

Facets and Correlates of Sexuality in Late Adulthood

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Mag. Karolina Kołodziejczak

Präsidentin der Humboldt-Universität zu Berlin

Prof. Dr. Julia von Blumenthal

Dekan der Lebenswissenschaftlichen Fakultät

Prof. Dr. Dr. Christian Ulrichs

Gutachter/innen: 1. Prof. Dr. Denis Gerstorff
2. Prof. Dr. Frieder R. Lang
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Original Research Articles

Kolodziejczak, K., Rosada, A., Drewelies, J., Düzel, S., Eibich, P., Tegeler, C., Wagner, G.

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(2019). Sexual activity, sexual thoughts, and intimacy among older adults: Links with physical health and psychosocial resources for successful aging. *Psychology and Aging*, 34(3), 389–404. <https://doi.org/10.1037/pag0000347>

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Eidesstattliche Erklärung

Hiermit erkläre ich an Eides statt,

1. dass ich die vorliegende Arbeit selbstständig und ohne unerlaubte Hilfe verfasst habe,
2. dass ich mich nicht anderwärts um einen Doktorgrad beworben habe und noch keinen Doktorgrad der Psychologie besitze,
3. dass mir die zugrunde liegende Promotionsordnung der Lebenswissenschaftlichen Fakultät vom 5. März 2015, veröffentlicht im amtlichen Mitteilungsblatt der HUB Nr. 12/2015 bekannt ist.

Berlin, den 13. Juni 2022

Karolina Kołodziejczak

Abstract

Over the past decades, aging research has provided valuable insights into key areas of psychosocial functioning in late adulthood, including close social relationships. However, sexuality has often been left out of focus and we know little about how sexuality relates to aspects of psychosocial functioning in old age. At the same time, there is accumulating evidence for considerable proportions of older adults engaging in sexual activity. Correspondingly, initial evidence exists for an active sex life being related to indicators of successful aging. Thus, there is a need for theoretical and empirical integration.

Within the scope of this cumulative doctoral thesis, we investigated sexuality in late adulthood to provide new insights into its nature and correlates. Within three empirical studies, we applied a multifaceted approach to sexuality and altogether distinguished seven facets of sexuality: sexual activity, sexual thoughts, intimacy, importance of sexuality, enjoyment of sexuality, physical intimacy experienced, and physical intimacy wished. To provide new insights into the nature of sexuality in late adulthood, we examined age differences, cohort differences and daily fluctuations within its several facets. To investigate the correlates of sexuality in late adulthood, we examined the associations between the facets of sexuality and a number of psychosocial factors, while accounting for sociodemographic and physical health factors.

As expected, the pattern of results differed by facet of sexuality, and we found both common and facet-specific associations between the facets of sexuality and the psychosocial factors examined. For example, having a partner was associated with more frequent sexual activity, more frequent sexual thoughts and more feelings of intimacy. In turn, longer relationship duration was related to less frequent sexual activity and sexual thoughts, but not less intimacy. We discuss the utility of distinguishing different facets of sexuality and argue for the need of considering sexuality as linked with close social relationships in late adulthood.

Zusammenfassung

Die Altersforschung beleuchtete in den letzten Dekaden Kernbereiche des psychosozialen Funktionierens im Alter, unter anderem diverse Aspekte von sozialen Beziehungen. Dabei blieb Sexualität allerdings häufig unberücksichtigt, weshalb Zusammenhänge zwischen Sexualität und engen sozialen Beziehungen wenig erforscht sind. Gleichzeitig zeigte die Sexualforschung, dass viele ältere Erwachsene davon berichten, sexuell aktiv zu sein, und dass sexuelle Aktivität im Alter mit Indikatoren erfolgreichen Alterns zusammenhängt. Eine umfassende theoretische und empirische Integration dieser Forschungsgebiete ist demzufolge erforderlich.

Im Rahmen dieser Dissertation wurden drei empirische Studien durchgeführt, um neue Erkenntnisse über die Sexualität im Alter und ihre Korrelate zu gewinnen. Sexualität wurde dabei als ein facettenreiches Konstrukt verstanden, was zu dem Ansatz führte, verschiedene Aspekte von Sexualität zu unterscheiden: sexuelle Aktivität, sexuelle Gedanken, Intimität, Bedeutsamkeit der Sexualität, sexuelles Vergnügen, erlebte körperliche Nähe und gewünschte körperliche Nähe. Um neue Erkenntnisse über die Natur der Sexualität im Alter zu gewinnen, wurden Zusammenhänge von Sexualität mit dem Alter und der Zugehörigkeit zu einer bestimmten Geburtskohorte untersucht, sowie berichtete Alltagsschwankungen in erlebter und gewünschter körperlicher Nähe. Für ein breiteres Verständnis der Korrelate der Sexualität im Alter wurden Zusammenhänge mit mehreren psychosozialen Faktoren unter gleichzeitiger Berücksichtigung soziodemographischer Merkmale und physischer Gesundheit analysiert.

Die Ergebnisse unterschieden sich je nach Aspekt der Sexualität. Das Ergebnismuster in Bezug auf die Zusammenhänge mit psychosozialen Faktoren war zum Teil für alle zusammen untersuchte Aspekte der Sexualität gleich, jedoch ergaben sich zumeist relevante Unterschiede. Zum Beispiel hing eine bestehende Partnerschaft mit häufigerer sexueller Aktivität, häufigeren sexuellen Gedanken und mehr erlebten Intimitätsgefühlen zusammen. Dafür sagte eine längere Beziehungsdauer weniger sexuelle Aktivität und weniger sexuelle Gedanken, aber nicht weniger Intimitätsgefühle voraus. Die Nützlichkeit der Unterscheidung verschiedener Facetten von Sexualität wird diskutiert und der notwendige Einbezug von Sexualität als ein Aspekt enger sozialer Beziehungen im Alter betont.

“Any approach to the study of human sexuality that sets biology and social behavior in competition, or that stresses only one dimension to the neglect of the other, is counterproductive.”

Alice S. Rossi (1994, p. 4)

“Let my dataset change your mindset”

Hans Rosling

Synopsis of Dissertation

1. Chapter 1: General Introduction

1.1. Life Span Psychological Perspective on Sexuality in Late Adulthood

Sexuality has been defined by the World Health Organization as “a central aspect of being human throughout life (...)” (2006, p. 5). Although this definition suggests the indispensability of sexuality across the lifespan, sexuality in late adulthood has received far less attention than sexuality in younger adults. Initially, the biomedical perspective in sexuality research emphasized the role of specific illnesses, multimorbidity and medication for sexual (dys-) function in late adulthood. The picture of sexuality of older adults that has emerged from clinical samples has increasingly been extended by the biopsychosocial perspective on sexuality, emphasizing the role of psychosocial factors for sexuality in the general population of older adults (for an overview see DeLamater & Koepsel, 2015). Correspondingly, an increasing number of theoretical proposals and empirical findings has highlighted the importance of psychosocial factors for sexuality in late adulthood as modulators for biological factors during development (i.e., extensions of the Neuroendocrine Perspective that incorporates psychosocial factors: Galinsky et al., 2014; Iveniuk & Waite, 2018). Still, as Træen and colleagues noted (2021), surprisingly little has been done to systematically link aging with sexuality. Thus, there is a need for a theoretical framework to accommodate the lifelong perspective on sexuality and integrate the insights gained from aging research and sexuality research.

Life span developmental psychology provides a framework to study stability and change in human functioning over the life course (Baltes, 1987; Baltes et al., 2006). It conceptualizes human development as a lifelong process that takes place within different domains (multidimensionality) and displays distinct trajectories, including increases and decreases, but also constancy (multidirectionality). From this perspective, late adulthood, here defined to encompass late midlife (e.g., post-menopause) and old age (e.g., retirement and

older age), constitutes an integral part of development over the life span. However, late adulthood also has its unique developmental agenda. That is, age differences may inevitably occur within different domains of functioning.

Correspondingly, research of the past decades has highlighted differences between young and old adults in several key domains of functioning, including psychosocial functioning. For example, we know that, across adulthood, selective reductions in social networks take place and, in old age, emotional closeness in significant relationships is being prioritized over exploration and maintenance of peripheral relationships (Carstensen, 1992; Carstensen, 2021). In line with this, the important role of romantic partners for well-being, physical health, and cognitive functioning in late adulthood has repeatedly been demonstrated (Hoppmann & Gerstorf, 2016). The literature review on close social relationships prior to 2006 has revealed that, in contrast to young adulthood, sexuality in late adulthood has rarely been addressed (Blieszner, 2006). More than one decade later, no change in this aspect has been noted (Blieszner & Ogletree, 2018). However, there are reasons to highlight the importance of inquiries about sexuality in late adulthood.

To begin with, midlife is characterized by unique developmental transitions (Infurna et al., 2020) that can be relevant for sexuality. For example, the menopausal transition may constitute a challenge for women's sexuality (Avis et al., 2017). At the same time, despite decreases in reproductive capacity, sexuality may remain an important aspect of romantic relationships, with functions of sexuality other than reproduction possibly becoming more central for engaging in sexual activity, for example, the fulfillment of emotional needs (Beier et al., 2005; Beier & Loewit, 2013). Moreover, sexuality has been increasingly considered to be linked with *successful aging* often defined as a "(...) low probability of disease and disease-related disability, high cognitive and physical functional capacity, and active

engagement with life” (Rowe & Kahn, 1997, p. 433)¹. Conceptually, an active and satisfying sex life is expected to enhance successful aging via benefiting psychological and physical health and well-being (Buczak-Stec et al., 2019; Syme et al., 2013). The possible underlying mechanism includes neuroendocrine changes and favorable cognitions due to emotional and physical intimacy that contribute to broadly understood well-being (Jakubiak & Feeney, 2017). Empirically, there has been accumulating evidence for different facets of sexuality being associated with indicators of successful aging (Štulhofer et al., 2019; Woloski-Wruble et al., 2010; Zhang & Liu, 2020). To illustrate, more frequent sexual activity has been associated with less depressive symptoms (Freak-Poli et al., 2017) and greater enjoyment of life (Smith et al., 2019). Taken together, sexuality may remain an important aspect of life in late adulthood and thus requires more focus in research on close social relationships.

1.2. Multifaceted Approach to Sexuality

Over the past two decades, definitions of sexuality have been scarce and inconsistent (Macleod & McCabe, 2020). One prominent and frequently cited definition provided by the World Health Organization (2006, p. 5) states that sexuality “(...) encompasses sex, gender identities and roles, sexual orientation, eroticism, pleasure, intimacy and reproduction. Sexuality is experienced and expressed in thoughts, fantasies, desires, beliefs, attitudes, values, behaviours, practices, roles and relationships. While sexuality can include all of these dimensions, not all of them are always experienced or expressed. (...)” This comprehensive definition of sexuality emphasizes its complexity and posits its multifaceted character. Correspondingly, conceptual perspectives on romantic relationships have long distinguished different facets of sexuality. For example, from the developmental perspective, Sternberg’s

¹ The term “successful aging” has been introduced by Havighurst (1961) and further developed by Rowe and Kahn (1987), Baltes and Baltes (1990), and others. The three-component definition provided by Rowe and Kahn in 1997 has to date been widely utilized in aging research. Over time, several additions to this definition have been proposed (Martinson & Berridge, 2015). In sexuality research, modified definitions of successful aging (e.g., low probability of disease and disability replaced with life satisfaction, Štulhofer et al., 2019) and other related constructs such as sexual health, sexual well-being, or healthy sexual aging (Fischer, 2020) have been adopted. In this thesis, we integrate this literature to provide an overview of the central findings on the links between sexuality and broadly defined successful aging.

Triangular Theory of Love (1986) and Duplex Theory of Love (2006) made a distinction between passion as erotic desire, intimacy as emotional closeness, and commitment as a long-term dedication to a romantic relationship. Sternberg postulated that passion, intimacy and commitment are *distinct* facets of romantic relationships that (may) *coincide*, which results in a unique pattern of love. In turn, from a clinical perspective, Beier and colleagues (Beier et al., 2005; Beier & Loewit, 2013, p. 9) have long argued that desire, reproduction, and attachment constitute three *distinct*, but *interrelated* dimensions of sexuality. In empirical research, sexuality has often been defined through its different facets, such as sexual activity, sexual desire, physical intimacy and emotional intimacy (Cross & Weeks, 2007; Macleod & McCabe, 2020). The sheer variety of terms that has to date been used to define sexuality suggests that it is difficult to capture the nature of sexuality by restricting it to one facet. At the same time, research has provided valuable insights into the nature of sexuality by distinguishing and examining its multiple facets. Thus, drawing from previous literature and moving one step further, we refer to sexuality going forward as a multifaceted phenomenon, with its facets being both distinct (i.e., each facet will describe a considerable part of sexuality as theoretical construct in a unique way) and interrelated (i.e., there are both links between the facets and commonalities between the facets in terms of how they are related to other aspects of functioning).

1.3. The Nature of Sexuality in Late Adulthood

Against the misconception that older adults have no sex life, an increasing number of studies have shown that many older adults report being sexually active (Gianotten, 2021). Importantly, conceptualizations of sexuality in late adulthood have been moving away from equating sexuality with sexual intercourse towards including a broader range of aspects more central to sexuality of older adults (Macleod & McCabe, 2020). First, *sexual activity* has been increasingly understood as encompassing a broad range of experiences other than penetrative sex, including physical intimacy (e.g., fondling or kissing; Smith et al., 2019). Second, older

adults often wish for more sexual activity and physical intimacy than they actually experience (Beier et al., 2020). Thus, it appears pivotal to consider older adults' *sexual thoughts* and wishes.

Third, the emotional component of sexuality (i.e., *intimacy*) is assumed to become more central to sexuality than the frequency of sexual activity (Beier et al., 2005; DeLamater & Koepsel, 2015). This perspective corresponds with the Socioemotional Selectivity Theory, which implies that older age, as a proxy of (perceived) limited time in life left, prompts shifts towards prioritizing emotionally valued goals and activities (Lang & Carstensten, 2002). Related to this, the effectiveness of emotion regulation remains relatively stable across adulthood (for a meta-analysis see Mikkelsen et al., 2021), which may be of essence for fostering intimacy within one's relationship(s) until old age. Likewise, empirical studies have shown that intimacy remains both highly valued and often experienced by considerable proportions of older adults, especially by those who have a partner (Fileborn et al., 2017; Lodge & Umberson, 2012; Müller et al., 2014; Træen, Štulhofer et al., 2019). Thus, intimacy might play a particularly important role for sexuality in late adulthood.

Fourth, the perceived *importance of sexuality* is closely intertwined with other facets of sexuality, including sexual activity and sexual thoughts (DeLamater & Sill, 2005; Thomas et al., 2015). Additionally, importance attributed to sexuality may constitute the link between older adults' experiences or evaluations of their sexuality and aspects of successful aging (e.g., longevity: Beerepoot et al., 2022). Finally, *enjoyment of sexuality* refers to older people's idiosyncratic definitions of fulfilling sex life and conveys information about the quality of sexual experience (Fileborn et al., 2017). As such, investigating enjoyment of sexuality may complement research on mere quantitative (e.g., the frequency of sexual activity) and emotional aspects of sexuality in late adulthood.

An important notion on sexuality is that it unfolds and is shaped by factors operating at different time scales (Pettit & Hegarty, 2014). First, as a part of individual development

across the life span, *age differences* in sexuality might occur. To illustrate, approx. 60% of 70-79-year-old adults who have a partner reported having had any sexual activity in the past year, whereas among 50-59-year-old partnered adults these were approx. 96% (Lee et al., 2016). However, less is known about other central facets of sexuality in late adulthood, for example, how intimacy unfolds with age of an individual.

Second, individual functioning and development are profoundly shaped by the *historical time* and sociocultural context people are born and living in (e.g., Baltes et al., 1979; Bronfenbrenner, 1993). Among others, historical increases in the accessibility of key sociodemographic, physical health, and psychosocial resources for successful aging might have substantially contributed to the occurrence of differences in functioning of earlier-born and later-born older adults (Drewelies et al., 2019). Research has also demonstrated historical trends towards later-born adults, compared to their earlier-born peers, being sexuality active until older ages (Beckman et al., 2014). However, given the gap between sexual activity experienced and wished by older adults (Beier et al., 2020), drawing inferences about the importance of sexuality from the reports on sexual activity is questionable. Thus, cohort differences in other central facets of sexuality than sexual activity should also be examined.

Third, sexuality is enacted on a momentary basis (Pettit & Hegarty, 2014) and is shaped by intrapersonal and interpersonal dynamics that occur in the *daily lives* of romantic partners (Dewitte et al., 2015). Previous studies have typically examined sexual activity and physical intimacy among older adults over the past 6 to 12 months (e.g., Freak-Poli et al., 2017). However, such one-time retrospective reports cannot provide insights into the moments of intimacy and the relevant between-person and within-person dynamics. As a consequence, we know little about the actual frequency and fluctuations of physical intimacy in older adults' daily lives.

1.4. Psychosocial Correlates of Sexuality in Late Adulthood

The comprehensive definition of sexuality by WHO (2006, p. 5) further states that sexuality “(...) is influenced by the interaction of biological, psychological, social, economic, political, cultural, ethical, legal, historical, religious and spiritual factors”. Although the relevance of psychosocial – next to biological – factors shaping human sexuality has already been claimed in the early 90s (Rossi, 1994), research on sexuality in late adulthood usually adopts the biomedical perspective that emphasizes the role of specific illnesses, multimorbidity and medication for sexual (dys-)function (for an overview see DeLamater, 2012). Because of that, the important role physical health plays for sexuality in late adulthood is widely acknowledged, whereas the importance of psychosocial factors is not well understood and often underestimated.

However, conceptual accounts and empirical research indicate that psychosocial factors play a significant role for sexuality in late adulthood. To begin with, with advancing age, the availability of a partner may be crucial for engaging in sexual activity and physical intimacy (Karraker et al., 2011; Schick et al., 2010), but also for reporting sexual thoughts (DeLamater & Sill, 2005) and considering sex as important (Gott & Hinchliff, 2003). Among partnered older adults, longer relationship duration may diminish sexual activity, but enhance intimacy (Sternberg, 1986). In turn, higher relationship satisfaction is thought to make partnered sexual activity more appealing (Iveniuk & Waite, 2018) and is associated with more frequent sexual activity (Thomas et al., 2015). Regardless of relationship status, social embeddedness (e.g., larger social networks: Iveniuk & Waite, 2018; engagement in social activities: Bach et al., 2013) is related to sexual interest and may thus facilitate sexual activity. In contrast, loneliness, understood as perceived social isolation (Luhmann & Hawkey, 2016; Peplau & Perlman, 1982) presumably undermines sexuality, be it because of the unsatisfying quality of social interactions itself or its devastating consequences, such as depressive symptoms (Cacioppo & Hawkey, 2009). In turn, depressive symptoms are often accompanied by a

general lack of interest in and pleasure derived from different activities, which also impacts sexuality (Bach et al., 2013). Finally, believing that there are obstacles beyond one's control that interfere with reaching one's goals (i.e., perceived constraints, Drewelies, Deeg et al., 2018; Lachman, 2006) can also stand in the way of taking action towards a fulfilling sexuality, and ultimately undermine sexuality.

Psychosocial factors may affect older people's sexuality, but it is also sexuality that affects psychosocial functioning. A key notion about sexuality is that it fosters well-being, indicated by, for example, higher positive affect and lower negative affect (as shown in younger and middle-aged adults: Burleson et al., 2007; Kashdan et al., 2018). Importantly, not only sexual intercourse, but also everyday physical intimacy (e.g., hugging, kissing) is related to lower negative affect and (both perceived and physiological) stress (Burleson et al., 2007; Ditzen et al., 2008). However, to date, physical intimacy both experienced and wished by older adults has received considerably less attention than sexual activity and sexual thoughts. Thus, it remains unclear whether and how experiences of and wishes for physical intimacy in late adulthood are related to indicators of well-being such as affect and stress.

1.5. Research Agenda

Integrating previous literature (Beier et al., 2005; Macleod & McCabe, 2020; Sternberg, 1986), in this original research, we pursued a multifaceted approach to sexuality. In doing that, within the scope of three empirical studies, we distinguished seven facets of sexuality that are crucial for a better understanding of sexuality in late adulthood: (a) sexual activity, (b) sexual thoughts, (c) intimacy, (d) importance of sexuality, (e) enjoyment of sexuality, (f) physical intimacy experienced, and (g) physical intimacy wished. In Study 1 (Kolodziejczak et al., 2019), we defined *sexual activity* to encompass a broad range of partnered sexual behaviors, including sex with and without intercourse, exchanging caresses, and body contact; we defined *sexual thoughts* as thoughts about and wishes for engaging in partnered sexual behaviors; and *intimacy* as encompassing emotional aspects of sexual activity such as feeling

safe, secure and accepted. In Study 2 (Kolodziejczak et al., 2021), we defined *importance of sexuality* as the role and value of sex in people's current lives; and *enjoyment of sexuality* as the degree to which people experience their sex life as pleasurable. In Study 3 (Kolodziejczak et al., 2022), we defined *physical intimacy experienced* as experiencing everyday touch actually or typically demonstrating affection (e.g., love, care) with one's partner; and *physical intimacy wished* as thoughts about and wishes for engaging in physical intimacy with one's partner. By distinguishing different facets of sexuality, the three studies pursued two major research goals each: (1) To provide new insights into the nature of sexuality in late adulthood and (2) to examine psychosocial correlates of sexuality in late adulthood.

1.5.1. Research Goal 1: Providing New Insights into the Nature of Sexuality in Late Adulthood

Study 1, Study 2 and Study 3 aimed at contributing to a better understanding of the nature of sexuality in late adulthood, each in a unique way. First, to approach an understanding of how sexuality unfolds in association with the chronological age of an individual, in Study 1, we examined age differences in sexual activity, sexual thoughts and intimacy among older adults aged 60 to 82 years ($M_{\text{age}} = 68.2$, $SD_{\text{age}} = 3.68$; $N = 1,514$). To put these findings in perspective, we additionally used data from a comparison sample of 475 younger adults ($M_{\text{age}} = 28.4$, $SD_{\text{age}} = 3.08$, range = 22 to 36 years) to examine differences in sexuality between younger and older adults. To our knowledge, our study was the first to investigate age differences in intimacy. Our overarching expectation was that *age differences within the three facets might show diverse patterns*. To illustrate, drawing from the literature demonstrating that, with advancing age, older adults report less frequent sexual activity and sexual thoughts (Lee et al., 2016), but prioritize emotionally meaningful goals (Lang & Carstensen, 2002) and highly value emotional aspects of sexuality (DeLamater & Koepsel, 2015), we hypothesized that older chronological age will be associated with less frequent sexual activity and less frequent sexual thoughts, but not less feelings of intimacy.

Second, to highlight historical trends with regard to sexuality, in Study 2, we examined cohort differences in the importance of sexuality and enjoyment of sexuality, two relevant yet often neglected facets of sexuality in middle and old age (Fileborn et al., 2017; Gott & Hinchliff, 2003). In doing that, we analyzed data obtained 20 years apart, 1992-1993 (718 participants born 1928-1937) and 2012-2013 (860 participants born 1948-1957) from two independent samples of adults aged 55 to 65 years ($M_{\text{age}} \approx 60$, $SD_{\text{age}} \approx 2.9$). Our overarching expectation was that *cohort differences might vary depending on the facet of sexuality*. However, considering the possible impact of historical and sociocultural circumstances (e.g., “sexual revolution” of the 1960-1970s) at an early stage of life (Stewart & Healy, 1989) on sexuality of the later-born cohort, but also historical improvements in psychosocial functioning of adults in late midlife (e.g., lower perceived constraints in the later-born cohort: Drewelies, Deeg et al., 2018), we hypothesized that both the importance and enjoyment of sexuality would be higher in the later-born cohort, compared to the earlier-born cohort examined.

Third, to capture daily life fluctuations in physical intimacy among older adults, in Study 3, we investigated the frequency of momentary physical intimacy experienced and physical intimacy wished among 120 heterosexual romantic couples aged 56 to 88 years ($M_{\text{age}} = 71.6$, $SD_{\text{age}} = 5.94$). In order to represent a typical week of older adults and reduce retrospective bias, the data were obtained six times per day over seven consecutive days. Additionally, acknowledging that older adults often wish for more physical intimacy than they experience (Beier et al., 2020) and thus not all momentary wishes for intimacy can be enacted, we expected that *physical intimacy experienced and wished might fluctuate within and across days in a different manner*.

1.5.2. Research Goal 2: Examining Psychosocial Correlates of Sexuality in Late Adulthood

To approach a better understanding of how sexuality is linked with close social relationships in late adulthood, within the scope of the aforementioned three empirical studies, we focused on psychosocial correlates of sexuality. Importantly, we acknowledge that an interplay of several, partially opposing forces rather than single factors explain the interindividual differences in sexuality of older adults best (DeLamater, 2012). For example, poor health can undermine sexual activity (Lindau et al., 2007), whereas being in a satisfying romantic relationship facilitates engaging in sexual activity (Gillespie et al., 2017). Thus, we examined the associations between sexuality and psychosocial factors, while accounting for well-known sociodemographic and physical health factors. Specifically, in Study 1, we examined associations of sexual activity, sexual thoughts and intimacy with psychosocial factors such as relationship status, relationship duration, relationship satisfaction, and loneliness, while accounting for age, gender, education, multimorbidity, and grip strength. Our overarching expectation was that the three facets of sexuality will show *both common and facet-specific associations with psychosocial factors*. For example, in line with previous research (Ganong & Larson, 2011; Karraker et al., 2011; Lee et al., 2016), we hypothesized that older adults who have a partner will report more sexual activity, more sexual thoughts, and more intimacy than older adults who have no partner. This example illustrates possible *common* associations between the facets of sexuality and the psychosocial factors. As an example for *facet-specific* associations, following the notion that long-term married couples are less characterized by sexual passion than by intimacy (Sternberg, 1986), we hypothesized that longer relationship duration will be associated with less sexual activity and less sexual thoughts, but not less intimacy.

In Study 2, we examined associations between the perceived importance of sexuality and enjoyment of sexuality and psychosocial factors such as relationship status, loneliness,

depressive symptoms, and perceived constraints, while accounting for age, gender, education, salience of religion, multimorbidity, and functional limitations. Again, we expected to observe *both common and facet-specific associations* of the two facets of sexuality with the psychosocial factors. More precisely, for the two facets of sexuality examined, we expected that differences with regard to whether and how they will be associated with psychosocial variables might occur. For example, we hypothesized that adults in late midlife who have a partner will report higher importance of sexuality, compared to same-aged adults not having a partner (as argued by Gott & Hinchliff, 2003). However, due to a research gap, it remained unclear whether and how relationship status would be associated with enjoyment of sexuality. Similarly, considering that greater social embeddedness is linked with more sexual interest in late adulthood (Iveniuk & Waite, 2018), we hypothesized that lower levels of loneliness reported would be associated with higher importance of sexuality, but the association between loneliness and enjoyment of sexuality in late midlife remained a subject of exploratory examination.

In Study 3, we examined the associations of physical intimacy experienced and physical intimacy wished with indicators of psychosocial functioning such as positive affect, negative affect, and additionally daily salivary cortisol as an indicator of physiological stress, while controlling for age, education, body mass index (BMI), and relationship satisfaction. Again, our overarching expectation was that for physical intimacy experienced and wished *both common and facet-specific associations* might occur. Based on findings from younger and middle-aged adults (Burlison et al., 2007; Ditzen et al., 2008), we hypothesized that experiencing more physical intimacy will be associated with more positive affect, less negative affect, and lower daily cortisol. Due to lacking indices from previous research, we exploratorily examined the association between physical intimacy wished and positive affect, negative affect, and daily cortisol.

2. Chapter 2: The Nature of Sexuality in Late Adulthood

This chapter entails brief summaries of the three empirical studies published in peer-reviewed journals. Detailed descriptions of the theoretical background, method, results (including tables and figures), and discussion can be found in each respective publication, referred to going forward as Study 1 (Kolodziejczak et al., 2019), Study 2 (Kolodziejczak et al., 2021) and Study 3 (Kolodziejczak et al., 2022).

2.1. Age Differences in Sexual Activity, Sexual Thoughts and Intimacy

Because of a number of biological, psychological, and relational age-related changes, sexuality is assumed to differ with chronological age (DeLamater, 2012). For example, on the health side, severe diseases (e.g., cardiovascular and metabolic conditions; Bach et al., 2013) and functional limitations (Waite et al., 2009), and on the social side, increases in widowhood (Karraker et al., 2011) may undermine sexual activity and sexual thoughts. However, older adults highly value emotional aspects of sexuality (DeLamater & Koepsel, 2015). Thus, we expected that *age differences within the three facets might show diverse patterns*. Specifically, we hypothesized that older chronological age will be associated with less frequent sexual activity and less frequent sexual thoughts, but not less feelings of intimacy.

2.1.1. Methods

To test our hypotheses, we used data from the Berlin Aging Study II (BASE-II). Detailed description of study design, sample and procedure can be found in previous publications (Bertram et al., 2014; Gerstorf et al., 2016). The BASE-II was approved by the ethics committee of the Charité—Universitätsmedizin Berlin (approval number EA2/029/09) and the ethics committee of the Max Planck Institute for Human Development, Berlin. The BASE-II participants were residents of the greater metropolitan area of Berlin, recruited via the participant pool at the Max Planck Institute for Human Development, Berlin and additionally via advertisements in newspapers and the public transportation system. The analysis sample consisted of 1,514 older adults aged 60 to 82 years ($M_{\text{age}} = 68.2$, $SD_{\text{age}} = 3.68$;

50% women, 50% men; 66% in a heterosexual relationship, 2% in a homosexual relationship) and 475 younger adults of 22 to 36 years ($M_{\text{age}} = 28.4$, $SD_{\text{age}} = 3.08$; 53% women, 47% men; 55% in a heterosexual relationship, 4% in a homosexual relationship), who provided data on at least one item assessing sexuality. *Sexual activity* was measured as the average of the indicated frequency of sexual intercourse, sex without intercourse, exchanging caresses, and body contact, assessed using four items with a 5-point response scale ranging from 0 (never before) to 4 (at least once per week); Cronbach's alpha = .86. *Sexual thoughts* were measured as the average frequency of thoughts about and wishes for the same four activities, applying the same response scale; Cronbach's alpha = .85. *Intimacy* was measured as the average of three items regarding one's sexuality and romantic relationships: "I experience through body contacts security and acceptance", "I feel safe and accepted during sex", "My needs for security and acceptance are currently satisfied", answered on a 5-point scale ranging from 0 (I do not agree) to 4 (I absolutely agree); Cronbach's alpha = .69. *Chronological age* was measured as number of years from birth until the year of data collection. *Age group* contrasted younger adults (22 to 36 years; 0) with older adults (60 to 82 years; 1).

The analytical strategy included two steps. First, within the sample of older adults, we examined zero-order associations between chronological age and sexual activity, sexual thoughts and intimacy. Additionally, we conducted multivariate regression analyses, in which we examined associations of sexuality with age while accounting for several sociodemographic, physical health, and psychosocial variables (for details see point 3.1.). Second, we examined age group differences between younger adults and older adults in sexual activity, sexual thoughts and intimacy using one-way ANOVA.

2.1.2. Results

Among older adults, sexual activity ($M = 2.37$, $SD = 1.07$, range = 0 to 4), sexual thoughts ($M = 2.85$, $SD = 0.98$, range = 0 to 4), and intimacy ($M = 2.53$, $SD = 1.30$, range = 0 to 4) were correlated $r = .21$ to $.65$, $ps < .01$. Older age was associated with reporting less

frequent sexual activity, $r = -.10$, $p < .01$, and less frequent sexual thoughts, $r = -.12$, $p < .01$, but not less intimacy, $r = .01$, $p > .10$. The pattern of findings remained unchanged after controlling for other sociodemographic, physical health and psychosocial variables ($\beta = -.10$, $\beta = -.13$ and $\beta = .00$, respectively). In contrast, among younger adults, chronological age was not significantly associated with sexual activity, sexual thoughts or intimacy. Compared to younger adults, older adults reported less frequent sexual activity, $F [1, 1987] = 134.49$, $p < .001$, $d = .63$, less frequent sexual thoughts, $F [1, 1987] = 235.23$, $p < .001$, $d = .81$, and less intimacy, $F [1, 1987] = 12.98$, $p < .001$, $d = .20$.

2.1.3. Discussion

Sexual activity, sexual thoughts and intimacy exhibited moderate-sized intercorrelations, indicating that they both coincide and cover slightly different parts of the larger measurement space of sexuality. In line with our overarching expectation, age differences within the three facets of sexuality exhibited in part diverse patterns. Specifically, among older adults, older age was associated with less frequent sexual activity and less sexual thoughts, but not less feelings of intimacy. Age group comparisons have additionally revealed that mean differences between younger and older adults were of the large size for sexual thoughts, followed by the medium size for sexual activity, and of the small size for intimacy. Our results corroborate previous findings on sexual activity and sexual thoughts in old age (Karraker et al., 2011; Lee et al., 2016), but also extend them by showing that interpersonal differences in experiencing intimacy cannot be reliably explained by chronological age.

2.2. Cohort Differences in the Importance of Sexuality and Enjoyment of Sexuality

Individual functioning is shaped by the historical and sociocultural context people are born and living in (Baltes et al., 1979; Bronfenbrenner, 1993). The influence of historical and cultural factors has also explicitly been noted with regard to sexuality (Pettit & Hegarty, 2014). Over the past decades, several historical shifts might have contributed to changes in sexuality in late midlife. For example, the “sexual revolution” of the 1960-1970s spread more

liberal attitudes towards sexuality that facilitated engagement with and enjoyment of sex life. Borrowing from the model outlining how an individual is receptive to the impact of sociocultural events depending on his/her stage of life (Stewart & Healy, 1989), it is conceivable that sexual revolution particularly impacted the adolescents and young adults at that time. Moreover, historical changes in psychosocial functioning of adults in late midlife (e.g., lower perceived constraints: Drewelies, Deeg et al., 2018) might have also contributed to cohort differences in how important and enjoyable sex lives are perceived. Thus, we hypothesized that both the importance and enjoyment of sexuality would be higher in the later-born cohort of adults in late midlife, compared to their earlier-born peers.

2.2.1. Methods

We used data derived from the Longitudinal Aging Study Amsterdam (LASA). Detailed information about study design, participants and procedure can be found elsewhere (Hoogendijk et al., 2016; Huisman et al., 2011). The LASA was approved by the Medical Ethical Committee of the VU University Medical Center in Amsterdam, the Netherlands (IRB numbers 92/138 and 2012/361) and conducted based on the Declaration of Helsinki. Our analysis sample included participants aged 55 to 65 years ($M_{\text{age}} \approx 60$, $SD_{\text{age}} \approx 2.9$) from two independent samples, who provided data on at least one item assessing sexuality: 718 adults born 1928-1937 (data obtained in 1992-1993) and 860 adults born 1948-1957 (data obtained in 2012-2013). Details on sample selectivity analyses can be found in Study 2. *Importance of sexuality* was assessed using the single item: “How important is sexuality for you now?”, answered on a 5-point scale ranging from 1 (very unimportant) to 5 (very important). *Enjoyment of sexuality* was assessed using the single item: “How do you experience your sex life now?”, answered on a 5-point scale ranging from 1 (very unpleasant) to 5 (very pleasant); an additional response category was “not applicable” and participants who endorsed this category were excluded from the analyses. *Cohort membership* was treated as a dichotomous variable, contrasting the participants born 1928-1937 (0) with those born 1948-1957 (1). The

analytical strategy included two steps. First, we examined mean-level differences between the two cohorts separately for the importance of sexuality and enjoyment of sexuality using one-way ANOVA. Second, we conducted hierarchical regression analyses separately for the importance of sexuality and enjoyment of sexuality to examine the predictive effect of cohort membership while accounting for a number of sociodemographic, physical health, and psychosocial correlates (see point 3.2.).

2.2.2. Results

Importance and enjoyment of sexuality were correlated in both cohorts, $r = .50$ for the earlier-born cohort and $r = .41$ for the later-born cohort, both $ps < .01$. Mean levels of the importance of sexuality reported in the earlier-born cohort were 3.08 ($SD = 1.03$, range = 1 to 5) and in the later-born cohort were 3.21 ($SD = 0.88$, range 1 to 5). One-way ANOVA revealed that the two cohorts significantly differed with regard to the reported importance of sexuality, $F [1, 1569] = 6.85, p < .01, d = .14$. Hierarchical regression analyses have shown a significant effect of cohort membership on the reported importance of sexuality both before accounting for other correlates, $\beta = .07, p < .01$ and afterwards, $\beta = .06, p < .05$.

Mean levels of the enjoyment of sexuality were 3.71 in the earlier-born cohort ($SD = 0.82$, range = 1 to 5) and 3.61 ($SD = 0.81$, range 1 = 5) in the later-born cohort. One-way ANOVA revealed that the two cohorts significantly differed with regard to the reported enjoyment of sexuality, $F [1, 1257] = 4.89, p < .05, d = -.12$. Hierarchical regression analyses have shown a significant effect of cohort membership on the reported importance of sexuality before accounting for other correlates, $\beta = -.06, p < .05$. However, after accounting for correlates, the cohort membership effect was not statistically significant anymore, $\beta = -.05, p > .05$.

2.2.3. Discussion

The importance and enjoyment of sexuality were moderately correlated in both samples, indicating that the two facets of sexuality coincide, but cover in part different aspects of the

measurement space of sexuality. For the cohort differences, as hypothesized, later-born adults in late midlife reported slightly higher importance of sexuality than their earlier-born peers. Contrary to expectations, after accounting for sociodemographic, physical health, and psychosocial factors other than cohort membership, earlier-born and later-born adults in late midlife did not differ with regard to their reported enjoyment of sexuality. The findings that the two cohorts significantly differed from each other in the importance of sexuality at the alpha level of $p < .05$, whereas they did not differ in enjoyment of sexuality, demonstrate that cohort differences might vary depending on the facet of sexuality.

2.3. Daily Life Fluctuations in Physical Intimacy Experienced and Physical Intimacy Wished

Physical intimacy is considered as an important channel for communicating affection in romantic relationships (Debrot et al., 2013). Previous research has shown that older adults who have a partner often report having experienced physical intimacy, for example, hugging, caressing, or kissing (Freak-Poli et al., 2017; Lee et al., 2016; Waite et al., 2009). Also, a big proportion of older partnered adults desires and highly values physical intimacy in their 60s to 90s (Galinsky et al., 2014; Müller et al., 2014). We thus hypothesized that physical intimacy will be often experienced and wished by older couples in their daily lives. However, not all wishes for physical intimacy can be enacted in old age (Beier et al., 2020). At the momentary level, we thus expected that *physical intimacy experienced and wished might fluctuate within and across days in a different manner*. Specifically, we expected that reports on physical intimacy wished will not always be accompanied by reports on physical intimacy experienced.

2.3.1. Methods

The analysis sample consisted of 120 heterosexual couples from Germany aged 56 to 88 years ($M_{\text{age}} = 71.6$, $SD_{\text{age}} = 5.94$). Participants were recruited from the participant pool of the Socio-Economic Panel (Wagner et al., 2007; details on eligibility criteria can be found in

Study 3). Ethics approval for data collection was granted by the ethics committee of the Department of Psychology at Humboldt University Berlin. Data were collected in 2018 by trained interviewers of the external data science company KANTAR. On seven consecutive days, participants completed six short questionnaires per day (upon waking, at 10 a.m., 1 p.m., 4 p.m., 7 p.m., and 9 p.m.) using an iPad. Momentary *physical intimacy wished* was assessed using the single item: “Since the last questionnaire, how much did you wish to have some kind of physical intimacy (e.g., touching, hugging, or kissing) with your partner?”, answered using a sliding scale ranging from 0 (no particular wish) to 100 (strong wish). Momentary *physical intimacy experienced* was assessed using the single item “Since the last questionnaire, how much physical intimacy did you actually experience with your partner?”, answered using a sliding scale ranging from 0 (no intimacy at all) to 100 (much intimacy).

We analyzed the characteristics of the distribution (mean, standard deviation, median, skewness, and interquartile range) of the data on physical intimacy experienced and physical intimacy wished across the 42 measurement occasions both in the entire sample ($N = 240$) and separately in women and men (both $ns = 120$). Additionally, we applied one-way ANOVA with time of day as a predictor of physical intimacy experienced or wished.

2.3.2. Results

The between-person correlation between physical intimacy experienced and physical intimacy wished was $r = .71$ for women and $r = .73$ for men, both $ps < .05$; the average within-person correlation was $.46$ ($SD = .28$). Mean level of physical intimacy experienced was 36.61 ($SD = 31.63$, median = 30.00 , range 0 to 98.24 ; skewness = 0.37), mean levels by gender were 33.64 for women ($SD = 23.28$) and 39.73 for men ($SD = 24.18$). Women and men differed in the reported frequency of physical intimacy experienced, $F [1, 10071] = 165.19$, $p < .05$, $d = .26$. Mean level of physical intimacy wished was 36.63 ($SD = 31.43$, median = 31.00 , range 0.48 to 99.90 ; skewness = 0.36), mean levels by gender were 29.48 for

women ($SD = 23.56$) and 44.01 for men ($SD = 25.20$). Women and men differed in the reported frequency of physical intimacy wished, $F [1, 10071] = 895.48, p < .05, d = .60$.

On 75% of all measurement occasions, physical intimacy experienced and physical intimacy wished were rated ≥ 6 (interquartile range = 59). Mean levels of physical intimacy both experienced and wished were highest between 9 p.m. and waking ($M = 45.11, SD = 31.87$ and $M = 43.04, SD = 31.22$, respectively) followed by the time between waking up and 10 a.m. ($M = 40.07, SD = 31.92$ and $M = 38.47, SD = 31.38$, respectively).

2.3.3. Discussion

Physical intimacy experienced and wished were moderately (within-person) to strongly (between-person) correlated, which suggests that the two facets of physical intimacy represent interrelated, but in part different aspects of a larger measurement space. The characteristics of the distribution indicated that, across all measurement occasions, the average levels of physical intimacy experienced and physical intimacy wished were relatively low. However, physical intimacy both experienced and wished were reported on the majority of occasions, with the highest levels being reported in the evenings and mornings (similar to sexual activity among adults aged 19 to 65 years: Dewitte et al., 2015). Importantly, although at the sample level reports of physical intimacy experienced and wished were very similarly distributed, considerable gender differences occurred. Specifically, men reported more physical intimacy experienced and more physical intimacy wished than women, the difference between women and men in reported physical intimacy experienced was small ($d = .26$), and in physical intimacy wished was moderate ($d = .60$; Cohen, 1988, pp. 24-27). This points towards the utility of distinguishing different facets of physical intimacy.

3. Chapter 3: Correlates of Sexuality in Late Adulthood

The correlates of sexuality have been examined within the framework of the same three empirical studies as has been the nature of sexuality in late adulthood (see Chapter 2).

Detailed description of the theoretical background, method, results (including tables and

figures), and discussion can be found in each respective publication referred to as Study 1 (Kolodziejczak et al., 2019), Study 2 (Kolodziejczak et al., 2021), and Study 3 (Kolodziejczak et al., 2022). Information on the ethics approval, recruitment of participants, general study procedure, and measures of sexuality is provided in Chapter 2 and will not be repeated.

3.1. The Role of Psychosocial Factors for Sexual Activity, Sexual Thoughts and Intimacy

Borrowing from the successful aging literature (Baltes & Baltes, 1990; Rowe & Kahn, 1997), we assumed that sociodemographic (e.g., education), physical health and psychosocial (e.g., social embeddedness) characteristics provide resources that facilitate active engagement with life. We hypothesized that such resources are also crucial for sexuality of older adults, however, to different degrees for different facets of sexuality. For example, in line with previous research (Ganong & Larson, 2011; Lee et al., 2016), we hypothesized that older adults who have a partner will report more sexual activity, more sexual thoughts, and more intimacy than older adults who have no partner (i.e., *common* associations between the facets of sexuality and the psychosocial factors). In turn, given that long-term couples are less characterized by sexual passion than by intimacy (Sternberg, 1986), we hypothesized that longer relationship duration would be associated with less sexual activity and less sexual thoughts, but not less intimacy (i.e., *facet-specific* associations).

3.1.1. Methods

Participants were 1,514 adults aged 60 to 82 years ($M_{\text{age}} = 68.2$, $SD_{\text{age}} = 3.68$; 50% women, 50% men; 66% in a heterosexual relationship, 2% in a homosexual relationship). Sociodemographic variables included *chronological age* (number of years from birth), *gender* (0 = women, 1 = men), and years of *education*. Physical health was indicated by *multimorbidity* (weighted number and severity of the diagnosed physical illnesses, with select diagnoses being additionally verified by blood laboratory tests; for details see Study 1) and *grip strength* (measured in kilograms using a hand dynamometer on the dominant hand over three trials). Psychosocial variables included *relationship status* (0 = non-partnered, 1 =

partnered), years of *relationship duration*, *relationship satisfaction* (assessed with the item “How satisfied are you with your relationship altogether?”, answered on a 5-point scale ranging from 0 (not at all) to 4 (very much)), and *loneliness* (the average of seven items from the UCLA Loneliness Scale, Russell et al., 1984; e.g., “I feel sad”, answered on a 1 (does not apply to me at all) to 5 (applies very well to me) scale; Cronbach’s alpha = .82).

We applied structural equation modeling (SEM) to simultaneously consider all three facets of sexuality, and conducted SEM-based multivariate regression analyses to simultaneously account for all sociodemographic, physical health and psychosocial variables. The models were estimated with Mplus Version 8 (Muthén & Muthén, 1998–2017).

3.1.2. Results

After controlling for sociodemographic and physical health variables, being partnered was associated with more sexual activity, $\beta = .48$, $SE = .02$, $p < .01$, more sexual thoughts, $\beta = .24$, $SE = .03$, $p < .01$, and more intimacy, $\beta = .40$, $SE = .02$, $p < .01$. Longer relationship duration was associated with less sexual activity, $\beta = -.12$, $SE = .02$, $p < .01$, and less sexual thoughts, $\beta = -.11$, $SE = .02$, $p < .01$, but not intimacy, $\beta = -.02$, $SE = .02$, $p > .01$. Participants who were more satisfied with their relationship also reported more sexual activity, $\beta = .22$, $SE = .02$, $p < .01$, more sexual thoughts, $\beta = .12$, $SE = .02$, $p < .01$, and more intimacy, $\beta = .36$, $SE = .02$, $p < .01$. Finally, increased loneliness was associated with less sexual activity, $\beta = -.11$, $SE = .02$, $p < .01$, and less intimacy, $\beta = -.18$, $SE = .02$, $p < .01$, but not with sexual thoughts, $\beta = -.03$, $SE = .03$, $p > .01$. Additionally, we found a significant two-way interaction effect of gender with relationship status for all three facets of sexuality. Specifically, the interaction effect indicated that, compared to older adults without a partner, partnered older adults reported more sexual activity, more sexual thoughts, and more intimacy, but this difference was consistently larger among older women than among older men across all three facets of sexuality ($d = 1.51$ vs. $d = 1.17$ for sexual activity, $d = .74$ vs. $d = .42$ for sexual thoughts, and $d = 1.11$ vs. $d = 1.06$ for intimacy).

The nine sociodemographic, physical health and psychosocial variables and the interaction effect explained altogether 45% of the variance in sexual activity, 28% of the variance in sexual thoughts, and 42% of the variance in intimacy. Psychosocial variables uniquely explained 25%, 7%, and 34% of the variance in the respective facets of sexuality, whereas physical health explained < 1% of the variance each.

3.1.3. Discussion

As expected, we found both common and facet-specific associations between sexuality and the indicators of psychosocial functioning. Specifically, having a partner and relationship satisfaction exhibited associations with all three facets of sexuality, whereas relationship duration and loneliness operated each in more unique and facet-specific ways. In our sample of relatively healthy older adults ($M_{\text{multimorbidity}} = 1.27$, $SD_{\text{multimorbidity}} = 1.31$, ranging from 0 to 10), much more of the individual differences in sexuality were explained by psychosocial variables than by physical health. This points out the relevance of indicators of psychosocial functioning for sexuality in later adulthood, as long as health problems do not stand in the way of enacting one's sexuality.

3.2. The Role of Psychosocial Factors for the Importance of Sexuality and Enjoyment of Sexuality

Historical changes in several life domains in late midlife (e.g., higher levels of internal control among later-born cohorts: Gerstorf et al., 2019) might have allowed later-born generations to perceive and experience their sexuality in late midlife differently, compared to earlier-born cohorts. However, psychosocial correlates of the perceived importance of sexuality and enjoyment of sexuality are not well understood. For the two facets of sexuality, we expected that differences with regard to whether and how they will be associated with psychosocial variables might occur. For example, we hypothesized that adults in late midlife who have a partner will perceive sexuality as more important, compared to same-aged adults who do not have a partner (Gott & Hinchliff, 2003), and we exploratorily examined the

association between relationship status and enjoyment of sexuality. Similarly, we hypothesized that lower levels of loneliness reported will be related to higher importance of sexuality, and exploratorily examined the association between loneliness and enjoyment of sexuality.

3.2.1. Methods

Participants were aged 55 to 65 years ($M_{\text{age}} \approx 60$, $SD_{\text{age}} \approx 2.9$) from two independent samples: data obtained in 1992-1993 ($N = 718$ adults born 1928-1937) and 2012-2013 ($N = 860$ adults born 1948-1957). Sociodemographic variables included *cohort membership* that contrasted the participants born 1928-1937 (0) with those born 1948-1957 (1), *chronological age* in years (calculated from the exact date of birth until the date of data collection), *gender* (0 = women, 1 = men), and years of *education*. *Saliency of religion* was operationally defined as endorsing strong faith as one of the most important aspects of life (1) vs. not (0; see Deeg, 2007). Physical health was indicated by *multimorbidity* (the number of the diagnosed chronic physical illnesses; for details see Study 2) and *functional limitations* (the average of participants' ratings for three items: walking up and down a staircase of 15 steps without resting, using public or one's own transportation, and cutting one's own toenails, answered on a 4-point scale ranging from 0 (no difficulties) to 3 (all with difficulty) each; Kriegsman et al., 1997; Cronbach's alpha = .67/.68 for earlier-born/late-born cohort). Psychosocial variables encompassed *relationship status* (0 = non-partnered, 1 = partnered), *loneliness* (the average of eleven items, de Jong Gierveld & Kamphuis, 1985; de Jong Gierveld & van Tilburg, 1999; e.g., "I miss having a really close friend", answered 1 (yes) vs. 0 (no); Cronbach's alpha = .87/.88), *depressive symptoms* (measured with the 20-item CES-D scale, Radloff, 1977; e.g., "I felt sad" referencing the past week, answered on a 4-point scale ranging from 0 (rarely or never) to 3 (mostly or always); Cronbach's alpha = .88/.89), and *perceived constraints* (measured with five negatively framed items from the Pearlin Mastery Scale, Pearlin & Schooler, 1978; e.g., "there is little I can do to change many of the important things in my

life”, answered on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree); Cronbach’s alpha = .74/.76).

We conducted stepwise hierarchical regression analyses separately for the importance of sexuality and enjoyment of sexuality as outcome variables. Because we particularly aimed at examining the role of psychosocial factors for sexuality, we introduced the psychosocial variables in the final steps of modeling after previously accounting for all other variables. Additionally, we examined interaction effects of the correlates included with cohort membership to explore whether historical changes are more pronounced in particular population segments than others.

3.2.2. Results

After controlling for sociodemographic and physical health variables, being partnered, $\beta = .23, p < .01$, and perceiving fewer constraints in one’s life, $\beta = -.06, p < .01$, were each and independently associated with reporting higher importance of sexuality. Additionally, we found three significant interaction effects, of those all included a psychosocial variable. First, the two-way interaction of gender and relationship status indicated that although both women and men in late midlife reported higher importance of sexuality when they had a partner, the difference was more prominent for women (large effect size, $d = .92$) than for men (medium effect size, $d = .43$). Second, the three-way interaction of cohort membership, gender and relationship status showed that, compared to earlier-born women without a partner, later-born non-partnered women in late midlife reported higher importance of sexuality, with a moderate effect size, $d = .56$. The last the three-way interaction of cohort membership, education and perceived constraints indicated particularly pronounced historical increases among individuals with higher education levels and who perceived fewer constraints in their lives, with a small effect size, $d = .26$.

For enjoyment of sexuality, reporting less loneliness, $\beta = -.13, p < .01$, and perceiving fewer constraints, $\beta = -.07, p < .01$, were each associated with reporting higher enjoyment of

sexuality. As for interaction effects, no statistically significant effects emerged with an alpha level of $p < .01$. The nine sociodemographic, physical health and psychosocial variables and their significant interactions conjointly accounted for 22% of the variance in the importance of sexuality, and 10% in enjoyment of sexuality.

3.2.3. Discussion

As hypothesized and in accordance with previous research (Gott & Hinchliff, 2003), adults in late midlife who had a partner reported higher importance of sexuality than same-aged adults not having a partner. In contrast, we found no support for our hypothesis that lower levels of loneliness are related to higher importance of sexuality. However, lower loneliness was associated with more enjoyment of sexuality, which extends previous findings on how social embeddedness is related to sexuality in late adulthood (e.g., social networks of bigger size are related to more sexual interest: Iveniuk & Waite, 2018).

In sum, perceived constraints were related to both the importance and enjoyment of sexuality, with the same direction and size of the associations, whereas relationship status and loneliness were each related to one of the two facets of sexuality examined. These findings are in line with our notion that different facets of sexuality display both common and facet-specific associations with psychosocial factors. Moreover, examining psychosocial variables enabled us to identify population segments for which historical increases in the importance of sexuality were particularly pronounced. This additionally illustrates the utility of examining psychosocial variables as correlates of sexuality.

3.3. The Role of Physical Intimacy Experienced and Physical Intimacy Wished for Momentary Affect and Daily Cortisol Levels

Physical intimacy is thought to be an important component of romantic relationships as it fosters partners' well-being (Burleson et al., 2013; Jakubiak & Feeney, 2017). For example, research with younger and middle-aged couples has shown that everyday physical intimacy (e.g., hugging, kissing) is related to lower negative affect and indicators of stress (Burleson et

al., 2007; Ditzen et al., 2008). Although older adults often report wishing for physical intimacy (Galinsky et al., 2014), little is known about how physical intimacy wished is related to indicators of well-being. We expected that for physical intimacy experienced and wished, both common and facet-specific associations might occur. Based on previous findings (Burlleson et al., 2007; Ditzen et al., 2008), we hypothesized that experiencing more physical intimacy would be associated with more positive affect, less negative affect, and lower daily cortisol, and we exploratorily examined the association between physical intimacy and positive affect, negative affect, and daily cortisol.

3.3.1. Methods

Participants were 120 German heterosexual couples aged 56 to 88 years ($M_{\text{age}} = 71.6$, $SD_{\text{age}} = 5.94$). On seven consecutive days, participants completed six questionnaires per day (upon waking, at 10 a.m., 1 p.m., 4 p.m., 7 p.m., and 9 p.m.; $n \approx 9,780$ valid measurements) and provided saliva samples concurrent to the questionnaires and additionally 30 minutes after waking (so as to capture diurnal cortisol profiles: Nater et al., 2013; $n = 11,405$ valid cortisol measurements). Momentary *positive affect* was measured as the average of ratings for six items: “happy” (e.g., “How happy do you feel right now?”), “interested”, “inspired”, “relaxed”, “balanced” and “at rest”, answered using a 0 (not at all) to 100 (strongly) response scale. Momentary *negative affect* was measured as the average of ratings for seven items: “depressed” (e.g., “How depressed do you feel right now?”), “disappointed”, “groggy”, “downcast”/ “glum”, “overwhelmed”, “nervous” and “jittery”, answered using the same 0 to 100 scale. Salivary cortisol has been assessed following a collection protocol (Hoppmann et al., 2018; for details see Study 3). Daily cortisol levels were calculated as the area under the curve with respect to ground (AUC_g), derived from the trapezoid formula using the cortisol measurements and the time between measurements (Pruessner et al., 2003). Control variables were *chronological age* (number of years from birth until the year of data collection), years of *education*, *body mass index* (BMI; calculated as self-reported body weight in kilograms,

divided by self-reported height in meters squared), and *relationship satisfaction* (assessed with the item “All in all, how would you you’re your current relationship?”, answered on a 5-point scale ranging from 1 (very bad) to 4 (very good). Additionally, we controlled for the physical intimacy wished by the partner.

To model the between-person and within-person differences in physical intimacy simultaneously, we separated the repeated assessments on physical intimacy experienced into between-person variables (calculated as the person-specific mean over 42 occasions) and within-person variables (occasion- or day-specific deviations from the person-specific mean; Bolger & Laurenceau, 2013); same for physical intimacy wished both by actor and partner. We examined the associations between physical intimacy (experienced and wished) and positive affect, negative affect, and daily cortisol levels using three separate actor-partner interdependence models for distinguishable dyads (*gender* as a distinguishing variable), implemented in a multilevel modeling framework each (Bolger & Laurenceau, 2013; Kenny et al., 2006). We additionally exploratorily examined two-way interaction effects of the correlates examined.

3.3.2. Results

The prototypical level of momentary positive affect was $\gamma_{00w} = 62.506$ for women and $\gamma_{00m} = 66.949$ for men. Among women, experiencing more physical intimacy was associated with more positive affect at the between-person level ($\gamma_{05w} = 0.236$) and among men at the within-person level ($\gamma_{10m} = 0.035$). Physical intimacy wished was not associated with positive affect. The prototypical level of negative affect was $\gamma_{00w} = 18.883$ for women and $\gamma_{00m} = 17.170$ for men. Among women, but not among men, experiencing more physical intimacy at both between-person and within-person level was associated with less negative affect ($\gamma_{05w} = -0.164$, $\gamma_{10w} = -0.027$). Women and men with higher overall levels of physical intimacy wished had higher negative affect ($\gamma_{06w} = 0.218$, $\gamma_{06m} = 0.190$).

Prototypical daily cortisol levels (scaled at 1:100) were $\gamma_{00w} = 49.611$ for women and $\gamma_{00m} = 49.339$ for men. Men with higher overall levels of physical intimacy had lower daily cortisol levels ($\gamma_{05m} = -0.392$). In turn, men who reported more overall wish for intimacy had higher cortisol levels ($\gamma_{06m} = 0.257$). We found no significant mean effect of physical intimacy experienced for cortisol among women, and no within-person associations of physical intimacy experienced with cortisol among men. Altogether, several significant interaction effects occurred. For example, men who reported on average more physical intimacy wished and less physical intimacy experienced, also had higher daily cortisol outputs ($\gamma_{08m} = 0.007$).

Fixed effects explained altogether $\approx 22\%$ of the variability in women's and 24% variance in men's positive affect, $\approx 27\%$ of the variability in women's and 30% in men's negative affect, and $\approx 1\%$ variance in women's and 20% in men's daily cortisol levels.

3.3.3. Discussion

Consistent with findings from younger and middle-aged adults (Burlison et al., 2007; Ditzen et al., 2008) and as hypothesized, experiencing more physical intimacy was associated with more positive affect and less negative affect in older couples. In turn, among both women and men, reporting on average more wish for physical intimacy was associated with *more* negative affect. We speculate that a strong wish for physical intimacy might result in negative affect when it does not go hand-in-hand with experiencing intimacy. However, because of the correlational nature of our analysis, it is also conceivable that in moments of higher negative affect, the wish for being comforted by a hug from one's partner increases.

For daily salivary cortisol, more physical intimacy experienced was associated with lower cortisol levels among older men, but not older women. Interestingly, again among men but not among women, more overall physical intimacy wished was associated with higher cortisol levels. This implies that physical intimacy *wished* operates in a reverse way,

compared to physical intimacy *experienced*, in terms of how these two facets are associated with daily cortisol (same for negative affect). We take it as initial evidence for physical intimacy experienced and wished exhibiting more facet-specific than common associations with momentary affect and daily cortisol.

4. Chapter 4: General Discussion

This original research aimed at adding on to the literature by providing new insights into the nature and the correlates of sexuality in late adulthood. In doing that, we pursued a multifaceted approach to sexuality. Within three empirical studies, we altogether distinguished seven facets of sexuality crucial for a better understanding of sexuality in late adulthood (Macleod & McCabe, 2020). Moreover, we examined associations of sexuality with a number of psychosocial factors, while accounting for sociodemographic and physical health factors.

4.1. Research Goal 1: Providing New Insights into the Nature of Sexuality in Late Adulthood

Conceptual accounts have long highlighted the complex and multifaceted nature of human sexuality (Rossi, 1994; WHO, 2006). Following the notion that sexuality varies across the lifespan, including shifts from sexual passion to intimacy in long-term couples (Sternberg, 1986), in Study 1, we targeted emotional aspects of sexuality understood as encompassing a sense of security and acceptance due to sexual activity and physical intimacy. To our knowledge, our study was the first to show that feelings of intimacy are not associated with age among older adults. However, this finding is in accordance with other works further suggesting that sexuality in late adulthood is increasingly detached from the frequency of sexual activity (Forbes et al., 2017) and centers around the emotional intimacy fostered by sexual partners (DeLamater & Koepsel, 2015; Fileborn et al., 2017). Our results are also consistent with conceptual notions and empirical evidence on emotional advantages in the functioning of older adults (Carstensen, 2021). Furthermore, focus on attachment (Beier et al.,

2005), supported by neurobiological findings (Acevedo et al., 2012), is represented in sexual therapy and counseling for older adults (Beier & Loewit, 2013) and efforts in questionnaire construction (Kroll et al., 2019). Taken together, our results highlight intimacy as an important facet of sexuality in late adulthood.

In line with research suggesting that sexuality differs in historical time (Pettit & Hegarty, 2014), in Study 2, we found that later-born adults in late midlife reported slightly higher importance of sexuality than their earlier-born peers. The small-sized effect at the population level was mostly driven by moderate-sized increases in the importance of sexuality in particular population segments, which is consistent with findings obtained for other domains of functioning (e.g., Drewelies, Agrigoroaei et al., 2018). For example, later-born women without a partner reported higher importance of sexuality than earlier-born women with no partner. We note that this subgroup has been identified in an exploratory manner and we can only speculate about possible reasons. For instance, women with no partner might have particularly benefited from historical advancements towards less pronounced gender disparities (Shockley & Shen, 2015) and more positive attitudes towards sexuality in old age (Beckman et al., 2008) today than in the past. Follow-up analyses treating year of birth as predictor variable (instead of cohort membership) have further decomposed the effect at the population level into an initial rise in the importance of sexuality for adults in late midlife born in 1930-1940s, compared to those born in 1920-1930s, followed by a plateau (see Online Supplement for Study 2). This speaks against a linear increase in the perceived importance of sexuality in late midlife, with each successively born generation perceiving sexuality as more important than the preceding generation. Thus, our results should not be overgeneralized. Importantly, perceiving sexuality more important today than in the past did not go hand in hand with experiencing sexuality as more enjoyable. Similar to the higher expectations towards marriages (Finkel et al., 2015), later-born cohorts may hold higher expectations towards sexuality than earlier-born, especially when perceiving sexuality as more important.

Our results need to be corroborated and extended in future research by examining whether the cohort differences found here hold across cohorts, periods and cultures.

Finally, in Study 3, older couples' reports on physical intimacy experienced and wished occurred on the majority of occasions, but strongly fluctuated across moments and differed by time of day. For example, the highest average levels of physical intimacy both experienced and wished were reported in the evenings and mornings (similar to sexual activity among adults aged 19 to 65 years: Dewitte et al., 2015). These findings suggest that physical intimacy remains an important aspect of romantic relationships in late adulthood. As the concept of sexuality possibly changes with age (Trudel et al., 2014), people's idiosyncratic definitions of sexuality may include a broad repertoire of partnered and solitary behaviors other than sexual intercourse (e.g., Fileborn et al., 2017). Physical intimacy might induce feelings of safety and acceptance and thus foster the attachment between partners (Beier et al., 2005), but it might also be an important component of sexual activity as it is associated with less arousal and orgasm difficulties (Galinsky, 2012). On the other hand, physical intimacy might not aim at immediate sexual gratification (Burlinson et al., 2013). A related construct is *affectionate touch*, defined as touch actually or typically demonstrating affection (love, care, fondness, or appreciation: Floyd, 2006). Affectionate touch is often understood as a non-sexual form of intimacy in close relationships (Jakubiak & Feeney, 2017), and its importance for psychosocial functioning has repeatedly been shown (Galinsky et al., 2014; Gullede et al., 2007). Future research might want to shed additional light on whether and how erotic or non-erotic interpretation of physical intimacy moderates its links with well-being in late adulthood.

4.2. Research Goal 2: Examining Psychosocial Correlates of Sexuality in Late Adulthood

Although physical intimacy has long been recognized as an important component of close relationships (Burlinson et al., 2013), research on sexuality and close relationships in late adulthood has been scarce (Blieszner & Ogletree, 2018). By examining psychosocial

correlates of sexuality in late adulthood, we highlighted the linkages between sexuality and aspects of close social relationships, and romantic relationships in particular. Specifically, we have shown that having a partner is associated with more sexual activity, more sexual thoughts and more intimacy (Study 1), as well as perceiving sexuality as more important (Study 2). Additionally, for partnered individuals, relationship duration and relationship satisfaction significantly predicted older adults' sexuality. The availability of a partner provides the opportunity for engaging in sexual activity, whereas a lack of (sexual) partner might constitute a barrier to enact one's sexuality in late adulthood (Karraker et al., 2011; Schick et al., 2010). Additionally, being in a (satisfying) relationship modulates peoples' sexual motivation (Galinsky et al., 2014; Iveniuk & Waite, 2018), which may be mirrored in sexual thoughts and the perceived importance of sexuality. Finally, our findings from Study 3 indicate that physical intimacy experienced and wished by older couples is related to indicators of well-being such as positive affect, negative affect and, among men, cortisol levels. By this, our results extended previous literature showing that physical intimacy benefits the well-being of younger couples (Burlison et al., 2007; Ditzen et al., 2008) and shed additional light on how sexuality might be related to successful aging (Buczak-Stec et al., 2019).

Another important finding was that loneliness was associated with less sexual activity and less intimacy, but not less sexual thoughts. Similarly, in Study 2, loneliness was related to less enjoyment of sexuality, but not less perceived importance of sexuality. This suggests that the wishes for sexuality remain unaffected by the levels of loneliness, but loneliness constitutes an obstacle for engaging in (enjoyable) sexual activity and experiencing intimacy. The literature on loneliness and sexuality is scarce, especially with regard to old age, which makes attempts to integrate the existing literature on close social relationships and the obtained findings difficult. In a daily life study on young couples by Mund and colleagues (2022), loneliness was related to subjective evaluation of relationship dynamics such as

relationship satisfaction, closeness, self-disclosure and self-reported conflicts. It is possible that the individual perception of key relationship dynamics that explains one's feelings of loneliness also includes the subjective evaluation of *sex-related* relationship dynamics such as intimacy and enjoyment of sexuality. However, in the same study by Mund et al. (2022), loneliness was not associated with sexual activity and physical intimacy of younger adults. It is conceivable that a daily life study on sexual activity of older couples would reveal a different pattern of results than obtained in Study 1. However, it is also possible that younger and older adults differ in how loneliness is associated with sexual activity and physical intimacy.

4.3. Theoretical and Practical Implications

4.3.1. Extending Proposition 1: Multifaceted Approach to Sexuality as The-State-of-The-Art

Conceptual accounts have long argued for distinguishing different, but interrelated dimensions of sexuality and romantic relationships (Beier et al., 2005; Sternberg, 1986). This empirical work provides evidence for and illustrates the utility of the *multifaceted approach to sexuality*, understood as examining distinct, but interrelated facets of sexuality, in late adulthood. First, in line with expectations, the facets of sexuality examined in each study were moderately to strongly correlated (ranging from $r = .21$ for sexual thoughts and intimacy in Study 1 to $r = .73$ for physical intimacy experienced and wished among men). This indicates that the facets of sexuality both coincide and cover slightly different aspects of sexuality. Second, as expected, both common and facet-specific associations between the facets of sexuality and psychosocial correlates emerged: In Study 1, having a partner and higher relationship satisfaction were each and independently associated with more sexual activity, more sexual thoughts and more intimacy, whereas relationship duration and loneliness each operated in facet-specific ways. In a similar way, in Study 2, fewer perceived constraints were related to both higher perceived importance and higher enjoyment of sexuality, while having a

partner and loneliness each displayed facet-specific associations. In turn, in Study 3, we found predominantly facet-specific associations of physical intimacy experienced and physical intimacy wished with momentary affect and daily cortisol. We conclude that distinguishing several facets of sexuality in one study setting constitutes a methodological advantage, as it allows for investigating links, as well as commonalities and differences between the facets of sexuality and other areas of functioning. This, in turn, provides valuable insights into the nature and correlates of sexuality as a complex phenomenon. We encourage future research to extend the focus by applying the multifaceted approach to sexuality across the lifespan.

4.3.2. Extending Proposition 2: Multifaceted Approach to Sexuality and Gender Differences

An important finding that requires more focus is the gender differences in sexuality that emerged in all three studies. To begin with, in Study 1, older men reported more sexual activity and more sexual thoughts than older women, whereas in Study 2, men in late midlife perceived sexuality as more important, and their sex lives as more pleasurable than same-aged women. These findings are in accordance with previous literature (e.g., Karraker et al., 2011; Lee et al., 2016; Lindau et al., 2007) and further highlight gender as a key predictor when examining facets of sexuality in late adulthood.

Additionally, in both studies (Study 1 and 2), we found significant interaction effects of gender with relationship status. Specifically, in Study 1, older adults who had a partner reported more sexual activity, more sexual thoughts, and more intimacy than older adults with no partner, however, this difference was more prominent among women than among men. Correspondingly, in Study 2, the difference between partnered and non-partnered adults in perceived importance and the enjoyment of sexuality was more prominent for women than for men. Previous reports that quantified sexual activity and sexual thoughts by gender and relationship status (e.g., Waite et al., 2009) have shown very similar patterns of results. This suggests that, in late adulthood, romantic relationships provide an important context for

engaging in sexuality at the behavioral (e.g., activity), cognitive (e.g., thoughts; attributing importance), and emotional (e.g., intimacy; enjoyment) levels, and this is particularly the case for older women. Conceptually, women and men are expected to considerably differ with regard to their behaviors and cognitions due to the exposure of the male brain to androgens perinatally and after the onset of puberty (Ellis, 2011). Until old age, testosterone levels are higher for men than for women (as depicted by Ellis, 2011), and higher testosterone levels are related to more sexual thoughts and sexual motivation among middle-aged and older men (Isidori et al., 2005). On the other hand, theoretical proposals have long argued for female sexuality being more responsive to relational and situational contexts than male sexuality (Basson, 2000; Baumeister, 2000). Combining this notion with the Motivational Theory of Life-Span Development (Heckhausen et al., 2010), it is possible that older adults adjust to experienced barriers for sexual activity (e.g., widowhood among women) by disengaging from goals and activities that may have been adaptive in the past (e.g., sexual activity in a romantic relationship). Future research should systematically acknowledge the unique role of relationship status for sexuality of older adults, and older women in particular, and further contribute to the understanding of gender differences in sexuality of older adults by investigating the underlying mechanisms.

In Study 3, the pattern of the associations between physical intimacy, momentary affect, and daily cortisol again differed by gender. For example, women who experienced on average more physical intimacy reported less momentary negative affect. In turn, men with higher overall levels of physical intimacy experienced had lower daily cortisol levels. Previous findings from experimental settings (Ditzen et al., 2019) and daily lives (Ditzen et al., 2008) highlighted the stress-buffering role of physical intimacy (presumably via oxytocin release) exchanged by partners in younger romantic couples. To the best of our knowledge, our study is the first to show that daily cortisol levels of older partnered women cannot be reliably explained by the amount of physical intimacy experienced by them in daily life. Light and

colleagues (2005) speculated that, for women, oxytocin release and its effects for stress regulation might be substantially stronger prior to menopause than afterwards. More research is needed in order to corroborate and further highlight the findings on gender differences in the role physical intimacy plays for well-being of older women and men.

4.4. Strengths, Limitations and Outlook

Core strengths of this original research included: (1) The assessment of seven distinguishable facets of sexuality in (2) big, independent samples of middle-aged and older adults; (3) study designs that operated at different time scales to examine age differences, cohort differences and daily fluctuations in sexuality; (4) a broad range of psychosocial correlates of sexuality examined, while accounting for sociodemographic factors and physical health; and (5) multiple analytical strategies (e.g., SEM-based multivariate regression analyses in Study 1; actor-partner multilevel models in Study 3), applied to accommodate complex data structures in our models.

We note several limitations of study design, sample, and measures. To begin with, all three studies utilized cross-sectional study designs that do not allow drawing inferences about intraindividual development. For example, in Study 1, older age was associated with less sexual activity and less sexual thoughts, but because of the correlational nature of this analysis, the age effects identified might be confounded by cohort effects (e.g., earlier-born older adults report less sexual activity in old age than later-born older adults, Beckman et al., 2014) or period effects (see the problem of age-period-cohort effect: Schaie, 2005). Thus, we cannot reliably attribute the age differences in sexuality to intraindividual developmental changes. As research on sexual development in late adulthood is underrepresented, future research might address this gap by applying the life span developmental perspective (Baltes, 1987; Baltes et al., 2006) to sexuality and implementing longitudinal study designs to examine change in different facets of sexuality across the (adult) lifespan. Similarly, no causal or temporal inferences should be drawn about how sexuality is linked with the correlates

examined. To illustrate, in Study 3, experiencing physical intimacy was associated with more positive affect. It is possible that positive affect increases in moments after experiencing physical intimacy (similarly to increased positive affect after sexual activity in younger adults: Kashdan et al., 2018), but it can also be that positive affect precedes engaging in physical intimacy, or the linkages are bidirectional (Burlinson et al., 2007; Dewitte et al., 2015). Employing lead-lag, time-ordered models and conducting more mechanism-oriented research is required to shed light on the intricate links between physical intimacy and well-being among older women and men. Finally, in Study 2, data were available for each cohort at baseline assessment only, which did not allow us to examine age trajectories for sexuality of subsequent cohorts. For example, in line with previous findings on cohort differences on sexuality (e.g., Beckman et al., 2014) and similar to other areas of functioning (e.g., Gerstorf et al., 2019), sexuality might exhibit later onset and less steep rates of decline today than in the past.

With regard to the sample, participants in all three studies have predominantly represented young old (third age), characterized by a relatively good physical health and mental fitness, as well as high levels of emotional functioning (Baltes & Smith, 2003). In contrast, in the oldest old (fourth age), chronic conditions accumulate (i.e., multimorbidity), losses in cognitive capacity and reductions in well-being prevail, etc. We speculate that sexuality of the oldest adults might be strongly influenced by the declines in other areas of functioning and also characterized by losses, such as loss of libido or erectile dysfunction. Empirical inquiries into sexuality and the oldest old are very rare, however, initial evidence supports our speculation: among adults aged 65 to 105 years, poorer cognitive functioning (assessed using the Mini Mental State Examination, Folstein et al., 1975) was particularly predictive for loss of sexual interest among individuals aged 75 and older (Padoani et al., 2000). At the farther end, simultaneously examining younger, middle-aged and older adults might help put the findings from each age group in (developmental) perspective and allow

between-group comparisons. We note that such analyses require identifying key facets of sexuality and their correlates for each age group (e.g., pregnancy and small children in the household for younger adults: Schröder & Schmiedeberg, 2015) in order to reduce the methodological bias in favor of a particular age group. Also, our findings were predominantly obtained from heterosexual couples. Data from older lesbian, gay, bisexual, transgender, queer and other (LGBTQ+) adults are scarce. Preliminary evidence exists that sexual activity in lesbian couples is less frequent and more strongly related to relationship duration than in heterosexual couples. Similar to older heterosexual women, lesbians' sexual activity was strongly determined by the availability of a partner and responsive to relational context (for an overview see Garnets & Peplau, 2006). We expect that the Gay Rights movements of the 1970s have profoundly shaped the way how we think of sexuality today. Still, LGBTQ+ people should be more systematically included in research on close social relationships in late adulthood.

With regard to the measures of sexuality, the facets of sexuality we assessed do not cover the entire spectrum of sexuality. In fact, several other facets of sexuality that have not been examined here might further contribute to a better understanding of sexuality in old age. For example, a facet related to enjoyment of sexuality is *sexual satisfaction*. Sexual satisfaction has been thought to facilitate successful aging, as it is associated with higher life satisfaction, more positive affect and less negative affect (Buczak-Stec et al., 2019). In turn, poorer physical health and less satisfying relationships are related to less sexual satisfaction among older adults (Syme et al., 2013). Despite decreasing frequency of sexual activity, considerable proportions of older adults report being sexually satisfied (Træen, Štulhofer et al., 2019), which again implies that sexual satisfaction in late adulthood cannot be entirely explained by mere quantitative aspects of sexuality (compare “sexual wisdom”: Forbes et al., 2017). *Attitudes towards sexuality* represent another relevant facet of sexuality. More positive attitudes towards sexuality are associated with more frequent sexual activity, more sexual

interest, and enjoyment of sex life (Fischer et al., 2022; Træen, Carvalheira et al., 2019). Examining psychosocial correlates of attitudes towards sexuality might be the next step towards a better understanding of sexuality in late adulthood. Also, our sexual activity items captured partnered behaviors (e.g., sex with sexual intercourse, exchanging caresses), but did not include solitary sexual activity such as *masturbation*. In old age, masturbation is an accessible and commonly reported way to enact one's sexuality regardless of relationship status (Fischer et al., 2022) and might thus indicate person's actual sexual interest – although it may not fully compensate for a lack of partnered sexual activity (Waite et al., 2009). Having included masturbation as a form of sexual activity in an additive way in Study 1 might have led to sexual activity being reported by study participants more frequently. Regarding the pattern of correlations with psychosocial factors, it is conceivable that the association between sexual activity including masturbation and relationship status would appear weaker, as the availability of the partner is not a precondition for solitary sexual activity.

With regard to the correlates, we note that the correlates examined explained only small- to moderate-sized proportions of variance in the respective facets of sexuality. From a psychological perspective, examining *subjective age* and *attitudes towards aging* might contribute to a better understanding of sexuality. For example, feeling older was associated with less enjoyment of sexuality and less sexual interest, and less positive attitudes towards aging again predicted less enjoyment of sexuality (Estill et al., 2018). We hypothesize that feeling older might be associated to less sexual activity and less sexual thoughts, but not intimacy. Also, it might be highly instructive to extend our results on the linkages between physical intimacy and daily cortisol obtained in Study 3 by examining the *perceived stress* reported by participants. Perceived stress and physiological stress are different and unique dimensions of the larger construct space that are only weakly correlated (Campbell & Ehlert, 2012). Initial evidence exists that experiencing affectionate touch is associated with less self-reported stress (Jakubiak & Feeney, 2018), but it is possible that the pattern of results would differ for

perceived and psychological stress when additionally considering physical intimacy wished. Finally, sexuality takes place in a dyadic context, and accounting for factors on the partner's side may help capture the nature of daily-life partnered sexuality more accurately (Dewitte et al., 2015). Future research should investigate both partner's physical health and psychosocial characteristics as predictors of sexuality in late adulthood more thoroughly.

4.5. Conclusion

This original research encompassed three empirical studies that aimed at providing new insights into the nature and correlates of sexuality in late adulthood. By examining age differences, cohort differences and daily fluctuations in several facets of sexuality, we have demonstrated the importance of key facets of sexuality at different time scales. For example, among older adults, feelings of intimacy as an emotional component of sexuality did not differ with age, whereas older age was associated with less frequency of sexual activity and less frequent sexual thoughts. Moreover, we have shown that psychosocial factors (e.g., relationship status; loneliness) accounted for additional variance in sexuality over and above sociodemographic and physical health factors and thus contribute to the understanding of sexuality in late adulthood. We conclude that close social relationships, and romantic relationships in particular, as well as their characteristics provide context for enacting sexuality in late adulthood and that sexuality can be related to older couples' well-being. Research on close social relationships and sexuality in late adulthood should thus be further integrated. The insights gained from this research might guide more fine-grained, mechanism-oriented research to highlight the intricate and gender-specific linkages between sexuality and aspects of close social relationships in the future.

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Sexual Activity, Sexual Thoughts, and Intimacy among Older Adults:
Links with Physical Health and Psychosocial Resources for Successful Aging

Karolina Kolodziejczak¹, Adrian Rosada², Johanna Drewelies¹,
Sandra Düzel³, Peter Eibich⁴, Christina Tegeler⁵, Gert G. Wagner^{3,6,7}, Klaus M. Beier²,
Nilam Ram^{6,8}, Ilja Demuth², Elisabeth Steinhagen-Thiessen², & Denis Gerstorff^{1,6,8}

¹Humboldt University Berlin, Germany

²Charité – Universitätsmedizin Berlin, Germany

³Max Planck Institute for Human Development, Berlin, Germany

⁴Max Planck Institute for Demographic Research, Rostock, Germany

⁵MSB Medical School Berlin, Germany

⁶German Institute for Economic Research (DIW Berlin), Berlin, Germany

⁷Alexander von Humboldt Institute for Internet and Society (HIIG), Berlin, Germany

⁸Pennsylvania State University, State College, US

Karolina Kolodziejczak, Department of Psychology at Humboldt University Berlin,

Germany. Adrian Rosada, Department of Geriatrics at Charité – Universitätsmedizin Berlin, Germany. Johanna Drewelies, Department of Psychology at Humboldt University Berlin, Germany. Sandra Düzel, Max Planck Institute for Human Development, Berlin, Germany. Peter Eibich, Max Planck Institute for Demographic Research, Rostock, Germany. Christina Tegeler, Department of Psychology at MSB Medical School Berlin, Germany. Gert G. Wagner, Max Planck Institute for Human Development, Berlin, Germany; German Institute for Economic Research (DIW Berlin), Berlin, Germany, and Alexander von Humboldt Institute for Internet and Society (HIIG), Berlin, Germany. Klaus M. Beier, Institute of Sexology and Sexual Medicine at Charité - Universitätsmedizin Berlin. Nilam Ram, Department of Human Development and Family Studies at the Pennsylvania State University, PA, US, and Socio-Economic Panel (SOEP) at the German Institute for Economic Research (DIW), Berlin, Germany. Ilja Demuth, Lipid Clinic at the Interdisciplinary Metabolism Center and Berlin-Brandenburg Center for Regenerative Medicine (BCRT) at Charité – Universitätsmedizin Berlin, Germany. Elisabeth Steinhagen-Thiessen, Department of Endocrinology and Metabolic Diseases (including Lipid Metabolism), at Charité – Universitätsmedizin Berlin. Denis Gerstorff, Department of Psychology at Humboldt University Berlin, Germany, Socio-Economic Panel (SOEP) at the German Institute for Economic Research (DIW), Berlin, Germany, and Department of Human Development and Family Studies at the Pennsylvania State University, PA, US.

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Parts of the current study have been presented at two conferences (at the 70th Annual Scientific Meeting of the Gerontological Society of America in Boston, MA in November 2018 and at the 51st Biennial Meeting of the German Society of Psychology, Frankfurt (Main), Germany in September 2018). Correspondence regarding this manuscript to: Karolina Kolodziejczak, Humboldt University Berlin, Department of Psychology, Unter den Linden 6, 10099 Berlin, Germany: E-mail: karolina.kolodziejczak@hu-berlin.de

Abstract

Research on close relationships in later life has received increased attention over the past decade. However, little is known about sexuality and intimacy in old age. Using cross-sectional data from the Berlin Aging Study II ($M_{age} = 68$ years, $SD = 3.68$; 50% women; $N = 1,514$), we examine age differences in behavioral (sexual activity), cognitive (sexual thoughts), and emotional (intimacy) facets of sexuality and investigate associations with physical health and psychosocial resources for successful aging. Older age was associated with less sexual activity and fewer sexual thoughts, but not with differences in intimacy. Relative to a reference sample of 22- to 36-year-olds within BASE-II ($N = 475$), the average older adult reported considerably fewer sexual activity and thoughts ($d_s > .60$), but only slightly lower intimacy ($d = .20$). Substantial heterogeneity existed among older adults, with almost one third of the 60- to 82-year-olds reporting more sexual activity and thoughts than the average younger adult. Examining correlates of sexuality among older adults revealed that, covarying for diagnosed illnesses and performance-based grip strength, psychosocial factors (e.g., partnered, relationship satisfaction) accounted for considerable shares of variance in sexual activity and intimacy, whereas age and gender explained more of the variance in sexual thoughts. Some psychosocial factors exhibited similar-sized associations with all sexuality facets, whereas other factors operated in more facet-specific ways. To illustrate, participants reporting more loneliness also reported less sexual activity and less intimacy, but not fewer sexual thoughts. We discuss implications of our findings for theories of successful aging.

Words: 250

Keywords: sexuality, intimacy, successful aging, old age, BASE-II

Sexual Activity, Sexual Thoughts, and Intimacy among Older Adults:

Links with Physical Health and Psychosocial Resources for Successful Aging

Psychological research on close social and romantic relationships in later life has received increased attention over the past decade. Conceptual work and empirical studies have provided insights into, for example, how and why older long-term partners often exhibit similarities and close interrelations in key health and psychosocial factors, including cognitive functioning (Berg Schindler, Smith, Skinner, & Beveridge 2011), well-being (Bookwala & Schulz, 1996), and blood pressure (Peek & Markides, 2003; for overview, see Hoppmann & Gerstorf, 2016). In a similar vein, a growing body of research has helped us to better understand sexual and intimate functioning in earlier adulthood and how this relates to other aspects of daily life, including daily stress (Ditzen, Hoppmann, & Klumb, 2008), biomarkers (Light, Grewen, & Amico, 2005), and emotions (Kashdan, Godman, Stikma, Milius, & McKnight, 2018). However, we know little about sexuality and intimacy in old age and how these are related to key resources for successful aging, such as good physical health and social embeddedness, that, for example, help older adults maintain functional capacities and engage with life in old age (Baltes & Baltes, 1990; Rowe & Kahn, 1997). In the current report, we make use of cross-sectional data from the Berlin Aging Study II (age: $M = 68$ years, $SD = 3.68$; range: 60 to 82; 50% women; $N = 1,514$) to examine age differences in behavioral, cognitive, and emotional facets of sexuality and investigate how individual differences in these aspects of sexuality among older adults are related to a variety of socio-demographic, physical health, and psychosocial factors.

The Nature of Sexuality in Old Age

Following the World Health Organization, sexuality is a multi-faceted phenomenon that ... *encompasses sex, gender identities and roles, sexual orientation, eroticism, pleasure, intimacy and reproduction. Sexuality is experienced and expressed in thoughts, fantasies,*

desires, beliefs, attitudes, values, behaviours, practices, roles and relationships. While sexuality can include all of these dimensions, not all of them are always experienced or expressed ... (WHO, 2006, p. 5). In line with this approach, conceptual perspectives over the past decades have considered a multitude of different components. For example, Sternberg's (1986; 2006) Triangular Theory of Love distinguished passion as erotic interests and desires from intimacy as emotional closeness, and noted that the two facets of passion and intimacy may or may not coincide. Similarly, Beier and colleagues (Beier, Bosinski, & Loewit, 2005; Beier & Loewit, 2013) have repeatedly noted that desire, reproduction, and attachment constitute three interrelated, yet distinct dimensions of sexuality.

Following from and extending conceptual notions on sexuality and intimacy in earlier phases of adulthood, we also use a multi-faceted approach to comprehensively describe sexuality in old age. In our study, we consider key components of sexuality at behavioral (e.g., sexual behaviors and practices), cognitive (e.g., sexual thoughts and wishes), and emotional (e.g., sense of security and acceptance) levels. We define the *behavioral* facet of sexuality to encompass different aspects of engaging in actual sexual activity and physical intimacy, including sex with and without intercourse, exchanging caresses, and body contact – referred to going forward as *sexual activity*. We define the *cognitive* facet of sexuality to encompass thoughts about and wishes for sexual activity and physical intimacy – *sexual thoughts*. Finally, we define the *emotional* facet of sexuality to encompass aspects such feeling safe, secure, and accepted when being sexually active and physically or emotionally intimate – *intimacy*. Drawing from earlier work (Beier et al., 2005; Freak-Poli et al., 2017; Galinsky, McClintock, & White, 2014), our overarching assumption is that despite changes in reproductive capacity, the noted facets of sexuality remain important and highly valued among older adults, continue to be crucial constituents of quality of life, and in turn contribute to maintaining and fostering well-being and physical health. We note that although

emotional closeness has long been considered in conceptual perspectives of sexuality (Basson, 2000; 2002; Dewitte & Mayer, 2018), empirical studies have primarily focused on sexual activity and sexual interest in old age, but did not pursue comprehensive operational definitions of sexuality that also include emotional aspects. In our report, we move one step further by pursuing such a multi-faceted approach to sexuality in old age and examine how the facets differ with age and exhibit associations with resources for successful aging.

Age Differences in Sexuality

Illustrating the utility of distinguishing different aspects of sexuality, it stands to reason that age differences within the three facets evince vastly different patterns. To begin with, because of a number of biological, psychological, and relational age-related changes, it is conceivable that older adults report less *sexual activity* with age. On the health side, more frequent and severe diseases (e.g., cardiovascular and metabolic conditions; Bach, Mortimer, Vande Weerd, & Corvin, 2013) and functional limitations (Waite, Laumann, Das, & Schumm, 2009) constitute age-related changes that likely undermine sexual activity. On the social side, age-related increases in widowhood, especially among older women (Ginsberg, Pomerantz, & Kramer-Feeley, 2005; Karraker, DeLamater, & Schwartz, 2011) can be expected to constitute a major barrier to act out one's sexuality.

For *sexual thoughts*, hormonal declines (e.g., ovarian steroids among women; Cappelletti & Wallen, 2016; testosterone among men; Harman, Metter, Tobin, Pearson, & Blackman, 2001; Isidori et al., 2005) and neuroendocrine changes that accompany aging (Galinsky et al., 2014) as well as disease-specific medication (Bach et al., 2013) can impair sexual desire. Age-related reductions in sexual thoughts can result also from motivational shifts. Drawing from the Motivational Theory of Life-Span Development (Heckhausen, Wrosch, & Schulz, 2010), one may argue that older adults adjust to experienced barriers for sexual activity (e.g., widowhood-related lack of a sexual partner) by disengaging from

activities that may have been highly valued in the past (e.g., sexual intercourse). Such disengagement will result in lower frequency of related sexual thoughts. Waite and colleagues (2009) have provided initial empirical evidence that is in line with this assumption: The older non-partnered men and women in their study were, the more often they reported lacking interest in sexual activity, whereas among partnered individuals such age differences in sexual interest did not exist.

For *intimacy*, one may expect that with age-related losses in reproductive capacity and decreases in passion, fulfillment of basic emotional and attachment-related needs such as feeling safe, secure and accepted, become more and more central for engaging in sexual and intimate contacts (Beier et al., 2005). Emotional aspects of sexuality may also become increasingly important in later life (DeLamater & Koepsel, 2015; Fileborn et al., 2017) as a consequence of perceiving increasingly limited time left in one's life, which often prompts shifts towards prioritizing emotionally meaningful experiences (see Socioemotional Selectivity Theory; Carstensen, Fung, & Charles, 2003). It is an open question though whether such emotional needs can indeed be fulfilled during a period of life in which widowhood prevails. As a consequence of these presumably opposing forces, one may thus expect age-related changes in intimacy to be of only minor size, particularly when compared with those for sexual activity and thoughts.

Empirical inquiry into age-related differences in sexuality is scarce, particularly for sexual thoughts and intimacy. Several empirical studies have, however, targeted questions about sexual activity among older adults. These reports typically indicate that with advancing age older adults report less frequent sexual activity (e.g., Karraker et al., 2011; Lee, Nazroo, O'Connor, Blake, & Pendleton, 2015; Schick et al., 2010). Of note is though that studies on sexual activity among older adults typically do not include other forms of body contact such as touching, hugging, cuddling, and kissing, which remain frequent in old age (Freak-Poli et

al., 2017; Ginsberg et al., 2005; Waite et al., 2009). Research on sexual desire and thoughts among older adults has shown that it remains evident (Kontula & Haavio-Manila, 2009), but levels of reported desire are lower as compared with younger adults (Beutel, Stöbel-Richter, & Brähler, 2008) and middle-aged adults (Chao et al., 2011). At the same time, a considerable number of older adults report that they wish that they had more sexual activity than they actually have. Such interest-activity gap (Pfeiffer, Verwoerd, & Wang, 1969) has repeatedly been reported for older adults. For example, Hyde and colleagues (2010) noted that 43% of their 75- to 90-year old men reported having less sex than they prefer. Again, the literature is unequivocal, with some studies reporting no age-related differences in sexual thoughts and desire among older adults, when controlling for other factors (e.g., Kontula & Haavio-Manila, 2009). To the best of our knowledge, no empirical study has yet examined age differences in emotional facets of sexuality such as intimacy.

The Role of Socio-Demographic, Physical Health, and Psychosocial Factors for Sexuality in Old Age

Again, referring to the definition of the WHO, sexuality is ... *influenced by the interaction of biological, psychological, social, economic, political, cultural, ethnical, legal, historical, religious, and spiritual factors* (WHO, 2006, pp. 5). Adopting this perspective, it thus appears pivotal to consider the role of individual difference characteristics in socio-demographic, physical health, and psychosocial areas of life to better understand sexuality (see DeLamater, 2012; DeLamater & Koepsel, 2015; Rossi, 1994). Borrowing from the vast successful aging literature (Baltes & Baltes, 1990; Rowe & Kahn, 1997), we operate under the overarching assumption that individual difference characteristics such as education, physical health, and psychosocial factors provide key resources people draw from to live and experience the different facets of sexuality into and across old age.

Starting with *socio-demographic characteristics* and gender differences in particular,

one would expect that older women report fewer sexual activity and thoughts than older men, be it because men typically reach old age married whereas older women are often widowed (Moen, 1998), because older women tend to attribute less importance to sex in a relationship (Orr, Layte, O'Leary, 2017; DeLamater & Sill, 2005), or because of menopause-related hormonal changes that often undermine sexual desire (Avis et al., 2009). Earlier studies have indeed found that older men report more sexual activity and sexual thoughts than older women (Lee et al., 2015; Lindau et al., 2007; Lindau & Gavrilova, 2010; Waite et al., 2009). It is an open question whether gender differences exist in intimacy. On one hand, younger and middle-aged women have been shown to place more importance than men on emotional and relational aspects when being sexually active (Dewitte & Mayer, 2018; Shrier & Blood, 2016). On the other hand, older men may be in a position to better satisfy their emotional needs because they are often still partnered, whereas older women are often faced with widowhood (Kontula & Haavio-Mannila, 2009). We will thus explore the existence and direction of differences in intimacy between older men and women.

It is also possible that education plays a role for sexual activity and thoughts because people with higher education may hold less negative attitudes towards sexuality in old age (DeLamater & Sill, 2005) or are in better physical health (Lynch, 2003), thereby reducing age-related decrements in sexuality. To date, empirical studies have not yet shown a consistent pattern of whether education is relevant for sexual life in old age (Laumann et al., 2006; Syme, Klonoff, Macera, & Brodine, 2013). We thus explore whether and how education is associated with any of the three facets of sexuality among older adults.

For a number of reasons *physical health* factors can be assumed to undermine sexual activity and thoughts among older adults. Chronic conditions such as cardiovascular diseases (e.g., hypertension) or metabolic diseases (e.g., diabetes) are at times accompanied by sexual dysfunctions that can stand in the way of engaging in sexual intercourse (Beckman, Waern,

Östling, Sundh, & Skoog, 2014; Syme et al., 2013). The medication prescribed for these conditions (e.g., beta blocker) can also impair sexual activity, presumably by inhibiting the libido (DeLamater & Sill, 2005; Hyde et al., 2010). Exacerbating the impairment, chronic conditions often also come with pain and fatigue that in turn are not conducive to fostering sexual activity and sexual desire (Bach et al., 2013). Indeed, empirical studies have repeatedly reported that poor self-rated health is associated with less frequent sexual activity (Beckman et al., 2014; Galinsky & Waite, 2014; Lee et al., 2015; Lindau & Gavrilova, 2010; Karraker et al., 2011; Mitchel et al., 2013). It will be intriguing to examine whether such associations also exist when physical health is measured more comprehensively using diagnosed illnesses and performance-based tests. We assume that poor physical health relates to less sexual activity and thoughts, but it is an open question how physical health factors are associated with intimacy.

Considering *psychosocial factors*, differences between partnered and non-partnered older adults can be expected in sexual activities that require a dyadic setting (e.g., cuddling, sexual intercourse) and being married or cohabitating are known to facilitate engaging in sexual activity across adulthood (Beckman et al., 2014; Freak-Poli et al., 2017; Schick et al., 2010; Waite et al., 2009). Also, non-partnered older adults may have adapted to sexual inactivity through cognitive reappraisal, resulting in less sexual thoughts (Heckhausen et al., 2010). We expect that partnered older adults report more intimacy than non-partnered individuals because they typically have more opportunities to engage in and thereby foster emotional and physical intimacy (Carstensen, Gottman, & Levenson, 1995; Ganong & Larson, 2011).

For partnered older adults, relationship duration and satisfaction are further presumably also relevant characteristics (Iveniuk & Waite, 2018). In his Triangular Theory of Love, Sternberg (1986; 2006) expected long-term married couples to be less characterized by

sexual passion, but more by commitment and affection for one another. We thus assume that longer relationship length is associated with less sexual activity and fewer sexual thoughts, but not less intimacy. We would also anticipate that reporting higher relationship satisfaction is associated with more sexual activity and thoughts because a satisfying partnership presumably makes the partner sexually more appealing (Iveniuk & Waite, 2018). Open communication (Gillespie, 2017) and other frequent characteristics of satisfying relationships also lead us to expect that higher relationship satisfaction is associated with more intimacy. Empirical studies have indeed reported that higher relationship satisfaction relates to more sexual activity and thoughts (Beckman et al., 2014; Galinsky & Waite, 2014; Iveniuk & Waite, 2018; Mitchel et al., 2013; Schafer, Upenieks & Iveniuk, 2017). To the best of our knowledge, links between relationship satisfaction and intimacy in old age have not yet been tested empirically.

The availability of a partner can be considered crucial for dyadic forms of sexuality. In line with this notion, social environment can contribute to sexuality among older adults by creating opportunities to enlarge one's own social networks (Iveniuk & Waite, 2018), engage in social activities (Bach et al., 2013), and receive social support (Freak-Poli et al., 2017), which in turn have all been shown to be associated with more sexual activity and interest. In contrast, a sheer lack of social partners to engage in intimate contacts presumably undermines sexual activity and intimacy. Moving one step further, we hypothesize that loneliness, defined as feeling socially and emotionally isolated (Peplau & Perlman, 1982; Luhmann & Hawkley, 2016), is associated with less frequent sexual activity and fewer feelings of intimacy, be it because of the more negative social displays and interactions that lonely people frequently exhibit (Cacioppo & Hawkley, 2010) or because of the often devastating physiological and motivational consequences that result from chronic forms of loneliness. We will explore associations between loneliness and sexual thoughts without any directional

hypotheses. We expect that at least minimal sexual thoughts remain even when loneliness is high, although it is unclear how self-regulatory processes may come into play here (e.g., when experiencing barriers to sexual activity, people may disengage from sexual thoughts).

The Present Study

In the current study, we describe sexuality and its relation with age and other individual difference constructs in later adulthood. To do so, we make use of cross-sectional data obtained in the Berlin Aging Study II (BASE-II; Bertram et al., 2014; Gerstorf et al., 2016) from 1,514 older adults (age: $M = 68.15$ years, $SD = 3.68$; range: 60 to 82; 50% women) and 475 younger adults (age: $M = 28.40$, $SD = 3.08$; range 22-36; 53% women). As a first set of questions, we examine age differences in three facets of sexuality: Sexual activity, sexual thoughts, and intimacy. We expect that both between the age groups and within the older sample, older age is associated with less frequent sexual activity and fewer sexual thoughts. We do not expect age differences in intimacy.

As a second set of research questions, we examine how socio-demographic characteristics (age, gender, education), physical health (morbidity, grip strength), and psychosocial (being partnered, relationship duration and satisfaction, loneliness) predictors tapping into the pool of resources for successful aging are related to the three facets of sexuality among older adults. Our overarching expectation is that some variables are consistently related to all three facets, whereas other variables are only related to one or two facets. As an example of commonalities, we expect that differences between partnered and non-partnered older adults will emerge consistently across the three facets, with partnered older adults reporting more sexual activity, sexual thoughts, and intimacy than non-partnered older adults. As an example of specificity, we expect that, among older adults, physical health factors are especially relevant for sexual activity and (to some extent) sexual thoughts among older adults, whereas psychosocial factors are especially relevant for intimacy among

older adults.

Method

In this report we used data from the Berlin Aging Study II (BASE-II). Detailed descriptions of the full sample, variables, and procedures can be found in previous publications (Bertram et al., 2014; Gerstorf et al., 2016). Select details relevant to this study are given below.

Participants and Procedure

The BASE-II sample included residents of the greater metropolitan area of Berlin. Participants were recruited via a participant pool at the Max Planck Institute for Human Development (Berlin) and via advertisements in local newspapers and the public transportation system. As part of a larger multi-component protocol, participants visited the Charité University hospital for an assessment that included physician examination (e.g., medical diagnoses) and completion of performance-based tasks (e.g., grip strength). Information about sexuality and the psychosocial variables were provided using a take-home questionnaire. The analysis sample used here includes all participants who provided data on one or more items assessing sexuality (the core construct of interest) and encompassed 1,514 older adults (age: $M = 68.15$ years, $SD = 3.68$; range: 60 to 82; 50% women; 66% in a heterosexual relationship, 2% in a homosexual relationship) and 475 younger adults as a reference group (age: $M = 28.40$ years, $SD = 3.08$; range 22 to 36; 53% women; 55% in a heterosexual relationship, 4% in a homosexual relationship).

Ethics approval for BASE-II was granted by the ethics committee of the Charité – Universitätsmedizin Berlin, approval number EA2/029/09, and the ethics committee of the Max Planck Institute for Human Development, Berlin. Data from the BASE-II study have been used in a comprehensive number of publications covering a variety of research questions (see <https://www.base2.mpg.de/en> for a list of all publications using BASE-II data).

Parts of the data on socio-demographic, physical health, and psychosocial variables have been used in Gerstorf et al., (2015), Hueluer et al. (2016), Mueller et al. (2016), and Koenig et al. (2018). Parts of the larger sexuality data have been used in Kossow et al. (2018) and Beier et al. (2018). The approach we use in the current study to measure facets of sexuality and how these relate to factors of successful aging only minimally overlaps with these earlier reports.

Measures

Sexuality. The three facets of sexuality considered here were measured using 11 items drawn from a more comprehensive 145-item sexuality questionnaire (Mundt, Beier, & Pauls, 2009), which combined multiple questionnaires (Ahlers, Schaefer, & Beier, 2002; 2004) that were designed to obtain clinically-oriented information on different aspects of sexuality, including sexual dysfunctions (see Kossow et al., 2018). For the current study, we selected the subset of items that indexed the three facets. Items selection considered face validity, scale construction (e.g., items with the same response format), and item wordings that allowed capture of the entire spectrum of individual differences, with prioritization of items that provided a psychological and developmental perspective on sexuality (rather than only a medical or clinical perspective). We note that each facet of sexuality is conceived of and measured in a summative or formative manner (invoked via arithmetic mean of three or four items). We chose not to enter into a latent factor space because conception and assessment of sexual activity and thoughts are in terms of frequencies that are additive (i.e., different sexual behaviors all contribute to sexual activity, but do not necessarily covary).¹

In the introduction of the questionnaire, participants were informed that questions pertain to sexuality and partnership (for wording, see appendix). Sexual activity was measured as the average of responses to four items asking about the frequency of actual sexual activity (Cronbach's $\alpha = .86$). Specifically, participants indicated the frequency they

had, in the past 12 months, engaged in sexual intercourse, sex without intercourse, exchanging caresses, and body contact (0 = never before, 1 = not at all, 2 = less often than once per month, 3 = at least once per month, 4 = at least once per week; $M = 2.37$, $SD = 1.07$).

Sexual thoughts were measured as the average of responses (same 0 to 4 scale; $M = 2.95$, $SD = 0.98$) to four items asking about thoughts of and wishes for sexual activity (Cronbach's $\alpha = .85$). Specifically, participants indicated the frequency they had thoughts of or wishes for sex with and without sexual intercourse, exchanging caresses, and body contact.

Intimacy was measured as the average of participant's agreement with three statements (Cronbach's $\alpha = .69$): (1) *I experience through body contacts security and acceptance*; (2) *I feel safe and accepted during sex*; and (3) *My needs for security and acceptance are currently satisfied* (0 = I do not agree, 1 = I agree a little bit, 2 = neither nor, 3 = I agree, 4 = I absolutely agree; $M = 2.53$, $SD = 1.30$). We note that the sexual activity and sexual thoughts items used the same frequency-based response scale, while the intimacy items were on an agreement-based scale.

Socio-demographic, physical health and psychosocial factors. Socio-demographic variables included *chronological age* (number of years from birth; $M = 68.15$, $SD = 3.68$), *gender* (0 = women, 1 = men; 50% women), and years of *education* ($M = 14.13$, $SD = 2.86$). Physical health variables included morbidity and grip strength. *Morbidity* was measured as the weighted sum of (co)occurrence and severity of the diagnosed, moderate to severe, long-term or chronic physical illnesses ($M = 1.27$, $SD = 1.31$). These were largely based on domains from the Charlson comorbidity index (Charlson, Pompei, Ales, & MacKenzie, 1987). As a measure of severity of the conditions, we have followed the scoring originally proposed by Charlson et al. (1987), ranging between 1 (e.g., myocardial infarct, diabetes mellitus), 2 (e.g., any tumor, leukemia), and 3 (e.g., moderate or severe liver disease).

Diagnoses were obtained as part of the medical examination at the Charité university hospital Berlin through participant reports, with select diagnosis (diabetes mellitus) being verified by additional blood-laboratory tests (Meyer et al., 2016). *Grip strength* was measured using a Smedley-type hand dynamometer (Scandidact, Denmark) on the dominant hand. The score indexed the average force in kilograms exerted over three trials ($M = 30.40$, $SD = 8.75$).

Psychosocial variables included relationship characteristics (status, duration, and satisfaction) and loneliness. *Relationship status* was a dichotomous variable indicating whether the participant was currently in a stable, marital, or non-marital relationship (1 = partnered) or not (0 = non-partnered; 68% partnered). *Relationship duration* was the number of years since the current relationship began ($M = 34.55$, $SD = 14.0$). *Relationship satisfaction* was assessed with the question “How satisfied are you with your relationship altogether?”, answered on a 5-point Likert-scale ranging from “not at all” (0) through “not much” (1), “mediocre” (2), “quite much” (3) to “very much” (4) ($M = 3.33$, $SD = 0.76$). Loneliness was measured as the average of seven items (e.g., “*I feel isolated.*”; Cronbach’s $\alpha = .82$) from the UCLA loneliness scale (Russell, Cutrona, Rose, & Yurko, 1984) that were answered on a 1 = “does not apply to me at all” to 5 = “applies very well to me” Likert scale ($M = 1.55$, $SD = 0.61$).

Statistical Procedure and Data Analysis

Age differences in sexuality. Age differences in sexual activity, sexual thoughts, and intimacy were examined in two ways. First, making use of the younger adult reference group, we tested for age group differences using one-way ANOVAs with age group (young vs. old) as a between-group factor. Second, within the sample of older adults, we examined how individual differences among older adults on the three facets of sexuality were correlated with chronological age.

The role of socio-demographic, physical health, and psychosocial factors for

sexuality in old age. Relations between individual differences in sexuality and the socio-demographic, physical health, and psychosocial variables were examined using a structural equation model (SEM) that allowed for simultaneous consideration of all three facets of sexuality. As shown in Figure 2, sexual activity, sexual thoughts, and intimacy were regressed on the nine socio-demographic, physical health, and psychosocial variables as well as their interactions. Linear and quadratic terms for age, and two-way and higher-order interactions were included in the original model but trimmed for parsimony. The final model contained only those terms that were statistically significant (Grimm, Ram, & Estabrook, 2016).

The SEM was estimated with Mplus version 8 (Muthén & Muthén, 1998-2017) using Full Information Maximum Likelihood (FIML) with missing data treated as missing at random. With the exception of age (centered at 70 years), all predictor variables were effect-coded/centered at sample means so that the regression parameters describe the extent of differences associated with a particular variable (rather than for a particular group). Because relationship duration and relationship satisfaction are not applicable to people who are not in a relationship, for these two variables non-partnered individuals were assigned a score of 0 (the mean score). In one follow-up analysis, we included only those older adults who were partnered ($N = 1,019$). Given the sample size ($N = 1,514$), significance tests were evaluated at $p < .01$.

Results

Descriptive statistics and intercorrelations for all measures under study are reported in Table 1. Three aspects of the data are of note. First, as seen in the upper portion of the correlation matrix, the three facets of sexuality are moderately intercorrelated: $r = .65$ between sexual activity and sexual thoughts; $r = .59$ between sexual activity and intimacy; and $r = .33$ between sexual thoughts and intimacy; all $ps < .01$. This pattern of

intercorrelations indicates that the three facets are both related and are located in slightly different areas of the larger sexuality construct. Second, intercorrelations among the socio-demographic, physical health, and psychosocial variables were in the low to moderate range (one notable exception: $r = .79$ between gender and grip strength, $p < .01$), an indication that the nine correlates examined here represent a broad range of individual differences factors. Third, zero-order intercorrelations of the three sexuality facets with the correlates were in part sizable (e.g., $r = .58$ between sexual activity and being partnered, $p < .01$), suggesting that these individual difference characteristics may indeed be related to individuals' sexuality.

Age Differences in Sexuality

Relations between the three facets of sexuality (sexual activity, sexual thoughts, and intimacy) and age are evident from the correlations in Table 1, and are depicted graphically in Figure 1. Among older adults ($N = 1,514$; aged 60 to 82 years), older age was associated with less frequent sexual activity ($r = -.10$, $p < .01$) and less frequent sexual thoughts ($r = -.12$, $p < .01$), but was not associated with feelings of intimacy ($r = .01$, $p > .10$). In contrast, among younger adults ($N = 475$; aged 22 to 36 years), age was not related to frequency of sexual activity ($r = .02$, $p > .10$), frequency of sexual thoughts ($r = -.01$, $p > .10$), or feelings of intimacy ($r = -.02$; $p > .10$). Age group differences have been reliably different from zero for the frequency of sexual activity ($z = 2.28$, two-tailed $p < .05$), frequency of sexual thoughts ($z = 2.10$, two-tailed $p < .05$), but not for intimacy ($z = 0.57$, two-tailed $p > .10$).

Mean levels of the three facets of sexuality also differed between the older and the younger age groups, with the older age group having lower average levels of sexual activity, $F(1, 1987) = 139.49$, $p < .001$; sexual thoughts, $F(1, 1987) = 235.23$, $p < .001$; and intimacy, $F(1, 1987) = 12.98$, $p < .001$. The standardized mean difference between the two age groups amounted to $d = .63$ for frequency of sexual activity, $d = .81$ for frequency of sexual

thoughts, and $d = .20$ for feelings of intimacy. Of note, however, is that even though older adults had on average substantially lower levels of sexual activity, sexual thoughts, and intimacy than younger adults, the distributions of older and younger adults' scores were overlapping. Of the 60- to 82-year-olds ($N = 1,514$), 30% ($n = 453$) reported more sexual activity and 27% ($n = 414$) reported more sexual thoughts than the average younger adult in the reference sample of 22- to 36-year-olds.

To better understand our sexuality construct, we conducted several follow-up analyses wherein we examined individual sexual activity items. Results revealed that among older adults, age-related differences were very similar across the four activities ($r = -.07$ to $-.10$, $p < .01$). However, when comparing older adults to younger adults, age differences were more prominent for the sexual intercourse item ($d = -.71$) than for the other three items indexing sexual activity ($d = -.53$).

The Role of Socio-Demographic, Physical Health, and Psychosocial Factors for Sexuality in Old Age

Results of SEM-based multivariate regression analyses examining relations between older adults' sexuality and the nine socio-demographic, physical health, and psychosocial variables are presented in Table 2 and Figure 2. Looking at the socio-demographic variables, age and gender were associated with sexuality, whereas education was not. Specifically, in addition to age differences ($\beta = -.10$, $p < .01$ for sexual activity; $\beta = -.13$, $p < .01$ for sexual thoughts; $\beta = .00$, $p > .10$ for intimacy), there were gender differences in some aspects of sexuality, and these gender differences were partially moderated by partnership status (see Figure 3). Women reported less frequent sexual activity ($\beta = .19$, $p < .01$; $d = .74$), less frequent sexual thoughts ($\beta = .31$, $p < .01$; $d = .86$), and similar levels of intimacy ($\beta = .08$, $p > .01$) compared to men; and while individuals with partners reported more frequent sexual activity ($\beta = .48$, $p < .01$), more frequent sexual thoughts ($\beta = .24$, $p < .01$), and more feelings

of intimacy ($\beta = .40, p < .01$) than individuals without partners, this gap was, for all three facets of sexuality, more evident among women than among men ($\beta = -.07, \beta = -.08, \beta = -.06$, all $ps < .01$).

The other psychosocial variables were also associated with sexuality. As might be expected, higher relationship satisfaction was associated with more frequent sexual activity ($\beta = .22$), more frequent sexual thoughts ($\beta = .12$), and higher levels of intimacy ($\beta = .36$). As shown in Figure 4, longer relationship duration was associated with less frequent sexual activity ($\beta = -.12$) and less frequent sexual thoughts ($\beta = -.11$, both $ps < .01$), but was not associated with differences in intimacy ($\beta = -.02, p > .10$). Follow-up analyses on a subsample of partnered older adults only ($N = 1,019$) revealed a substantively identical pattern of results. As shown in Figure 5, greater loneliness was associated with less frequent sexual activity ($\beta = -.11$) and less feelings of intimacy ($\beta = -.18$, both $ps < .01$), but was not associated with differences in the frequency of sexual thoughts ($\beta = -.03, p > .10$).

Differences in physical health – *morbidity* and *grip strength* – were not uniquely associated with any of the three facets of sexuality. In follow-up analyses, we examined zero-order associations of physical health with sexuality without including the other predictors. In these separate analyses, lower grip strength was associated with less frequent sexual activity ($r = .29$), less frequent sexual thoughts ($r = .34$), and less feelings of intimacy ($r = .19$, all $ps < .01$). In a similar vein, follow-up analyses that had examined specific diseases rather than the overall morbidity composite revealed that, as expected, suffering from cerebrovascular diseases and congestive heart failure was associated with less sexual activity ($r = -.07$ and $r = -.08$, respectively, both $ps < .01$) and fewer sexual thoughts ($r = -.13$ and $r = -.07$, respectively, both $ps < .01$).

As seen in the bottom rows of Table 2 (R^2 rows), the nine socio-demographic, physical health, and psychosocial variables accounted altogether for between 28% (sexual thoughts)

and 45% (sexual activity) of the individual differences in all three facets of sexuality. Of note is that much more of the variance was uniquely explained by the psychosocial variables (e.g., $R^2 = .25$ for sexual activity) than by the physical health variables (e.g., $R^2 = .00$ for sexual activity). In contrast, variance in sexual thoughts was primarily accounted for by age and gender ($R^2 = .21$).

Discussion

The main objective of our study was to examine how sexual activity, sexual thoughts, and intimacy differ among older adults and what role socio-demographic characteristics, and both physical health and psychosocial resources of successful aging play. To do so, we conducted multivariate regression analyses using data obtained from 1,514 participants in BASE-II aged 60 to 82 years (age: $M = 68.15$, $SD = 3.68$; 50% women). Results revealed that with advancing age, older adults reported less frequent sexual activity and less frequent sexual thoughts, but no less feelings of intimacy. Relative to 22- to 36-year-olds in our reference sample, the average older adult reported considerably less frequent sexual activity and sexual thoughts ($d_s > .60$). However, there were substantial individual differences. For example, almost one third of our 60- to 82-year-olds reported both more sexual activity and sexual thoughts (30% and 27%, respectively) than the average younger adult.

Analyses also revealed that among our relatively healthy older adults, psychosocial characteristics (relationship status, duration, and satisfaction; loneliness) accounted for a larger proportion of variance than the physical health factors examined (morbidity and grip strength). Some of the psychosocial factors (being partnered, relationship satisfaction) exhibited associations with all three sexuality facets, whereas others (relationship duration, loneliness) operated in more facet-specific ways. To illustrate, increased loneliness was associated with less frequent sexual activity and less feelings of intimacy, but not less frequent sexual thoughts. In our discussion, we consider implications of our findings for

theories of successful aging.

Age Differences in Sexuality

Based on conceptualizations of sexuality and intimacy in earlier phases of adulthood (Beier et al., 2005; Beier & Loewit, 2013; Basson, 2000; 2002; Dewitte & Mayer, 2018; Muise, Maxwell, & Impett, 2018; Sternberg, 1986; 2006), our overarching assumption was that sexuality in old age represents a multi-faceted phenomenon encompassing behavioral (sexual activity), cognitive (sexual thoughts), and emotional (intimacy) facets. Four sets of empirical findings obtained here from a sample of more than 1,500 older adults in their 60s and 70s provide initial evidence for the utility of our multi-faceted approach to sexuality. First, the three facets exhibited moderately-sized intercorrelations, indicating that levels of functioning on the three facets coincide to a certain extent for a given person. Second, the direction and size of age differences vastly varied across facets, with steepest cross-sectional age gradients observed for sexual activity and sexual thoughts, but no age differences for intimacy. Third, sexual activity and sexual thoughts evinced similar-sized age differences, but the levels at which these occurred differed, with sexual thoughts being and remaining considerably more frequent throughout old age than sexual activity. Finally, in the context of such mean-level age differences and age-related cross-sectional decrements, we still observed large individual differences among older adults. This suggests that factors other than chronological age are of importance for individual differences in sexuality among older adults. We take these results of multidimensionality, multidirectionality of age differences, and heterogeneity as constituting one step towards helping us better understand sexuality in old age.

Starting with sexual activity, our findings suggest rather small age-related differences in the frequency of sexual activity among older adults ($r = -.10, p < .01$). This may be due to our operational definition of sexual activity, which was relatively broad and moved beyond

sexual intercourse by also including exchanging caresses and body contact. As a consequence, our findings may differ from other studies that had operationally defined sexual activity as sexual intercourse only (e.g., Kontula & Haavio-Mannila, 2009) and may be more consistent with reports using more inclusive definitions of sexual activity (e.g., Freak-Poli et al., 2017). In line with this interpretation, age differences between young and old were more prominent in follow-up analyses that had made use of only the sexual intercourse item as compared with the other three sexual activity items. This suggests that non-intercourse forms of sexual contacts constitute a considerable part of older adults' sexual activity.

Our operational definition of cognitive aspects of sexuality encompassed thoughts about and wishes for sexual activity and physical intimacy. As expected, we observed less frequent sexual thoughts among older adults with advancing age, which is consistent with previous conceptual notions and empirical findings (e.g., Chao et al., 2011). However, the observed age-related differences in the levels of sexual thoughts among older adults were rather small ($r = -.13, p < .01$). Again, this can in part be a result of including wishes for sexual activities that go beyond sexual intercourse into the measure of sexual thoughts. We also note that our results are consistent with expectations of age-related decreases in sexual desire (e.g., because of hormonal changes, including testosterone; Amelung, Kuhle, Konrad, Pauls, & Beier, 2012) as well as with empirical findings that older adults wish for more sexual activity than they actually have (Ginsberg et al., 2005).

We had defined emotional aspects of sexuality as including sense of security and acceptance when being sexually active and physically intimate. Our approach was based on the notion that sexuality can contribute to satisfying one's basic emotional and attachment-related needs (Beier et al., 2005; Muise et al., 2018) as well as foster intimacy between partners (Ganong & Larson, 2011). We are not aware of earlier empirical studies that have examined age differences in intimacy. Our results square well with conceptual notions

according to which attachment and accompanying feelings of security and acceptance persist across the lifespan and become – relative to other facets of sexuality – even more prominent and less concealed in old age when sexual activity and sexual desire lose intensity (Beier et al., 2005). Supported by neurobiological findings in long-term relationships (Acevedo, Aron, Fisher, & Brown, 2012), such focus on attachment is also mirrored by current trends in sexual counselling and therapy for older adults (Beier & Loewit, 2013) and efforts in questionnaire construction (Kossow et al., 2018). Our results are also consistent with conceptual notions and empirical evidence that emotional functioning is robust and effective into old age (Carstensen et al., 2003), with feelings of intimacy remaining relatively stable when people are in their 60s and 70s. Considering the decreasing sexual activity and sexual thoughts among older adults with age, feelings of intimacy in older age presumably becomes increasingly independent from the frequency of sexual activity and thoughts. For future research, it will be instructive to examine time-ordered dynamics between the three facets of sexuality and how such associations change with advancing age and could be influenced by tailored interventions.

The Role of Socio-Demographic, Physical Health, and Psychosocial Factors for Sexuality in Old Age

We examined how socio-demographic characteristics, physical health, and psychosocial resources for successful aging are intertwined with facets of sexuality among older adults. Highlighting the utility of our multi-faceted perspective, these predictors exhibited, in part, facet-specific associations. Starting with socio-demographic factors, older men were found to report more frequent sexual activity and more frequent sexual thoughts than older women, which is consistent with previous empirical findings (e.g., Lee et al., 2015). Gender differences in all three aspects of sexuality were moderated by partnership status, with the gap between partnered and non-partnered women being greater than among

partnered and non-partnered men. Given that many more men (84%) than women (51%) in our sample were partnered, we assume that a considerable proportion of gender differences in sexuality in old age can be accounted for by the living situation and the availability of a partner. It stands to reason that in the second half of life, when menopause-related hormonal changes undermine sexual desire in women (Avis et al., 2009), motivational and self-regulatory factors play a role. Drawing from theories of self-regulation (Heckhausen et al., 2010), we speculate that non-partnered older women disengage from sexuality more easily than non-partnered older men by downgrading its importance. We note though that our findings are largely unprecedented given that earlier research often did not address such an interaction when examining sexuality, in part because many analyses are conducted for men and women separately. As a consequence, our initial finding needs to be corroborated in future studies.

Associations between education and sexuality have only been found at the zero-order level, with more educated people reporting slightly more sexual activity, more sexual thoughts, and more sexual intimacy. In the full model, however, no differences whatsoever were found. This initial pattern presumably reflects differences between education strata in psychosocial and health variables (e.g., correlation with grip strength: $r = .11, p < .01$). It is possible that the generally high level of education in our sample has restricted the range of heterogeneity. It is thus still an open question as to whether education and other socioeconomic factors may play a role in sexuality for more diverse and heterogeneous samples of older adults.

In our sample of older adults in their 60s and 70s, performance-based grip strength was associated at the zero-order level with all three facets of sexuality (see Table 1), whereas morbidity was not associated with any of the sexuality facets. When controlling for other factors in our conjoint model, the zero-order associations of grip strength were not found

anymore. As can be obtained from Table 1, grip strength was considerably higher among men than among women ($r = .79, p < .01$), and men reported significantly more sexual activity ($r = .35, p < .01$), sexual thoughts ($r = .40, p < .01$), and intimacy ($r = .22, p < .01$) than women. We conducted follow-up analyses that controlled for gender when examining associations of grip strength with the sexuality facets. Results revealed that gender was indeed significantly related to all three facets of sexuality, whereas no significant association of grip strength was found with any of the sexuality facets. This indicates that the zero-order correlations of grip strength with sexuality were confounded by differences between men and women in grip strength and sexuality.

Our findings of morbidity and grip strength being non-significant in a full model are in line with previous reports on non-clinical samples (DeLamater & Sill, 2005) showing that taking into account psychosocial factors reduces the importance of physical illnesses and medications for sexuality in old age. However, our results obtained here in a relatively healthy sample of older adults may not generalize to older adults who suffer from poor health. When chronic illnesses and functional limitations are not the main obstacle to engage in sexual activity and physical intimacy, the frequency of sexual activity and thoughts relates more strongly to psychosocial factors.

The psychosocial resources examined here (relationship status, duration, and satisfaction; loneliness) accounted for considerable portions of individual differences, especially in the frequency of sexual activity and the feelings of intimacy. Of note is that differences between partnered and non-partnered older adults were of roughly similar size for sexual activity and intimacy and significantly stronger than for sexual thoughts. Having a partner thus seemed to be conducive for being sexually active and experiencing intimacy in old age, but also to some degree for the frequency of sexual thoughts. This suggests that although self-regulatory processes may contribute to decreased levels of sexual thoughts

among non-partnered older adults, they still wish for more sexual activity and physical intimacy than they actually have and such wishes are obviously difficult to satisfy. It would be of interest to further investigate whether non-partnered older individuals might have a wider range of solitary sexual activities (Beier et al., 2018; Das & Sawin, 2016).

For partnered older adults, relationship satisfaction plays an important role especially for the frequency of sexual activity and the feelings of intimacy. Multidirectional dynamics are possible in that satisfied couples engage in more (emotionally satisfying) sexual activity and, in turn, more (emotionally satisfying) sexual activity leads to a higher relationship satisfaction. In contrast, the frequency of sexual thoughts appeared to be more closely associated with other individual and relationship difference variables than relationship satisfaction. We speculate that the availability of the partner helps maintain the wish for sexual activity and physical intimacy, which in unhappy relationships probably remains mostly unsatisfied. If wishes for sexual activity remain unsatisfied, for example, because of a mismatch in the importance partners attribute to sexual activity, relationship strain is likely to occur (Orr et al., 2017). Relationship duration was related to slightly less frequent sexual activity and sexual thoughts, but had no predictive effect for the level of intimacy. This suggests that less sexual activity and sexual thoughts that long-term older couples often experience do not necessarily undermine their feelings of intimacy. It is even possible that older adults compensate the decreasing quantity of sexual activity with the quality of their intimate physical contacts (Forbes, Eaton, & Krueger, 2016).

Finally, increased loneliness, defined as feeling socially and emotionally isolated (Peplau & Perlman, 1982), was associated with lower levels of both sexual activity and intimacy, but not with less frequent sexual thoughts. These findings suggest that wishes for sexual activity continue to be evident among older adults, independent of how socially embedded they feel. For older adults who perceive themselves as lonely and not socially

embedded, our results suggest that sexual needs, especially in emotional aspects such as the attachment dimension of sexuality (Beier & Loewit 2013), remain unsatisfied. It will be intriguing for future research to examine questions about lead-lag dynamics. For example, it is possible that engaging rarely in sexual activity and poor intimacy constitute risk factors for increases in loneliness and so are involved in time-ordered associations with key outcomes of successful aging (Syme et al., 2013). These results can also be taken to highlight that fundamental human needs such as the desire for sense of security and acceptance are vital for people's social life across the lifespan. From this perspective, it appears promising to strengthen the attachment dimension of sexuality in (couple-oriented) health care services for older adults, in particular because of the known health and mortality implications of (positive) social relationships (Holt-Lundstad, 2010, Robles & Kiecolt-Glaser, 2003; Scott & Kayser, 2009). It will thus also be instructive for future research to examine in more detail how facets of sexuality as these contribute to quality of life as well as people's physical and mental health.

Limitations and Outlook

In closing, we note limitations of study design, measures, and sample. The cross-sectional data set did not allow us to answer pivotal questions about what functional and adaptive value and utility sexuality may have. For example, it would be intriguing for future research to examine whether and how the different facets of sexuality in old age may contribute to maintaining and fostering well-being and physical health (Smith et al., 2019; Syme et al., 2013). Following our multi-faceted perspective, we speculate that older adults' well-being becomes increasingly detached from sexual activity and thoughts as people grow older, whereas intricate links between emotional facets of sexuality and well-being remain into advanced ages.

As limitations in our study measures, we acknowledge that both sexual activity and thoughts referred to dyadic behaviors only. In contrast, older adults may also engage in or wish for solitary sexual practices that can be rewarding and pleasurable, and may constitute the only available type of sexual activity they can engage in (e.g., because of a lack of a partner). An additional limitation is the retrospective assessment of sexual activity and thoughts, which may bias reports of both the actual frequency of activities and thoughts. We also note that the sexual activity and sexual thoughts scales may not have interval scaling. Thus, the unequal distances between scores have to be considered when interpreting the findings.

For partnered older adults, not only their own health status, but also that of the partner can be a barrier for engaging in sexual activity. Following Waite et al. (2009), a great majority of partnered older women reported partner's health problems as the most frequent primary reason for not engaging in sexual behavior. When controlling for partner's health status among older adults, having a physically and mentally healthier partner goes hand in hand with more sexual activity (Beckman et al., 2014; Galinsky & Waite, 2014). Thus, considering information about the health of people's partner promises to be of additional predictive utility to better understand sexuality in old age.

The great majority of both younger and older adults in our sample have had experienced some form of intimate contact with another person before (99.37% and 97.95%, respectively). At the same time, one fifth (22% or $n = 329$) of our older adults (vs. 6% or $n = 30$ among younger adults) reported no sexual activity in the preceding year or ever before. We speculate that older adults who have not had even minimal forms of broadly-defined sexual contacts in the preceding year have answered questions about their feelings of intimacy based on their general self-perception and their previous experiences or with regard to some other social relationship. This might have been one of the reasons why our intimacy

scale showed relatively low reliability (Cronbach's $\alpha = .69$). It would be instructive to corroborate our findings using refined measures that allow distinguishing romantic or sexual relationships from other close social relationships as a source of sense of security and acceptance. We also note that our operational definition of intimacy involved only one of three items that did not refer to physical contact and sex. We thus cannot draw solid inferences about genuinely emotional aspects of intimacy such as emotional closeness that are crucial, for example, in Sternberg's perspective (2006). As noted earlier, differences in response format also preclude level comparisons between the three scales used herein. It would be highly instructive in future studies to test whether and how the frequency of sexual activity and sexual thoughts align with feelings of intimacy.

Our major focus in this initial effort has been to comprehensively describe and better understand sexuality in old age. To move in this direction, we have selected the correlates studied based on the existing literature on sexuality among older adults. It stands to reason that other factors such as pregnancy and small children in the household (Dewitte & Mayer, 2018; Schröder & Schmiedeberg, 2015) play an important role for sexuality in young adulthood, but are not included in our study. Even if we were to use the same set of predictors, some of these predictors change in meaning across adulthood and thus are presumably of different predictive utility among older vs. younger adults (e.g., relationship duration: $M = 35$ years vs. 5 years). It would thus be highly informative to examine in-depth commonalities and differences in the relevance that socio-demographic characteristics, physical health, and psychosocial resources play for sexuality among younger vs. older adults. We also acknowledge that information about presumably further relevant facets of sexuality such as sexual satisfaction has not been considered in our initial attempt. For example, it would be highly instructive to examine whether the frequency of sexual activity is

associated with sexual satisfaction among older adults, how this differs from younger adults, and what role health and psychosocial resources or constraints play for such associations.

As limitation of our sample, we note that the large majority of older adults in our sample from a metropolitan region in the 2010s was relatively healthy and morbidity was low, as exemplified in a mean of $M = 1.27$ ($SD = 1.31$) diseases. Inferences drawn from our study thus shed light on increasingly larger shares of the general population in Western societies (Lindau & Gavrilova, 2010). At the same time, our findings may not generalize to older, more diverse, and less well functioning population segments. For people in their 80s and beyond, for example, we would expect physical health challenges to play a much more prominent role than found here. Finally, our sample and design also did not allow us to disentangle age differences from cohort differences. It is thus possible that lower levels of sexual activity among older adults in their 70s and 80s than among those in their 60s may not only represent aging outcomes, but also historical change, with later-born older adults reporting to be more often sexually active than their earlier-born age peers (Beckman et al., 2014). It would also be intriguing to examine cohort differences in cognitive and emotional facets of sexuality because, for example, older adults today may consider sexuality more important and assign more weight to an emotionally satisfying sex life than their age peers several decades ago.

Conclusions

Drawing from theoretical perspectives about sexuality and intimacy among young and middle-aged adults, the current study conceptualized and examined sexuality among older adults as a multi-faceted phenomenon. We identified age-related differences and correlates of sexuality in old age using cross-sectional data from 1,514 older adults of the Berlin Aging Study II. Among older adults, we found less sexual activity and fewer sexual thoughts, but no differences in feelings of intimacy with advancing age, which highlights the continued if not

growing relevance of this sexuality component throughout old age. When compared with young adults in our reference group ($N = 475$), older adults reported considerably less frequent sexual activity and sexual thoughts, and slightly lower levels of intimacy. In the context of these age group differences, one out of three of our older adults reported being as sexually active as the average young adult in our reference sample, thereby indicating that sexuality is an important theme in old age. Among our relatively healthy older adults, psychosocial factors were found to account for the lion's share of individual differences in sexuality, thereby highlighting that resources for successful aging are highly relevant for facets of sexuality in old age. More mechanism- and process-oriented research is needed in order to shed light on how and why sexuality evolves across adulthood and into old age and what some of the underlying pathways are that link sexuality facets with successful aging.

Words: 9,168

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Footnotes

1 Relations among the 11 items were examined using a series of confirmatory factor models specifically structured to evaluate configural, weak, strong, and strict measurement invariance. While each nested ΔX^2 test was significant with this sample size, overall loss in fit to the empirical data with each successive constraint suggested that the factor structure supported configural, weak, and to some extent strong invariance (CFIs = .912, .904, .874). Strict invariance resulted in relatively more misfit ($\Delta X^2/df = 67.47$, CFI = .777), but is not needed for examination of longitudinal change. We concluded from the series of factorial invariance tests that there was sufficient evidence of factorial invariance to proceed to models that imposed a level of factorial invariance needed for the subsequent examinations of age-related differences. In the Online Supplementary Material, we additionally provide a table of intercorrelations of the 11 items separately for young and old adults (see Table S1).

Table 1

Descriptive Statistics and Intercorrelations of Variables under Study

Variables (range)	N	M	SD	Intercorrelations										
				1	2	3	4	5	6	7	8	9	10	11
Facets of sexuality														
1. Sexual activity (0–4)	1,514	2.37	1.07		.53*	.55*								
2. Sexual thoughts (0–4)	1,514	2.85	0.98	.65*		.21*								
3. Intimacy (0–4)	1,514	2.53	1.30	.59*	.33*									
Correlates														
4. Age (60–82)	1,514	68.15	3.68	-.10*	-.12*	.01								
5. Men (0, 1)	1,514	50%		.35*	.40*	.22*	.09*							
6. Education (7–18)	1,304	14.13	2.86	.10*	.11*	.07	-.05	.14*						
7. Morbidity (0–10)	1,354	1.27	1.31	-.05	.00	-.05	.03	.05	-.03					
8. Grip strength (7.50–58.75)	1,452	30.40	8.75	.29*	.34*	.19*	-.01	.79*	.11*	-.01				
9. Partnered (0, 1)	1,506	68%		.58*	.38*	.48*	.00	.35*	.06	-.03	.31*			
10. Relationship duration (1–63)	998	34.55	14.0	-.19*	-.20*	.00	.22*	-.05	-.03	.02	-.05	.04		
11. Relationship satisfaction (0–4)	1,014	3.33	0.76	.36*	.19*	.55*	.12*	.12*	.02	-.04	.13*	.05	.08	
12. Loneliness (1–4.86)	1,216	1.55	0.61	-.26*	-.11*	-.33*	.09*	.05	-.06	.07	-.03	-.20*	.06	-.24*

Note. *M* = mean, *SD* = standard deviation. *N* = frequency of older participants. Intercorrelations among the three facets of sexuality for younger adults (*N* = 475) shown above the diagonal; intercorrelations among the variables under study for older adults shown below the diagonal. Age, education, and relationship duration in years. Grip strength in kilograms. Relationship duration and satisfaction reported for partnered older adults.

**p* < .01

Table 2

Results from SEM-based Multivariate Multiple Regression Analysis for three Facets of Sexuality

Predictors	Facets of sexuality					
	Sexual activity		Sexual thoughts		Intimacy	
	β	<i>SE</i>	β	<i>SE</i>	β	<i>SE</i>
Age	-.10*	.02	-.13*	.02	.00	.02
Men	.19*	.03	.31*	.04	.08	.04
Education	.03	.02	.05	.02	.02	.02
Morbidity	-.03	.02	.01	.02	-.02	.02
Grip strength	-.03	.03	.00	.04	-.03	.03
Partnered	.48*	.02	.24*	.03	.40*	.02
Relationship duration	-.12*	.02	-.11*	.02	-.02	.02
Relationship satisfaction	.22*	.02	.12*	.02	.36*	.02
Loneliness	-.11*	.02	-.03	.03	-.18*	.02
Men \times partnered	-.07*	.02	-.08*	.02	-.06*	.02
R^2 overall	.45	.02	.28	.02	.42	.02
R^2 health	<.01	<.01	<.01	<.01	<.01	<.01
R^2 psychosocial	.25	.00	.07	.00	.34	.01

Note. $N = 1,514$. Age was centered at 70 years; all other predictors mean centered. R^2 health = variance accounted for by morbidity and grip strength; R^2 psychosocial = variance accounted for by being partnered, relationship duration, relationship satisfaction, and loneliness.

* $p < .01$

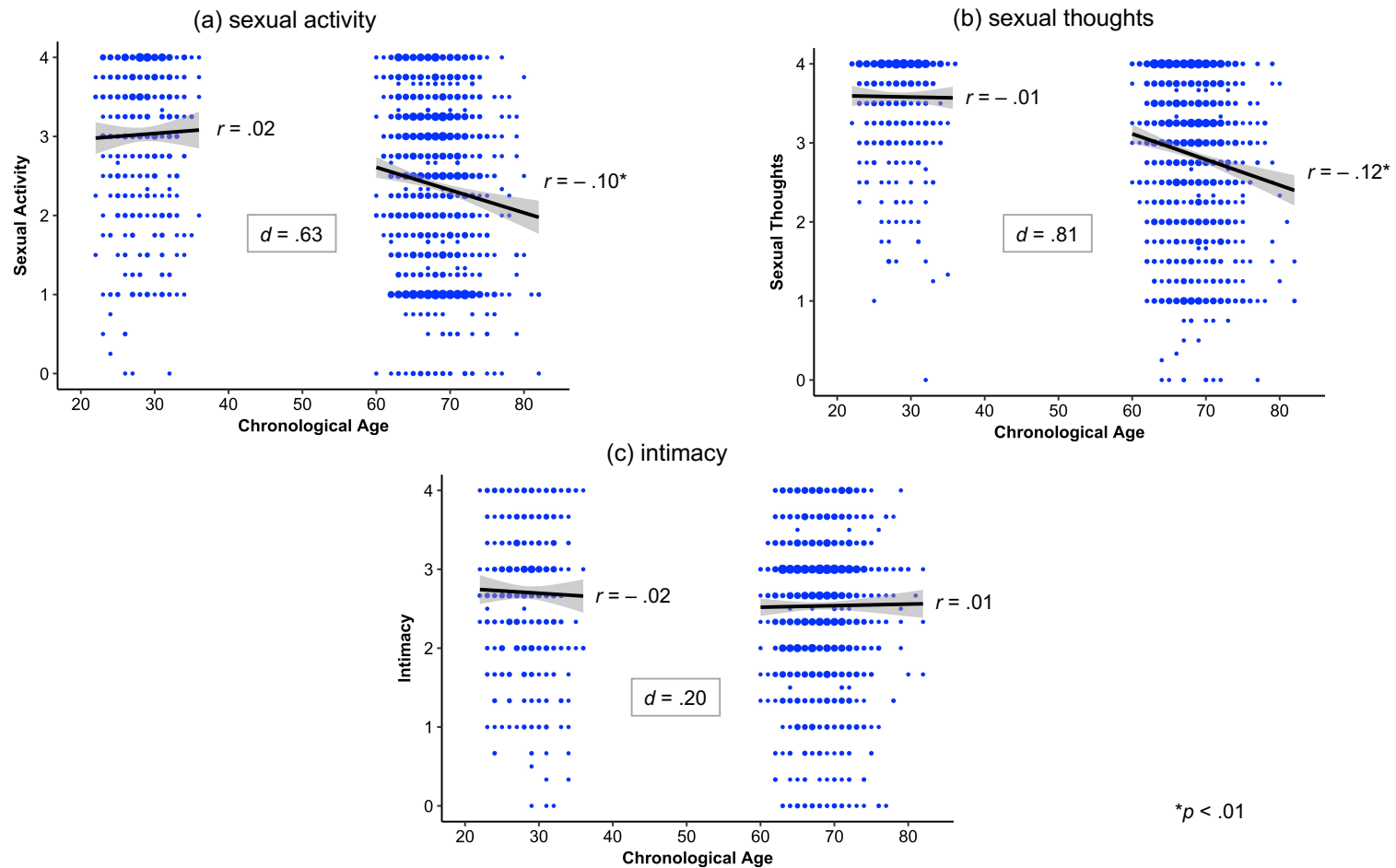


Figure 1. Illustrating associations between chronological age (in years) and three facets of sexuality among older adults, sexual activity (upper left-hand panel a), sexual thoughts (upper right-hand panel b), and intimacy (lower middle panel c). It can be obtained that among older adults, the older participants were, the less frequent sexual activity and sexual thoughts they reported (0 = never before, 1 = not at all, 2 = less often than once per month, 3 = at least once per month, 4 = at least once per week), whereas no age differences emerged for feelings of intimacy (0 = I do not agree, 1 = I agree a little bit, 2 = neither nor, 3 = I agree, 4 = I absolutely agree). Among young adults, no age-related differences in any of the sexuality facets were observed. For visual presentation, marker size was frequency weighted and confidence intervals (95%) were represented around the regression line.

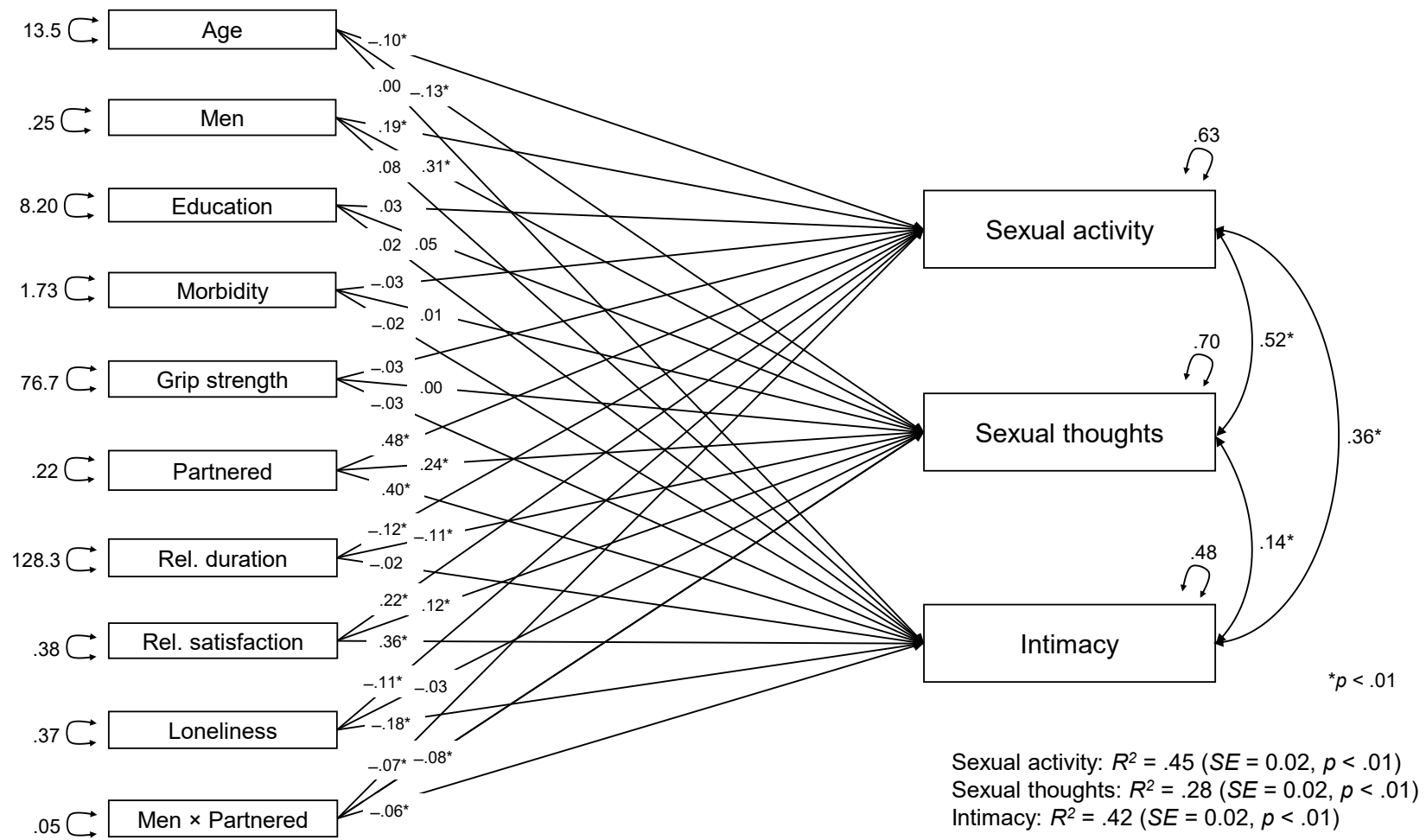


Figure 2. Standardized regression weights, intercorrelations, and variances from the full multivariate regression analyses predicting sexual activity (0 = never before ... 4 = at least once per week), sexual thoughts (0 = never before ... 4 = at least once per week), and intimacy (0 = I do not agree ... 4 = I absolutely agree) conjointly from socio-demographic (age, gender, education), physical health (morbidity, grip strength), and psychosocial factors (partnered, relationship duration, relationship satisfaction, loneliness). Intercorrelations of predictors were omitted for clarity of visual presentation.

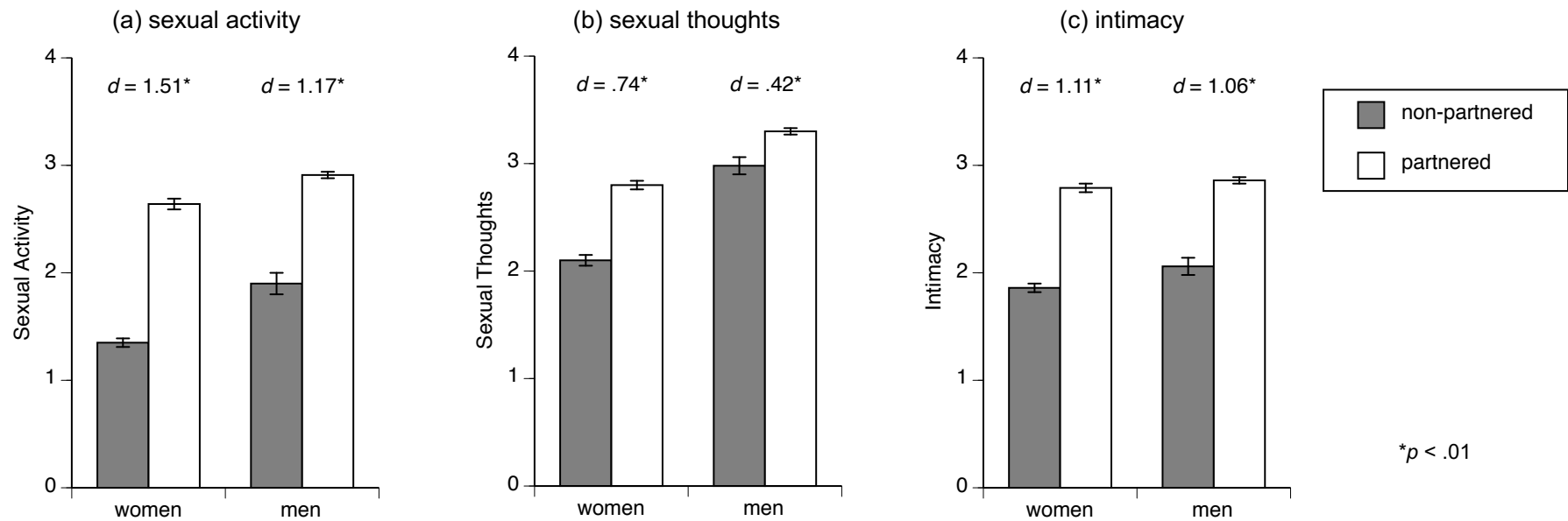


Figure 3. Illustrating the significant two-way interaction of being a man and being partnered that had emerged consistently for all three facets of sexuality, sexual activity (left-hand panel a), sexual thoughts (middle panel b), and intimacy (right-hand panel c). Overall, women reported lower frequency of sexual activity and of sexual thoughts (for both, 0 = never before ... 4 = at least once per week), and similar levels of intimacy (0 = I do not agree ... 4 = I absolutely agree) compared to men. The interaction indicates that participants with partners had more sexual activity, more sexual thoughts, and more feelings of intimacy than those without partners – however, this was consistently across all three facets of sexuality more evident among women than among men.

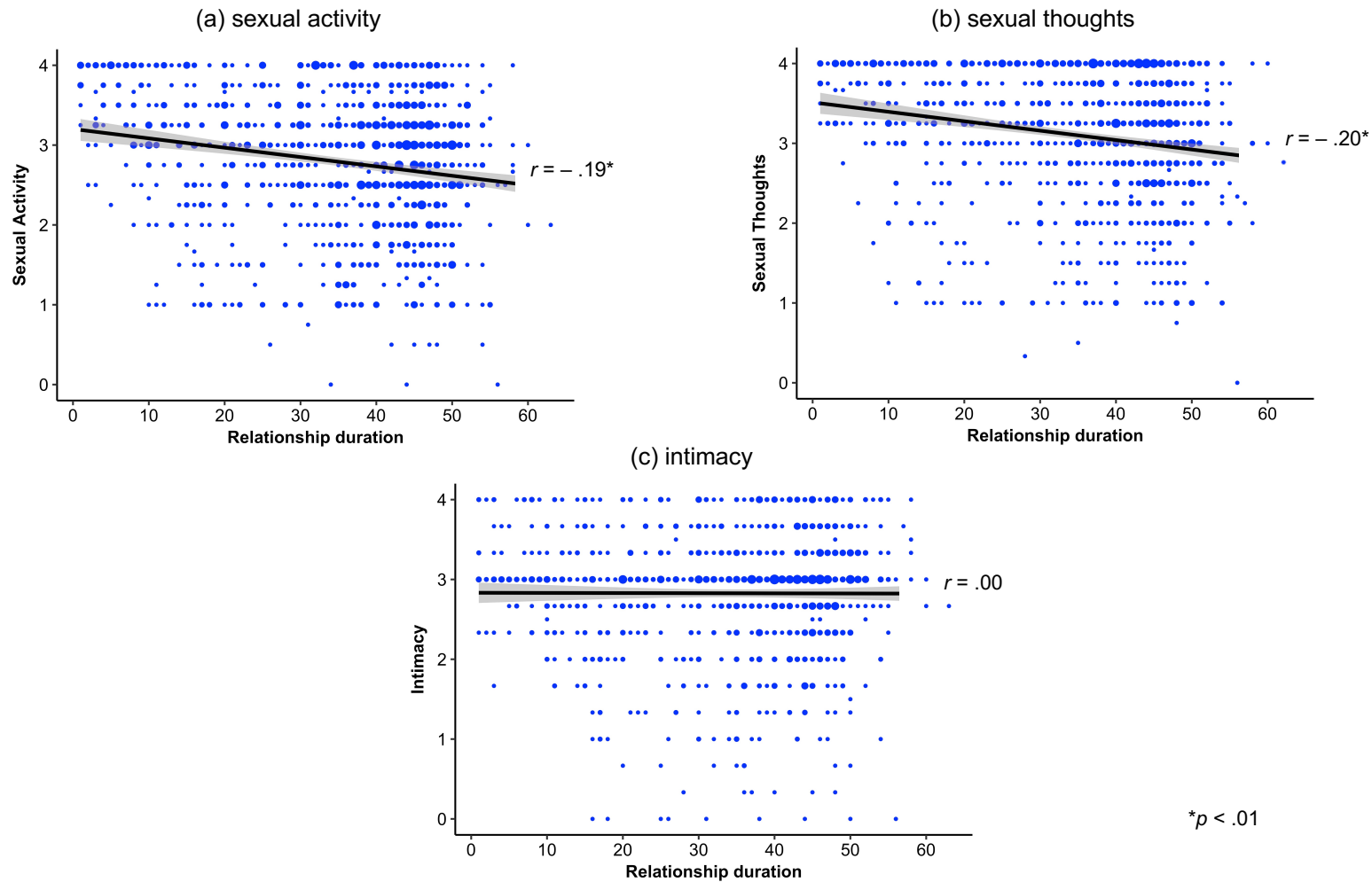


Figure 4. Illustrating associations between relationship duration (in years) and three facets of sexuality among older adults, sexual activity (upper left-hand panel a), sexual thoughts (upper right-hand panel b), and intimacy (lower middle panel c). Among older adults, longer relationship duration was associated with less frequent sexual activity and less frequent sexual thoughts (for both, 0 = never before ... 4 = at least once per week), but not less feelings of intimacy (0 = I do not agree ... 4 = I absolutely agree). For visual presentation, marker size was frequency weighted and confidence intervals (95%) were represented around the regression line.

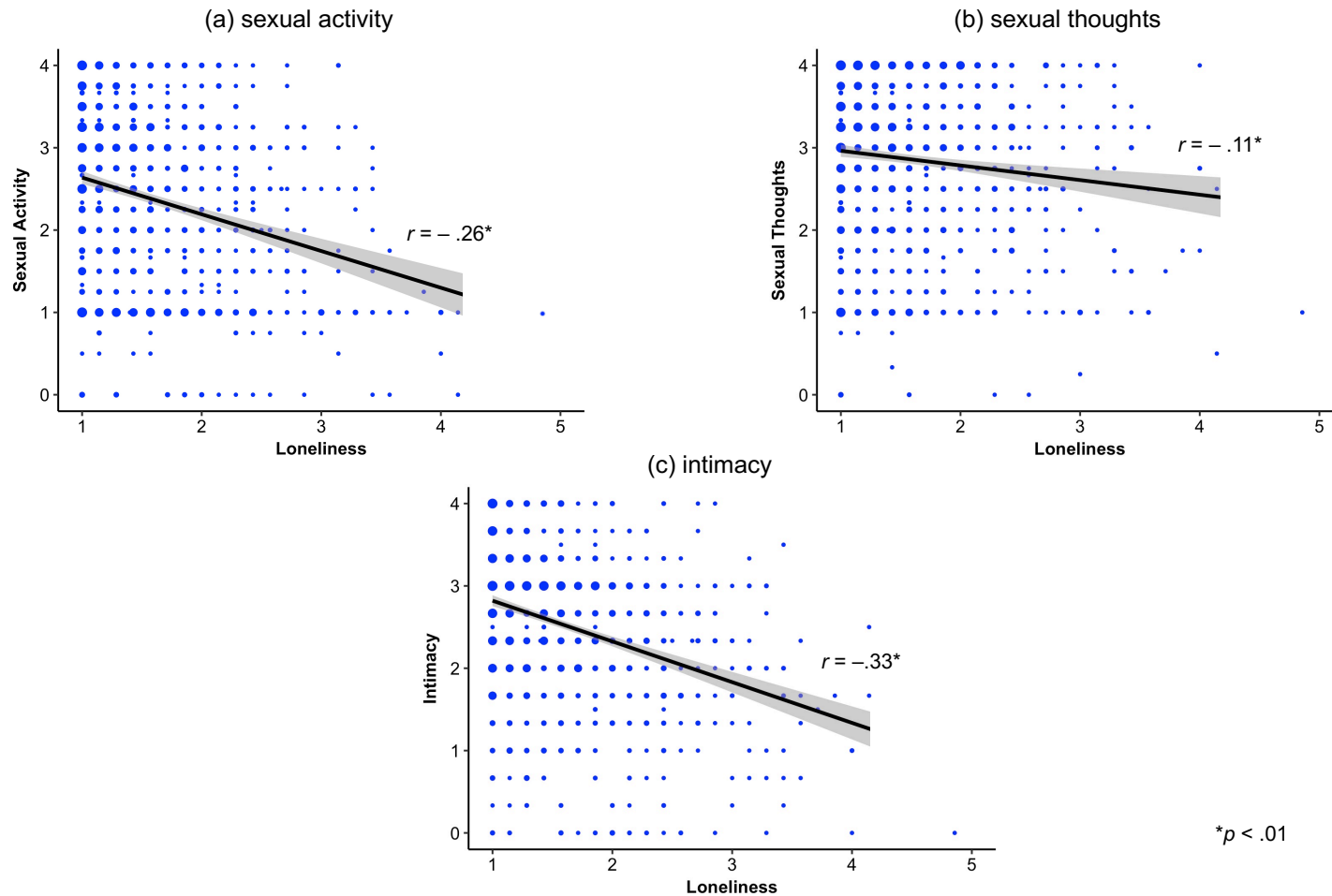


Figure 5. Illustrating associations between loneliness and three facets of sexuality among older adults, sexual activity (upper left-hand panel a), sexual thoughts (upper right-hand panel b), and intimacy (lower middle panel c). Older adults who reported more feelings of loneliness also reported less frequent sexual activity (0 = never before ... 4 = at least once per week) and less feelings of intimacy (0 = I do not agree ... 4 = I absolutely agree) both with and without controlling for the correlates. However, for the frequency of sexual thoughts (0 = never before ... 4 = at least once per week), the minor associations of loneliness seen at the zero-order level were not found anymore when controlling for relevant individual difference characteristics. For visual presentation, marker size was frequency weighted and confidence intervals (95%) were represented around the regression line.

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**Sexual Activity, Sexual Thoughts, and Intimacy among Older Adults:
Links with Physical Health and Psychosocial Resources for Successful Aging**

Karolina Kolodziejczak¹, Adrian Rosada², Johanna Drewelies¹,
Sandra Düzel³, Peter Eibich⁴, Christina Tegeler⁵, Gert G. Wagner^{3,6,7}, Klaus M. Beier²,
Nilam Ram^{6,8}, Ilja Demuth², Elisabeth Steinhagen-Thiessen², & Denis Gerstorff^{1,6,8}

¹Humboldt University, Berlin, Germany

²Charité – Universitätsmedizin Berlin, Germany

³Max Planck Institute for Human Development, Berlin, Germany

⁴Max Planck Institute for Demographic Research, Rostock, Germany

⁵MSB Medical School Berlin

⁶German Institute for Economic Research (DIW Berlin), Berlin, Germany

⁷Alexander von Humboldt Institute for Internet and Society (HIIG), Berlin, Germany

⁸Pennsylvania State University, State College, US

Correspondence regarding this manuscript to: Karolina Kolodziejczak, Humboldt University Berlin, Department of Psychology, Unter den Linden 6, 10099 Berlin, Germany; phone: +49-(0)30-2093-9424; fax: +49-(0)30-2093-9351; karolina.kolodziejczak@hu-berlin.de.

FACETS OF SEXUALITY AMONG OLDER ADULTS

Item wording

Introduction to the questionnaire

Bei den folgenden Fragen geht es um Sexualität und Partnerschaft. Bitte beantworten Sie die Fragen möglichst spontan! Es gibt keine richtigen und falschen Antworten. Markieren Sie die Antwort, die am ehesten auf Sie zutrifft. Der Einfachheit halber bezieht sich der Begriff “Partner” sowohl auf Frauen als auch auf Männer. Falls Sie etwas nicht verstehen, fragen Sie bitte den Studienarzt! (The following questions concern sexuality and partnership. Please answer the questions as spontaneous as possible! There are no right or wrong answers. Please check the response category that describes you best (relatively speaking). For the sake of simplicity, the term “partner” applies for both women and men. If you do not understand anything, please ask the study doctor!)

Relationship status

Leben Sie in einer festen Partnerschaft (eheliche oder nicht-eheliche Partnerschaft)? Nein/ja.
(Do you live in a stable relationship (marital or non-marital relationship)? No/yes.

Sexual activity

Während der letzten 12 Monate, wie häufig haben Sie bzw. hatten Sie... (During the last 12 months, how often have you (had)...)

- (1) ... Körperkontakt? (body contact?)
- (2) ... Zärtlichkeiten ausgetauscht? (exchanged caresses?)
- (3) ... Sex ohne Geschlechtsverkehr? (sex without intercourse?)
- (4) ... Geschlechtsverkehr? (sexual intercourse?)

Antwortformat (response format): mindestens 1x pro Woche (at least once per week) –
mindestens 1x pro Monat (at least once per month) – seltener als 1x pro Monat (less often
than once per month) – gar nicht (not at all) – noch nie (never before)

FACETS OF SEXUALITY AMONG OLDER ADULTS

Sexual thoughts

Während der letzten 12 Monate... (During the last 12 months...)

- (1) ... wie häufig haben Sie sich Körperkontakt gewünscht? (how often have you wished for body contact?)
- (2) ... wie häufig dachten Sie an den Austausch von Zärtlichkeiten? (how often have you thought about exchanging caresses?)
- (3) ... wie häufig dachten Sie an Sex ohne Geschlechtsverkehr? (how often have you thought about having sex without intercourse?)
- (4) ... wie häufig dachten Sie an Geschlechtsverkehr? (how often have you thought about having sexual intercourse?)

Antwortformat (response format): mindestens 1x pro Woche (at least once per week) – mindestens 1x pro Monat (at least once per month) – seltener als 1x pro Monat (less often than once per month) – gar nicht (not at all) – noch nie (never before)

Intimacy

- (1) Ich erlebe durch Körperkontakte Geborgenheit und Akzeptanz. (I experience through body contacts security and acceptance.)
- (2) Ich fühle mich beim Sex geborgen und angenommen. (I feel safe and accepted during sex.)
- (3) Meine Bedürfnisse nach Geborgenheit, Sicherheit und Akzeptanz sind derzeit erfüllt. (My needs for security and acceptance are currently satisfied.)

Antwortformat (response format): stimmt nicht (I do not agree) – stimmt wenig (I agree a little bit) – weder noch (neither nor) – stimmt (I agree) – stimmt absolut (I absolutely agree)

FACETS OF SEXUALITY AMONG OLDER ADULTS

Table S1

Intercorrelations of Sexuality Items Organized into Three Facets (Behavioral, Cognitive, and Emotional) Separately for Young and Old Adults

Variables	Intercorrelations										
	1	2	3	4	5	6	7	8	9	10	11
1. beh1		.88*	.54*	.74*	.42*	.37*	.26*	.42*	.49*	.27*	.32*
2. beh2	.89*		.58*	.81*	.45*	.42*	.28*	.44*	.52*	.31*	.36*
3. beh3	.45*	.48*		.61*	.33*	.32*	.54*	.36*	.37*	.30*	.35*
4. beh4	.63*	.65*	.49*		.43*	.40*	.23*	.46*	.49*	.34*	.43*
5. cog1	.56*	.56*	.37*	.52*		.76*	.33*	.60*	.08	.19*	.16*
6. cog2	.59*	.63*	.38*	.48*	.82*		.42*	.62*	.04	.18*	.14*
7. cog3	.30*	.30*	.51*	.27*	.45*	.48*		.38*	.08	.19*	.17*
8. cog4	.45*	.46*	.39*	.60*	.67*	.63*	.49*		.09	.17*	.26*
9. emo1	.42*	.47*	.26*	.33*	.08*	.12*	.05	.09*		.41*	.51*
10. emo2	.47*	.50*	.30*	.33*	.36*	.40*	.23*	.24*	.43*		.49*
11. emo3	.42*	.44*	.29*	.48*	.33*	.32*	.18*	.36*	.35*	.49*	

Note. $N = 1,989$. Intercorrelations for younger adults ($n = 475$) shown above the diagonal; intercorrelations for older adults ($n = 1,514$) shown below the diagonal. *beh1–beh4* = Items of the behavioral component; *cog1–cog4* = Items of the cognitive component; *emo1–emo3* = Items of the emotional component.

* $p < .01$.



Perceived Importance and Enjoyment of Sexuality in Late Midlife: Cohort Differences in the Longitudinal Aging Study Amsterdam (LASA)

Karolina Kolodziejczak¹ · Johanna Drewelies¹ · Dorly J. H. Deeg² · Martijn Huisman^{2,3} · Denis Gerstorf^{1,4}

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Abstract

Introduction Age-related declines in multiple facets of sexuality in later life are well documented. However, most studies have been cross-sectional with data collected at one point in time, leaving questions about cohort differences and interrelated historical changes in physical health and psychosocial functioning unanswered.

Methods We examined cohort differences in perceived importance and enjoyment of sexuality in late midlife using data from the Longitudinal Aging Study Amsterdam (LASA) obtained 20 years apart, 1992–1993 ($N = 718$) and 2012–2013 ($N = 860$), from two independent samples aged 55 to 65 years (both samples: $M_{\text{age}} \approx 60$, 52–53% women).

Results Later-born adults in late midlife reported attributing slightly higher importance to sexuality than their earlier-born peers and experiencing their sex life as slightly less pleasant. Effect sizes were small at the sample level ($d < .15$), but substantial for certain population segments. For example, historical increases in reported importance of sexuality were especially pronounced among women with no partner ($d = .56$). When controlling for socio-demographic, physical health, and psychosocial factors, cohort differences in perceived importance of sexuality remained significant, but those for enjoyment did not.

Conclusions Late-midlife sexuality undergoes historical changes. Specifically, reported perceived importance of sexuality has increased over historical time, especially in particular population segments.

Policy implications We discuss whether our findings represent historical changes in actual behavior, perception, or the willingness to report on one's sex life.

Keywords Sexuality · Middle age · Old age · Cohort differences · Historical change

Introduction

Over the past decade, sexuality in midlife and old age has received increased attention (Buczak-Stec et al., 2019;

Karraker et al., 2011; Orr et al., 2017). A number of studies converge in suggesting that several aspects of sexuality show on average age-related decrements, but a considerable proportion of adults continue having an active sex life into advanced ages (Kolodziejczak et al., 2019; Schick et al., 2010). However, previous empirical reports were typically based on cross-sectional data collected at one specific point in time (e.g., Lee et al., 2016). Thus, they did not allow disentangling age-related differences from those associated with the historical times people were born and living in. Given that sexuality is considerably shaped by historical and social circumstances (Pettit & Hegarty, 2014), it stands to reason that attitudes toward sexuality differ across historical time and contribute to the occurrence of cohort differences in sexual behaviors and experiences (Mercer et al., 2013; Twenge et al., 2017). Additionally, historical changes in several life domains in late midlife that are closely intertwined with sexual functioning such as lower levels of loneliness (Suanet & van Tilburg, 2019) and higher levels of internal control among later-born cohorts (Gerstorf et al., 2019) might have allowed later-born

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✉ Karolina Kolodziejczak
karolina.kolodziejczak@hu-berlin.de

¹ Department of Psychology, Humboldt University Berlin, Unter den Linden 6, 10099 Berlin, Germany

² Department of Epidemiology and Data Science, Amsterdam Public Health Research Institute, Amsterdam UMC, Vrije Universiteit Amsterdam, Amsterdam, the Netherlands

³ Department of Sociology, Vrije Universiteit Amsterdam, Amsterdam, the Netherlands

⁴ Department of Human Development and Family Studies, Pennsylvania State University, State College, PA, USA

generations to perceive sexuality differently, compared with their earlier-born peers. Thus, in the current study, we examined cohort differences in two aspects of late-midlife sexuality: the importance people attribute to sexuality and the extent to which they experience their sex life as pleasant. We also accounted for a comprehensive number of socio-demographic, physical health, and psychosocial correlates that are known to differ between individuals and across historical time (Drewelies et al., 2018; Galenkamp et al., 2016) and tested interactions between these and cohort membership to explore if the historical changes examined have been more pronounced in particular population segments than others. To do so, we made use of data from two independent adult samples aged 55 to 65 years (both samples: $M_{\text{age}} \approx 60$, 52–53% women) obtained 20 years apart: in 1992–1993 ($N = 718$) and 2012–2013 ($N = 860$) in the Longitudinal Aging Study Amsterdam (LASA; Hoogendijk et al., 2016; Huisman et al., 2011).

Importance and Enjoyment of Sexuality in Late Midlife

Midlife is a life phase characterized by several unique developmental transitions (Infurna et al., 2020) that are presumably also relevant for experiencing one's sexuality. To illustrate, the menopausal transition may constitute a challenge for sexual functioning (Avis et al., 2017). In a similar vein, late midlife is assumed to be the period of life of increasing risk of health problems (e.g., disease onset), and poor health has been repeatedly shown to be related to poor sexual functioning among adults aged 50 and older (Lee et al., 2016). On the other hand, sexuality remains for many adults a valuable aspect of life until old age, and a fulfilling sex life in older age is linked with indicators of successful aging (Buczak-Stec et al., 2019; Štulhofer et al., 2018). Late midlife may thus be a critical period for maintaining a (satisfying) sex life into old age.

In this study, we focused on two aspects of sexuality: perceived importance of sexuality and enjoyment of sex life, both crucial for a better understanding of individual differences in late-midlife sexuality. The importance people attribute to sexuality reflects the role and value of sex in people's current lives (Gott & Hinchliff, 2003). Previous studies have suggested that, for a considerable number of adults, sexuality remains a valuable aspect of life into old age (Laumann et al., 2006; Müller et al., 2014) and plays an important role, for example, for fostering intimacy in one's partnership, experiencing sexual pleasure or vitality (Fileborn et al., 2017; Ševčíková & Sedláková, 2020). Importance attributed to sexuality is closely intertwined with other key aspects of sexuality, including sexual activity, sexual desire, and sexual satisfaction (DeLamater & Sill, 2005; Thomas et al., 2015), and presumably also with other areas of functioning. For example, higher within-couple discrepancy in the importance

attributed to sex in middle and older age is related to more pronounced relationship strain (Orr et al., 2017). Of note is that numerous studies have inferred the importance of sexuality in later life from the frequency of sexual activity reported by study participants. However, such operational definition is questionable, for example, because of the interest-activity gap (Pfeiffer et al., 1969), which indicates that sexual interest in later life often exceeds actual sexual activity (Beier et al., 2019). Thus, empirical research should aim at using more direct measures of the importance people attribute to sexuality.

Enjoyment of sexuality reflects the degree to which people experience their sex life as pleasurable. Such enjoyment refers to people's idiosyncratic definition of a fulfilling sex life and conveys information about the quality of sexual experience (Fileborn et al., 2017). Enjoyment of sex has been linked with other important aspects of sexuality such as sexual desire (DeLamater & Sill, 2005) and related constructs such as sexual satisfaction are expected to be beneficial for other areas of functioning such as overall subjective well-being (Buczak-Stec et al., 2019). Examining enjoyment thus complements earlier empirical reports by moving beyond considering mere quantitative aspects of sexuality, such as the frequency of sexual activity.

Cohort Differences in Late-Midlife Sexuality

Life course sociology and lifespan psychology have long noted that individual functioning and development are profoundly shaped by the historical and socio-cultural contexts people are living in (Baltes et al., 1979; Bronfenbrenner, 1993; Elder Jr., 1974; Schaie, 1965). Acknowledging that sexual functioning is shaped by biological, psychological, and social factors (DeLamater, 2012), societal contexts and historical changes therein have presumably also formed and affected people's experiences and perceptions of sexuality. Three sets of historical shifts over the past decades may have particularly contributed to changes in perception of sexuality in later life nowadays.

First, the sexual revolution of the late 1960s and early 1970s might have particularly impacted adolescents and young adults at that time (Forbes et al., 2017) and profoundly shaped their identity-relevant attitudes and values (Duncan & Agronick, 1995; Stewart & Healy, 1989). The movement has spread more liberal attitudes toward sexuality that facilitated engagement with sex life. In a similar vein, the Gay Rights movement of the 1970s is often thought of as having had society-wide effects that profoundly shaped how people think about sexuality (Shield, 2020). Assuming that such attitudes continue to be relevant today (DeLamater, 2012), we hypothesized that cohorts born after the Second World War value and enjoy their sex lives in late midlife more than earlier-born cohorts. Second, feminist societal movements in the 1960s

have broadened the debate on gender equality and promoted, among other things, sexual self-determination and sexual pleasure among women (Rubin, 1998). This, in turn, has contributed to the popularization of the birth control pill, which provided more reproductive autonomy to women (Liao & Dollin, 2012). Women have increasingly entered the labor market, which forced changes in family models and the division of labor in couples (Shockley & Shen, 2015). Following Baumeister's (2000) notion of gender differences in erotic plasticity suggesting that female sexuality is more responsive to social circumstances and situational factors than male sexuality, one could infer that the overall more permissive sexual climate of the 1960s and 70s has particularly affected women at that time (see also Duncan & Agronick, 1995). As a consequence, we hypothesized that historical shifts in the perceived importance and enjoyment of sexuality are probably more pronounced among women than among men, with later-born women in late midlife reporting higher importance and more enjoyment of sexuality than earlier-born same-aged women.

Third, more recent developments such as medical advancements over the past decades can also be expected to have shaped late-midlife sexuality. Such changes encompass increases in treatments of sexual dysfunction both in women (e.g., hormonal replacement therapy used also for dyspareunia due to vaginal dryness or loss of libido; Sarrel, 2000) and men (e.g., sildenafil for erectile dysfunction; Goldstein et al., 1998). To illustrate, Viagra® entered the US market in the late 1990s and 10 years later annual sales reached almost two billion USD (Pfizer Inc, 2010). Better sexual functioning presumably facilitates perceiving sexuality as important and engaging with sex life into old age. Likewise, easy access to medication that improves sexual function might contribute to a more pleasurable sex life. At the same time, the efforts and finances invested into maintaining sexual functions such as purchasing Viagra® likely mirror the importance midlife and older adults attribute to their sex life. Thus, this relationship might be bidirectional.

Empirically, studies examining historical trends in sexuality have indeed reported cohort differences on its several dimensions. Specifically, later-born adults presumably remain sexually active until older age: Beckman, Waern, Östling, Sundh, and Skoog (2014) reported that a higher percentage of later-born Swedish 70-year-olds engage with sex life today compared with their same-aged peers 20 years ago. Another study on adults in the US has shown historical decreases in the frequency of sexual activity among those in their 50s, but no decline among those over 60 (Twenge et al., 2017). Later-born cohorts of older adults have also been found to report more positive attitudes to sexuality, higher satisfaction with sexuality, and fewer sexual dysfunctions than earlier-born cohorts (Beckman et al., 2008). Very few studies though have specifically targeted adults in late midlife to examine cohort differences in sexuality. In particular, Forbes et al. (2017) have

examined perceived quality of sexual aspects of life (i.e., sexual frequency, number of sexual partners, perceived control over as well as thought and effort put into sex life) among US adults in late midlife, interviewed in 1995 and 2013. Their results provided no evidence for historical changes in these aspects of sexuality. In our report, we capitalize on conceptual accounts and earlier empirical studies and investigate cohort differences in perceived importance and enjoyment of sex life as further indicators of historical change in late-midlife sexuality.

The Role of Socio-Demographic, Physical Health, and Psychosocial Factors

We speculate that perceived importance and enjoyment of sexuality in late midlife have increased over historical time also because of changes that emerged in socio-demographic, physical health, and psychosocial functioning. Moreover, drawing from previous works on cohort differences (e.g., Drewelies et al., 2018), we hypothesize that historical changes in sexuality might have been particularly pronounced in certain subgroups of the population, but not others. In the following, we consider several individual and cohort differences that may be particularly relevant for perceived importance and enjoyment of sexuality in late midlife.

To begin with, older age is a known risk factor for declines in sexual activity (e.g., Karraker et al., 2011). Gender differences in later-life sexuality have also been well documented, with older men reporting higher importance of sexuality and having a lower risk of sexual dissatisfaction than older women (Laumann et al., 2006; Müller et al., 2014; Syme et al., 2012). Also, later-born cohorts have experienced more years of formal education (Drewelies, Deeg, et al., 2018). Better educated older adults may hold less negative attitudes toward sexuality (DeLamater & Sill, 2005), which may correspond to higher importance and enjoyment of sexuality. Religiosity, in turn, may have a prohibitive role for sexual activity in unmarried older adults, especially among women (McFarland et al., 2011), which may result in attributing lower importance to sexuality among those individuals perceiving religion as more salient. It remains to be seen how salience of religion relates to enjoyment of sexuality.

Physical health problems may be experienced as a barrier for having sex, which in turn may undermine the importance people attribute to sexuality (Gott & Hinchliff, 2003). Recent reports have documented that the numbers of diagnosed illnesses in late midlife are currently on the rise (e.g., for diagnosed cancer, diabetes, or stroke), and provided mixed results on cohort differences in functional limitations (Crimmins et al., 2019; Hoeymans et al., 2012). However, it remains unclear whether and how these cohort differences in health relate to sexuality. There is initial evidence that health problems impact sexuality among later-born older adults less,

comparing to the earlier-born cohorts (Beckman et al., 2014). In the current report, we will test how multimorbidity and functional limitations relate to historical changes in the importance and enjoyment of sexuality among adults in late midlife.

For psychosocial resources, having a partner has repeatedly been found to be crucial for sexuality in old age, particularly for women (Kolodziejczak et al., 2019; Schick et al., 2010). Twenge et al. (2017) reported historical declines in sexual activity in the USA partially due to increased numbers of adults having no partner. In line with previous findings, we expected that having a partner is related to attributing higher importance to sexuality (Gott & Hinchliff, 2003). However, it remains unclear whether partner status relates to enjoyment of sexuality. Apart from partner status, acknowledging that greater social embeddedness is associated with more sexual interest in later life (Iveniuk & Waite, 2018), we expect that historically lower levels of loneliness, especially among divorced adults in late midlife (Van Tilburg et al., 2014), go hand in hand with perceiving sexuality as more important among adults in late midlife.

Depressive symptoms have repeatedly been found to undermine sexuality, possibly because of general lack of interest in and pleasure derived from different activities (Bach et al., 2013). Finally, perceived constraints might undermine sexuality because believing that one has little control over one's life may indeed stand in the way of taking any action toward fulfilling one's (sexual) desires. We assumed that historical shifts toward fewer perceived constraints among adults in late midlife (e.g., Drewelies, Deeg, et al., 2018) have contributed to the presumed historical increases in the perceived importance and, to some degree, enjoyment of sexuality.

The Present Study

In our study, we drew from earlier reports about historical changes in key aspects of sexuality in later life (e.g., Beckman et al., 2014; Forbes et al., 2017; Twenge et al., 2017) and extended those to specifically consider the importance and enjoyment of sexuality among adults in late midlife. Because many societal trends evolve gradually over time, one can expect developmentally relevant societal conditions to differ more strongly from one another the further away the historical times are that people have experienced and lived in when being at the same or comparable phases of their lives (Drewelies et al., 2019). There is empirical evidence implying that a time window of about 20 years may allow for historical changes in psychosocial functioning to emerge (e.g., Drewelies, Deeg, et al., 2018; Hülür et al., 2016). Thus, we investigated mean-level differences between two samples in perceived importance of sexuality and the enjoyment of one's sex life and examined the socio-demographic, physical health, and psychosocial correlates of both aspects of sexuality, as

well as their interactions with cohort membership to account for domain-specific cohort differences.

Method

Detailed information about participants, variables, and data collection procedures can be found in previous publications (Hoogendijk et al., 2016; Huisman et al., 2011) and online (Lasa-vu.nl, 2020). Selected details relevant for our report are noted below.

Participants and Procedure

The LASA is a prospective longitudinal study of middle-aged and older adults in the Netherlands, examining a wide range of physical, cognitive, emotional, and social aspects of functioning in the aging population (Huisman et al., 2011). Study participants were recruited from municipal registries in three, both urban and rural regions of the Netherlands, selected to optimally represent the Dutch older adult population.

The first LASA cohort included adults aged 55 to 85 years (born between 1908 and 1937), with older men and the oldest participants being oversampled. Sixty-two percent of contacted eligible persons completed the pre-initial Living Arrangements and Social Networks (LSN) interview ($n = 3805$), from which 3107 took part in the main LASA-I interview in 1992–1993 (Deeg et al., 2002). Of those, 966 participants (born between 1928 and 1937) were 55 to 65 years old. The third LASA cohort examined adults aged 55 to 65 years (born between 1948 and 1957). Of the contacted persons, 63% completed the interview, resulting in a sample size of 1023 participants (Hoogendijk et al., 2016). Eligible for inclusion in this report were participants aged 55 to 65 years who provided data on at least one of two sexuality measures of interest. From the first LASA cohort, our eligibility criteria led to 718 participants (73% of the eligible sample) that we have included in the *earlier-born* cohort ($M_{\text{age}} = 60.29$, $SD_{\text{age}} = 2.84$; 53% women; 82% in a relationship). From the third LASA cohort, we included 860 participants (84% of the eligible sample) in the *later-born* cohort ($M_{\text{age}} = 60.38$, $SD_{\text{age}} = 2.92$; 52% women; 82% in a relationship).

Sample selectivity analyses revealed that, in both cohorts, participants who provided data on the sexuality items of interest and were thus included in our analyses ($N = 718$ and $N = 860$, respectively) did not significantly differ from those who were not included ($N = 270$ and $N = 163$, respectively) on age, gender, partner status, comorbidity, functional limitations, and depressive symptoms. In the earlier-born LASA cohort, included participants were slightly more educated ($M = 9.64$, $SD = 3.21$ vs. $M = 8.88$, $SD = 3.46$, $F(1, 985) = 10.63$, $R^2 = .011$), reported lower salience of religion (12% vs. 21%, $F(1, 779) = 4.29$, $R^2 = .005$) and fewer perceived

constraints ($M = 11.87$, $SD = 3.29$ vs. $M = 12.52$, $SD = 3.55$, $F(1, 969) = 7.08$, $R^2 = .007$; all $ps < .05$) than those who were not. In the later-born cohort, there were no significant differences in education, religiosity, and perceived constraints. Descriptive information for both samples included in the study is provided in Table 1.

Data on sexuality measures of interest were available from the baseline assessment for each LASA cohort. Data on sexuality and salience of religion were collected via self-administered questionnaires; data on all other correlates used in this study were obtained as a part of the main face-to-face interview at participants' homes. The assessment procedures and all measures used here were identical for both samples.

Measures

Sexuality Two indicators of sexuality were assessed, each with a single item. The perceived importance of sexuality was assessed using the item “How important is sexuality for you now?”, answered on a five-point Likert scale ranging from very unimportant (1) to very important (5). Enjoyment of sexuality was assessed using the item “How do you experience your sex life now?”, answered on a five-point Likert scale ranging from very unpleasant (1) to very pleasant (5). An additional response category for the latter item was “not applicable.”

Cohort Cohort membership was treated as a dichotomous variable, contrasting those born between 1928 and 1937 who had provided data in 1992–1993 as the earlier-born cohort (0) with those born between 1948 and 1957 who had provided data in 2012–2013 as the later-born cohort (1).

Correlates As socio-demographic factors, *age* was calculated in years from the exact date of birth until the date of data collection. *Gender* was assessed as a dichotomous variable (0 = woman, 1 = man). *Education* was indexed as years of formal schooling. *Salience of religion* was derived from the questionnaire asking about important aspects in one's life. Participants were asked to indicate three out of nine aspects of life listed (including, for example, strong faith, good income, and good physical health) that they consider most important to them (Deeg, 2007). Using this information, we constructed a dichotomous variable, with those endorsing strong faith as one of the most important aspects of life (1) vs. not (0).

As physical health indicators, *multimorbidity* was indexed by the number of self-reported chronic illnesses from a list of eight medical conditions: heart disease, peripheral arterial disease, diabetes, chronic obstructive lung disease, cancer, osteoarthritis, rheumatoid arthritis, and stroke. A higher multimorbidity score (0–8) indicated more co-occurring illnesses reported by the participant. *Functional limitations* were based on self-reports for three activities expected to capture

mild levels of functional limitation: (a) walking up and down a staircase of 15 steps without resting, (b) using public or one's own transportation, and (c) cutting one's own toenails (Kriegsman et al., 1997). For each activity, participants were asked if they were able to perform the activity without difficulty (0) or not (1). For our report, we calculated a mean score across the three activities, ranging from 0 (no difficulties) to 3 (all with difficulty), Cronbach's alpha = .67/.68 (earlier-born/ later-born cohort, respectively; all alpha values acceptable, Cronbach, 1951; Tavakol & Dennick, 2011).

As psychosocial variables, *partner status* was assessed by asking participants whether they have a partner (inside or outside the household; 1) or not (0). The large majority of partnered participants were co-residing with the partner ($n = 1241$). In the small subgroup of participants not co-residing with the partner ($n = 51$), living-apart-together was the most common case (de Jong Gierveld, 2004). *Loneliness* was assessed using an 11-item scale (de Jong Gierveld & Kamphuis, 1985; de Jong Gierveld & van Tilburg, 1999) capturing emotional (perceived lack of close, intimate relationships; e.g., “I miss having a really close friend”) and social aspects of loneliness (lack of a broader social network; e.g., “there are plenty of people I can rely on when I have problems”), each answered as yes (1) vs. no (0), Cronbach's alpha = .87/.88. *Depressive symptoms* were measured using the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). The 20 items (e.g., “I felt sad”) referenced the past week and were answered on a 4-point scale ranging from rarely or never (0) to mostly or always (3), Cronbach's alpha = .88/.89. Finally, *perceived constraints* were measured with five negatively framed items selected from the Pearlin Mastery Scale (Pearlin & Schooler, 1978; e.g., “there is little I can do to change many of the important things in my life”), rated on a 5-point scale ranging from strongly disagree (1) to strongly agree (5), Cronbach's alpha = .74/.76.

Statistical Procedure and Data Analysis

To examine our research questions, we proceeded in two steps. In a first step, we examined mean-level differences between the two cohorts separately on (a) perceived importance and (b) enjoyment of sexuality using one-way ANOVA. In a second step, we conducted hierarchical regression analyses separately for the two sexuality measures to examine the predictive effect of cohort membership while accounting for a number of further correlates. We particularly aimed at examining the unique predictive effect of psychosocial factors, over and above the well-documented socio-demographic and health correlates of late-midlife sexuality. Thus, the stepwise sequence of models tested was as follows: cohort membership (model 1), age, gender, education (model 2), salience of

Table 1 Descriptive Statistics and Intercorrelations of Variables under Study, Separately for the Two Cohorts

Variables (range)	$M_{1992-1993}$	$SD_{1992-1993}$	Intercorrelations											
			1	2	3	4	5	6	7	8	9	10	11	12
1. Importance of sexuality (1–5)	3.08	1.03		.41**	-.03	.29**	.08*	-.02	-.17**	-.17**	.27**	-.09*	-.14**	-.16**
2. Enjoyment of sexuality (1–5)	3.71	0.82	.50**		-.04	.13**	.09*	.06	-.15**	-.19**	.11**	-.20**	-.22**	-.17**
3. Age (54.79–65.55)	60.29	2.84	-.14**	-.08		.02	-.05	-.03	.08*	.07*	-.01	.00	-.05	-.04
4. Men (0, 1)	0.47	0.50	.33**	.16**	.00		.10**	-.02	-.10**	-.07*	.12**	.06	-.14**	-.09**
5. Education (5–18)	9.64	3.21	.11**	.07	-.08*	.26**		-.07*	-.13**	-.17**	-.02	-.02	-.08*	-.19**
6. Salience of religion (0, 1)	0.12	0.33	-.02	.04	.03	-.06	-.06		-.04	-.04	.02	.00	-.07	.10**
7. Multimorbidity (0–8)	1.08	1.02	-.10*	-.07	.13**	-.09*	-.07*	-.01		.39**	-.11**	.11**	.23**	.17**
8. Functional limitations (0–3)	0.25	0.61	-.17**	-.10*	.09*	-.01	-.08*	.00	.33**		-.10**	.24**	.29**	.27**
9. Partnered (0, 1)	0.82	0.38	.34**	.05	-.08*	.14**	.07	.00	-.03	-.08*		-.34**	-.28**	-.13**
10. Loneliness (0–11)	1.59	2.29	-.14**	-.20**	.04	-.01	-.03	-.04	.14**	.14**	-.32**		.45**	.37**
11. Depressive symptoms (0–48)	6.96	7.28	-.14**	-.14**	.00	-.13**	-.07	.00	.20**	.27**	-.21**	.51**		.52**
12. Perceived constraints (5–25)	11.87	3.29	-.13**	-.18**	.05	-.09*	-.06	.01	.16**	.18**	-.09*	.33**	.44**	
$M_{2012-2013}$			3.21	3.61	60.38	0.48	11.70	0.09	1.55	0.44	0.82	1.45	7.22	11.32
$SD_{2012-2013}$			0.88	0.81	2.92	0.50	3.41	0.28	1.27	0.79	0.39	2.26	7.02	3.16

Note. $N = 1578$ ($N_{1992-1993} = 718$; $N_{2012-2013} = 860$). Descriptive statistics and intercorrelations for the earlier-born cohort (born between 1928 and 1937, data obtained in 1992–1993) are presented below the diagonal, for the later-born cohort (born between 1948 and 1957, data obtained in 2012–2013) above the diagonal. M = mean, SD = standard deviation. Age and education in years

* $p < .05$

** $p < .01$

religion (model 3), multimorbidity, functional limitations (model 4), relationship status, loneliness (model 5), depressive symptoms, and perceived constraints (model 6). When analyzing the enjoyment of sexuality item, we excluded participants who used the “not applicable” response category ($n = 305$ in total).

Additionally, acknowledging gender differences in how being partnered or not is associated with sexuality in later life (Kolodziejczak et al., 2019), we explicitly tested the interaction of gender and relationship status and the three-way interaction with cohort membership,

including the corresponding lower-order interactions. Also, we exploratory tested the quadratic term for age as well as two-way and higher-order interactions of cohort membership with correlates included in a stepwise manner, separately for importance and enjoyment of sexuality. Of those explored interactions, we trimmed all non-significant cohort interactions for parsimony (Grimm et al., 2016). The final model (model 6) includes each the aforementioned two- and three-way cohort interactions with gender and partner status, as well as the cohort interactions that occurred significant at $p < .01$

level and respective lower-order interactions. Age was centered at 60 years, and all other predictors were centered at the mean of the total sample. Analyses were conducted using the SAS 9.4 software.

Results

Table 1 shows descriptive statistics and intercorrelations of the variables under study. Three aspects are of note. First, importance and enjoyment of sexuality were moderately correlated in both samples ($r = .50$ for the earlier-born, and $r = .41$ for the later-born LASA cohort, both $ps < .01$), indicating that the two cover in part different aspects of the larger measurement space of sexuality. Second, both sexuality measures exhibited small to moderately sized associations with the correlates included, suggesting that the correlates represent a wide range of relevant background factors. Third, in line with previous LASA reports (Drewelies, Deeg, et al., 2018; Hoogendijk et al., 2016), later-born LASA participants reported on average higher education, $F(1, 1577) = 149.43, p < .01, d = .65$; higher multimorbidity, $F(1, 1576) = 65.07, p < .01, d = .39$; more functional limitations, $F(1, 1575) = 28.49, p < .01, d = .24$; and fewer perceived constraints, $F(1, 1561) = 11.32, p < .01, d = .22$. The percentage of partnered individuals did not differ between the two samples (82% for both cohorts).

Cohort Differences in Late-Midlife Sexuality

One-factor ANOVAs with cohort membership as the independent variable and the measures of sexuality as the respective dependent variable indicated that cohort differences were reliably different from zero for both the importance ($F[1, 1569] = 6.85, p < .01, d = .14$) and enjoyment of sexuality ($F[1, 1257] = 4.89, p < .05, d = -.12$). As can be inferred from Fig. 1, later-born adults in late midlife reported slightly higher importance of sexuality than their earlier-born peers, but they also experience their sex life as slightly less pleasant.

The Role of Socio-Demographic, Physical Health, and Psychosocial Factors

In a second step, we examined the role of the correlates for cohort differences in late-midlife sexuality. Table 2 reports results of hierarchical regression analyses for the perceived importance of sexuality. Three aspects are of note. First, the point estimate for the cohort effect has only minimally altered across the series of models and predictors included. Second, in the final model (model 6), being younger ($\beta = -.06, p < .01$), being a man ($\beta = .26, p < .01$), reporting fewer functional limitations ($\beta = -.08, p < .01$), having a partner ($\beta = .23, p < .01$), and perceiving fewer constraints in one's life ($\beta = -.06,$

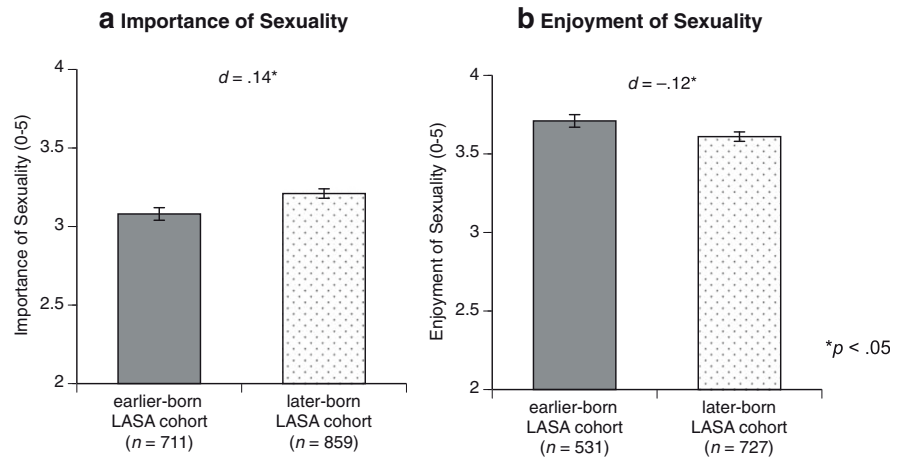
$p < .05$) were each and independently associated with attributing more importance to sexuality. Additionally, three statistically significant interaction effects emerged. The gender-by-partner-status two-way interaction is graphically illustrated in Fig. 2 (upper panels a and b). It can be inferred that both men and women in late midlife perceived sexuality as less important when they did not have a partner. However, for women having no partner, the difference was more prominent than for men without a partner, a large effect size for women ($d = .92$) and a medium effect size for men ($d = .43$). The three-way cohort-by-gender-by-partner-status interaction is also shown in Fig. 2 (lower panels c to f) and indicates that later-born women without a partner perceived sexuality as more important, compared with earlier-born single same-aged women. That is, historical increases in the importance of sexuality were particularly pronounced among women having no partner, the effect size lies in the medium range ($d = .56$). The last three-way cohort-by-education-by-perceived-constraints interaction indicates that historical increases in the importance of sexuality were particularly pronounced among adults in late midlife with high education and who perceive few constraints. The effect size lay in the small range ($d = .26$).

Table 3 reports results of hierarchical regression analyses for the enjoyment of sexuality. Two aspects are of note. First, the point estimate for the cohort effect has again only minimally altered across the series of models and predictors included, but in the final model, the effect did not reliably differ from zero at the significance level $p < .05$. Second, in the final model (model 6), younger age ($\beta = -.05, p < .05$), being a man ($\beta = .14, p < .01$), reporting higher salience of religion ($\beta = .06, p < .05$), reporting fewer functional limitations ($\beta = -.08, p < .05$), feeling less lonely ($\beta = -.13, p < .01$), and perceiving fewer constraints ($\beta = -.07, p < .01$) were each and independently associated with experiencing one's sex life as more pleasant. For enjoyment of sexuality, the two-way gender-by-partner-status interaction and the same three-way interaction with cohort membership were both not statistically significant. We have not found any other two- or three-way cohort interactions that would reliably differ from zero at the significance level $p < .01$. Cohort membership and the correlates included in our models conjointly accounted for 22% of the variance in importance of sexuality and 10% in the enjoyment of one's sex life.

Discussion

The objective of this study was to examine cohort differences among adults in late midlife in (a) the importance they attribute to sexuality and (b) the enjoyment of their current sex life and to investigate further socio-demographic, physical health, and psychosocial correlates of perceived importance and enjoyment of sexuality in late midlife, as well as to account for

Fig. 1 Cohort Differences in Perceived Importance and Enjoyment of Sexuality Among Adults in Late Midlife



Note. Mean levels, standard errors, and effect sizes (Cohen's d) for perceived importance (left-hand panel a) and enjoyment of sexuality (right-hand panel b), separately for two LASA cohorts: those born between 1928 and 1937 (earlier-born LASA cohort; data obtained in 1992–1993) and born between 1948 and 1957 (later-born LASA cohort; data obtained in 2012–2013). The group sizes (n s) are indicated in the category labels.

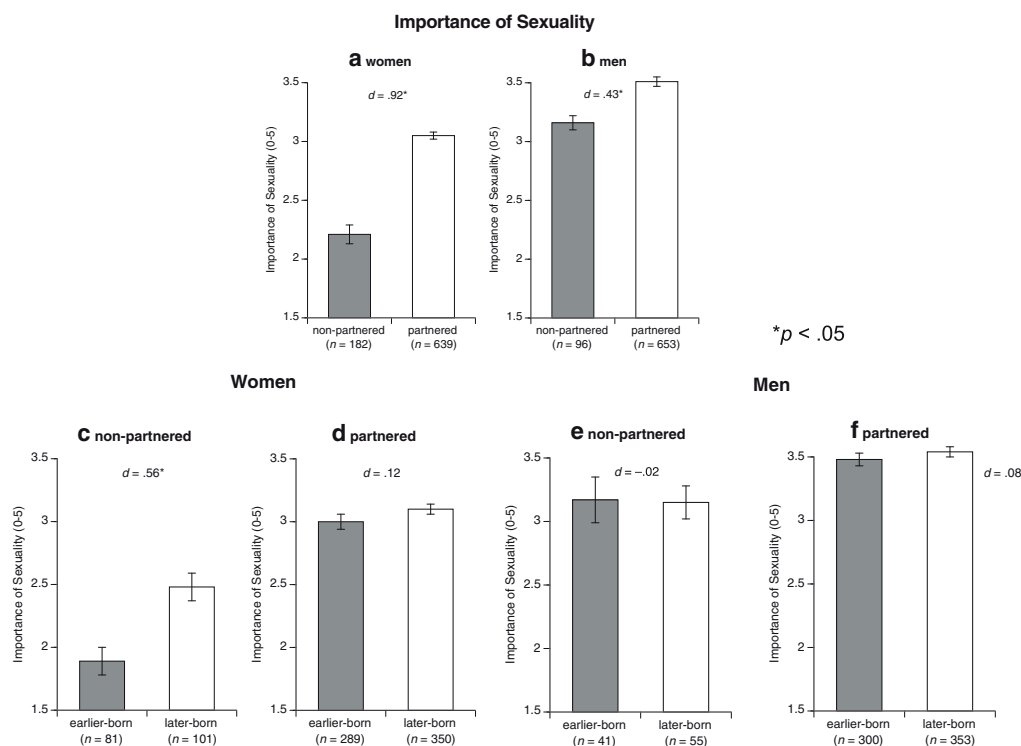
Table 2 Standardized Betas (β) from Regression Analyses of Perceived Importance of Sexuality by Cohort and the Correlates

Predictors	Importance of sexuality					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Cohort	.07**	.06*	.06*	.09**	.08**	.06*
Age	–	–.09**	–.08**	–.07**	–.06**	–.06**
Men	–	.31**	.30**	.30**	.27**	.26**
Education	–	.04	.04	.01	.03	.02
Salience of religion	–	–	.00	–.01	–.01	.00
Multimorbidity	–	–	–	–.05*	–.05	–.04
Functional limitations	–	–	–	–.12**	–.10**	–.08**
Partnered	–	–	–	–	.23**	.23**
Loneliness	–	–	–	–	–.01	.00
Depressive symptoms	–	–	–	–	–	.02
Perceived constraints	–	–	–	–	–	–.06*
Men \times Partnered	–	–	–	–	–.11**	–.10**
Education \times Perceived constraints	–	–	–	–	–	.03
Cohort \times Men	–	–	–	–	–.04	–.04
Cohort \times Education	–	–	–	–	–	.01
Cohort \times Partnered	–	–	–	–	–.04	–.04
Cohort \times Perceived constraints	–	–	–	–	–	–.01
Cohort \times Men \times Partnered	–	–	–	–	.06*	.06*
Cohort \times Education \times P. constraints	–	–	–	–	–	–.07**
Total R^2	<.01	.11	.11	.13	.21	.22
F	6.85**	48.52**	37.45**	32.78**	31.87**	22.06**
(dfs)	(1, 1569)	(4, 1569)	(5, 1553)	(7, 1550)	(13, 1547)	(19, 1531)

Note. $N = 1570$ ($N_{1992-1993} = 711$; $N_{2012-2013} = 859$). Age centered at 60 years; all other predictors grand mean centered

* $p < .05$

** $p < .01$



Note. Mean levels, standard errors, and effect sizes (Cohen's d) for perceived importance of sexuality, separately for women (upper left-hand panel a) and men (upper right-hand panel b) pooled across both LASA cohorts (data obtained in 1992–1993 and 2012–2013), and mean levels, standard errors, and effect sizes (Cohen's d) for perceived importance of sexuality by gender and relationship status, separately for the earlier-born (data obtained in 1992–1993) and the later-born (data obtained in 2012–2013) LASA cohorts (lower panels c to f). The group sizes (n s) are indicated in the category labels.

Fig. 2 Gender Differences in Perceived Importance of Sexuality and Cohort Differences in the Gender-by-Partner-Status Interaction Effect of on Importance of Sexuality Among Adults in Late Midlife

their cohort interactions. To do so, we used data from the LASA obtained 20 years apart from two independent samples. Zero-order analyses revealed that later-born adults in their late midlife interviewed in 2012–2013 considered sexuality slightly more important than the earlier-born same-aged adults asked 20 years earlier, and they reported experiencing their sex lives as slightly less pleasant. When covarying for socio-demographic, physical health, and psychosocial factors, cohort differences in perceived importance of sexuality remained statistically significant at the $p < .05$ level, but cohort differences in enjoyment of sexuality were not statistically significant anymore. We discuss ways to interpret our findings and consider their implications.

Cohort Differences in Late-Midlife Sexuality

At the study population level, effects of cohort membership on both indicators of sexuality among adults in late midlife were small in size. To illustrate, for the importance of sexuality, the predictive effect of partner status was about four times larger than the population-level cohort effect (β s = .23 vs. .06). In contrast, moderate effect sizes of cohort membership were

obtained for the perceived importance of sexuality within certain population segments, such as women without a partner and people with higher education also reporting fewer constraints. It is thus possible that the increases in the importance attributed to sexuality found at the zero-order level were mostly driven by historical changes in particular population segments. Because the significant three-way interaction effects with cohort membership were identified in an exploratory manner, the interpretation of such findings is purely speculative and should be treated with some caution. For women with no partner, one possible explanation is that they have particularly benefited from less pronounced gender disparities today (Shockley & Shen, 2015), as well as changes in social norms and attitudes toward non-marital sexuality (Karraker et al., 2011) and late-life sexuality (Bouman et al., 2007) that have both become more permissive over the past decades. One could also speculate about the role of hormonal replacement therapy, which has been widely applied to reduce menopausal symptoms, but can also increase sexual desire in postmenopausal women (Cappelletti & Wallen, 2016). It is possible that better sexual functioning in women constitutes one of the factors that contributed to the documented historical rise in

Table 3 Standardized Betas (β) from Regression Analyses of Enjoyment of Sexuality by Cohort and the Correlates

Predictors	Enjoyment of sexuality					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Cohort	-.06*	-.07*	-.07*	-.04	-.04	-.05
Age	–	-.06*	-.06*	-.05	-.05	-.05*
Men	–	.14**	.15**	.14**	.16**	.14**
Education	–	.05	.05	.03	.03	.03
Salience of religion	–	–	.06*	.06*	.05	.06*
Multimorbidity	–	–	–	-.06*	-.05	-.04
Functional limitations	–	–	–	-.12**	-.10**	-.08*
Partnered	–	–	–	–	.04	.04
Loneliness	–	–	–	–	-.17**	-.13**
Depressive symptoms	–	–	–	–	–	-.05
Perceived constraints	–	–	–	–	–	-.07*
Men \times Partnered	–	–	–	–	.05	.04
Cohort \times Men	–	–	–	–	-.01	-.01
Cohort \times Partnered	–	–	–	–	.02	.02
Cohort \times Men \times Partnered	–	–	–	–	-.02	-.01
Total R^2	< .01	.03	.04	.06	.10	.10
F	4.89*	10.34**	9.66**	11.41**	10.00**	9.28**
(dfs)	(1, 1257)	(4, 1257)	(5, 1246)	(7, 1244)	(13, 1241)	(15, 1231)

Note. $N = 1258$ ($N_{1992-1993} = 531$; $N_{2012-2013} = 727$). Age centered at 60 years; all other predictors grand mean centered

* $p < .05$

** $p < .01$

perceiving sexuality as an important aspect of one's life. The higher importance attributed to sexuality by more educated adults in late midlife who perceive fewer constraints may indicate that education and a high sense of control over one's life have been increasingly relevant resources for perceiving sexuality as an important area of this period in life. Historical change in importance of late-midlife sexuality might thus have been taking place gradually in the past decades, spearheaded by those educated individuals perceiving fewer constraints in their lives. One could also speculate that highly educated adults with a high sense of control are more prone to dissolve an unsatisfying relationship today than in the past (Finkel et al., 2015), and that historical increases in the importance of sexuality in this population segment are partially driven by partner changes.

Cohort effects in the enjoyment of sexuality indicated that later-born adults in late midlife experience their sex life as slightly less pleasant than their earlier-born peers. These effects, however, were minor in size at the population level and not reliably different from zero when relevant background factors were covaried. Independent of whether the effects are reliably different from zero or not, we note that, in our study sample, considering sexuality more important today than in

the past did not go hand in hand with experiencing one's sex life as more enjoyable. It is possible that increasing importance of sex life creates new expectations toward sexuality. Similar to the developments of higher expectations toward one's marriage (Finkel et al., 2015), individuals might apply higher standards to sexuality today and expect both themselves and their partners to sexually perform in ways that cannot easily be fulfilled. Also, it is an open question whether the medical progress of the past decades has increased the frequency of sexual activity without necessarily improving the quality of sex life (Lee et al., 2015).

For both sexuality aspects, it is not possible to disentangle whether the cohort differences observed reflect actual changes in experiences and perceptions of sexuality, or the willingness to report on these. Given that the attitudes toward later-life sexuality have become more positive over the past decades (Beckman et al., 2008), it is possible that the willingness to reveal and share information about one's sex life has increased, too. Interpreted this way, higher importance of sexuality among later-born cohorts would reflect changes in the communication about late-midlife sexuality rather than in the actual value attributed to sexuality. Although the underlying mechanisms remain unclear, one could take our findings as

contributing to the empirical evidence that older adults today hold, to some degree, different attitudes toward sexuality than in the past (DeLamater, 2012). Drawing from earlier reports (e.g., Mercer et al., 2013), we speculate that these findings likely mirror the shift toward the liberalization of social norms in Western societies.

The Role of Socio-Demographic, Physical Health, and Psychosocial Factors

Our findings corroborated and extended previous reports that socio-demographic, physical health, and psychosocial factors are relevant correlates of central sexuality facets in later life. To begin with, our finding that men in late midlife consider sexuality as more important and slightly more pleasant than same-aged women parallels findings obtained from samples of older adults (e.g., Müller et al., 2014; Syme et al., 2012) and qualifies these by partner status. Acknowledging that the menopause transition often undermines sexual functioning in women (Avis et al., 2017), we speculate that the importance postmenopausal women attribute to sexuality depends much more on relationship-oriented motivational processes than spontaneous (hormone-driven) sexual desire. Such motivational component of the female sexual response, including nonsexual motivation for sexual behavior, has already been postulated by Basson (2000) and shown in empirical studies for premenopausal women (Dewitte & Mayer, 2018). After having become widowed or divorced, downgrading the importance of sexuality may thus serve as an adaptive self-regulatory strategy (Gott & Hinchliff, 2003). More mechanism-oriented research is needed to disentangle biological from psychosocial factors affecting sexuality in later life, which can help better understand sexuality of postmenopausal women.

After covarying for socio-demographic and psychosocial factors, multimorbidity was significantly associated with neither perceived importance nor enjoyment of sexuality. These findings are in line with some of the earlier reports showing that, at the population level, individual differences in psychosocial functioning are often more decisive for sexuality than diagnosed illnesses or medications (DeLamater & Sill, 2005; Kolodziejczak et al., 2019). Our finding that reporting more functional limitations was related to lower scores on both importance and enjoyment of sexuality is in line with the expectation that key quality of life outcomes are not so much shaped by the mere presence of a (medical) condition, but more so by the way this condition interferes with living an independent life. Also, engaging in sexual activity when people have one or another form of physical limitations, especially if these occurred recently, requires some degree of extra energy, which might be increasingly limited in late midlife.

We also found that perceiving fewer constraints in one's life was related to both considering sexuality more important

and experiencing one's sex life as more pleasant. These findings enrich and complement earlier reports that perceiving more control over the sexual aspects of life is related to more frequent sexual activity (Lachman & Firth, 2004) and higher quality of sex life in middle age (Forbes et al., 2017). Because of the cross-sectional nature of our study, it is not possible to address questions about temporal ordering or lead-lag associations. Thus, it is possible that perceiving lower constraints contributes to attributing higher importance to one's sex life and experiencing it as more pleasant. Likewise, valuing sexuality more and having a pleasant sex life may help people perceive fewer constraints in their lives. Finally, higher loneliness was not associated with perceived importance of sexuality, but it was related to lower enjoyment of sex life. Follow-up analyses including the emotional or social component of the loneliness scale as a correlate, respectively, revealed a substantively identical pattern of results as reported in the main text. This suggests that people in middle age who experience loneliness do not necessarily attribute less importance to sexuality, but being lonely is associated with how people feel about their sex lives. Again, our findings do not allow us to draw any inferences about the direction of such associations.

Limitations and Outlook

We note several limitations of our study measures, design, and sample. To begin with, as a limitation of our outcome measures, both aspects of sexuality examined here were assessed with a single item each. Thus, internal consistency as a measure of reliability cannot be computed and there is a risk of an unknown bias of individual interpretation. Despite the noted limitations, single-item measures are often used in research on sexuality. In several aspects, these have shown convergent validity with results obtained from more comprehensive measures, but lower test-retest reliability (e.g., for sexual satisfaction, Mark et al., 2014). It is thus important to corroborate and extend our findings with more comprehensive measures.

Among our predictor variables, salience of religion was operationally defined as a dichotomous variable and reflects endorsing strong faith as one of the most important aspects in life vs. not. Being to some degree religious, attending church, or other forms of religious involvement (Braam et al., 2004), was not analyzed in our study. We thus note that the results obtained for religiosity might have been restricted by the dichotomous variable type and may not generalize to other types of religiosity measures. We also note that all data used in our study were based on self-reports. Thus, an unknown self-report bias, e.g., due to reference group comparisons (Dowd & Todd, 2011) cannot be excluded. Given that the correlates examined did explain small to moderate shares of variance ($R^2 = .10$ to $.22$), further predictors of importance and enjoyment of late-midlife sexuality should be considered. For

example, it would be intriguing for future research to make use of behavioral data that were not available in the current study. For example, it is possible that if enjoyment declines because sexual problems emerge, then importance (in the sense of salience, tension between partners, etc.) might increase as a result. From a psychological perspective, examining differences in the attitudes toward aging and experiences of ageism might help explain additional portions of variance in the importance attributed to sexuality and the enjoyment of sex life (Estill et al., 2018). For cohort differences, we speculate that more positive views on aging among adults born later could enhance their experience of sexuality as an important and enjoyable area of life.

As limitations of the study design, we note that data on sexuality measures of interest were available for each cohort only at baseline assessment. Drawing from reports showing less steep age-related declines in psychosocial functioning among later-born older adults (for internal control beliefs: Gerstorff et al., 2019; for cognitive functioning: Gerstorff et al., 2011), we would speculate that age trajectories of the sexuality facets examined here probably also exhibit later onset and less steep rates of decline. Among the possible contributing factors could be medical progress of the past decades, which has been aimed to reduce the declines in sexual function often accompanying aging (e.g., low sexual desire among postmenopausal women; Cappelletti & Wallen, 2016; erectile dysfunction after prostate cancer and radical prostatectomy; Salonia et al., 2015).

As a limitation of our sample, we acknowledge that our findings were derived from adults in late midlife (55 to 65 years) living in a highly developed Western nation. Although the study sample was selected to optimally represent the Dutch population, with respondents from both predominantly protestant, predominantly catholic, and largely secularized areas of the Netherlands (Hoogendijk et al., 2016), the data indicated a high degree of secularization: only 9 to 12% of the participants (in the later-born and earlier-born cohort, respectively) were endorsing strong faith as one of the most important aspects in life. It is thus an open question whether the historical changes documented here generalize to populations with a different cultural background. Because sexuality is shaped by socio-cultural circumstances, we would expect that societies fostering less permissive views on later-life sexuality (e.g., because of having not experienced the sexual revolution of the 1960s and 1970s) will exhibit a different pattern of secular changes. At the same time, it is an open question whether and how our findings generalize to other Western European and non-European nations, including the USA. For example, it will be intriguing to examine whether the historical rise in the importance of sexuality for non-partnered Dutch women can also be found in other regions. Considering the interaction effects, we note that the small

numbers in the category groups might have limited our statistical power and result in very few significant interaction effects with cohort membership.

Also, we acknowledge that only less than 1% of participants included in the analysis from both cohorts reported being in a non-marital same-sex relationship ($n = 15$, in total). Whereas same-sex marriages were legalized in the Netherlands in 2001, the LASA questionnaire on partner status remained unchanged since 1992 and allows to specify the sex of the non-marital partner, but not the sex of the spouse. Thus, it remains unclear how many participants in the later-born cohort were in a same-sex marital relationship. Because of this limitation of our partner status measure, and due to a small number of respondents in non-heterosexual relationships, we were not able to account for sexual orientation in our analysis, or draw comparisons between heterosexual and non-heterosexual partnered individuals.

Finally, our findings on cohort differences in the importance and enjoyment of sexuality in late midlife should be corroborated and put into perspective in further studies, e.g., by examining if these results hold across other cohorts and periods. We note that our analyses do not allow concluding that there is a linear increase in the perceived importance of sexuality, with each successively born generation perceiving sex in midlife as more important than the preceding one. On the contrary, our follow-up analyses treating year of birth as continuous predictor (procedures applied as in other cohort studies, e.g., Drewelies, Deeg, et al., 2018) suggest an initial rise in the importance of sexuality for those born in the late 1930s and early 1940s, compared with those born in the late 1920s and early 1930s, followed by a plateau (see [Online Supplementary Material](#)). Several studies have recently reported historical declines in sexual frequency among adults in developed Western countries (e.g., Twenge et al., 2017; Wellings et al., 2019). It is an open question, how these and other reported changes in sex lives of young adults will impact their perceptions of sexuality in their 50s and 60s.

Conclusions

In closing, our analyses of cohort differences using the LASA data have revealed a small-sized and robust historical increase of the perceived importance of sexuality in late midlife at the population level that was mostly driven by moderately sized increases in the importance of sexuality in particular population segments, such as women who do not have a partner. After accounting for a number of further factors, cohort membership has not reliably predicted change in enjoyment of sexuality. Our findings contribute to the literature on sexuality in later life undergoing historical changes, with later-born adults in late midlife being more likely to report sexuality as important. More mechanism-oriented research is needed to

better understand whether and how these changes are intertwined with other areas of life.

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Compliance with Ethical Standards

The LASA study was approved by the Medical Ethics Committee of the VU University Medical Center in Amsterdam, the Netherlands (IRB numbers 92/138 and 2012/361), and conducted based on the Declaration of Helsinki.

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Correction to: Perceived Importance and Enjoyment of Sexuality in Late Midlife: Cohort Differences in the Longitudinal Aging Study Amsterdam (LASA)

Karolina Kolodziejczak¹ · Johanna Drewelies¹ · Dorly J. H. Deeg² · Martjin Huisman^{2,3} · Denis Gerstorf^{1,4}

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✉ Karolina Kolodziejczak
karolina.kolodziejczak@hu-berlin.de

¹ Department of Psychology, Humboldt University Berlin, Unter den Linden 6, 10099 Berlin, Germany

² Department of Epidemiology and Data Science, Amsterdam Public Health Research Institute, Amsterdam UMC, Vrije Universiteit Amsterdam, Amsterdam, the Netherlands

³ Department of Sociology, Vrije Universiteit Amsterdam, Amsterdam, the Netherlands

⁴ Department of Human Development and Family Studies, Pennsylvania State University, State College, PA, USA

ONLINE SUPPLEMENTARY MATERIAL

Perceived Importance and Enjoyment of Sexuality in Late Midlife:
Cohort Differences in the Longitudinal Aging Study Amsterdam (LASA)

Karolina Kolodziejczak¹, Johanna Drewelies¹,
Dorly J. H. Deeg², Martijn Huisman^{2,3}, & Denis Gerstorf^{1,4}

¹Department of Psychology, Humboldt University Berlin, Berlin, Germany

²Department of Epidemiology and Data Science, Amsterdam Public Health Research Institute,
Amsterdam UMC, Vrije Universiteit Amsterdam, Amsterdam, the Netherlands

³Department of Sociology, Vrije Universiteit Amsterdam, Amsterdam, the Netherlands

⁴Department of Human Development and Family Studies, Pennsylvania State University,
State College, PA, USA

Author Note

Correspondence regarding this manuscript to: Karolina Kolodziejczak, Humboldt University Berlin, Department of Psychology, Unter den Linden 6, 10099 Berlin, Germany. Phone number: +49 (030) 2093-9424. Fax: +49 (030) 2093-9351. E-mail: karolina.kolodziejczak@hu-berlin.de.

In follow-up analyses, we additionally included data collected in 2002–2003 from 55- to 65-year-old adults (born between 1938–1947) and tested the association between the year of birth as a predictor variable (numeric variable ranging from 1928 to 1957 instead of the categorical cohort variable) and (a) perceived importance and (b) enjoyment of sexuality, respectively. Results are reported in Table S1. Later year of birth was related to higher ratings of the perceived importance of sexuality, which is consistent with the findings obtained from the analyses using the binary cohort variable, reported in the main text. However, when introducing a quadratic term for year of birth and simultaneously covarying for the socio-demographic, physical health, and psychosocial variables, the quadratic but not the linear effect of year of birth was reliably different from zero (graphically illustrated in Figure S1). Specifically, an initial historical rise in the importance of sexuality occurred for adults in late midlife born in the 1930s and 1940s, followed by reaching a plateau for those born in the 1950s.

In turn, later year of birth was significantly related to experiencing sexuality as slightly less pleasant only when including into the analysis all other predictors. For the enjoyment of sexuality, the quadratic term for year of birth as cohort variable was not statistically different from zero and thus omitted in the full model.

Table S1

Standardized Betas (β) From Separate Regression Analyses of Perceived Importance of Sexuality and Enjoyment of Sexuality by Year of Birth and the Correlates Using LASA Cohorts 1, 2, 3

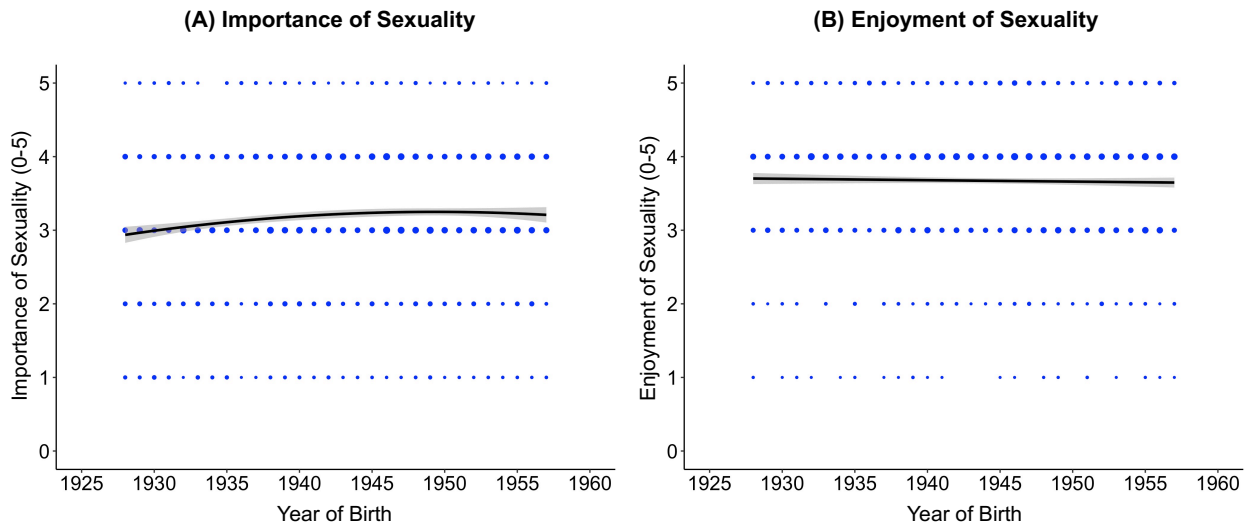
Predictors	Importance of sexuality		Enjoyment of sexuality	
	Model 1	Model 2	Model 1	Model 2
Year of birth	.08**	.03	-.02	-.05*
Year of birth (quadratic)	–	-.04*	–	–
Age	–	-.06**	–	-.10**
Men	–	.28**	–	.15**
Education	–	.06**	–	.02
Salience of religion	–	-.01	–	.05
Multimorbidity	–	-.01	–	-.02
Functional limitations	–	-.05*	–	-.08**
Partnered	–	.19**	–	.02
Loneliness	–	-.03	–	-.14**
Depressive symptoms	–	-.01	–	-.08**
Perceived constraints	–	-.07**	–	-.08**
Men \times Partnered	–	-.09**	–	.04
Education \times Perceived constr.	–	.03	–	–
Year of birth \times Men	–	-.03	–	.00
Year of birth \times Education	–	.00	–	–
Year of birth \times Partnered	–	-.03	–	.00
Year of birth \times Perceived constr.	–	-.01	–	–
Year of birth \times Men \times Partnered	–	.05*	–	-.01
Year of birth \times Education \times Perceived constr.	–	-.05*	–	–
Total R^2	< .01	.21	< .01	.12
F	17.14**	31.43**	0.75	17.69**
(dfs)	(1, 2489)	(20, 2440)	(1, 2489)	(15,1955)

Note. $N = 2,490$ ($N_{1992-1993} = 711$; $N_{2002-2003} = 920$; $N_{2012-2013} = 859$). Age centered at 60 years; all other predictors grand-mean centered.

* $p < .05$, ** $p < .01$

Figure S1

Associations Between Year of Birth and Perceived Importance (Quadratic Effect; Left-Hand Panel A) and Enjoyment of Sexuality (Linear Effect; Right-Hand Panel B) Among Adults in Late Midlife



Note. Data were obtained from all three Longitudinal Aging Study Amsterdam (LASA) cohorts of 55- to 65-year-old adults born between 1928 and 1957. For visual presentation, marker size was frequency weighted and confidence intervals (95%) were represented around the regression line.

Research Article

Physical Intimacy in Older Couples' Everyday Lives: Its Frequency and Links With Affect and Salivary Cortisol

Karolina Kolodziejczak, Mag.,^{1,*} Johanna Drewelies, PhD,^{1,2} Theresa Pauly, PhD,^{3,6} Nilam Ram, PhD,⁴ Christiane Hoppmann, PhD,⁵ and Denis Gerstorf, PhD^{1,6,6}

¹Department of Psychology, Humboldt University Berlin, Berlin, Germany. ²Department of Gender in Medicine, Charité Universitätsmedizin Berlin, Berlin, Germany. ³Department of Psychology, University of Zurich, Zürich, Switzerland. ⁴Departments of Psychology and Communication, Stanford University, Stanford, California, USA. ⁵Department of Psychology and Center for Hip Health & Mobility, University of British Columbia, Vancouver, British Columbia, Canada. ⁶The German Socio-Economic Panel (SOEP), German Institute for Economic Research (DIW), Berlin, Germany.

*Address correspondence to: Karolina Kolodziejczak, Mag., Department of Psychology, Humboldt University Berlin, Unter den Linden 6, 10099 Berlin, Germany. E-mail: karolina.kolodziejczak@hu-berlin.de

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Abstract

Objectives: Physical intimacy is important for communicating affection in romantic relationships. Theoretical and empirical work highlights linkages between physical intimacy, affect, and physiological stress among young and middle-aged adults, but not older adults. We examine physical intimacy and its associations with positive and negative affect and cortisol levels in the daily lives of older couples.

Methods: We applied actor–partner multilevel models to repeated daily-life assessments of physical intimacy (experienced and wished) and affect obtained 6 times a day over 7 consecutive days from 120 older heterosexual German couples ($M_{\text{age}} = 71.6$, $SD_{\text{age}} = 5.94$). Physiological stress was indexed as total daily cortisol output, the area under the curve with respect to ground (AUC_g).

Results: Physical intimacy experienced and wished were reported at the vast majority of occasions, but to different degrees at different times. Within persons, in moments when participants experienced more physical intimacy, older women reported less negative affect, whereas older men reported more positive affect. Between persons, higher overall levels of physical intimacy experienced were associated with higher positive affect and less negative affect among women and with lower daily cortisol output among men. A stronger wish for intimacy was related to more negative affect among both women and men, and to higher daily cortisol output among men.

Discussion: Physical intimacy is linked with mood and stress hormones in the daily life of older couples. We consider routes for future inquiry on physical intimacy among older adults.

Keywords: Affectionate touch, Physiological stress, Positive and negative emotions, Repeated within-person assessment, Romantic partners

Physical intimacy is intertwined with relational, psychological, and physical well-being, and thus constitutes an important component of close relationships (Burlleson et al., 2013; Jakubiak & Feeny, 2017). Research with younger

samples has shown that physical intimacy in everyday life, such as a hug or a kiss, is associated with elevated mood and reduced secretion of stress hormones (e.g., Ditzen et al., 2008), but we know little about the frequency and

correlates of physical intimacy in the day-to-day lives of older adults. Importantly, the few studies available demonstrate that many older adults who have a partner often report experiencing physical intimacy (e.g., [Freak-Poli, Kirkman, et al., 2017](#); [Lee, Nazroo, et al., 2016](#)). It is not yet known, though, how everyday physical intimacy in old age relates to time-varying indicators of well-being such as positive affect, negative affect, and stress hormone levels. To address these questions, we applied actor-partner multilevel models ([Kenny et al., 2006](#)) to daily-life data on intimacy, affect, and salivary cortisol from 120 heterosexual German couples aged 56–88 years ($M_{\text{age}} = 71.6$, $SD_{\text{age}} = 5.94$) obtained up to seven times per day over seven consecutive days.

Everyday Physical Intimacy in Older Couples

Physical intimacy is linked with indicators of successful aging, such as social embeddedness ([Kolodziejczak et al., 2019](#)) or enjoyment of life ([Smith et al., 2019](#)), and thus requires more focus in aging research. Conceptual accounts suggest that one facet of physical intimacy is *affectionate touch*, defined as touch actually or typically demonstrating affection (e.g., love; care), for example, hugging, caressing, or kissing ([Floyd, 2006](#); [Jakubiak & Feeney, 2017](#)). In some (operational) definitions, the nonsexual aspects of affectionate touch are emphasized ([Galinsky et al., 2014](#); [Gulledge et al., 2007](#)); in other definitions affectionate touch is not aimed at immediate sexual gratification ([Burlinson et al., 2013](#)), whereas elsewhere it is closely intertwined with sexuality ([Smith et al., 2019](#)). Following this literature, we refer to broadly defined everyday affectionate touch as *physical intimacy*.

Physical intimacy is an important channel for communicating affection throughout life, which helps maintain romantic relationships ([Debrot et al., 2013](#); [Gallace & Spence, 2010](#)). Correspondingly, various forms of everyday intimacy are often reported by partnered older adults ([Freak-Poli, Kirkman, et al., 2017](#); [Lee, Nazroo, et al., 2016](#); [Waite et al., 2009](#)). However, these empirical studies have typically asked whether participants have experienced physical intimacy over the past 6–12 months. Such one-time retrospective reports cannot capture the interpersonal and intrapersonal dynamics that characterize how intimacy unfolds in older adults' daily life. Additionally important is that the majority of older adults continue to desire intimacy in their 60s to 90s ([Galinsky et al., 2014](#)). For example, more than 80% of partnered German women and 90% of men in their mid-70s rated physical intimacy as important, and these numbers were higher than the ratings of sexual activity ([Müller et al., 2014](#)). This suggests that physical intimacy is highly valued and possibly desired by considerable proportions of older couples. Consequently, in the present study we examine both experienced and wished physical intimacy.

Importantly, physical intimacy takes place in a *dyadic* context. Accounting for factors from both partners helps capture the nature of daily-life partnered sexuality more accurately ([Dewitte et al., 2015](#)). Research from a dyadic perspective has demonstrated that, in older couples, the frequency of wishing for sexual activity was interrelated and correlated with the frequency of sexual activity ([Waite et al., 2017](#)). Likewise, both one's own and the partner's physical intimacy wished might be crucial for experiencing physical intimacy, which is in alignment with the idea that both partners would need to consent to intimacy. In turn, physical intimacy experienced might affect one's well-being. For example, experiencing more physical intimacy was related to more positive affect ([Debrot et al., 2013](#)) and lower daily stress hormone levels in young and middle-aged couples ([Ditzen et al., 2008](#)). In older couples, partners' physical intimacy wished might also be directly linked with indicators of well-being such as affect and (an absence of) physiological stress, similarly to how sexual desire is related to partnered older adults' subjective well-being (see [Lee, Vanhoutte, et al., 2016](#)).

Everyday Physical Intimacy and Affect in Older Couples

Conceptual perspectives have long posited that physical intimacy is closely intertwined with affect in romantic relationships ([Gallace & Spence, 2010](#); [Gulledge et al., 2007](#)). Drawing from [Jakubiak and Feeney's \(2017\)](#) work, we assume that physical intimacy contributes in many ways to well-being, both through neurobiological (e.g., via an upregulating hormone release, such as oxytocin and endogenous opioids) and relational-cognitive pathways (e.g., feeling valued and accepted). According to this, neuroendocrine and cognitive changes that occur in response to touch are expected to improve mood. Empirically, associations of everyday physical intimacy with affect have received less attention than those of sexual activity. However, the few studies available indicate that everyday intimacy is experienced more often than sexual activity among partnered individuals (e.g., [Lee, Nazroo, et al., 2016](#)) and is associated with positive affect and negative affect among young and middle-aged adults ([Burlinson et al., 2007](#); [Ditzen et al., 2008](#)). For older partnered individuals, initial evidence suggests that experiencing physical intimacy in the past 6 months is associated with higher positive affect ([Freak-Poli, De Castro Lima, et al., 2017](#)). Investigating the association between physical intimacy and affect in the daily life of older couples may help shed more light on relationship characteristics relevant for well-being in old age.

Everyday Physical Intimacy and Physiological Stress in Older Couples

Another central notion of physical intimacy in romantic relationships is the buffering of stress. Again, conceptual

accounts suggest that well-being and health benefits due to physical intimacy presumably occur through neurobiological and relational-cognitive pathways (Jakubiak & Feeney, 2017; Shrout, 2021). For example, the neuromodulator oxytocin that is released due to physical intimacy targets multiple areas in the brain and might induce, among others, feelings and cognitions of safety and belonging (Ditzen et al., 2019). This, in turn, downregulates physiological stress parameters. Correspondingly, in laboratory studies, gentle forms of intimacy between romantic partners (e.g., shoulder massage or hugging; holding hands during conflict discussions) have been found to lower people's stress-induced cortisol levels, heart rate, and blood pressure (Ditzen et al., 2007, 2019; Gullledge et al., 2003; Light et al., 2005). In daily-life studies, cortisol, as a biomarker of stress that indexes activity of the hypothalamus–pituitary–adrenal axis (Piazza et al., 2010), is uniquely suited to highlight both between- and within-person characteristics that relate to stress reactivity (Hoppmann et al., 2018). Importantly, in daily-life studies, salivary cortisol assessments are relatively easy to implement and maximize ecological validity (Kudielka et al., 2012). Initial evidence exists that middle-aged couples who spent more time in physical intimacy exhibit lower daily salivary cortisol levels (Ditzen et al., 2008). This demonstrates the utility of salivary cortisol assessments in daily life for providing insights into the stress-buffering role of physical intimacy. To the best of our knowledge, links between physical intimacy and daily cortisol levels have not yet been examined among older couples.

The Present Study

This study examines (1) how physical intimacy fluctuates in older couples' daily lives and (2) how these fluctuations are associated with (a) self-reported positive affect and negative affect and (b) overall cortisol levels. To do so, we used data from 120 couples aged 56–88 years that reported momentary physical intimacy experienced and wished, and positive and negative affect. Additionally, participants provided salivary cortisol samples. Based on prior research on physical intimacy in the everyday lives of younger and middle-aged couples (Ditzen et al., 2008), we focused on overall daily cortisol secretion operationally defined by the area under the curve with respect to ground (AUC_g; Pruessner et al., 2003). In our models, we controlled for variables known to influence daily emotions, cortisol profiles, and physical intimacy (including chronological age, education, body mass index [BMI], and relationship satisfaction: Gullledge et al., 2003; Hoppmann et al., 2018; Wrzus et al., 2013). We utilized gender as a distinguishing variable (Bolger & Laurenceau, 2013), but did not have any specific predictions regarding gender differences in the pattern of results. Drawing from previous literature that demonstrates how intimacy is linked with affect and cortisol levels among young and middle-aged adults (e.g., Burleson et al., 2007; Ditzen et al., 2008), we hypothesize that experiencing physical intimacy is associated

with higher positive affect, lower negative affect, and lower salivary cortisol AUC_g levels in daily lives of older partnered adults. Additionally, we explore how both the actor's and partner's physical intimacy wished relates to changes in momentary affect and daily cortisol. Moreover, we test two-way interactions of physical intimacy, both experienced and wished, with other independent variables under study. We hypothesize that, for example, in moments when wish for intimacy is stronger than usual, experiencing more physical intimacy than usual correlates with more positive affect.

Method

Participants and Procedure

Participants consisted of 120 older heterosexual German couples recruited from the Socio-Economic Panel (Wagner et al., 2007). In 2018, trained interviewers contacted participants who fulfilled the eligibility criteria: Speaking German fluently; being around retirement age or older; living in a heterosexual relationship, married or cohabiting; having no vision or hearing impairments that could interfere with using an iPad; and having received treatment if participants had currently been diagnosed with hyper- or hypothyroidism. Studies with similar design and sample size ($n = 87$: Drewelies et al., 2020) showed significant actor and partner effects, suggesting that our study should provide sufficient statistical power to examine within-person associations (Bolger et al., 2011).

The protocol consisted of an introduction session, repeated daily-life assessments across seven consecutive days, and a Computer-Assisted Personal Interview. During a typical week, participants completed six short questionnaires per day (upon waking, at 10 a.m., 1 p.m., 4 p.m., 7 p.m., and 9 p.m.) using an iPad, and provided saliva samples seven times per day concurrent to the questionnaires and additionally 30 min after waking (so as to capture diurnal cortisol profiles: Nater et al., 2013). To avoid interference with daily routines, respondents were allowed to fill out questionnaires between 10 a.m. and 9 p.m. either 30 min prior or up to 120 min after the preset times (average deviation from scheduled times was 10 min, $SD = 22.84$). In the closing session, participants rated the study week as typical for their everyday lives ($M = 4.08$, $SD = 1.02$, ranging from 1 = "not at all" to 5 = "very typical") and were compensated up to 100 Euros per person for completing all assessments. Further information on the study protocol can be found elsewhere (Pauly, Kolodziejczak, et al., 2021). Ethics approval for data collection was granted by the ethics committee of the Department of Psychology at Humboldt University Berlin.

Measures

Physical intimacy

We assessed two aspects of physical intimacy. First, momentary *physical intimacy wished* with "Since the last

questionnaire, how much did you wish to have some kind of physical intimacy (e.g., touching, hugging, or kissing) with your partner?”, answered using a 0 (“no particular wish”) to 100 (“strong wish”) sliding scale. Second, momentary *physical intimacy experienced* with “Since the last questionnaire, how much physical intimacy did you actually experience with your partner?”, rated on a 0 (“no intimacy at all”) to 100 (“much intimacy”) scale.

Positive and negative affect

Using the item “How (e.g., happy) do you feel right now?”, momentary *positive affect* was assessed with six items (mean across: “happy,” “interested,” “inspired,” “relaxed,” “balanced,” and “at rest”) and momentary *negative affect* with seven items (mean across: “depressed,” “disappointed,” “groggy,” “downcast”/“glum,” “overwhelmed,” “nervous,” and “jittery”), each answered using a 0 (“not at all”) to 100 (“strongly”) scale. The *select items* cover a broad range of low and high arousal emotions that have been shown in previous studies to: (a) fluctuate from one moment to the next, (b) be associated among older adults with other important daily-life constructs, such as perceived control or health sensitivity (e.g., Drewelies et al., 2020; Potter et al., 2021), and (c) exhibit good within-person reliabilities in our analysis sample ($R_c = 0.74$ for positive affect, $R_c = 0.78$ for negative affect; calculated as recommended by Cranford et al., 2006).

Salivary cortisol AUC_g

Participants provided saliva samples using synthetic sticks in plastic tubes (Salivette® Cortisol, Sarstedt, Nümbrecht, Germany), labeled to indicate day of study and time of assessment. Samples were stored during the study week in participants’ home freezer, afterwards at -31°C at Humboldt University Berlin, and subsequently shipped to Dresden LabService GmbH (Prof. Clemens Kirschbaum) for cortisol assaying; extremely low and high values were double-checked. The data were screened for compliance with the collection protocol (Hoppmann et al., 2018).

As an indicator of physiological stress, we calculated for each study day the area under the curve with respect to ground (AUC_g), derived from the trapezoid formula using the discrete cortisol measurements and the time between measurements (Pruessner et al., 2003). We calculated AUC_g for days on which the two first cortisol measurements (upon waking and 30 min later) and in total, at least 3 cortisol measurements per day were available. Higher AUC_g scores can be interpreted as reflecting higher overall physiological stress levels (Hoppmann et al., 2018).

Covariates

Age was calculated as the difference between a participant’s year of birth and the year of data collection. *Education* was assessed as years of formal schooling. *BMI* was calculated as self-reported body weight in kilograms, divided by self-reported height in meters squared. *Relationship satisfaction*

was assessed with the item: “All in all, how would you rate your current relationship?”, answered on a 5-point scale ranging from 1 (“very bad”) to 5 (“very good”). The utility of single-item measures of relationship satisfaction in large-scale studies has been shown elsewhere (Fülöp et al., 2020).

Data Preparation

Participants provided valid data on both physical intimacy and affect on more than 9,780 occasions (e.g., physical intimacy experienced: $M = 40.77$ of 42 possible, $SD = 2.30$, range = 24–42). To model between-person differences and within-person fluctuations simultaneously, we separated the repeated assessments into time-invariant between-person variables (calculated as the person-specific mean over 42 occasions, i.e., *physical intimacy experienced* BP_{*i*} and *physical intimacy wished* BP_{*i*}), and time-varying within-person variables (occasion-specific deviations from the person-specific mean for positive affect and negative affect as outcome variables, and day-specific deviations for salivary cortisol AUC_g as outcome variable, *physical intimacy experienced* WP_{*it*} and *physical intimacy wished* WP_{*it*}; Bolger & Laurenceau, 2013). Acknowledging that intimacy takes place in a dyadic context (Hülür & Weber, 2019), we additionally created partner variables: *partner physical intimacy wished* BP_{*i*} and *partner physical intimacy wished* WP_{*it*}. Unconditional multilevel models revealed that 50% of the variance in momentary positive affect originated at the measurement occasion level, 32% at the between-person level, and 18% at the couple level. For momentary negative affect, the numbers were highly comparable (43%, 40%, and 17%, respectively).

Valid cortisol measurements were available on 11,405 occasions ($M = 47.52$ of 49 scheduled assessments, $SD = 3.99$, range = 14–49). As part of data cleaning, we winsorized cortisol (i.e., outliers of $>\pm 3 SD$ recoded as $\pm 3 SD$) and imputed missing values on occasions 3 through 7 ($n = 145$ occasions; 1.27%) using person-and-assessment-time-specific mean cortisol values (Wrosch et al., 2007). We replaced missing values on time intervals between assessments with the person-and-assessment-time-specific mean at occasions 1 and 2, and with the assessment-time-specific time interval at occasions 3 through 7 (180 or 120 min). For model convergence, we scaled the AUC_g cortisol variable at 1:100. The within-person predictors were centered at the person mean, age was centered at 70 years, and all other between-person predictors were centered at the sample mean. Unconditional models showed that 40% of the variance in the daily AUC_g originated at the day level, 42% at the person level, and 18% at the couple level.

Data Analysis

We examined our research questions using repeated measures actor-partner interdependence models for distinguishable dyads, implemented in a multilevel modeling

framework (Bolger & Laurenceau, 2013; Kenny et al., 2006). For the momentary positive affect outcome, we specified our models (subscript w for women; identical models for men and for negative affect) as:

$$\begin{aligned} \text{Positive affect}_{iitw} = & \beta_{0iw} \\ & + \beta_{1iw}(\text{physical intimacy experienced WP}_{iitw}) \\ & + \beta_{2iw}(\text{physical intimacy wished WP}_{iitw}) \\ & + \beta_{3iw}(\text{partner physical intimacy wished WP}_{iitw}) \\ & + e_{iitw}, \end{aligned} \quad (1)$$

where positive affect reported at occasion t by woman i is a function of a person-specific intercept coefficient β_{0i} that indicates the expected value of the woman's momentary positive affect; a person-specific slope coefficient β_{1i} that indicates the association between occasion-specific physical intimacy experienced and momentary positive affect; a person-specific slope β_{2i} that indicates the association between woman's physical intimacy wished and positive affect; a person-specific slope β_{3i} that indicates the association between male partner's physical intimacy wished and woman's positive affect; and residual error, e_{it} . Between-person differences in the person-specific intercept coefficient β_{0i} were modeled as:

$$\begin{aligned} \beta_{0iw} = & \gamma_{00w} + \gamma_{01w}(\text{age}_{iitw}) + \gamma_{02w}(\text{education}_{iitw}) \\ & + \gamma_{03w}(\text{BMI}_{iitw}) \\ & + \gamma_{04w}(\text{relationship satisfaction}_{iitw}) \\ & + \gamma_{05w}(\text{physical intimacy experienced BP}_{iitw}) \\ & + \gamma_{06w}(\text{physical intimacy wished BP}_{iitw}) \\ & + \gamma_{07w}(\text{partner physical intimacy wished BP}_{iitw}) \\ & + \gamma_{08w}(\text{physical intimacy experienced BP}_{iitw} \\ & \times \text{physical intimacy wished BP}_{iitw}) + u_{0iw}, \end{aligned} \quad (2)$$

and the person-specific coefficients β_{1i} , β_{2i} , and β_{3i} were modeled as:

$$\beta_{1iw} = \gamma_{10w} + \gamma_{11w}(\text{physical intimacy wished WP}_{iitw}) + u_{1iw}, \quad (3)$$

$$\beta_{2iw} = \gamma_{20w} + \gamma_{21w}(\text{physical intimacy wished BP}_{iitw}) + u_{2iw}, \quad (4)$$

$$\beta_{3iw} = \gamma_{30w}, \quad (5)$$

where γ_{00} indicates the expected momentary positive affect scores for the prototypical older partnered woman in the sample; γ_{10} and γ_{20} represent prototypical within-person associations between woman's momentary positive affect and physical intimacy experienced or physical intimacy wished, respectively; and γ_{30} indicates the prototypical association between the woman's positive affect and her partner's physical intimacy wished. Statistically significant two-way interactions, γ_{08w} , γ_{11w} , and γ_{21w} were identified in exploratory ways (for each outcome separately), and, in the final models, nonsignificant interactions (at alpha level of 0.05 for both women and men) were trimmed. The level-2 residuals, u_{0iw} and u_{0im} , the level-1 residuals, u_{1iw} and u_{1im} , and

u_{2iw} and u_{2im} , and the level-1 residual error terms, e_{iitw} and e_{iitm} , were allowed to covary,

$$\begin{bmatrix} u_{0iitw} \\ u_{0iitm} \end{bmatrix} \sim \text{MVN} \left(0, \begin{bmatrix} \sigma^2 u_{0w} & \\ \sigma u_{0w} u_{0m} & \sigma^2 u_{0m} \end{bmatrix} \right) \quad (6)$$

$$\begin{bmatrix} u_{1iitw} \\ u_{1iitm} \end{bmatrix} \sim \text{MVN} \left(0, \begin{bmatrix} \sigma^2 u_{1w} & \\ \sigma u_{1w} u_{1m} & \sigma^2 u_{1m} \end{bmatrix} \right) \quad (7)$$

$$\begin{bmatrix} u_{2iitw} \\ u_{2iitm} \end{bmatrix} \sim \text{MVN} \left(0, \begin{bmatrix} \sigma^2 u_{2w} & \\ \sigma u_{2w} u_{2m} & \sigma^2 u_{2m} \end{bmatrix} \right) \quad (8)$$

$$\begin{bmatrix} e_{iitw} \\ e_{iitm} \end{bmatrix} \sim \text{MVN} \left(0, \begin{bmatrix} \sigma^2 e_w & \\ \sigma e_w e_m & \sigma^2 e_m \end{bmatrix} \right) \quad (9)$$

Also, residuals were allowed to covary between successive occasions (autocorrelation). All equations described above were estimated simultaneously for women and men in a dyadic multilevel model.

For daily salivary cortisol AUC_g, the within-person physical intimacy variables were configured as *day*-specific (instead of moment-specific) deviations from person-specific means (for details, see [Supplementary Material](#)). All models were estimated with SAS PROC MIXED (Littell et al., 2006) using restricted maximum likelihood estimation with missing data treated as missing at random (Little & Rubin, 1987).

Results

Descriptive statistics and bivariate correlations for the variables under study are presented in [Table 1](#). Participants ($N = 240$) were on average in their early 70s, predominantly married (97%), and in a long-term relationship ($M = 46.5$, $SD = 11.2$, range = 12–66 years). Relative to men, women reported on average lower positive affect ($d = 0.44$), physical intimacy experienced ($d = 0.26$), and physical intimacy wished ($d = 0.60$), and exhibited lower daily cortisol levels ($d = 0.31$). Experiencing more physical intimacy was associated with higher positive affect among both women ($r = 0.34$) and men ($r = 0.37$, both $ps < 0.05$) and with lower daily cortisol levels among men ($r = -0.20$ $p < 0.05$).

Everyday Physical Intimacy in Older Couples

Mean physical intimacy experienced across occasions was 36.61 ($SD = 31.63$, median = 30.00), mean physical intimacy wished was 36.63 ($SD = 31.43$, median = 31.00); both distributions were positively skewed (0.36–0.37). On 75% of all occasions, ratings of both experienced and wished physical intimacy were ≥ 6 (interquartile range = 59). Mean levels of both experienced and wished physical intimacy were highest between 9 p.m. and waking ($M = 45.11$; $SD = 31.87$ for physical intimacy experienced and $M = 43.04$; $SD = 31.22$

Table 1. Descriptive Statistics and Intercorrelations for the Variables Under Study

		Intercorrelations									
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1)	Salivary cortisol AUC ₆ (2.15–118.78)		-0.07	0.03	-0.04	0.08	-0.05	0.11	-0.20*	-0.04	-0.13
(2)	Positive affect (32.05–96.56)	-0.06		-0.67*	0.18*	0.05	-0.05	0.39*	0.37*	0.16	0.20*
(3)	Negative affect (0.08–65.53)	0.14	-0.62*		-0.09	-0.03	0.13	-0.41*	-0.13	0.14	-0.16
(4)	Age (56–88)	0.13	-0.04	0.07		0.00	-0.23*	0.17	0.06	-0.02	0.05
(5)	Education (1–17)	-0.05	0.12	-0.21*	-0.22*		-0.20*	0.09	-0.11	-0.03	0.03
(6)	Body mass index (17.04–49.60)	-0.06	0.12	-0.09	-0.14	-0.03		-0.08	-0.02	-0.04	0.04
(7)	Relationship satisfaction (1–5)	-0.07	0.30*	-0.35*	0.12	-0.01	0.01		0.33*	0.15	0.17
(8)	Physical intimacy experienced (0–98.24)	-0.01	0.34*	-0.05	0.15	-0.14	-0.07	0.34*		0.73*	0.40*
(9)	Physical intimacy wished (0.48–99.90)	-0.04	0.16	0.18*	0.10	-0.12	0.00	0.17	0.71*		0.38*
(10)	Partner physical intimacy wished (0.48–99.90)	-0.02	0.11	0.07	-0.06	-0.10	0.07	0.08	0.45*	0.38*	
<i>M</i> _{women}		47.83 ^a	64.20 ^a	17.46	70.28 ^a	9.64 ^a	26.60	4.29	33.64 ^a	29.48 ^a	44.01 ^a
<i>SD</i> _{women}		15.18	12.86	13.33	6.00	2.04	5.61	0.81	23.28	23.56	25.20
<i>M</i> _{men}		53.05 ^a	69.64 ^a	16.45	72.83 ^a	10.25 ^a	27.37	4.38	39.73 ^a	44.01 ^a	29.48 ^a
<i>SD</i> _{men}		18.60	11.68	13.01	5.63	2.63	4.27	0.64	24.18	25.20	23.56

Notes: *N* = 120 couples (240 individuals) who provided on average data on approx. 41 occasions (on positive affect, negative affect, physical intimacy experienced, and physical intimacy wished) and approx. 48 saliva samples each. Intercorrelations for women presented below the diagonal, for men above the diagonal. All variables are between-person; values in brackets represent sample minimum and maximum. *M* = mean. *SD* = standard deviation. AUC₆ = the area under the curve with respect to ground, scaled 1:100 for the purposes of the analysis. Positive affect = average of ratings for relaxed, balanced, at rest, happy, interested, inspired. Negative affect = average of ratings for depressed, disappointed, groggy, downcast/gloom, overwhelmed, nervous, jittery. Age and education in years. Mean levels that differ between women and men (tested using ANOVA at *p* < .05 level) share the superscript (^a). **p* < .05.

for physical intimacy wished) followed by the time between waking up and 10 a.m. ($M = 40.07$; $SD = 31.92$ and $M = 38.47$; $SD = 31.38$, respectively). The average within-person correlation between both intimacy variables was 0.46 ($SD = 0.28$). Example distribution of physical intimacy experienced and wished over the course of the study is depicted in Figure 1. It shows interindividual differences in how much physical intimacy fluctuated within and across days.

Everyday Physical Intimacy and Affect in Older Couples

Results from actor-partner multilevel models for positive affect and negative affect as outcome variables are presented in Table 2. The prototypical level of momentary positive affect was $\gamma_{00w} = 62.506$ for women and $\gamma_{00m} = 66.949$ for men. As expected, among women, experiencing more physical intimacy was associated

with more positive affect at the between-person level ($\gamma_{05w} = 0.236$), and among men, at the within-person level ($\gamma_{10m} = 0.035$). No significant associations between positive affect and physical intimacy wished (both actor and partner effects) were found. For the covariates, higher relationship satisfaction was associated with more positive affect among both women and men ($\gamma_{04w} = 3.028$, $\gamma_{04m} = 3.857$); no significant associations were found for age, education, and BMI. Additionally, several significant interaction effects occurred. For example, older women and men who reported on average more physical intimacy wished but less physical intimacy experienced also reported lower positive affect ($\gamma_{08w} = 0.006$, $\gamma_{08m} = 0.004$). Women's and men's intercepts were correlated 0.32, and the level-1 residuals 0.18. Fixed effects explained $\approx 22\%$ of the variability in women's and 24% variance in men's positive affect.

The prototypical level of negative affect was $\gamma_{00w} = 18.883$ for women and $\gamma_{00m} = 17.170$ for men. Among women, experiencing more physical intimacy at both between-person and within-person level was associated with less negative affect ($\gamma_{05w} = -0.164$, $\gamma_{10w} = -0.027$). The within-person associations of physical intimacy experienced with negative affect among women are depicted in Figure 2, showing that in moments of experiencing more physical intimacy than usual, women reported less negative affect. Among men, no associations between physical intimacy experienced and negative affect were found. Women and men with higher overall levels of physical intimacy wished had higher negative affect ($\gamma_{06w} = 0.218$, $\gamma_{06m} = 0.190$). No partner effects emerged. For the covariates, higher education among women was related to lower negative affect ($\gamma_{02w} = -1.049$), and higher BMI among men was related to more negative affect ($\gamma_{03m} = 0.521$). Higher relationship satisfaction was associated with lower negative affect ($\gamma_{04w} = -5.332$, $\gamma_{04m} = -5.382$). Again, significant interactions occurred. For example, participants who reported on average more physical intimacy wished and on average less physical intimacy experienced, also reported more negative affect ($\gamma_{08w} = -0.004$, $\gamma_{08m} = -0.006$). Women's and men's intercepts were correlated 0.17, and the level-1 residuals 0.24. Fixed effects explained $\approx 27\%$ of the variability in women's and 30% in men's negative affect.

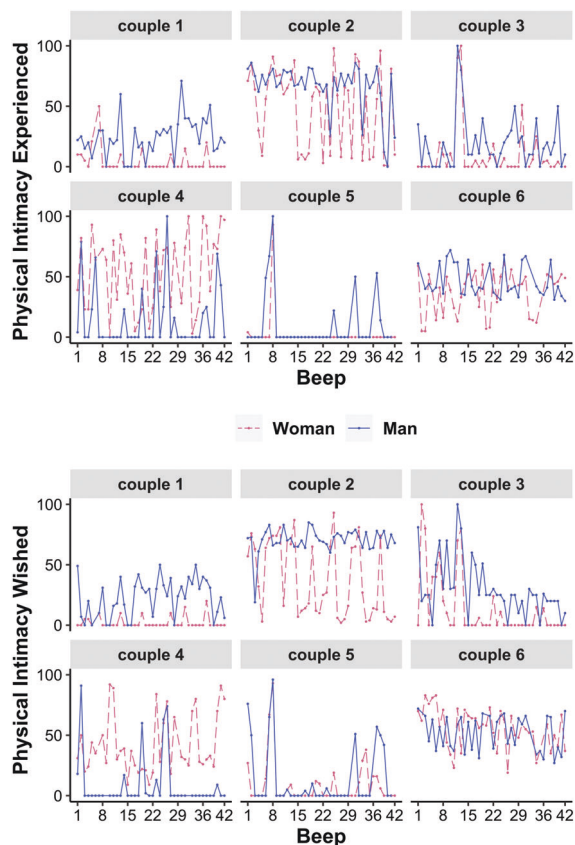


Figure 1. Distribution of responses on physical intimacy experienced (upper panel) and physical intimacy wished (bottom panel) over the course of the study. Data plotted for six randomly selected couples. It can be obtained that study participants differed in how much physical intimacy they experienced and wished for throughout the week and in how much their reports on intimacy fluctuated within days and across days. Full color version is available within the online issue.

Everyday Physical Intimacy and Physiological Stress in Older Couples

Table 2 presents findings for cortisol. Prototypical daily cortisol output (scaled at 1:100) was $\gamma_{00w} = 49.611$ for women and $\gamma_{00m} = 49.339$ for men. As hypothesized, men with higher overall levels of physical intimacy had lower daily cortisol levels ($\gamma_{05m} = -0.392$), and men who reported more overall wish for intimacy also had higher cortisol levels ($\gamma_{06m} = 0.257$). Contrary to expectations, we found no significant associations of physical intimacy

Table 2. Multilevel Models Examining Positive Affect (Left-Hand), Negative Affect (Middle), and Total Daily Salivary Cortisol AUC_g (Right-Hand) Each as a Function of Physical Intimacy, Physical Intimacy Wished, Partner Physical Intimacy Wished, and Age, Education, Body Mass Index, and Relationship Satisfaction

Parameter	Positive affect				Negative affect				Salivary cortisol AUC _g			
	Women		Men		Women		Men		Women		Men	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Fixed effects												
Intercept, γ_{00}	62.506*	1.382	66.949*	1.432	18.883*	1.412	17.170*	1.538	49.611*	1.861	49.339*	2.382
Age, γ_{01}	-0.277	0.172	0.123	0.168	0.131	0.181	0.131	0.182	0.503*	0.252	-0.181	0.284
Education, γ_{02}	0.433	0.491	0.309	0.358	-1.049*	0.521	0.136	0.390	0.260	0.699	-0.203	0.643
Body mass index, γ_{03}	0.238	0.177	-0.112	0.220	-0.186	0.189	0.321*	0.240	-0.025	0.248	-0.179	0.365
Relationship satisfaction, γ_{04}	3.028*	1.312	3.857*	1.568	-5.332*	1.367	-5.382*	1.705	-0.948	1.784	5.770*	2.595
Physical intimacy experienced BP, γ_{05}	0.236*	0.066	0.080	0.068	-0.164*	0.070	-0.050	0.074	0.043	0.091	-0.392*	0.115
Physical intimacy experienced WP, γ_{10}	0.022	0.014	0.035*	0.012	-0.027*	0.010	-0.027	0.014	-0.039	0.050	0.006	0.055
Physical intimacy wished BP, γ_{06}	-0.080	0.061	-0.018	0.057	0.218*	0.014	0.190*	0.061	-0.035	0.085	0.257*	0.098
Physical intimacy wished WP, γ_{20}	0.025	0.017	0.017	0.015	0.012	0.013	0.015	0.014	-0.054	0.054	-0.054	0.063
Partner physical intimacy wished BP, γ_{07}	-0.046	0.047	0.006	0.045	0.032	0.047	-0.063	0.048	0.007	0.064	-0.125	0.075
Partner physical intimacy wished WP, γ_{30}	-0.019	0.011	0.006	0.009	-0.002	0.010	0.011	0.008	0.049	0.050	-0.038	0.054
Physical intimacy experienced BP × Physical intimacy wished BP, γ_{08}	0.006*	0.002	0.004*	0.002	-0.004*	0.002	-0.006*	0.002	-0.004*	0.002	0.007*	0.003
Age × Physical intimacy wished BP, γ_{09}	—	—	—	—	—	—	—	—	0.009	0.011	-0.026*	0.011
Education × Physical intimacy wished BP, γ_{010}	—	—	—	—	—	—	—	—	0.048	0.030	0.054*	0.027
Physical intimacy experienced WP × Physical intimacy wished WP, γ_{11}	0.001*	0.001	0.001	0.001	—	—	—	—	—	—	—	—
Physical intimacy wished BP × Physical intimacy wished WP, γ_{21a}	0.002*	0.001	0.003*	0.001	-0.002*	0.001	-0.003*	0.001	—	—	—	—
Age × Physical intimacy wished WP, γ_{21b}	—	—	—	—	—	—	—	—	-0.016	0.008	0.019*	0.009
Random effects												
Between couples												
Variance intercept, σ^2_{i0}	125.30*	17.899	101.26*	14.249	126.87*	17.935	115.29*	16.170	192.71*	31.365	247.15*	39.401
Variance physical intimacy experienced WP, σ^2_{i1}	0.007*	0.003	0.005*	0.002	0.002	0.002	0.012*	0.003	—	—	—	—
Variance physical intimacy wished WP, σ^2_{i2}	0.011*	0.004	0.010*	0.003	0.005*	0.002	0.010*	0.003	—	—	—	—
Covariance physical intimacy experienced WP intercept, σ_{i1i0}	35.276*	12.037	-0.151	0.164	20.183	12.875	-0.204	0.166	81.664*	26.666	—	—
Covariance physical intimacy experienced WP women intercept men, σ_{i1i0}^{woman}	-0.115	0.143	—	—	-0.067	0.129	—	—	—	—	—	—
Covariance physical intimacy experienced WP men intercept men, σ_{i1i0}^{man}	0.070	0.132	—	—	-0.093	0.115	—	—	—	—	—	—
Covariance physical intimacy experienced WP men intercept women, σ_{i1i0}^{woman}	—	—	—	—	-0.162	0.174	—	—	—	—	—	—

Table 2. Continued

Parameter	Positive affect			Negative affect			Salivary cortisol AUC _g					
	Women		Men	Women		Men	Women		Men			
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE		
Covariance physical intimacy experienced WP women men, $\sigma_{\eta_{10e}^2 \eta_{11m}}$	0.001	0.002			-0.001	0.002						
Covariance physical intimacy wished WP intercept, $\sigma_{\eta_{20}^2 \eta_0}$	-0.097	0.202	-0.158	0.153	-0.193	0.160	0.211	0.181				
Covariance physical intimacy wished WP women intercept men, $\sigma_{\eta_{20e}^2 \eta_{10m}}$	0.116	0.184			0.095	0.159						
Covariance physical intimacy wished WP physical intimacy WP, $\sigma_{\eta_{20}^2 \eta_1}$	-0.003	0.003	-0.002	0.002	-0.001	0.001	-0.004*	0.002				
Covariance physical intimacy wished WP women physical intimacy WP men, $\sigma_{\eta_{20e}^2 \eta_{11m}}$	0.004	0.002			0.003	0.002						
Covariance physical intimacy wished WP men intercept women, $\sigma_{\eta_{20m}^2 \eta_{10e}}$	-0.492*	0.171			-0.107	0.175						
Covariance physical intimacy wished WP men physical intimacy WP women, $\sigma_{\eta_{20m}^2 \eta_{11e}}$	-0.001	0.003			0.001	0.002						
Covariance physical intimacy wished WP men physical intimacy wished WP men	-0.003	0.003			-0.003	0.002						
Within couples												
Residual variance, e_{η_i}	119.19*	2.577	182.02*	3.972	102.29*	2.290	144.49*	3.199	205.94*	12.056	185.55*	10.880
Residual covariance women men, $e_{\eta_{11e} \eta_{11m}}$	37.584*	2.307			22.628*	1.863			35.239*	7.767		
Autocorrelation	0.176*	0.011			0.240*	0.011			0.186*	0.036		
Fit indices												
AIC	74,930.0		74,880.0		73,033.3		72,983.3		13,652.2		13,638.2	
-2LL												

Notes: N = 120 couples (240 individuals). Number of observations used in the momentary data model = 9,503. Number of observations used in the daily data model = 1,628. Estimate unstandardized. Positive affect = average of ratings for relaxed, balanced, at rest, happy, interested, inspired. Negative affect = average of ratings for depressed, disappointed, groggy, downcast/glum, overwhelmed, nervous, jittery. For model convergence, the salivary cortisol AUC_g variable was scaled at 1:100. -2LL = -2 res log likelihood; AIC = Akaike information criterion; AUC_g = the area under the curve with respect to ground; BP = between-person variable (person-specific mean over 42 occasions); SE = standard error; WP = within-person variable (occasion- or day-specific deviation from the person-specific mean); γ_{211} = Interaction effect examined in model for positive/negative affect as outcome variable only. γ_{211b} = Interaction effect examined in model for as salivary cortisol AUC_g as outcome variable only.

* $p < .05$.

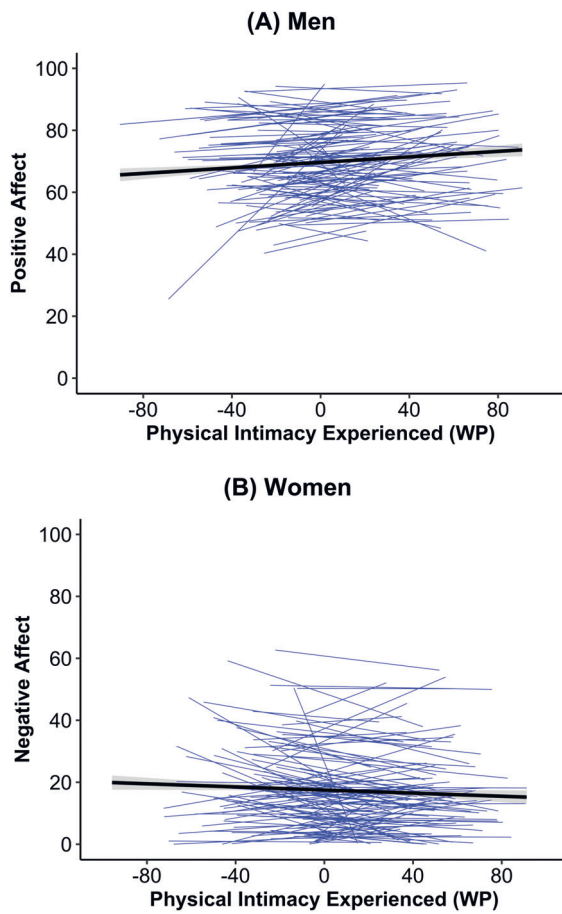


Figure 2. $N = 120$ couples (9,784 observations). Illustrating zero-order associations between physical intimacy experienced (within-person variable) and momentary positive affect among men (panel A) and momentary negative affect among women (panel B). It can be obtained that in moments of more physical intimacy than usual, men reported more positive affect and women reported less negative affect. Confidence intervals (95%) were represented around the regression line. WP = within-person variable. Full color version is available within the online issue.

experienced with cortisol among women, and no within-person associations of physical intimacy experienced with cortisol among men. Considering the covariates, older age among women ($\gamma_{01w} = 0.503$) and higher relationship satisfaction among men ($\gamma_{04m} = 5.770$) were related to higher daily cortisol output. Between-person associations between physical intimacy experienced and cortisol AUC_g are depicted in Figure 3. For the interactions, for example, men who reported on average more physical intimacy wished and less physical intimacy experienced, also had higher daily cortisol outputs ($\gamma_{08m} = 0.007$). Women's and men's intercepts were correlated 0.37, and the level-1 residuals 0.19. Fixed effects explained $\approx 1\%$ variance in women's and $\approx 20\%$ in men's physiological stress levels.

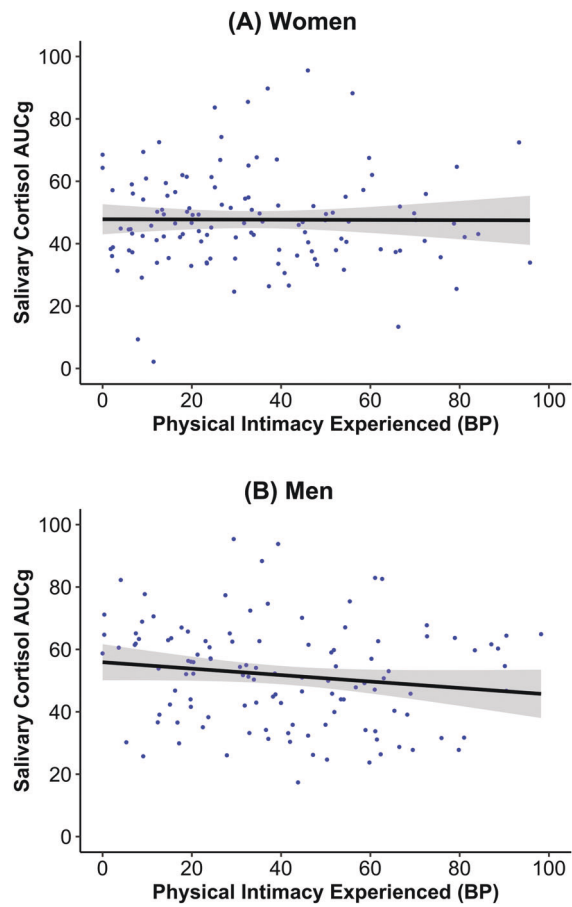


Figure 3. $N = 120$ couples (240 observations). Illustrating zero-order associations between mean physical intimacy experienced and the mean daily cortisol output calculated as the AUC_g , separately for women (panel A) and men (panel B). It can be obtained that, at the between-person level, experiencing more physical intimacy was associated with lower daily cortisol levels among men, but not women. Confidence intervals (95%) were represented around the regression line. AUC_g = the area under the curve with respect to ground; BP = between-person variable. Full color version is available within the online issue.

Discussion

Our objective was to provide further insights into the nature of physical intimacy and its associations with affect and physiological stress in the daily lives of older couples. Results revealed that in moments of more physical intimacy experienced, women reported less negative affect, and men reported more positive affect. For the between-person associations, women who experienced on average more physical intimacy reported more momentary positive affect and less negative affect. In turn, among men, more overall physical intimacy experienced was related to lower daily cortisol levels, and more overall physical intimacy wished was related to higher cortisol levels. In general, both women and men who reported on average more physical intimacy wished displayed more negative affect.

Everyday Physical Intimacy in Older Couples

Mean levels of both experienced and wished physical intimacy dipped into the lower halves of the response scales. This suggests that, across all assessments, the levels of (experienced and wished) intimacy were relatively low, which is not surprising given the six assessments across any given day. At the same time, experiences of and wishes for intimacy were reported on the vast majority of occasions. Also, unsurprisingly, levels of experienced and wished intimacy differed by time of day, with more intimacy reported in the evenings and mornings (as shown earlier for sexual activity in adults aged 19–65 years; Dewitte et al., 2015). Considering that ≈ 90% ($n = 109$) of couples reported sharing a bedroom, the moments of physical proximity in bed may serve as a context that favors engaging in intimacy. On the other hand, exchanging physical intimacy might not be possible or desired when spending time on other activities during the day; for example, in public, or when one's partner is not physically present. This might imply that physical intimacy remains an important channel for communicating affection in older romantic relationships; however, not all physical intimacy wished were enacted by participants, and the other way around, not all moments of experiencing physical intimacy were accompanied by intimacy wished. An avenue for future research should be to investigate correlates and implications of such discrepancies.

Importantly, there were both inter- and intraindividual differences in intimacy ratings. For example, the finding that men reported more physical intimacy experienced and wished than women presumably mirrors gender differences in the importance of physical intimacy (Müller et al., 2014) or the willingness to report intimacy. For the *within*-person differences, it is possible that physical intimacy occurs when partners exchange positive behaviors and interactions (Dewitte et al., 2015).

Everyday Physical Intimacy and Affect in Older Couples

Consistent with findings from young and middle-aged adults (e.g., Burleson et al., 2007; Debro et al., 2013; Ditzen et al., 2008), we found that more physical intimacy relates to more positive affect and less negative affect in the everyday lives of older couples. This implies that the previously identified linkages between physical intimacy and mood generalize to older adults. We note that reported gender differences in how physical intimacy experienced is associated with affect were identified in an exploratory manner, and should thus be interpreted with caution. Nevertheless, theoretical proposals have long argued for gender-specific linkages between intimacy and emotions in long-term relationships (Basson, 2000). For example, experiences of physical intimacy were less predictive for next-day positive mood among

women than among men (Dewitte et al., 2015). With regard to the interaction effects, more physical intimacy wished and more physical intimacy experienced at momentary level were significantly associated with more positive affect only among women, and the effect was small in size. However, other interaction effects occurred among women and men, for example, the reported increased intimacy wished and less intimacy experienced at between-person level were associated with lower positive affect. Still, the significant interactions were identified in an exploratory fashion and were small in size; thus, they need to be corroborated in future research.

Interestingly, both women and men who on average reported more intimacy wished also reported more negative affect. This might reflect the discrepancy between intimacy desired and experienced for affect. Specifically, strong wish for bodily contact might result in negative affect when it does not go hand-in-hand with experiencing intimacy. However, because of the correlational nature of our analysis, it may also be that in moments of bad mood, the wish for being comforted by a hug from one's partner increases. Although both items on intimacy were assessed on a 0%–100% scale, the labels of the scale endings differed. We thus decided not to create discrepancy measures between the two items, but rather opted to test for intimacy experienced and wished instead. It would be instructive for future research to examine whether greater discrepancy between intimacy experienced and desired predicts more negative affect. Also, future research might examine whether a greater discrepancy between actor's and partner's physical intimacy wished predicts actor's negative affect.

Finally, to advance understanding of how the between- and within-day fluctuations in physical intimacy experienced and wished shape affect, we conducted follow-up analyses using *between-day* (person-and-day-specific mean over 6 occasions per day) and *within-day* (occasion-specific deviation from the person-and-day-specific mean) physical intimacy variables as predictors of positive affect and negative affect (see [Supplementary Table S1](#)). Results revealed that especially the between-day variable was a significant predictor of momentary affect. For example, on days where older adults experienced higher levels of physical intimacy, they also reported more positive affect and less negative affect. Informed by current results (of post-hoc analyses), we speculate that higher daily levels of physical intimacy, rather than within-day ups and downs, are related to elevated good mood of older partners.

Everyday Physical Intimacy and Physiological Stress in Older Couples

Previous evidence on the linkages between physical intimacy and stress have primarily been obtained among women in experimental settings (e.g., Ditzen et al., 2019),

or in young and middle-aged couples (e.g., Ditzen et al., 2008). To our knowledge, our study is the first to show that associations between everyday physical intimacy and physiological stress do not generalize to older women. Light and colleagues (2005) speculated that, among women, release of oxytocin and its beneficial effects for health and stress regulation might be substantially stronger prior to menopause than afterwards. In contrast, we found associations of experienced and wished physical intimacy with cortisol among older men. It is possible that experiencing physical intimacy buffers physiological stress in older men more strongly than in older women. For example, higher salivary cortisol levels were associated with increased psychological sexual arousal in young men (Goldey & van Anders, 2012). However, our study design does not allow for the investigation of the mechanisms underlying these gender differences.

Partner's physical intimacy wished was not related to actor's physiological stress. We speculate that this might be due to the subjectivity of people's desires, which—if not communicated—would diminish the impact of physical intimacy wished on others' mood and stress levels, as long as the wishes remain unexpressed. Previous studies suggest that open communication between older partners contributes to more satisfying sexual lives (Gillespie, 2017). Questions about how communicating intimate desires relates to well-being in everyday lives of older couples should be addressed in future research. Furthermore, it is possible that other partner variables are more central to one's cortisol levels, such as partner's cortisol levels (e.g., Saxbe & Repetti, 2010).

Prior research has reported that moments of physical and emotional closeness between partners are associated with greater cortisol synchrony (Pauly, Gerstorf, et al., 2021). Thus, future research could build on these findings by not only investigating whether cortisol levels are lower following moments of intimacy in daily life, but also whether cortisol and affect levels of both partners synchronize after such interactions. For modeling daily cortisol levels, the difference in women's and men's level-2 residuals' correlation (estimated G correlation as produced by SAS PROC MIXED = 0.37) and level-1 residuals' correlation (autocorrelation = 0.19) can be taken to indicate that constant effects (i.e., between-person) might play a more crucial role than temporary effects (i.e., within-person) for the shared variance in daily cortisol levels—if the numbers can indeed be compared directly across levels of analyses.

Strengths, Limitations, and Outlook

The core strength of this project was the use of data from repeated assessments of older couples' typical daily life, including assessments of physical intimacy and salivary cortisol. Another strength was the between-person and within-person levels of analysis, which enabled us to shed light on the underexplored topic of everyday physical intimacy and its correlates among older adults. However, our

results do not allow us to draw temporal or causal inferences on how physical intimacy relates to affect and stress. For example, it is possible that in moments when people experience physical intimacy, their positive affect increases (similar to improved mood after sexual activity: Kashdan et al., 2018), but it is also possible that momentary good mood precedes engaging in intimate behavior, which additionally implies bidirectionality (Burlinson et al., 2007; Dewitte et al., 2015). In our follow-up analyses, we proposed models that utilize positive affect, negative affect, and daily cortisol levels as predictor variables, and physical intimacy experienced and physical intimacy wished as outcome variables. We found some evidence that momentary affect, but not daily cortisol was related to experiencing and wishing for physical intimacy (for details, see Supplementary Tables S2 and S3). We note that employing lead-lag, time-ordered models would be required to examine whether physical intimacy experienced (or wished) at a given moment precedes more positive affect and less negative affect than usual at the next momentary measurement occasion. To approach a better understanding of possible bidirectionality, future research might also examine whether the size of the aforementioned effect is larger or smaller than the reverse direction of higher positive affect than usual at a given moment predicting physical intimacy experienced (or wished) at the next momentary measurement occasion.

Regarding the measures, our two single items captured peoples' perceptions of physical intimacy, therefore providing more in-depth information on intimacy than frequency measures. In contrast, such measures do not allow clearly disentangling different types of behaviors (hug, kiss, etc.). Also, considering that both partners were asked about actual behaviors, we had expected these reports to overlap more strongly. Yet, the ratings sometimes differed between partners (see Figure 1), as did mean levels of reported intimacy. These discrepancies might highlight that "intimacy is in the eye of the beholder." Though, it might be informative to consider such within-*couple* discrepancies more thoroughly. We speculate that larger everyday discrepancies in partners' perceptions and needs for intimacy undermine relationship functioning (see Orr et al., 2019). Acknowledging that perceived stress and physiological markers of stress represent different and unique dimensions of the larger construct space (Campbell & Ehlert, 2012), we hypothesize that experiencing physical intimacy might be associated with *less* self-reported stress, and more physical intimacy wished with *more* self-reported stress (see also Jakubiak & Feeney, 2018). We also note that other stress dynamics may have emerged had we moved from cortisol as a physiological stress measure to cardiovascular outcomes (heart rate; blood pressure).

Finally, participants were in long-term, satisfying marital relationships. Thus, it is an open question whether our results generalize to less positively selected population

segments. It would also be instructive to put our findings in perspective by examining physical intimacy among nonpartnered older adults. We speculate that for older singles other types of social relationships (e.g., emotional and instrumental support) are more important for well-being and quality of life (Thoits, 2011).

Conclusion

This study used repeated assessment data obtained across seven consecutive days from couples aged 56–88 to examine time-varying associations of physical intimacy with positive affect, negative affect, and daily cortisol levels in the everyday lives of partnered older adults. As expected, results revealed that older partners wished for and experienced physical intimacy on a day-to-day basis, and that the extent of wishes and experiences fluctuated within and across days. Additionally, in moments of experiencing more physical intimacy than usual, older women and men reported less negative affect and older men experienced more positive affect. Higher mean levels of physical intimacy experienced were associated with more positive affect and less negative affect among older women, and lower daily cortisol levels among older men. Our findings extend previous research on intimacy in old age by applying a microlongitudinal perspective and contribute to the literature by demonstrating that physical intimacy is linked with positive and negative mood and stress hormone levels in the daily life of older couples. More mechanism-oriented research is needed to better understand the intricate links between everyday physical intimacy and well-being and gender differences therein among older adults.

Supplementary Material

Supplementary data are available at *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* online.

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Conflict of Interest

None declared.

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ONLINE SUPPLEMENT

Physical Intimacy in Older Couples' Everyday Lives:
Its Frequency and Links with Affect and Salivary Cortisol

Karolina Kolodziejczak¹, Mag., Johanna Drewelies^{1,2}, PhD, Theresa Pauly³, PhD
Nilam Ram⁴, PhD, Christiane Hoppmann⁵, PhD & Denis Gerstorff^{1,6}, PhD

¹Humboldt University Berlin, Department of Psychology

²Charité Universitätsmedizin Berlin, Department of Gender in Medicine

³University of Zurich, Department of Psychology

⁴Stanford University, Departments of Psychology and Communication

⁵University of British Columbia, Department of Psychology and Center for Hip Health & Mobility

⁶German Institute for Economic Research (DIW)

Correspondence regarding this manuscript to: Karolina Kolodziejczak, Humboldt
University Berlin, Department of Psychology, Unter den Linden 6, 10099 Berlin, Germany.
E-mail: karolina.kolodziejczak@hu-berlin.de.

Data Analysis

For salivary cortisol as outcome variable, we specified our models (subscript w for women; identical models for men) as:

$$\begin{aligned} \text{Salivary cortisol AUC}_{gtiw} = & \beta_{0iw} + \beta_{1iw}(\text{physical intimacy experienced WP}_{tiw}) + \\ & \beta_{2iw}(\text{physical intimacy wished WP}_{tiw}) + \\ & \beta_{3iw}(\text{partner physical intimacy wished WP}_{tiw}) + e_{tiw} \end{aligned} \quad (1)$$

where salivary cortisol AUC_g reported at day t by woman i is a function of a person-specific intercept coefficient β_{0i} that indicates the expected value of woman's daily cortisol; a person-specific slope coefficient β_{1i} that represents the association between day-specific physical intimacy experienced and daily cortisol levels; a person-specific slope β_{2i} that indicates the association between woman's physical intimacy wished and daily cortisol levels; a person-specific slope β_{3i} that indicates the association between partner's physical intimacy wished and woman's daily cortisol levels; and residual error, e_{ti} . Between-person differences in the person-specific intercept coefficient β_{0i} were modeled as:

$$\begin{aligned} \beta_{0iw} = & \gamma_{00w} + \gamma_{01w}(\text{age}_{iw}) + \gamma_{02w}(\text{education}_{iw}) + \gamma_{03w}(\text{BMI}_{iw}) + \\ & \gamma_{04w}(\text{relationship satisfaction}_{iw}) + \gamma_{05w}(\text{physical intimacy experienced BP}_{iw}) + \\ & \gamma_{06w}(\text{physical intimacy wished BP}_{iw}) + \\ & \gamma_{07w}(\text{partner physical intimacy wished BP}_{iw}) + \\ & \gamma_{08w}(\text{physical intimacy experienced BP}_{iw} \times \text{physical intimacy wished BP}_{iw}) + \\ & \gamma_{09w}(\text{age}_{iw} \times \text{physical intimacy wished BP}_{iw}) + \\ & \gamma_{010w}(\text{education}_{iw} \times \text{physical intimacy wished BP}_{iw}) + u_{0iw}, \end{aligned} \quad (2)$$

and the person-specific coefficients β_{1i} , β_{2i} , and β_{3i} were modeled as:

$$\beta_{1iw} = \gamma_{10w}, \quad (3)$$

$$\beta_{2iw} = \gamma_{20w} + \gamma_{21w}(\text{age}_{iw}), \quad (4)$$

$$\beta_{3iw} = \gamma_{30w}, \quad (5)$$

where γ_{00} indicates expected daily cortisol levels for the prototypical older partnered woman (or man, respectively) in the sample; γ_{10} and γ_{20} represent prototypical within-person associations between woman's daily cortisol and physical intimacy experienced or wished, respectively, and γ_{30} indicates the prototypical within-couple association between woman's daily cortisol and her partner's physical intimacy wished. Final model includes statistically significant two-way interactions that were identified in an exploratory manner. Both the between-couple differences in level-2 residuals, u_{0iw} and u_{0im} , and the within-couple level-1 residual error terms, e_{tiw} and e_{tim} , were allowed to covary,

$$\begin{bmatrix} u_{0iw} \\ u_{0im} \end{bmatrix} \sim MVN \left(0, \begin{bmatrix} \sigma^2_{u0w} & \\ \sigma_{u0wu0m} & \sigma^2_{u0m} \end{bmatrix} \right) \quad (6)$$

$$\begin{bmatrix} e_{tiw} \\ e_{tim} \end{bmatrix} \sim MVN \left(0, \begin{bmatrix} \sigma^2_{e_w} & \\ \sigma_{e_w e_m} & \sigma^2_{e_m} \end{bmatrix} \right) \quad (7)$$

Also, residuals were allowed to covary between successive occasions (autocorrelation). All equations described above were estimated simultaneously for women and men in a dyadic multilevel model.

Table S1

Multilevel Models Examining Positive Affect (Left-Hand), and Negative Affect (Right-Hand) Each as a Function of Physical Intimacy Experienced (Between-Day and Within-Day), Physical Intimacy Wished (Between-Day and Within-Day), Partner Physical Intimacy Wished (Between-Day and Within-Day), and Age, Education, BMI, and Relationship Satisfaction

Parameter	Positive affect				Negative affect			
	Women		Men		Women		Men	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Fixed effects								
Intercept, γ_{00}	65.105*	1.148	68.303*	1.128	17.406*	1.128	16.907*	1.288
Age, γ_{01}	-0.278	0.178	0.198	0.173	0.141	0.180	0.053	0.201
Education, γ_{02}	0.414	0.506	0.263	0.362	-1.036*	0.518	0.081	0.424
Body Mass Index, γ_{03}	0.227	0.182	-0.048	0.226	-0.179	0.187	0.433	0.266
Relationship satisfaction, γ_{04}	3.727*	1.293	4.998*	1.507	-5.276*	1.304	-7.371*	1.757
Physical intimacy experienced BD, γ_{05}	0.073*	0.022	0.069*	0.019	-0.067*	0.021	-0.051*	0.019
Physical intimacy experienced WD, γ_{10}	0.015	0.014	0.028*	0.012	-0.013	0.011	-0.021	0.011
Physical intimacy wished BD, γ_{06}	0.057*	0.023	0.054*	0.020	0.093*	0.022	0.007	0.020
Physical intimacy wished WD, γ_{20}	0.007	0.019	0.015	0.016	0.005	0.015	-0.008	0.015
Partner physical intimacy wished BD, γ_{07}	0.037	0.021	0.021	0.018	-0.050*	0.020	0.045*	0.018
Partner physical intimacy wished WD, γ_{30}	-0.032*	0.012	-0.001	0.010	0.009	0.011	0.003	0.009
Random effects								
Between couples								
Variance intercept, σ^2_{u0}	138.08*	19.405	108.24*	14.963	133.53*	18.725	142.46*	19.805
Variance physical intimacy experienced WD, σ^2_{u1}	0.007*	0.003	0.004*	0.002	0.002	0.002	0.004*	0.002
Variance physical intimacy wished WP, σ^2_{u2}	0.014*	0.005	0.012*	0.004	0.008*	0.003	0.010*	0.003
Covariance intercept women men, $\sigma_{u0w, u0m}$	41.701*	12.862			22.826	14.497		
Covariance physical intimacy experienced WD intercept, $\sigma_{u1, u0}$	-0.359	0.185	-0.117	0.128	-0.153	0.144	-0.207	0.152
Covariance physical intimacy experienced WD women intercept men, $\sigma_{u1w, u0m}$	-0.079	0.148			0.077	0.129		
Covariance physical intimacy experienced WD men intercept women, $\sigma_{u1m, u0w}$	-0.051	0.144			-0.083	0.143		

Covariance physical intimacy experienced WD women men, $\sigma_{u1w}, u1m$	0.001	0.002			-0.001	0.001		
Covariance physical intimacy wished WD intercept, $\sigma_{u2}, u0$	0.063	0.231	-0.166	0.172	-0.192	0.198	-0.095	0.205
Covariance physical intimacy wished WD women intercept men, $\sigma_{u2w}, u0m$	-0.036	0.197			-0.004	0.186		
Covariance physical intimacy wished WD physical intimacy experienced WD, $\sigma_{u2}, u1$	-0.001	0.003	-0.001	0.002	-0.001	0.002	-0.002	0.002
Covariance physical intimacy wished WD women physical intimacy experienced WD men, $\sigma_{u2w}, u1m$	0.006*	0.003			0.002	0.002		
Covariance physical intimacy wished WD men intercept women, $\sigma_{u2m}, u0w$	-0.419*	0.198			-0.371*	0.187		
Covariance physical intimacy wished WD men physical intimacy experienced WD women, $\sigma_{u2m}, u1w$	-0.005	0.003			0.001	0.002		
Covariance physical intimacy wished WD men physical intimacy wished WD women, $\sigma_{u2m}, u2w$	-0.001	0.004			0.001	0.003		
Within couples								
Residual variance, e_{ij}	120.16*	2.596	181.96*	3.983	106.62*	2.360	145.73*	3.238
Residual covariance women men, e_{tiw}, tim	37.578*	2.317			23.061*	1.904		
Autocorrelation	0.181*	0.011			0.258*	0.011		
Fit indices								
AIC			74,893.9				73,098.0	
-2LL			74,843.9				73,048.0	

Note. $N = 120$ couples (240 individuals). Number of observations used in the momentary data model = 9,503. Estimate unstandardized. Positive affect = average of ratings for relaxed, balanced, at rest, happy, interested, inspired. Negative affect = average of ratings for depressed, disappointed, groggy, downcast/glum, overwhelmed, nervous, jittery. For model convergence, the salivary cortisol AUC_g variable was scaled at 1:100. SE = Standard Error; BD = Between-day variable (person-and-day-specific mean over 6 occasions per day); WD = Within-day variable (occasion-specific deviation from the person-and-day-specific mean); AIC = Akaike information criterion; -2LL = -2 Res Log Likelihood.

* $p < .05$

Table S2

Multilevel Models Examining Momentary Physical Intimacy Experienced as a Function of Positive Affect (Model 1), Negative Affect (Model 2), or Salivary Cortisol AUC_g (Model 3), and Age, Education, BMI, and Relationship Satisfaction

Parameter	Physical Intimacy Experienced											
	Model 1				Model 2				Model 3			
	Women		Men		Women		Men		Women		Men	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Fixed effects												
Intercept, γ_{00}	2.927	9.391	6.034	12.035	32.742*	3.179	38.610*	3.503	33.179*	6.053	51.812*	5.901
Age, γ_{01}	0.336	0.309	0.028	0.353	0.291	0.320	0.214	0.353	0.320	0.329	0.048	0.356
Education, γ_{02}	-1.121	0.872	-1.220	0.725	-0.771	0.919	-1.011	0.727	-0.904	0.910	-0.996	0.732
Body Mass Index, γ_{03}	-0.539	0.311	-0.091	0.449	-0.448	0.321	0.220	0.453	-0.490	0.323	-0.196	0.451
Relationship satisfaction, γ_{04}	5.917*	2.286	6.439*	3.198	7.950*	2.434	9.155*	3.225	8.280*	2.329	9.822*	3.059
Positive affect BP, γ_{05}^a	0.472*	0.142	0.488*	0.172	–	–	–	–	–	–	–	–
Positive affect WP, γ_{10}^a	0.062*	0.028	0.123*	0.031	–	–	–	–	–	–	–	–
Negative affect BP, γ_{05}^b	–	–	–	–	0.046	0.150	0.048	0.154	–	–	–	–
Negative affect WP, γ_{10}^b	–	–	–	–	-0.047	0.030	-0.094*	0.035	–	–	–	–
Salivary cortisol AUC _g BP, γ_{05}^c	–	–	–	–	–	–	–	–	0.012	0.123	-0.203	0.104
Salivary cortisol AUC _g WP, γ_{10}^c	–	–	–	–	–	–	–	–	-0.004	0.029	-0.023	0.025
Random effects												
Between couples												
Variance intercept, σ_{u0}^2	420.94*	58.353	477.61*	66.122	467.07*	64.380	525.70*	72.735	461.62*	63.662	490.51*	68.458
Variance predictor WP ^{a,b,c} , σ_{u1}^2	0.031*	0.113	0.035*	0.014	0.021	0.014	0.044*	0.016	–	–	–	–
Covariance intercept women men, σ_{u0w}, u_{0m}	204.97*	50.274			254.97	55.979			232.93*	53.643		
Covariance predictor WP ^{a,b,c} intercept, σ_{u1}, u_0	0.164	0.596	0.920	0.710	-0.167	0.687	-2.476*	0.891	–	–	–	–
Covariance predictor WP ^{a,b,c} women intercept men, σ_{u1w}, u_{0m}	-0.614	0.620			0.246	0.688			–	–		
Covariance predictor WP ^{a,b,c} men intercept women, σ_{u1m}, u_{0w}	1.605*	0.671			-1.912*	0.836			–	–		
Covariance predictor WP ^{a,b,c} women men, σ_{u1w}, u_{1m}	0.006	0.010			0.007	0.011			–	–		

Within couples												
Residual variance, e_{ti}	407.81*	8.660	465.32*	9.969	407.95*	8.654	467.90*	10.017	418.72*	8.866	473.20*	10.118
Residual covariance women men, e_{tiw}, tim	144.04*	6.793			144.05*	10.017			146.11*	6.941		
Autocorrelation	0.204*	0.011			0.201*	0.011			0.204*	0.011		
Fit indices												
AIC			86,439.8				86,472.4				85,066.4	
-2LL			86,411.8				86,444.4				85,052.4	

Note. $N = 120$ couples (240 individuals). Number of observations used in the positive affect/negative affect models = 9,702. Number of observations used in the salivary cortisol AUC_g model = 9,532. Estimate unstandardized. Positive affect = average of ratings for relaxed, balanced, at rest, happy, interested, inspired. Negative affect = average of ratings for depressed, disappointed, groggy, downcast/glum, overwhelmed, nervous, jittery. For model convergence, the salivary cortisol AUC_g variable was scaled at 1:100. *SE* = Standard Error; BP = Between-person variable (person-specific mean over 42 occasions); WP = Within-person variable (occasion- or day-specific deviation from the person-specific mean); AIC = Akaike information criterion; -2LL = -2 Res Log Likelihood.

^a positive affect as predictor variable of interest

^b negative affect as predictor variable of interest

^c salivary cortisol AUC_g as predictor variable of interest

* $p < .05$.

Table S3

Multilevel Models Examining Momentary Physical Intimacy Wished as a Function of Positive Affect (Model 1), Negative Affect (Model 2), or Salivary Cortisol AUC_g (Model 3), and Age, Education, BMI, and Relationship Satisfaction

Parameter	Physical Intimacy Wished											
	Model 1				Model 2				Model 3			
	Women		Men		Women		Men		Women		Men	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Fixed effects												
Intercept, γ_{00}	13.653	10.799	30.184*	14.001	23.138*	3.363	35.218*	3.798	31.734*	6.806	47.639*	6.978
Age, γ_{01}	0.438	0.352	-0.151	0.407	0.333	0.340	-0.096	0.381	0.383	0.364	-0.222	0.415
Education, γ_{02}	-0.475	1.004	-0.694	0.842	-0.326	0.983	-0.790	0.791	-0.790	1.025	-0.622	0.865
Body Mass Index, γ_{03}	-0.168	0.360	-0.274	0.523	-0.113	0.344	-0.723	0.494	-0.067	0.367	-0.380	0.537
Relationship satisfaction, γ_{04}	3.668	2.603	2.239	3.705	6.376*	2.579	7.732*	3.501	4.764	2.579	5.613	3.594
Positive affect BP, γ_{05}^a	0.242	0.163	0.212	0.201	-	-	-	-	-	-	-	-
Positive affect WP, γ_{10}^a	0.064*	0.029	0.106*	0.033	-	-	-	-	-	-	-	-
Negative affect BP, γ_{05}^b	-	-	-	-	0.367*	0.160	0.578*	0.168	-	-	-	-
Negative affect WP, γ_{10}^b	-	-	-	-	0.016	0.032	-0.047	0.035	-	-	-	-
Salivary cortisol AUC _g BP, γ_{05}^c	-	-	-	-	-	-	-	-	-0.010	0.141	-0.039	0.123
Salivary cortisol AUC _g WP, γ_{10}^c	-	-	-	-	-	-	-	-	-0.042	0.027	-0.012	0.025
Random effects												
Between couples												
Variance intercept, σ^2_{u0}	526.20*	71.988	621.83*	84.641	508.44*	69.332	604.74*	82.715	534.61*	72.982	628.38*	85.454
Variance predictor WP ^{a,b,c} , σ^2_{u1}	0.050*	0.013	0.048*	0.014	0.049*	0.015	0.054*	0.018	-	-	-	-
Covariance intercept women men, $\sigma_{u0w, u0m}$	208.08*	58.778			234.90*	58.408			214.18*	59.654		
Covariance predictor WP ^{a,b,c} intercept, $\sigma_{u1, u0}$	1.371	0.708	1.687	0.836	-1.211	0.771	-2.664*	0.953	-	-	-	-
Covariance predictor WP ^{a,b,c} women intercept men, $\sigma_{u1w, u0m}$	-0.346	0.740			-0.124	0.809			-	-		
Covariance predictor WP ^{a,b,c} men intercept women, $\sigma_{u1m, u0w}$	0.441	0.783			0.183	0.872			-	-		
Covariance predictor WP ^{a,b,c} women men, $\sigma_{u1w, u1m}$	-0.007	0.011			0.006	0.012			-	-		

Within couples												
Residual variance, e_{ti}	348.36*	7.528	345.72*	7.484	349.46*	7.555	348.93*	7.537	359.08*	7.746	357.35*	7.719
Residual covariance women men, e_{tiw}, tim	60.749*	5.201			61.544*	5.224			61.264*	5.360		
Autocorrelation	0.250*	0.011			0.247*	0.011			0.250*	0.011		
Fit indices												
AIC			84,565.4				84,597.3				83,254.9	
-2LL			84,537.4				84,569.3				83,240.9	

Note. $N = 120$ couples (240 individuals). Number of observations used in the positive affect/negative affect models = 9,702. Number of observations used in the salivary cortisol AUC_g model = 9,532. Estimate unstandardized. Positive affect = average of ratings for relaxed, balanced, at rest, happy, interested, inspired. Negative affect = average of ratings for depressed, disappointed, groggy, downcast/glum, overwhelmed, nervous, jittery. For model convergence, the salivary cortisol AUC_g variable was scaled at 1:100. *SE* = Standard Error; BP = Between-person variable (person-specific mean over 42 occasions); WP = Within-person variable (occasion- or day-specific deviation from the person-specific mean); AIC = Akaike information criterion; -2LL = -2 Res Log Likelihood.

^a positive affect as predictor variable of interest

^b negative affect as predictor variable of interest

^c salivary cortisol AUC_g as predictor variable of interest

* $p < .05$.