Enjoyment of Sexuality and Longevity in Late Midlife and Older Adults: The Longitudinal Ageing Study Amsterdam

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Abstract

Sexual well-being refers to the evaluation of one's sexuality. We examined the association of enjoyment of sexuality with longevity and the moderating role of perceived importance of sexuality in this association. In the population-based Longitudinal Ageing Study Amsterdam, the survival of initially 55–84-year-olds was followed during 27 years. Complete data were available for 1042 participants (45.3%). Analyses were adjusted for health-related and psychosocial covariates. 60% of the participants experienced their sexuality as enjoyable and 44% as important. Enjoyment of sexuality was weakly, positively associated with longevity (B[CI] = 0.29[-0.004;0.58]). Perceived importance modified this association: only in those who perceived sexuality as important, the association between enjoyment and longevity was statistically significant (B[CI] = 0.78[0.29;1.27]). Positive affect, functional limitations, emotional loneliness, self-rated health, sense of mastery and alcohol consumption accounted for 35% of the latter association. Interventions may target older adults who perceive sexuality as important but not enjoyable.

Keywords

older population, enjoyment of sexuality, perceived importance of sexuality, longevity

Introduction

Sexual well-being refers to the evaluation of one's sexuality and is considered an important aspect of quality of life (Laumann et al., 2006; Træen & Villar, 2020). With ageing, sexual activity may decrease and sexuality may be expressed and valued in different ways. Older adults' sexuality becomes more multifaceted and is expressed more in forms of intimacy such as kissing, touching and responsiveness than as sexual intercourse (Ginsberg et al., 2005). Enjoyment of sexuality has been reported as one of the most salient aspects of older adults' sexuality (Syme et al., 2019). Evidence shows that in later life, men experience greater sexual well-being than women and that sexual well-being is associated with social and psychological aspects of quality of life, including partner relationship quality, the absence of loneliness and psychological well-being (Lee et al., 2016; Matthias et al., 1997). Evidence also exists on physical benefits of sexual well-being including cardiovascular health (Liu et al., 2016). This study expands on earlier findings by addressing the association of sexual well-being with longevity.

Sexual well-being may affect longevity for several reasons. First, sexuality and intimacy are a source of emotional support, which is known to protect against mortality (Penninx et al., 1997; Schnarch, 1991). Second, satisfaction with sexuality may reduce health effects of stress (Ein-Dor & Hirschberger, 2012), thereby reducing the risk of mortality. Third, older women who have higher levels of sexual activity and interest, rate themselves higher on a subjective scale of successful ageing (Thompson et al., 2011), which in turn may increase longevity. Last, sexuality and intimate relationships and their health and well-being benefits are unique and cannot be replaced by general social relations or friendships (Hillman, 2000; Liu et al., 2016).

When studying the potential effect of sexual well-being on longevity, a broad range of demographic, physical, emotional and social characteristics needs to be accounted for. Demographic characteristics known to be associated with both

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sexual well-being and longevity are age, sex, level of education and occupation and particularly marital or partner status (Laumann et al., 2006). Chronic disease, disability and depressive and anxiety symptoms are known to reduce sexual satisfaction, to increase in older age and to be associated with mortality (Baldwin et al., 2015; Syme, Klonof, Macera, & Brodine, 2013). The same may be true for life style factors (Addis et al., 2006). Positive indicators of mental health, such as positive affect and sense of mastery, may help undertake action to fulfil one's (sexual) desires and are also associated with longevity (Kolodziejczak et al., 2021; Wiest et al., 2011). Social and cultural factors that may play a role are social support, loneliness, religiousness and attitude towards ageing (Estill et al., 2018).

As many factors potentially affect the association between sexual well-being and longevity, data from comprehensive studies are needed to investigate this association. Previous studies showing an association between sexuality and longevity focus on sexual activity rather than sexual enjoyment (Chen et al., 2007; Davey Smith et al., 1997; Hsu et al., 2017; Kepler et al., 2020). One of these shows that the univariate association of sexual activity with longevity does not hold after adjustment for depression (Hsu et al., 2017). Other studies adjusted only for demographic characteristics. It remains to be examined if enjoyment of sexuality is associated with longevity.

The extent to which enjoyment of sexuality contributes to longevity, furthermore, may depend on the perceived importance of sexuality. Gerontological theories state that with ageing, adaptation occurs such that subjective importance shifts to those domains in life in which one is still able to exert a degree of control or to participate (Baltes, 1997; Brandtstädter & Rothermund, 2002). These domains may be smaller in number, but remain a source of well-being. Applied to sexuality, these theories predict that when sexuality can no longer be enjoyed, people tend to perceive it as less important and compensate this loss by focussing on domains from which they can still derive enjoyment. Sexuality is one domain of which the perceived importance has been shown to decrease with ageing (Laumann et al., 2006; Lindau et al., 2007). Vice versa, if people fail to make this adaptation and no longer enjoy sexuality but still attach importance to it, their lack of sexual enjoyment may contribute negatively to their quality of life and ultimately, their longevity. This argument leads to the expectation that the association between sexual well-being and longevity depends on the importance attached to sexuality.

Using data from a longitudinal, comprehensive study of ageing, we investigated the long-term effects of enjoyment of sexuality on longevity in older persons. We hypothesised that enjoyment of sexuality is positively associated with longevity. We further hypothesised that this association is stronger in older adults who perceive sexuality as important, because not enjoying sexuality may shorten their longevity, and that this association is weaker or non-existent in those who perceive sexuality as unimportant. In other words, we expected perceived importance of sexuality to be a moderator of the association between enjoyment of sexuality and longevity. In addition, we examined a range of health and psychosocial factors that may account for this association.

Methods

Sample

Our study sample consisted of participants in the Longitudinal Ageing Study Amsterdam (LASA), which is based on a representative random sample of Dutch adults initially aged 55–85 years ($N = 3107$). The design of the study has been described earlier (Hoogendijk et al., 2020). In brief, data collection started in 1992–1993 (baseline) with follow-up measurements being conducted at roughly 3-year intervals. Except for vital status, only baseline data were used for this study to maximise the follow-up period. The cooperation rate at baseline was 62%. Face-to-face interviews were conducted in the participants' homes. In addition, participants were asked to fill in a self-completion questionnaire. Written informed consent was obtained from every participant.

The questions on the experience of sexuality were included in the self-completion questionnaire, to which 2302 participants responded, that is, 74.1% of baseline participants. The question on importance of sexuality was listed before the question on enjoyment and had valid responses for 1899 participants (82.5% of self-completion questionnaire respondents). The question on enjoyment had valid responses for 1042 participants (45.3% of self-completion questionnaire respondents). The latter constituted the study sample. Potential selection bias was assessed on all study variables in two stages. First, the participants who responded to the question on importance were compared to self-completion questionnaire respondents who did not respond to this question. Second, the participants with valid responses on both importance and enjoyment questions were compared to those who responded to the importance question only (Table 1).

Measures

Experience of Sexuality. Experience of sexuality was assessed using three questions (Hartmans et al., 2015). First a question was asked about *past enjoyment* of sexual life, phrased as: 'How did you experience your sexual life in the past?' with response categories: (1) very unpleasant; (2) unpleasant; (3) not unpleasant, not pleasant; (4) pleasant and (5) very pleasant. Next came the *importance* question, phrased as: 'How important is sexuality for you at the moment?' with response categories: (1) very unimportant; (2) unimportant; (3) not unimportant, not important; (4) important and (5) very important. Last, the *current enjoyment* question was phrased:

Table 1. Comparison between characteristics[a] of participants with valid data on enjoyment and/or importance of sexuality and with missing data on both sexuality items (first three columns) and between characteristics of participants with valid data on both enjoyment and importance of sexuality and with valid data on importance of sexuality only (last three columns): means (standard deviations), unless specified otherwise.

	Data on One (n = 1899)	Missing Data on Both (n = 396)	p-Value of Difference	Data on Both (n = 1042)	Data on Importance Only (n = 857)	p-Value of Difference
LRPD[b]	0.08 (1.65)	−0.12 (1.57)	.022	0.14 (1.57)	0.01 (1.74)	.082
Age	69.2 (8.5)	73.8 (8.4)	<.001	66.3 (7.6)	72.9 (8.0)	<.001
Sex, % female	50.1	55.1	.072	40.7	61.5	<.001
Education in years	9.1 (3.3)	7.9 (3.0)	<.001	9.3 (3.2)	8.7 (3.4)	<.001
Job level (1–5)	2.7 (1.0)	2.5 (0.9)	<.001	2.8 (0.9)	2.6 (1.0)	<.001
With partner (%)	73.3	48.6	<.001	92.7	49.7	<.001
In care institution (%)	2.1	4.8	.005	1.0	3.5	<.001
Self-rated health (1–5)	2.4 (0.9)	2.4 (1.0)	.489	2.3 (0.8)	2.5 (1.0)	<.001
No of chronic diseases	1.4 (1.2)	1.5 (1.2)	.060	1.2 (1.1)	1.6 (1.3)	<.001
No of medications	1.7 (1.8)	1.9 (1.9)	.028	1.4 (1.6)	2.1 (1.9)	<.001
Functional limitations (0–24)	2.2 (4.0)	3.9 (5.6)	<.001	1.2 (2.8)	3.4 (4.9)	<.001
MiniMental state exam (0–30)	27.4 (2.4)	26.4 (3.2)	<.001	27.7 (2.1)	27.0 (2.7)	<.001
Depressive symptoms (0–60)	7.6 (7.5)	7.9 (8.3)	.455	6.2 (6.6)	9.3 (8.1)	<.001
Positive affect (0–12)	8.9 (2.9)	8.8 (3.0)	.595	9.3 (2.6)	8.3 (3.0)	<.001
Anxiety symptoms (0–21)	2.6 (3.3)	2.3 (3.1)	.124	2.3 (3.1)	2.9 (3.6)	<.001
Sense of mastery (5–25)	17.4 (3.3)	16.9 (3.2)	.008	18.0 (3.2)	16.8 (3.4)	<.001
Emotional support (0–36)	22.2 (7.9)	21.4 (8.2)	.087	22.9 (7.5)	21.3 (8.3)	<.001
Social loneliness (0–5)	0.9 (1.3)	0.9 (1.3)	.752	0.7 (1.2)	1.1 (1.4)	<.001
Emotional loneliness (0–6)	1.1 (1.6)	1.2 (1.7)	.049	0.7 (1.2)	1.6 (1.9)	<.001
Waist circumference	97.3 (11.0)	99.4 (11.5)	.003	97.0 (10.8)	97.8 (11.2)	.133
Alcohol consumption[c]	19.5	27.9	.001	15.5	24.5	<.001
-% no	76.7	69.9		79.8	72.8	
-% mild	3.8	2.2		4.8	2.7	
-% moderate/extreme						
Current smoker (%)	25.5	20.2	.032	26.0	24.8	.585
Attitude towards ageing (0–8)	4.3 (2.4)	4.0 (2.4)	.072	4.2 (2.4)	4.4 (2.4)	.053
Religiousness	29.7	44.2	<.001	28.0	31.7	.078
-% protestant	30.2	30.8	.803	31.8	28.2	.096
-% Roman Catholic						
Past enjoyment of sexuality (1–5)	4.0 (0.7)	4.0 (0.8)	.833	4.1 (0.7)	3.9 (0.8)	<.001
Current importance of sexuality (1–5)	—	—	—	3.3 (0.9)	1.9 (1.0)	<.001

[a]for continuous variables, the range is given in brackets.
[b]Logit of the Realised Probability of Dying, values >0 indicate longer survival than the median population.
[c]mild: <21 days/month or <4 glasses/day; moderate to extreme: ≥ 21 days/month and ≥4 glasses/day.

'How do you experience your sexual life at the moment?' with the same response categories as the past enjoyment question. For descriptive purposes, the current importance and enjoyment variables were dichotomised, grouping participants who responded neutrally with those responding negatively (Laumann et al., 2006).

Survival Time. Vital status of each participant was traced using official population registries from baseline through December 31, 2019, that is, 26.9 years of follow-up. The ascertainment was complete except for nine cases. We used the Realized Probability of Dying (RPD) as a relative measure of longevity (Deeg et al., 1989). Using life tables based on the total Dutch

population for successive years during the study period, the RPD compares for each individual, according to year of birth and sex, his or her survival time with the total Dutch population's survival time from the start of the study onward. Thus, the RPD adjusts simultaneously for the effects of age and sex on survival time. RPD values range from 0 to 1. RPD values below 0.50 indicate that survival is longer than the median population; values above 0.50 indicate shorter survival. For example, the value of a man's RPD is 0.80 if, at the time of his death, 80% of his cohort is still alive. At the end of follow-up, 24.7% of the study sample (*n* = 258) was still alive. The RPD for these participants is estimated by assuming that their remaining survival time corresponds to the median population survival time from end-of-follow-up onward. This amounts to multiplying the probability of reaching the end of 2019 by 0.5.

As the RPD has a uniform distribution, it was transformed to a standard normal distribution using the logit. Minus the logit of the RPD (LRPD) was used as the dependent variable in linear regression models, where higher LRPD values indicate greater longevity.

Covariates: Socio-Demographics. Age and sex were available from the population registry. Education was self-reported as the highest educational level attained and recoded into number of years (5–18). Level of longest-held job ranged from (1) unschooled to (5) scientific. Partner status was categorised as: (1) no partner and (2) partner (including non-married partner and living apart together). Living arrangements were categorised as (1) community-living and (2) in care institution.

Covariates: Physical Health. Self-perceived health was assessed with response options (1) very good to (5) poor. Functional limitations were based on self-reported difficulty in performing six activities: walk up and down a 15-step staircase without stopping, cut one's own toenails, dress oneself, transfer in and out of chairs, walk outside for 5 minutes without stopping and use private or public transportation. For each activity, a score between (0) no difficulty and (4) cannot perform was assigned; the summed score ranged from 0 to 24. The number of chronic diseases was assessed by self-reports of the following diseases: chronic non-specific lung disease, cardiac disease, peripheral arterial disease, diabetes mellitus, stroke, arthritis and cancer and ranged from 0 to 7. The number of medications used was recorded by the interviewer upon inspecting the containers of medications currently used by participants.

Covariates: Mental Health. Cognitive functioning was measured using the Mini-Mental State Examination (MMSE). Scores range from 0 to 30, with higher scores indicating better cognitive functioning (Folstein et al., 1975). Depressive symptoms were measured using the 20-item Centre for Epidemiologic Studies Depression (CES-D) scale (Radloff, 1997). Response categories ranged from (0) (almost) never

to (3) (almost) always; the summed score ranged from 0 to 60. Anxiety was assessed using the Hospital Anxiety Depression Scale-Anxiety subscale which measures seven symptoms of anxiety (Zigmond & Snaith, 1983). Response categories ranged from (0) (almost) never to (3) (almost) always; the summed score ranged from 0 to 21. Positive affect was based on the four positive items from the CES-D scale, with a summed score from 0 to 12. Sense of mastery, defined as feeling that one has control over one's life and experiences rather than these being ruled by chance or others, was assessed using a five-item version of the Mastery scale (Pearlin & Schooler, 1978). Its scores range from 5 to 25.

Covariates: Life Style. Current smoking status was assessed by asking the participants whether they currently smoked or not. Alcohol consumption was assessed using two questions: on how many days per month alcoholic beverages were consumed and how many glasses each time (Mulder & Garretsen, 1983). Responses were combined into three categories: (0) no alcohol use, (1) 1–3 glasses a time or less than 21 days/month and (2) four or more glasses a time and 21 or more days/month. Waist circumference (in cm) was calculated as the mean of two measurements in standing position, midway between the lower rib and the iliac crest after expiration.

Covariates: Social and Cultural Factors. Social support was assessed as the emotional support received from the nine most frequently contacted persons, coded as (1) never to (4) often and summed to a maximum of 36 (Penninx et al., 1997). Social and emotional loneliness were measured using the De Jong Gierveld loneliness scale, ranging from 0 to 5 for social and from 0 to 6 for emotional loneliness (de Jong Gierveld et al., 2009). Religious denomination was assessed as membership of a church or religious group, specifically, of one of the predominant denominations in the Netherlands: (1) Protestant, (2) Roman Catholic or (0) none or other (Braam et al., 1999). Attitude towards ageing was asked using four questions on perceived influence of ageing on daily activities, financial situation, contacts with family and friends and involvement in current affairs. Response categories were (0) no, (1) more or less and (2) yes. The summed scores ranged from 0 to 8.

Statistical Analyses

Descriptive data were tested using chi-square for categorical and t-tests for continuous variables. First, differences between the included and excluded participants were examined. Subsequently, within the study sample, differences were examined between those who reported their sexuality as not enjoyable and as enjoyable and between those who reported their sexuality as not important and as important.

The effect of enjoyment of sexuality on longevity, defined as the LRPD, was first assessed in a basic linear regression model. This model included age as a covariate, because the LRPD was positively associated with age, implying that older

participants in our study sample had greater longevity as compared to the general population. The LRPD was not associated with sex. As enjoyment of sexuality proved to have a nonlinear association with the LRPD, it was transformed using the square root. Moderation of the association of enjoyment and longevity by importance of sexuality was assessed with the product term of enjoyment and dichotomised importance. In case of moderation, the coefficients for the importance strata were derived from the full sample (Figueiras et al., 1998). To account for possible confounders, covariates were included, aiming for parsimony without overlooking influential variables. Thus, covariates were included one by one in the regression model. The covariate that yielded the largest change in the regression coefficient of enjoyment was kept in the model, after which the covariate yielding the next largest change was included, and so on, until this regression coefficient did not change anymore. A p-value of <0.05 was considered statistically significant.

Results

Characteristics of Participants Excluded From the Study Sample

Examination of potential selection bias of our study sample involved two comparisons. First, comparing participants with data on enjoyment and/or importance of sexuality with participants without data on both (Table 1, columns 1–3), the latter had a shorter longevity, were older and more often female, had fewer years of education and a lower job level, less often had a partner and more often lived in a care institution. They also had poorer physical and cognitive, but not mental health. They did experience less mastery and more emotional loneliness. They had a greater waist circumference, but less often consumed alcohol or smoked. Finally, they more often had a Protestant denomination.

Second, comparing participants with data on importance only to participants with complete data, the former on average perceived sexuality as unimportant (score 1.9 on a 1–5 scale), in stark contrast to participants with complete data (score 3.3) (Table 1, columns 4–6). They also more often reported having experienced their sexuality as less enjoyable in the past, although this difference was small. About half had no partner, versus only 7% of the participants with complete data. Participants with incomplete and complete data further differed on similar characteristics as those with incomplete and no data but did not differ statistically significantly regarding religious denomination and longevity ($p > 0.05$).

Bivariate Associations of Enjoyment and Importance of Sexuality With Covariates

In the study sample, 59.9% of the participants experienced their sexuality as enjoyable, and 43.7% of the participants rated their sexuality as important.

No meaningful difference was observed in LRPD between participants who reported low and high enjoyment of sexuality (Table 2). Participants who reported their sexuality as enjoyable were slightly younger and more often male, somewhat more often had a partner, had better self-rated health and fewer chronic diseases, used fewer medications, had fewer depressive and anxiety symptoms and higher positive affect and sense of mastery, experienced less social and emotional loneliness and had a more positive attitude towards ageing. No statistically significant differences were observed regarding level of education, job level, living arrangement, cognitive functioning, emotional support, waist circumference, alcohol consumption, smoking and religious denomination.

Differences regarding perceived importance were observed along the same lines, although these differences tended to be smaller. Notable exceptions were the absence of differences in social and emotional loneliness and attitude towards ageing, and the presence of a statistically significant greater alcohol use in those who rated their sexuality as important.

Past enjoyment of sexuality was greater in participants who reported enjoyment and importance of current sexuality. Finally, there was a clear mutual association between high enjoyment and high importance.

Association of Enjoyment of Sexuality With Longevity

The main effect of enjoyment of sexuality on longevity did not reach significance in the basic regression model, the regression coefficient and confidence interval (B(CI)) being 0.286 (−0.004;0.577). This coefficient indicates that one point increase in the square root of enjoyment of sexuality (i.e. from one to four on the original response scale) is associated with 0.29 standard deviation of the LRPD, or 0.29 standard deviation longer survival.

The interaction term of perceived importance and enjoyment in the model including both main effects showed statistical significance ($p = 0.018$). In participants who rated sexuality as unimportant, the B(CI) of enjoyment was 0.020 (−0.378;0.413). In contrast, in those who rated sexuality as important, this was 0.782 (0.289; 1.274). To visualise this contrast, the remaining life expectancy for participants of the predominant sex and average age in the study sample, that is, men aged 65 years, was calculated from the LRPD for each enjoyment score in the two importance strata (Figure 1). Whereas in men who perceived sexuality as unimportant, there was only a 1-year difference in life expectancy between those who perceived sexuality as very unpleasant and very pleasant, this difference amounted to as much as 7 years for those who rated sexuality as important. It must be noted that in our study sample, the proportion of older adults who perceived sexuality as important but not enjoyable was only 5.4%.

Table 2. Comparison of characteristics[a,b,c] of participants with low and high enjoyment of sexuality and with low and high importance attached to sexuality: means (standard deviations), unless specified otherwise

	Enjoyment			Importance		
	Low[b,c] (n = 419)	High[b,c] (n = 624)	p-Value of difference	Low[d] (n = 587)	High[d] (n = 455)	p-Value of difference
LRPD[e]	0.12 (1.61)	0.16 (1.55)	.645	0.15 (1.56)	0.13 (1.60)	.831
Age	67.8 (7.8)	65.3 (7.4)	<.001	66.9 (7.7)	65.6 (7.5)	.006
Sex, % female	49.9	34.5	<.001	48.0	31.2	<.001
Education in years	9.4 (3.1)	9.6 (3.3)	.195	9.5 (3.2)	9.6 (3.3)	.370
Job level (1–5)	2.8 (1.0)	2.8 (0.9)	.605	2.8 (1.0)	2.8 (0.9)	.539
With partner (%)	90.9	93.9	.071	91.8	93.8	.213
In care institution (%)	50.0	50.0	.526	30.0	70.0	.381
Self-rated health (1–5)	2.4 (0.9)	2.2 (0.8)	<.001	2.4 (0.9)	2.2 (0.8)	<.001
No of chronic diseases	1.3 (1.1)	1.1 (1.1)	<.001	1.3 (1.1)	1.1 (1.1)	.003
No of medications	1.6 (1.7)	1.2 (1.5)	.001	1.4 (1.7)	1.3 (1.5)	.370
Functional limitations (0–24)	1.5 (3.0)	0.9 (2.5)	<.001	1.4 (3.0)	0.8 (2.3)	.001
MiniMental State Exam (0–30)	27.8 (2.0)	27.7 (2.2)	.469	27.8 (2.1)	27.7 (2.2)	.368
Depressive symptoms (0–60)	7.4 (7.4)	5.4 (6.0)	<.001	6.8 (7.1)	5.6 (5.9)	.004
Positive affect (0–12)	8.8 (2.4)	9.7 (2.40)	<.001	9.1 (2.7)	9.6 (2.5)	.002
Anxiety symptoms (0–21)	2.7 (3.3)	2.0 (2.8)	<.001	2.5 (3.2)	2.0 (2.8)	.008
Sense of mastery (5–25)	17.3 (3.3)	18.4 (3.0)	<.001	17.7 (3.2)	18.3 (3.1)	.009
Emotional support (0–36)	22.4 (7.6)	23.1 (7.4)	.146	22.6 (7.6)	23.2 (7.4)	.146
Social loneliness (0–5)	0.9 (1.3)	0.6 (1.1)	.001	0.8 (1.2)	0.7 (1.1)	.583
Emotional loneliness (0–6)	0.9 (1.4)	0.5 (1.1)	<.001	0.7 (1.3)	0.6 (1.2)	.576
Waist circumference	97.5 (11.2)	96.6 (10.5)	.225	96.9 (11.0)	97.2 (10.5)	.664
Alcohol consumption[f]	18.5	13.4	.082	17.9	12.3	.004
- % no	76.8	81.8		78.7	81.1	
- % mild	4.6	4.8		3.3	6.6	
- % moderate/extreme						
Current smoker (%)	23.7	27.5	.167	24.8	27.5	.329
Attitude towards ageing (0-8)	4.4 (2.4)	4.0 (2.4)	.007	4.3 (2.4)	4.1 (2.5)	.168
Religiousness	27.9	28.1	.953	28.6	27.3	.626
-% Protestant	31.5	31.9	.881	30.3	33.6	.256
-% Roman Catholic						
Past enjoyment sexuality (1–5)	3.8 (0.7)	4.3 (0.6)	<.001	3.9 (0.7)	4.3 (0.7)	<.001
Current enjoyment of sexuality (1–5)	—	—	—	3.3 (0.7)	4.0 (0.7)	<.001
Importance of sexuality (1–5)	2.8 (0.8)	3.7 (0.7)	<.001	—	—	—

[a]All variables have <4% missing values, except waist circumference (valid n = 986)
[b]for continuous variables, the range is given in brackets
[c]low: (very) unpleasant or neutral; high: (very) pleasant
[d]low: (very) unimportant or neutral; high: (very) important
[e]Logit of the Realized Probability of Dying, values >0 indicate longer survival than the median population
[f]mild: <21 days/month or <4 glasses/day; moderate to extreme: >= 21 days/month and >=4 glasses/day

To examine the net effect of enjoyment of sexuality on longevity in participants who rated sexuality as important, covariates were added one by one (Supplemental Table). The final model (Table 3) included positive affect, functional limitations, emotional loneliness, self-rated health, sense of mastery, and alcohol consumption. Inclusion of other co-variates did not reduce the regression coefficient of the enjoyment of sexuality any more. In the final model, the regression coefficient was reduced by 35% from 0.782 to 0.510 and was only marginally significant ($p = 0.051$). Thus, the covariates accounted for 35% of the association between

enjoyment of sexuality and longevity in those who rated sexuality as important. In this subsample, a one point increase in the square root of enjoyment of sexuality is associated with 0.51 standard deviation better survival.

Discussion

Our study showed that enjoyment of sexuality was associated with longevity in older adults, but only in those who per-ceived sexuality as important. This association was partly accounted for by positive affect, functional limitations,
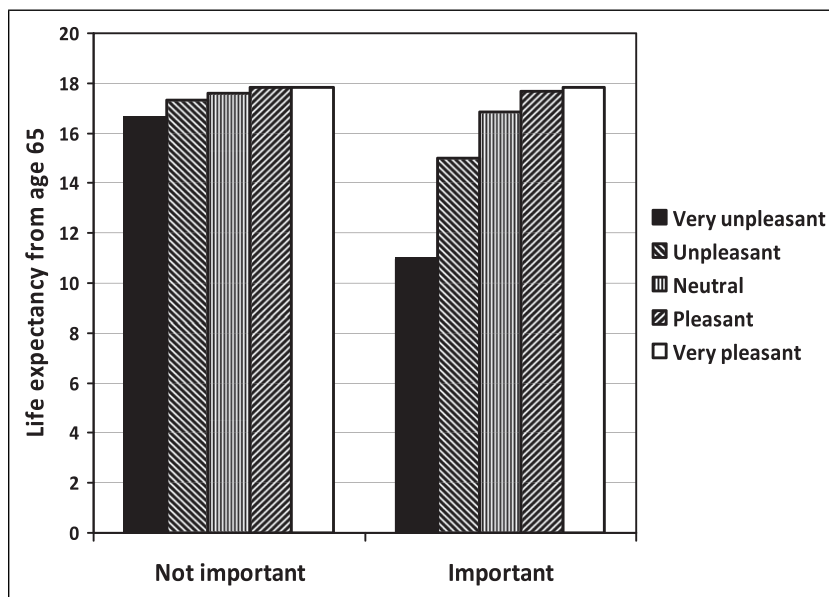
Figure 1. Remaining life expectancy by enjoyment of sexuality for men aged 65 years in 1992-1993, distinguishing men who perceived sexuality as unimportant (left) and important (right).

Table 3. Regression coefficients and confidence intervals (B (CI)) for the effects on the Logit of the Realized Probability of Dying of all variables included in the final model.

	B	CI	p-Value
Enjoyment of sexuality (square root)	0.508	0.289; 1.274	.002
Importance of sexuality (dichotomous)	1.194	0.116; 2.271	.030
Interaction enjoyment*importance	−0.678	−1.329; 0.027	.041
Age	0.037	0.023; 0.050	<.001
Positive affect, range 0–12	−0.006	−0.047; 0.035	.784
Functional limitations, range 0–24	0.101	0.060; 0.142	<.001
Past enjoyment of sexuality, range 1–5	0.094	−0.060; 0.247	.233
Emotional loneliness, range 0–6	−0.040	−0.125; 0.044	.351
Self-rated health, range 1–5	−0.072	−0.202; 0.057	.274
Sense of mastery, range 5–25	−0.001	−0.035; 0.034	.973
Alcohol consumption[a]	0.131	−0.145; 0.408	.351
- Mild versus no	−0.683	−1.136;-0.231	.003
- Moderate to extreme versus no			
Variance explained (R-square)	7.1%		

[a]mild: <21 days/month or <4 glasses/day; moderate to extreme: ≥ 21 days/month and ≥4 glasses/day.

emotional loneliness, self-rated health, sense of mastery, and alcohol consumption. Among participants who perceived their sexuality as unimportant, no association with longevity was found. Thus, whereas no unambiguous evidence exists for the association of sexual activity and longevity (Hsu et al., 2017), our findings support an association of sexual enjoyment with longevity, conditional on perceiving sexuality as important.

Sexuality in late life is considered to be a sensitive issue. Health professionals are hesitant whether they can probe into this part of older people's lives (Hillman, 2000). This prevents effective exploration and treatment of sexual problems (Hinchliff et al., 2018; Taylor & Gosney, 2011). However, for

many older adults this may not be necessary. Several studies have shown that the importance attached to sexuality decreases with ageing (Laumann et al., 2006; Lindau et al., 2007). Also, the negative impact of sexual difficulties varies (Hinchliff et al., 2018). Even when some older people find sexuality important, they may suppress their desire for sexuality, for example, in consideration of their partner's wishes. Single older adults, especially when living in a long-term care facility, may attach less importance to sexuality due to a perceived lack of opportunities to engage in intimate relationships (Bender et al., 2020). Thus, in line with gerontological theory (Baltes, 1997; Brandtstädter & Rothermund, 2002), these older adults are able to adjust

their experience of sexuality without intervention of health professionals.

In our study sample, the percentage of older adults who find sexuality important, but do not enjoy their sexual life is small (5.4%). Whether or not professional attention is warranted for individuals in this group, will depend on each individual's situation. The reasons for their shorter longevity can be partly derived from the covariates that accounted for the association between enjoyment of sexuality and longevity in our study. These included indicators of health and emotional well-being, some of which may be amenable for treatment, for example by rehabilitation of disability or by counselling to help cope with emotional loneliness. Meanwhile, these factors accounted for only a part of the association, so that the full association remains to be understood. Another factor that might play a role, but could not be investigated in the present study, is the partner's poor health (Hinchliff et al., 2018; Syme et al., 2013), which in itself places an additional burden on the healthy partner, with consequences for their own health (Kaschowitz & Brandt, 2020). In addition, it is possible that these older adults experienced sexual difficulties that may be linked to specific health problems that were not sufficiently accounted for in our study. These and possibly other factors would warrant further research.

Strengths and Limitations

This study is based on a large sample with a substantial proportion of participants aged 70 and over. A broad set of covariates was available, and their observed associations with enjoyment of sexuality correspond to earlier reports (Lee et al., 2016; Liu et al., 2016; Matthias et al., 1997; Thompson et al., 2011). Furthermore, the sample has a well-balanced sex composition and includes participants both with and without a partner, although it must be acknowledged that participants without a partner were underrepresented. Because partner status did not contribute to the final model, our findings may be considered to apply to older people regardless of their partner status.

Limitations to this study include, first, that the data used were collected several decades ago, in 1992–1993. However, our study is unique in that it examined the association of sexuality with longevity in older age and therefore we believe that our results contribute to the existing literature, especially given the long follow-up of our participants. The question remains open, to what extent results from our study are transferable to more recent generations of older adults, since attitudes towards and perceptions of sexuality may have changed (Beckman et al., 2008). A study in Dutch men and women aged 55–65 years showed, however, that the perceived importance of sexuality slightly increased over 20 years since 1993, but that this increase was limited to single women (Kaschowitz & Brandt, 2020).

Second, 'sexuality' may mean very different things to individual participants. By consequence, what participants enjoy or find important may differ widely. Our study did not include information about what sexual activities participants actually engage in. However, it may be assumed that the meaning of 'sexuality' varies with many of the covariates included in our model, so that the final model at least partly corrects for this lack of information.

Third, the study was subject to selective non-response, with the included participants clearly perceiving sexuality as more important. Non-response was also higher among the female, older, lower educated, partnerless, institutionalised and physically and mentally less healthy participants. This selection bias was amplified in two successive exclusion steps. The non-response may have weakened the association between sexuality and longevity, because the non-responders had a higher risk of a shorter longevity. However, important covariates on which non-responders differed from responders were included in the final regression model to compensate for potential bias in the final results.

Fourth, participants who did not answer the questions about enjoyment of sexuality may have simply perceived sexuality as not applicable, not meaning that they do not have a perception about their sexuality. This may be the case, for instance, in the absence of a partner (Table 1). In such cases, sexuality might remain important despite the perceived lack of possibilities to be sexually active. In future studies, the phrasing of questions about experience of sexuality should allow for perceived non-applicability.

Fifth, the experience of sexuality was measured only once. Thus, changes in participants' perceptions, for example, subsequent to the onset of illness or partner loss, were not accounted for. The association of such changes with longevity warrants future research.

Finally, ageism may have played a role in self-reports of the experience of sexuality (Estill et al., 2018; Syme et al., 2019). The ageist stereotype depicts older people as non-sexual beings. To the extent that this stereotypical belief is internalised, study participants may either have skipped the questions or marked the response that they considered socially desirable. In our study, however, attitude towards ageing was not significantly associated with perceived importance of sexuality. Regardless, in future studies of the experience of sexuality, the inclusion of questions about perceived ageism is recommended.

Despite these limitations, a clear longevity difference was observed in older adults who perceive sexuality as important: those who experience sexuality as less enjoyable can expect to live fewer years than those who experience their sexuality as more enjoyable. Thus, the effect of enjoyment of sexuality equals that of many health and psychosocial factors that have been reported to be associated with longevity. It is recommended to routinely incorporate questions about sexuality in surveys among older adults (Hinchliff et al., 2018). Also, more qualitative research may be indicated to investigate in-depth possible discrepancies in enjoyment and importance of sexuality. Further clarification of the multifaceted experience of sexuality during

ageing may help adjust social norms and beliefs about sexuality at older ages and may aid in decision making what type of health professionals, if any, might have a role in exploring, diagnosing and treating sexual problems of older adults.

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Supplemental Material

Supplement material for this article is available in online.

References

Addis, I. B., Van Den Eeden, S. K., Wassel-Fyr, C. L., Vittinghoff, E., Brown, J. S., & Thom, D. H., Reproductive Risk Factors for Incontinence Study at Kaiser (RRISK) Study Group (2006). Sexual activity and function in middle-aged and older women. *Obstetrics and Gynecology*, *107*(4), 755–764. https://doi.org/10.1097/01.AOG.0000202398.27428.e2

Baldwin, D. S., Manson, C., & Nowak, M. (2015). Impact of antidepressant drugs on sexual function and satisfaction. *CNS Drugs*, *29*(11), 905–913. https://doi.org/10.1007/s40263-015-0294-3

Baltes, P. B. (1997). On the incomplete architecture of human ontogeny. *American Psychologist*, *52*(4), 366–380. https://doi.org/10.1037/0003-066X.52.4.366

Beckman, N., Waern, M., Gustafson, D., & Skoog, I. (2008). Secular trends in self-reported sexual activity and satisfaction in Swedish 70 year olds: Cross-sectional survey of four populations, 1971-2001. *BMJ: British Medical Journal*, *337*(7662), a279. https://doi.org/10.1136/bmj.a279

Bender, A. A., Burgess, E. O., & Barmon, C. (2020). Negotiating the lack of intimacy in assisted living: Resident desires, barriers, and strategies. *Journal of Applied Gerontology*, *39*(1), 28–39. https://doi.org/10.1177/0733464817746756

Braam, A. W., Beekman, A. T. F., Van den Eeden, P., Deeg, D. J. H., Knipscheer, K. P. M., & Van Tilburg, W. (1999). Religious climate and geographical distribution of depressive symptoms in older Dutch citizens. *Journal of Affective Disorders*, *54*(1-2), 149–159. https://doi.org/10.1016/S0165-0327(98)00172-4

Brandtstädter, J., & Rothermund, K. (2002). The life-course dynamics of goal pursuit and goal adjustment: A two-process framework. *Development Review*, *22*(1), 117-150. https://doi.org/10.1006/drev.2001.0539.

Chen, H. K., Tseng, C. D., Wu, S. C., Lee, T. K., & Chen, T. H. H. (2007). A prospective cohort study on the effect of sexual activity, libido and widowhood on mortality among the elderly people: 14-year follow-up of 2453 elderly Taiwanese. *International Journal of Epidemiology*, *36*(5), 1136–1142. https://doi.org/10.1093/ije/dym109

Davey Smith, G., Frankel, S., & Yarnell, J. (1997). Sex and death: are they related? Findings from the Caerphilly cohort study. *Bmj: British Medical Journal*, *315*(7123), 1641–1644. https://doi.org/10.1136/bmj.315.7123.1641

de Jong Gierveld, J., Broese van Groenou, M., Hoogendoorn, A. W., & Smit, J. H. (2009). Quality of marriages in later life and emotional and social loneliness. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *64*(4), 497–506. https://doi.org/10.1093/geronb/gbn043

Deeg, D. J. H., van Oortmarssen, G. J., Habbema, J. D. F., & van der Maas, P. J. (1989). A measure of survival for long term follow up studies of the elderly. *Journal of Clinical Epidemiology*, *42*(6), 541–549. https://doi.org/10.1016/0895-4356(89)90150-9

Ein-Dor, T., & Hirschberger, G. (2012). Sexual healing: Daily diary evidence that sex relieves stress for men and women in satisfying relationships. *Journal of Social and Personal Relationships*, *29*(1), 126–139. https://doi.org/10.1177/0265407511431185

Estill, A., Mock, S. E., Schryer, E., & Eibach, R. P. (2018). The effects of subjective age and aging attitudes on mid- to late-life sexuality. *Journal of Sex Research*, *55*(2), 146–151. https://doi.org/10.1080/00224499.2017.1293603

Figueiras, A., Domenech-Massons, J. M., & Cadarso, C. (1998). Regression models: Calculating the confidence interval of effects in the presence of interactions. *Statistics in Medicine*, *17*(18), 2099–2105. https://doi.org/10.1002/(SICI)1097-0258(19980930)17:18<2099::AID-SIM905>3.0.CO;2-6

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). Minimental state: A practical method for the clinician. *Journal of Psychiatric Research*, *12*(3), 189–198. https://doi.org/10.1016/0022-3956(75)90026-6

Ginsberg, T. B., Pomerantz, S. C., & Kramer-Feeley, V. (2005). Sexuality in older adults: Behaviours and preferences. *Age and Ageing*, *34*(5), 475–480. https://doi.org/10.1093/ageing/afi143

Hartmans, C., Comijs, H., & Jonker, C. (2015). The perception of sexuality in older adults and its relationship with cognitive functioning. *American Journal of Geriatric Psychiatry*, *23*(3), 243–252. https://doi.org/10.1016/j.jagp.2013.04.003

Hillman, J. L. (2000). *Clinical perspectives on elderly sexuality*. Kluwer Academic Plenum.

Hinchliff, S., Tetley, J., Lee, D., & Nazroo, J. (2018). Older adults' experiences of sexual difficulties: Qualitative findings from the English Longitudinal Study on Ageing (ELSA). *Journal of Sex*

Research, *55*(2), 152–163. https://doi.org/10.1080/00224499.2016.1269308

Hoogendijk, E. O., Deeg, D. J. H., de Breij, S., Klokgieters, S. S., Kok, A. A. L., Stringa, N., Timmermans, E. J., van Schoor, N. M., van Zutphen, E. M., van der Horst, M., Poppelaars, J., Malhoe, P., & Huisman, M. (2020). The longitudinal aging study Amsterdam: Cohort update 2019 and additional data collections. *European Journal of Epidemiology*, *35*(1), 61–74. https//doi.org/10.1007/s10654-019-00541-2

Hsu, B., Hirani, V., Naganathan, V., Blyth, F. M., Le Couteur, D. G., Seibel, M. J., Waite, L. M., Handelsman, D. J., & Cumming, R. G. (2017). Sexual function and mortality in older men: The Concord Health and Ageing in Men Project. *Journals of Gerontology A: Biological Sciences and Medical Sciences*, *72*(4), 520–527. https://doi.org/10.1093/gerona/glw101

Kaschowitz, J., & Brandt, M. (2020). Health effects of informal caregiving across Europe: A longitudinal approach. *Social Science & Medicine*, *173*(1), 72-80. https://doi.org/10.1016/j.socscimed.2016.11.036.

Kepler, S. B., Hasin, T., Benyamini, Y., Goldbourt, U., & Gerber, Y. (2020). Frequency of sexual activity and long-term survival after acute myocardial infarction. *American Journal of Medicine*, *133*(1), 100–107. https://doi.org/10.1016/j.amjmed.2019.06.019

Kolodziejczak, K., Drewelies, J., Deeg, D. J. H., Huisman, M., & Gerstorf, D. (2021). Perceived importance and enjoyment of sexuality in late midlife: Cohort differences in the longitudinal aging study Amsterdam (LASA). *Sexuality Research & Social Policy*, *18*(3), 621–635. https://doi.org/10.1007/s13178-020-00486-2

Laumann, E. O., Paik, A., Glasser, D. B., Kang, J. H., Wang, T., Levinson, B., Moreira, E. D. Jr., Nicolosi, A., & Gingell, C. (2006). A cross-national study of subjective sexual well-being among older women and men: Findings from the global study of sexual attitudes and behaviors. *Archives of Sexual Behavior*, *35*(2), 143–159. https://doi.org/10.1007/s10508-005-9005-3

Lee, D. M., Vanhoutte, B., Nazroo, J., & Pendleton, N. (2016). Sexual health and positive subjective well-being in partnered older men and women. *Journals of Gerontology B: Psychological Sciences and Social Sciences*, *71*(4), 698–710. https://doi.org/10.1093/geronb/gbw018

Lindau, S. T., Schumm, L. P., Laumann, E. O., Levinson, W., O'Muircheartaigh, C. A., & Waite, L. J. (2007). A study of sexuality and health among older adults in the United States. *New England Journal of Medicine*, *357*(8), 762–774. https://doi.org/10.1056/NEJMoa067423

Liu, H., Waite, L. J., Shen, S., & Wang, D. H. (2016). Is sex good for your health? A national study on partnered sexuality and cardiovascular risk among older men and women. *Journal of Health and Social Behavior*, *57*(3), 276–296. https://doi.org/10.1177/0022146516661597

Matthias, R. E., Lubben, J. E., Atchison, K. A., & Schweitzer, S. O. (1997). Sexual activity and satisfaction among very old adults: Results from a community-dwelling medicare population survey. *The Gerontologist*, *37*(1), 6–14. https://doi.org/10.1093/geront/37.1.6

Mulder, P. G., & Garretsen, H. F. (1983). Are epidemiological and sociological surveys a proper instrument for detecting true problem drinkers? (The low sensitivity of an alcohol survey in Rotterdam). *International Journal of Epidemiology*, *12*(4), 442–444. https://doi.org/10.1093/ije/12.4.442

Pearlin, L. I., & Schooler, C. (1978). The structure of coping. *Journal of Health and Social Behavior*, *19*, 2–21. https://doi.org/10.2307/2136319

Penninx, B. W. J. H., van Tilburg, T. G., Kriegsman, D. M. W., Deeg, D. J. H., Boeke, A. J. P., & van Eijk, J. T. M. (1997). Effects of social support and personal coping resources on mortality in older age. *American Journal of Epidemiology*, *146*(6), 510–519. https://doi.org/10.1093/oxfordjournals.aje.a009305

Radloff, L. S. (1997). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1*(3), 385–401. https://doi.org/10.1177/014662167700100306

Schnarch, D. M. (1991). *Constructing the sexual crucible. An integration of sexual and marital therapy*. Norton.

Syme, M. L., Cohn, T. J., Stoffgren, S., Kaempfe, H., & Schippers, D. (2019). "At my age ": Defining sexual wellness in mid- and later life. *Journal of Sex Research*, *56*(7), 832–842. https://doi.org/10.1080/00224499.2018.1456510

Syme, M. L., Klonoff, E. A., Macera, C. A., & Brodine, S. K. (2013). Predicting sexual decline and dissatisfaction among older adults: The role of partnered and individual physical and mental health factors. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *68*(3), 323–332. https://doi.org/10.1093/geronb/gbs087

Taylor, A., & Gosney, M. A. (2011). Sexuality in older age: Essential considerations for healthcare professionals. *Age and Ageing*, *40*(5), 538–543. https://doi.org/10.1093/ageing/afr049

Thompson, W. K., Charo, L., Vahia, I. V., Depp, C., Allison, M., & Jeste, D. V. (2011). Association between higher levels of sexual function, activity, and satisfaction and self-rated successful aging in older postmenopausal women. *Journal of the American Geriatrics Society*, *59*(8), 1503–1508. https://doi.org/10.1111/j.1532-5415.2011.03495.x

Træen, B., & Villar, F. (2020). Sexual well-being is part of aging well. *European Journal of Ageing*, *17*(2), 135-138. https://doi.org/10.1007/s10433-020-00551-0.

Wiest, M., Schüz, B., Webster, N., & Wurm, S. (2011). Subjective well-being and mortality revisited: Differential effects of cognitive and emotional facets of well-being on mortality. *Health Psychology*, *30*(6), 728–735. https://doi.org/10.1037/a0023839

Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica*, *67*(6), 361–370. https://doi.org/10.1111/j.1600-0447.1983.tb09716.x