connection between sex and subsequent positive affect reported better relationship satisfaction over time.

Because sexuality is a defining feature of romantic relationships and a powerful predictor of well-being, it is essential to merge literature on sex and relationship processes; studying affection is one important way to do so. Romantic relationships are crucial for well-being, but maintaining relationship satisfaction over time is challenging. Our research suggests the important role of nonverbal intimate exchanges—sex and affectionate touch—to maintain well-being. This appears particularly important nowadays because of the increased use of electronic communication might compromise nonverbal affectionate exchanges (e.g., Kim, LaRose, & Peng, 2009).

Authors' Note

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Supplemental Material

The online supplemental material is available at http://pspb.sagepub .com/supplemental.

Notes

1. Sex was not defined, participants could determine what sex meant to them.
2. We report standardized coefficients, which can be considered as effect sizes.
3. The analyses with the entire Dispositional Positive Emotion Scale (DPES) Scale did not differ from the results reported in this study. The Love and Compassion subscales were removed for conceptual reasons.
4. For Studies 2 and 3, we computed an effect size r (e.g., Rosenthal, Rosnow & Rubin, 2000) based on the Wald Test. This computation might overestimate the true size and should thus be interpreted with caution.
5. In Study 3, the currency was in Swiss francs, but to facilitate understanding of the values, we indicated the amount in US$.
6. A moderate omega is not surprising because (a) it is based on only two indicators and (b) the items represent different interpersonal interactions reflecting the category "sexual activity" that do not need to occur simultaneously, but can be alternative measurements of the same kind of interaction.

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