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PSYCHOLOGY

Physical and Mental Health Problems and Their Associations With Inter-Personal Sexual Inactivity and Sexual Dysfunctions in Denmark: Baseline Assessment in a National Cohort Study



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ABSTRACT

Background: Physical and mental health are important to sexual function and wellbeing. Yet, associations of ill-health with sexual inactivity and dysfunctions are scarcely researched at population level.

Aim: To explore and document associations of self-rated health and physical and mental health problems with inter-personal sexual inactivity and sexual dysfunctions.

Methods: We used data from a probability-based, nationally representative sample of 60,958 sexually experienced Danes aged 15–89 years who participated in the 2017–18 Project SEXUS cohort study. Logistic regression analyses provided demographically weighted odds ratios for associations between health measures and sexual outcomes adjusted for partner status and other potential confounders.

Outcomes: Inter-personal sexual inactivity and a range of male and female sexual dysfunctions.

Results: Inter-personal sexual inactivity was more common among individuals with bad or very bad self-rated health compared to peers rating their health as good or very good (men: adjusted odds ratio 1.93, 95% confidence interval 1.66–2.25; women: 1.66, 1.42–1.94). Individuals rating their health as bad or very bad were also consistently more likely to report sexual dysfunctions, with associated statistically significant adjusted odds ratios ranging from 1.66 to 6.38 in men and from 2.25 to 3.20 in women. Patient groups at high risk of sexual dysfunctions comprised individuals afflicted by cardiovascular diseases, pain conditions, diabetes, gastrointestinal and liver diseases, cancer, skin diseases, nervous system diseases, gynecological diseases, benign prostatic hyperplasia, other physical health problems, stress, anxiety, affective disorders, self-injury or suicide ideation and attempts, posttraumatic stress disorder, personality disorders, eating disorders, psychoses and other mental health problems.

Clinical Implications: These findings warrant heightened awareness among healthcare professionals, public health promoters and researchers concerning insufficiently appreciated sexual challenges among individuals with poor health.

Strengths & Limitations: The major strengths of our investigation include the large size of the study cohort, the detailed assessment of health-related variables, potential confounders and sexual outcomes, and the fact that we provide new population-based knowledge about less common and sparsely researched sexual dysfunctions and diseases. Limitations of our study include its cross-sectional nature and its modest response rate (35%).

Conclusion: Findings from our large and nationally representative cohort study provide evidence that poor self-rated health and a range of specific physical and mental health problems are associated with statistically significantly increased rates of inter-personal sexual inactivity and sexual dysfunctions. **Bahnsen MK, Graugaard C, Andersson M, et al. Physical and Mental Health Problems and Their Associations With Inter-Personal Sexual Inactivity and Sexual Dysfunctions in Denmark: Baseline Assessment in a National Cohort Study. J Sex Med 2022;19:1562–1579.**

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Key Words: Sexual Health; Sexual Dysfunctions; Mental Health; Chronic Diseases; Epidemiology; Denmark

INTRODUCTION

Sexual dysfunctions are common experiences in the general population, with reported overall prevalence estimates among sexually active people between 11% and 42% in men and between 11% and 51% in women.^{1–4} In a recent, nationally representative study among sexually active Danes aged 15–89 years, we showed that 18.0% of men and 20.4% of women had experienced at least 1 sexual dysfunction within the last year.⁵ In Australia, sexual difficulties experienced for at least a month during the last year were reported by as many as 48% of men and 68% of women in a national survey, but large proportions of these difficulties were not perceived as problematic, thus failing to constitute sexual dysfunctions.⁶

Associations between indicators of poor health and sexual problems have been the subject of several investigations. The British Natsal-3 survey demonstrated that a considerable proportion of sexual dysfunctions were associated with current health problems,⁷ and links between erectile dysfunction and chronic conditions such as cardiovascular diseases and diabetes are well-established.^{8,9} Other physical and mental diseases have also been found to be associated with problems concerning sexual desire, function and satisfaction.^{10–12} Generally, however, the impact of physical or mental health challenges on intimate relations and sexual functioning is understudied, and data from unselected, nationally representative studies that aim to unravel links between health problems and inter-personal sexual inactivity or sexual dysfunctions are scarce.

Mechanisms underlying associations of health problems with sexual inactivity and dysfunctions are complex, reflecting intertwined bio-psycho-social factors, including direct effects of the disease, side-effects from treatment and non-specific disease ramifications such as pain, nausea, fatigue, psychological distress, body image disorders and relational tensions.¹³ Adding further complexity to the clinical handling of these issues, both patients and clinicians may be reluctant to initiate conversations about disease-induced sexual challenges, thereby establishing or maintaining a ‘two-way taboo’, which may ultimately have a negative impact on patients’ coping competencies and quality-of-life.¹⁴ Consequently, improved knowledge about the complex interrelationship between physical and mental health problems and sexual activity and functioning is crucial to secure scientific evidence that may promote targeted public health interventions and ensure high-quality clinical counselling. With the aim to contribute new knowledge in the field based on solid, population-based data, we here provide a comprehensive assessment of inter-personal sexual

inactivity and sexual dysfunctions among individuals affected by a broad spectrum of physical or mental health problems.

METHODS

Project SEXUS was established in 2017 as a prospective national cohort study aimed to serve as a data resource for sexuality research and studies on the interplay between sexuality and health in the general Danish population. The self-administered online questionnaire, which had been developed, cognitively validated, subjected to peer review among national experts in sexual health and tested in a pilot study comprising 3,000 individuals prior to study start, covered more than 600 items, but due to strategic and logical filter questions, each participant was only presented with a median of 180 questions. After the successful pilot phase, which gave rise to only minor adjustments in wording and logistics, the project was launched in September 2017. The analyses of the present study are based on baseline questionnaire data collected between September 2017 and August 2018.¹⁵

Participants

Using a probability-based sampling frame, we initially identified 250,000 individuals who fulfilled a series of demographic criteria for potential participation in the Project SEXUS study. We excluded individuals who were younger than 15 or older than 89 years, those who died before the day of intended invitation and those with address protection, thus leaving a sample of 187,084 eligible Danes aged 15–89 years, whom we invited to participate in the study. Of the invited individuals, 64,706 provided complete or almost-complete responses, thus yielding a response rate (AAPOR response rate 1) of 34.6% according to criteria established by the American Association for Public Opinion Research.^{16,17} A total of 62,675 respondents provided complete and plausible answers and, upon restriction to sexually experienced participants, 60,958 individuals contributed data for the present study. We applied an individual weighting procedure, in which we calibrated for imbalances in the study sample due to different sampling probabilities and rates of non-participation in various demographic strata, to ensure exact national representativeness with regard to sex, birth year, region of residence, marital status (including history of same-sex marriage or registered partnership), cultural background (reflecting the country of birth of parents) and twin status, using a weighting procedure that is widely used by national statistical agencies in Denmark and Sweden.^{17,18} Specifically, Table 8 of the online technical

report for Project SEXUS¹⁷ documents that our weighting procedure ensured 100% national representativeness with respect to the demographic variables mentioned.

Sexual Outcome Measures

Inter-Personal Sexual Inactivity Within the Last Year.

Regardless of respondents' possible masturbation activities, those reporting no sexual activity with another person (ie, vaginal intercourse, anal intercourse, oral sex or hand sex) within the last year were considered sexually inactive.

Sexual Dysfunctions Within the Last Year. Men who had been sexually active within the last year were asked if they had experienced difficulties achieving or maintaining an erection, ejaculating prematurely, reaching an orgasm and/or experiencing genital pain in relation to inter-personal sexual activity. Women who had been sexually active within the last year were asked if they had experienced difficulties achieving sufficient vaginal lubrication, reaching an orgasm, experiencing vaginal cramps that precluded penetration and/or experiencing genital pain in relation to inter-personal sexual activity. Individual questions were answered using a 5-point Likert scale (*not at all, rarely, sometimes, often, every time*). Respondents reporting that they had experienced a specific sexual difficulty *often* or *every time* were further asked if they perceived the difficulty in question as a problem or not (*yes, no*).

To be categorized as a *sexual dysfunction*, we demanded that an experienced sexual difficulty be both frequent (ie, *often* or *every time*) and reported as a problem. Less frequent difficulties, and difficulties that were not perceived as a problem regardless of their frequency, were categorized as *sexual difficulties*. This trisection (*no sexual difficulty, sexual difficulty and sexual dysfunction*), which has been used in other studies,^{1,5,11} is in concordance with the ICD-11 classification of mental and behavioral disorders related to sexuality.¹⁹ To reduce complexity and focus on the clinically most relevant outcomes, we only present associations of physical and mental health problems with sexual dysfunctions.

Hypoactive Sexual Desire Disorder Within the Last Four Weeks. To identify participants with likely hypoactive sexual desire disorder, both sexually active and inactive respondents with a spouse/partner were asked to indicate their level of sexual desire within the last 4 weeks. For this purpose, we used the first question about sexual desire in the Female Sexual Function Index with response options presented as a 5-point Likert scale (*very low or none at all, low, moderate, high, very high*). Participants were further asked if they perceived their reported level of sexual desire as a problem (*yes, no*).

We categorized participants whose level of sexual desire was *low* or *very low* or *none at all*, and who deemed their level of sexual desire problematic, as having hypoactive sexual desire disorder. For the statistical analyses, a trisection was used: (1) no sexual desire disorder, (2) hypoactive sexual desire disorder and (3) desire-related disorder associated with *very high, high* or *medium* levels of sexual desire. To reduce complexity, we only present associations of physical and mental health problems with hypoactive sexual desire disorder.

IIEF-5 and FSFI-6 Scores Within the Last Four Weeks.

We included internationally validated scoring instruments measuring male and female sexual dysfunction among participants with a spouse/partner who had attempted to have sexual intercourse within the last 4 weeks. Male erectile function was measured by the 5-item International Index of Erectile Function (IIEF-5),²⁰ whereas female sexual function was measured by the 6-item Female Sexual Function Index (FSFI-6).²¹ For male respondents with a male spouse/partner, the IIEF-5 instrument was modified slightly by replacing the words "*sexual intercourse*" with "*anal sex (with you as the 'active' partner)*" to enable inclusion of men who practiced insertive anal intercourse with other men. In the statistical analyses, men with an IIEF-5 score of 5–11 points (*moderate* or *severe erectile dysfunction (ED)*), referred to as ED_{IIEF-5≤11}) were compared to those with a score of 22–25 points (*no ED*). Women with an FSFI-6 score of 6–19 points (*female sexual dysfunction*), referred to as FSD_{FSFI-6≤19}) were compared to those with a score of 20–30 points (*normal sexual function*).²¹

Health Measures

Self-Rated Health. Participants were asked "*In general, how do you rate your health?*" with response categories *very good, good, neither good nor bad, bad* or *very bad*. For the statistical analyses, the categories *very good* and *good* were combined, and so were the categories *bad* and *very bad*.

Physical and Mental Health Problems. Participants were asked "*Have you ever been treated by a doctor for a long-lasting or severe physical disease?*" and "*Have you ever received treatment by a doctor, psychologist or similar professional for a mental health problem?*" with response categories *yes, no* or *I do not know*. Participants answering *yes* were further asked to go through a list of specific diseases to indicate which ones they had received treatment for and, when relevant, when they had received such treatment (*within the last year, more than a year ago, I do not know*).

Statistical Analyses

Depending on the sexual outcome, associations of self-rated health and physical and mental health problems with inter-personal

sexual inactivity and sexual dysfunctions were analyzed by means of binary or polytomous logistic regression, as appropriate, using demographically weighted data to yield odds ratios with 95% confidence intervals. In all analyses, participants who had never received treatment for the particular health problem served as reference. Participants treated for a particular health problem more than a year ago were included in the logistic regression models as a separate category. However, to reduce complexity, we only present odds ratios for specific physical and mental health problems comparing individuals treated within the last year *vs* the reference group of individuals who never received treatment for the health problem in question.

To avoid the presentation of unstable results, odds ratios linking individual health problems to specific sexual outcomes are presented only in situations with at least 5 observed cases of the particular sexual outcome among individuals with the health problem in question. All odds ratios are adjusted for age in 10-year intervals (7 categories), and odds ratios referred to as adjusted odds ratios are additionally adjusted for partner status (2 categories), education (5 categories), ability to pay household bills (3 categories), body mass index (4 categories), smoker status (3 categories), weekly alcohol consumption (6 categories) and weekly time spent on moderate or hard physical activity (5 categories). Covariate categories are shown in Table 1.

When reporting our results, we operationally defined patient groups at high risk of sexual dysfunction as those with statistically significant adjusted odds ratios above 2 for 2 or more sexual dysfunctions.

To address possible synergy between current physical and mental health problems, we conducted an additional analysis, in which individuals who were treated within the last year for (a) physical health problems only, (b) mental health problems only or (c) both physical and mental health problems were compared to a reference group of (d) individuals who had never received treatment for any long-lasting or severe physical disease or any mental health problems.

All statistical analyses were carried out in SAS version 9.4.

Ethics

According to Danish law, ethics approval is not required for purely questionnaire-based studies. Prior to study onset, institutional approval at Statens Serum Institut (approval no. 21-00053) was obtained to ensure compliance with the EU's general data protection regulation (GDPR).

RESULTS

Selected sociodemographic, lifestyle- and health-related background characteristics of the 60,958 sexually experienced study participants are shown in Table 1. Overall, 24.8% of men and 29.5% of women did not have a spouse or partner, and 23.0% of men and 28.8% of women reported inter-personal sexual

Table 1. Sociodemographic, lifestyle and health-related characteristics of 60,958 sexually experienced study participants, Denmark 2017–2018

	Men N (%)	Women N (%)
Overall	28,583 (50.0)	32,375 (50.0)
Age (years)		
15–24	3,155 (16.7)	5,309 (15.8)
25–34	3,453 (13.6)	5,313 (13.0)
35–44	4,298 (14.4)	5,436 (14.2)
45–54	5,096 (17.5)	5,972 (17.2)
55–64	5,163 (15.5)	5,231 (15.4)
65–74	4,599 (14.0)	3,647 (14.5)
≥75	2,819 (8.1)	1,467 (9.9)
Partner status		
No spouse/partner	5,777 (24.8)	8,252 (29.5)
Spouse/partner	22,652 (75.2)	23,953 (70.5)
Inter-personal sexual activity within the last year		
No	6,345 (23.0)	7,467 (28.8)
Yes	22,238 (77.0)	24,908 (71.3)
Education		
≤10 years	4,806 (18.8)	4,134 (14.8)
Secondary education	2,506 (10.9)	3,256 (9.5)
Short-cycle higher education	4,012 (13.7)	6,574 (20.5)
Medium-cycle higher education	11,674 (39.2)	13,412 (41.4)
Long-cycle higher education	5,311 (17.5)	4,783 (13.8)
Difficulties paying bills last year		
Not at all	24,911 (86.4)	26,644 (84.2)
Sometimes	3,100 (11.9)	4,646 (13.8)
Often	416 (1.7)	693 (2.1)
Body mass index (kg/m ²)		
<18.5 (underweight)	378 (1.9)	988 (3.2)
18.5–<25 (normal weight)	11,580 (42.3)	17,206 (53.3)
25–<30 (overweight)	11,905 (40.2)	8,574 (27.1)
≥30 (obese)	4,615 (15.7)	5,435 (16.4)
Smoker status (daily smoking)		
Current smoker	4,392 (15.9)	4,756 (14.4)
Former smoker	9,663 (31.3)	8,879 (28.7)
Never smoker	14,404 (52.9)	18,610 (56.8)
Average weekly alcohol consumption within the last year		
0 alcoholic beverages	3,398 (13.3)	8,070 (24.6)
1–2 alcoholic beverages	7,858 (28.2)	11,583 (35.1)
3–7 alcoholic beverages	7,788 (26.9)	7,639 (24.5)
8–14 alcoholic beverages	4,766 (16.3)	3,377 (11.4)
15–21 alcoholic beverages	2,882 (9.7)	966 (3.3)
22+ alcoholic beverages	1,692 (5.7)	340 (1.1)
Average weekly moderate to hard physical activity		
<1/2 h	5,774 (20.0)	6,947 (21.3)
1/2–1 1/2 h	6,796 (23.2)	8,127 (25.4)
1 1/2–2 1/2 h	5,653 (19.5)	6,658 (20.6)
2 1/2–5 h	6,478 (22.8)	7,369 (22.6)
>5 h	3,882 (14.5)	3,274 (10.1)
Self-rated health		
Very good or good	22,606 (79.2)	25,780 (78.7)

(continued)

Table 1. Continued

	Men N (%)	Women N (%)
Neither good nor bad	4,466 (15.7)	4,705 (15.2)
Bad or very bad	1,511 (5.1)	1,890 (6.2)
Treatment for any long-lasting or severe physical disease		
Within the last year	4,622 (15.2)	5,418 (18.4)
More than a year ago	3,008 (10.4)	2,812 (9.2)
Never	20,457 (74.4)	23,549 (72.4)
Treatment for any mental health problem		
Within the last year	1,825 (6.9)	4,644 (13.7)
More than a year ago	4,088 (14.4)	7,940 (23.6)
Never	22,383 (78.7)	19,351 (62.7)

N = number of participants (unweighted). (%) = percentage (weighted).

inactivity within the last year. Self-rated health was bad or very bad for 5.1% of men and 6.2% of women. Proportions who had been treated for a long-lasting or severe physical disease within the last year were 15.2% among men and 18.4% among women, and corresponding proportions who had been treated for a mental health problem within the last year were 6.9% among men and 13.7% among women.

Associations Between Health Problems and Inter-Personal Sexual Inactivity

Self-Rated Health and Inter-Personal Sexual Inactivity. As shown in Table 2, individuals with bad or very bad self-rated health were markedly more likely, in age-adjusted analyses, to be sexually inactive compared to peers rating their health as good or very good (men: odds ratio 3.54, 95% confidence interval 3.11–4.02; women: 2.43, 2.17–2.73). Associations weakened, yet remained statistically significant, after additional adjustment for partner status and other potential confounders (men: adjusted odds ratio 1.93, 95% confidence interval 1.66–2.25; women: 1.66, 1.42–1.94).

Physical and Mental Health Problems and Inter-Personal Sexual Inactivity. Inter-personal sexual inactivity was more common among men and women who had received treatment within the last year for any long-lasting or severe physical disease (men: adjusted odds ratio 1.24, 95% confidence interval 1.13–1.37; women: 1.14, 1.03–1.26) compared to individuals who had never received treatment for such physical health problems. Overall, there was no statistically significant association between inter-personal sexual inactivity and having received treatment for any mental health problem within the last year (men: 1.16, 0.99–1.35; women: 0.96, 0.86–1.08) (Table 2).

Among men, strong and statistically significant associations with inter-personal sexual inactivity were seen for most of the individual physical and mental health problems studied. In fully

adjusted analyses, associations remained statistically significant for cardiovascular diseases (adjusted odds ratio 1.28, 95% confidence interval 1.14–1.45), asthma, other lung diseases and allergies (1.30, 1.05–1.61), cancer (2.03, 1.56–2.64), stress (1.25, 1.00–1.56), anxiety (1.36, 1.10–1.69), affective disorders (1.42, 1.12–1.81) and psychoses (2.16, 1.26–3.70). Among women, only cancer (1.46, 1.05–2.02) and autism spectrum disorders (2.21, 1.22–4.02) remained positively associated with inter-personal sexual inactivity after full adjustment. Conversely, women with personality disorders (0.67, 0.46–0.98) and those with attention deficit hyperactivity disorder (0.52, 0.31–0.86) were significantly less likely to report inter-personal sexual inactivity within the last year (Table 2).

Synergy Between Physical and Mental Health Problems and Inter-Personal Sexual Inactivity.

There was no indication of major synergy between physical and mental health problems in relation to inter-personal sexual inactivity. As shown in Figure 1, using individuals who had never received treatment for any long-lasting or severe physical disease or any mental health problems as reference, adjusted odds ratios for inter-personal sexual inactivity were similar among those who had received treatment for physical health problems only (men: adjusted odds ratio 1.25, 95% confidence interval 1.12–1.38; women: 1.11, 1.00–1.25) and those treated for both physical and mental health problems within the last year (men: 1.31, 0.98–1.75; women: 1.14, 0.92–1.41).

Associations Between Health Problems and Sexual Dysfunctions

Self-Rated Health and Sexual Dysfunctions. As shown in Table 3, comparing individuals with self-reports of *bad* or *very bad* health with those reporting *good* or *very good* health revealed statistically significant adjusted odds ratios for all male and female sexual dysfunctions studied, ranging from 1.66 (premature ejaculation dysfunction) to 6.38 (genital pain dysfunction) in men and from 2.25 (orgasmic dysfunction) to 3.20 (genital pain dysfunction) in women.

Physical and Mental Health Problems and Sexual Dysfunctions in Men.

Men who had been treated for any long-lasting or severe physical disease within the last year had 2- to 3-fold elevated odds of all sexual dysfunctions studied, except for premature ejaculation (Table 4). Patient groups at high risk of sexual dysfunction, operationally defined as those with statistically significant adjusted odds ratios above 2 for 2 or more sexual dysfunctions, comprised men afflicted by cardiovascular diseases, pain conditions, diabetes, gastrointestinal and liver diseases, cancer, skin diseases, nervous system diseases, benign prostatic hyperplasia or other physical health problems.

Table 2. Inter-personal sexual inactivity within the last year according to self-rated health and treatment for physical or mental health problems among 28,583 sexually experienced men and 32,375 sexually experienced women, Denmark 2017–2018

	Men			Women		
	N (%)	OR (95% CI)	aOR (95% CI)	N (%)	OR (95% CI)	aOR (95% CI)
Self-rated health						
Very good or good	22,606 (19.8)	1 (ref)	1 (ref)	25,780 (26.0)	1 (ref)	1 (ref)
Neither good nor bad	4,466 (32.4)	2.14 (1.97–2.32)	1.58 (1.43–1.74)	4,705 (37.0)	1.67 (1.54–1.80)	1.34 (1.21–1.48)
Bad or very bad	1,511 (43.6)	3.54 (3.11–4.02)	1.93 (1.66–2.25)	1,890 (43.8)	2.43 (2.17–2.73)	1.66 (1.42–1.94)
Treatment for any long-lasting or severe physical disease						
Never	20,457 (20.7)	1 (ref)	1 (ref)	23,549 (26.0)	1 (ref)	1 (ref)
More than a year ago	3,008 (23.8)	1.11 (1.00–1.23)	1.11 (0.98–1.24)	2,812 (29.6)	0.99 (0.89–1.10)	0.98 (0.86–1.11)
Within the last year	4,622 (32.1)	1.51 (1.39–1.64)	1.24 (1.13–1.37)	5,418 (38.0)	1.32 (1.22–1.43)	1.14 (1.03–1.26)
Treatment for specific physical diseases within the last year						
Cardiovascular diseases*	2,173 (37.7)	1.63 (1.46–1.81)	1.28 (1.14–1.45)	1,473 (49.7)	1.40 (1.23–1.59)	1.07 (0.91–1.25)
Rheumatic diseases*	1,017 (28.1)	1.30 (1.10–1.52)	0.97 (0.80–1.18)	1,618 (43.2)	1.36 (1.19–1.54)	1.11 (0.95–1.30)
Asthma, other lung diseases and allergies	698 (32.5)	1.42 (1.18–1.72)	1.30 (1.05–1.61)	1,056 (41.8)	1.48 (1.28–1.71)	1.17 (0.97–1.41)
Pain conditions*	510 (30.5)	1.60 (1.28–2.01)	0.95 (0.72–1.24)	1,207 (33.7)	1.33 (1.14–1.54)	1.05 (0.86–1.27)
Diabetes	805 (37.7)	1.75 (1.48–2.06)	1.21 (0.99–1.48)	452 (46.9)	1.75 (1.40–2.19)	1.14 (0.84–1.55)
Gastrointestinal and liver diseases	387 (32.8)	1.60 (1.25–2.06)	1.21 (0.91–1.62)	575 (37.3)	1.34 (1.08–1.67)	1.22 (0.91–1.63)
Hyper- or hypothyroidism	119 (33.2)	1.43 (0.93–2.21)	1.27 (0.78–2.06)	651 (39.1)	1.34 (1.10–1.63)	1.19 (0.93–1.52)
Cancer	412 (48.1)	1.94 (1.56–2.43)	2.03 (1.56–2.64)	351 (48.9)	1.59 (1.23–2.07)	1.46 (1.05–2.02)
Skin diseases	233 (30.5)	1.37 (0.98–1.90)	1.20 (0.83–1.73)	353 (31.0)	1.08 (0.80–1.45)	0.86 (0.61–1.22)
Nervous system diseases	160 (35.7)	1.91 (1.29–2.85)	1.29 (0.83–2.00)	206 (31.2)	1.22 (0.84–1.77)	1.35 (0.92–1.98)
Gynecological diseases	.	.	.	238 (18.2)	0.78 (0.50–1.23)	0.86 (0.54–1.38)
Benign prostatic hyperplasia	181 (38.6)	1.05 (0.75–1.46)	0.97 (0.66–1.42)	.	.	.
Other physical health problems*	615 (30.0)	1.55 (1.25–1.92)	1.02 (0.80–1.30)	853 (32.7)	1.24 (1.04–1.49)	1.05 (0.85–1.30)
Treatment for any mental health problem						
Never	22,383 (22.9)	1 (ref)	1 (ref)	19,351 (30.9)	1 (ref)	1 (ref)
More than a year ago	3,272 (21.1)	1.26 (1.15–1.39)	1.06 (0.95–1.18)	7,940 (24.7)	1.10 (1.02–1.18)	0.99 (0.90–1.08)
Within the last year	1,825 (26.6)	1.74 (1.52–1.98)	1.16 (0.99–1.35)	4,644 (24.7)	1.33 (1.22–1.46)	0.96 (0.86–1.08)
Treatment for specific mental health problems within the last year						
Stress	854 (22.5)	1.53 (1.26–1.85)	1.25 (1.00–1.56)	2,398 (21.7)	1.23 (1.09–1.38)	0.95 (0.82–1.10)
Anxiety	760 (29.8)	1.95 (1.61–2.35)	1.36 (1.10–1.69)	2,055 (26.4)	1.43 (1.27–1.62)	1.05 (0.90–1.23)
Affective disorders ^d	613 (30.5)	2.07 (1.68–2.55)	1.42 (1.12–1.81)	1,625 (28.4)	1.53 (1.34–1.75)	1.08 (0.92–1.28)
Self-injury or suicide ideation and attempts	262 (33.4)	2.09 (1.52–2.86)	1.10 (0.74–1.62)	550 (24.7)	1.22 (0.98–1.53)	0.84 (0.64–1.09)
Posttraumatic stress disorder (PTSD)	138 (29.6)	2.25 (1.47–3.44)	1.58 (0.97–2.59)	312 (24.6)	1.26 (0.93–1.71)	0.77 (0.52–1.15)
Personality disorders	71 (28.7)	1.73 (0.88–3.40)	1.27 (0.58–2.78)	282 (20.3)	1.19 (0.85–1.66)	0.67 (0.46–0.98)
Attention deficit hyperactivity disorder (ADHD)	131 (22.2)	1.14 (0.69–1.86)	0.74 (0.42–1.31)	211 (18.4)	0.93 (0.63–1.37)	0.52 (0.31–0.86)
Obsessive compulsive disorder (OCD)	82 (32.9)	2.01 (1.16–3.46)	1.45 (0.79–2.66)	220 (22.6)	1.17 (0.82–1.66)	0.97 (0.64–1.48)
Eating disorders	31 (51.6)	4.44 (1.76–11.20)	1.89 (0.75–4.74)	223 (31.2)	1.71 (1.24–2.37)	0.95 (0.64–1.42)

(continued)

Table 2. Continued

	Men			Women		
	N (%)	OR (95% CI)	aOR (95% CI)	N (%)	OR (95% CI)	aOR (95% CI)
Psychoses	98 (44.2)	4.48 (2.71–7.41)	2.16 (1.26–3.70)	122 (33.1)	2.02 (1.30–3.15)	1.00 (0.58–1.72)
Autism spectrum disorders	80 (56.1)	4.14 (2.52–6.81)	1.58 (0.86–2.90)	97 (49.4)	3.84 (2.42–6.09)	2.21 (1.22–4.02)
Other mental health problems	534 (26.7)	1.66 (1.31–2.10)	1.03 (0.79–1.35)	1,281 (26.6)	1.35 (1.16–1.57)	0.91 (0.75–1.11)

N = number of participants with the given self-rated health or health problem who were also sexually inactive (weighted). OR = odds ratio adjusted for age in 10-y intervals. aOR = odds ratio adjusted for age in 10-y intervals, education, ability to pay household bills, partner status, smoker status, weekly alcohol consumption, weekly time spent on physical activity, and BMI. Reference categories for specific health problems composed of participants who were never treated for the particular health problem in question.

*Cardiovascular diseases include the following: cardiac rhythm disorders, hypertension, apoplexia and other heart diseases. Rheumatic diseases include the following: back disorders, rheumatoid arthritis, osteoarthritis, osteoporosis and connective tissue disease. Pain conditions include the following: migraine or recurring headache and chronic pain conditions. Other physical health problems include the following: functional disorders, kidney diseases and unspecified diseases. Affective disorders include the following: depression unrelated to childbirth, depression in relation to childbirth and manic episodes.

Men who had received treatment for any mental health problem within the last year had statistically significantly increased odds of all the sexual dysfunctions studied, except premature ejaculation (Table 4). Particularly strong associations with mental health problems were seen for orgasmic dysfunction (adjusted odds ratio 2.90, 95% confidence interval 2.22–3.78) and hypoactive sexual desire disorder (3.14, 2.38–4.14). Patient groups at high risk of sexual dysfunction comprised men afflicted by stress, anxiety, affective disorders, self-injury or suicide ideation and attempts, posttraumatic stress disorder, psychoses or other mental health problems.

Physical and Mental Health Problems and Sexual Dysfunctions in Women. Women who had been treated for any long-lasting or severe physical disease within the last year had statistically significantly elevated odds of all studied sexual dysfunctions (Table 5). Associations were strongest for vaginal cramp dysfunction (adjusted odds ratio 2.15, 95% confidence interval 1.41–3.26) and genital pain dysfunction (2.07, 1.76–2.45). Patient groups at high risk of sexual dysfunction comprised women afflicted by cancer or gynecological diseases.

Women treated for any mental health problem within the last year had consistently increased odds of all female sexual dysfunctions studied, with the strongest association observed for hypoactive sexual desire disorder (adjusted odds ratio 2.46, 95% confidence interval 2.17–2.79). Patient groups at high risk of sexual dysfunction comprised women afflicted by stress, affective disorders, self-injury or suicide ideation and attempts, personality disorders or eating disorders.

Synergy Between Physical and Mental Health Problems and Sexual Dysfunctions. As shown in Figure 2, we observed no evidence of strong synergy between physical and mental health problems in relation to sexual dysfunctions. With the exception of hypoactive sexual desire disorder in both men and women, individuals who had received treatment for both physical and mental health problems within the last year had higher odds of sexual dysfunctions than those treated only for physical or mental health problems but, in most situations, confidence intervals overlapped.

DISCUSSION

With the use of baseline data from Project SEXUS, a large and nationally representative cohort study in Denmark, the present study is, to the best of our knowledge, the first population-based investigation to address associations between a broad range of health problems and long-term inter-personal sexual inactivity. Moreover, as a result of the large cohort size, we were able to document hitherto unnoticed, statistically significant links between several physical and mental diseases and a number of sexual dysfunctions.

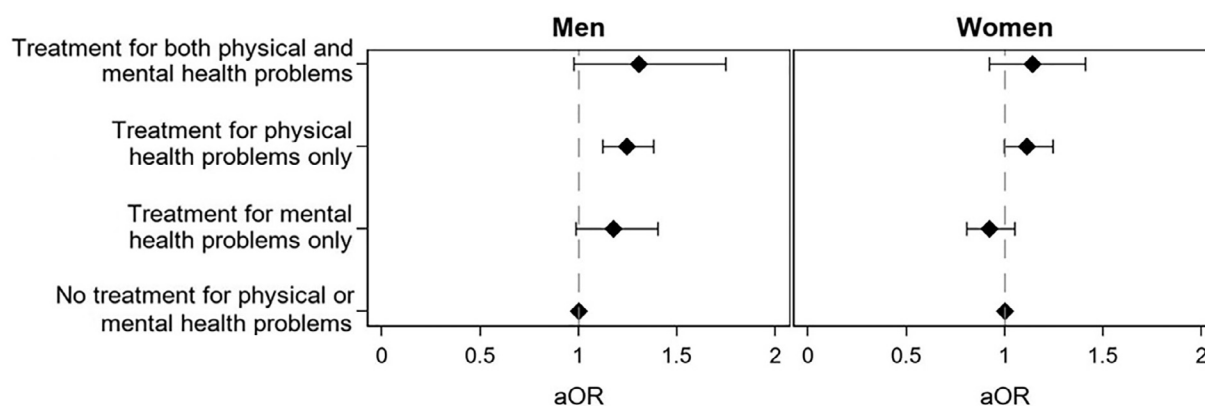


Figure 1. Adjusted odds ratios for inter-personal sexual inactivity according to treatment for physical and mental health problems within the last year among sexually experienced men and women, Denmark 2017–2018. aOR = odds ratio adjusted for age in 10-y intervals, education, ability to pay household bills, partner status, smoker status, weekly alcohol consumption, weekly time spent on physical activity, and BMI. Reference categories for men and women composed of participants who were never treated for any long-lasting or severe physical disease or any mental health problem.

Inter-Personal Sexual Inactivity

The perceived severity of several chronic diseases may fluctuate considerably over time, thus enabling affected individuals to have periods with an active sex life followed by periods with no inter-personal sexual activity. In the present study, we focused on prolonged inter-personal sexual inactivity lasting for at least 1 year.

In a recent Australian survey covering the age span 16–69 years, 13.7% of men and 18.1% of women had not engaged in partnered sex in the previous year.⁶ Presumably due to the broader age range of respondents in the present study, we observed somewhat higher proportions of inter-personal sexual inactivity (men: 23.0%; women: 28.8%). Such sexual inactivity was more common among participants with poor self-rated health and those with physical or mental disease in age-adjusted analyses. However, several associations weakened or became statistically non-significant after subsequent confounder adjustment, suggesting that inter-personal sexual inactivity among participants with health problems was partly explained by partner-related, sociodemographic or lifestyle factors. Except for comparable findings in the Natsal-3 study regarding short-term inter-personal sexual inactivity,⁷ sex surveys have generally focused on individuals who are sexually active. Overall, our findings provide population-based evidence that poor self-rated health and a range of physical and mental health problems are associated with increased rates of prolonged inter-personal sexual inactivity.

Sexual Dysfunctions

Among both men and women, we observed strong and statistically significant associations between poor self-rated health and all studied sexual dysfunctions. These findings are well in line with those of previous studies. A Danish survey reported around 2-fold increased odds of having experienced a sexual dysfunction within the last year among participants who rated their overall

health as *fair*, *bad* or *very bad* compared to those rating it as *good* or *very good*.¹¹ Among Australian men aged 18–55 years, strong associations with self-rated health were found across multiple sexual difficulties, with the strongest associations seen for psychological sexual difficulties such as lack of sexual interest and enjoyment and feeling anxious during sex.²²

Our study confirms and expands data from smaller studies reporting elevated rates of sexual dysfunctions among individuals with specific health problems such as cardiovascular diseases,⁸ rheumatic diseases,^{23,24} diabetes,⁹ cancer,^{25,26} nervous system diseases,^{27,28} benign prostatic hyperplasia,²⁹ gynecological diseases,³⁰ anxiety,^{11,12} affective disorders,^{2,12,31} posttraumatic stress disorder³² and eating disorders.^{12,33} Further, we observed that physical health problems were more strongly associated with sexual dysfunctions in men than women, thus corroborating findings in previous studies.^{11,34} We have no explanation to offer for this repeatedly observed sex difference.

To the best of our knowledge, ours is the first population-based study to show that individuals afflicted by pain conditions or gastrointestinal and liver diseases, and those burdened by stress or personality disorders may constitute patient groups at high risk of sexual dysfunction. Among men, long-lasting or severe pain conditions, which included migraine or recurrent headaches and other chronic pain conditions in our study, were associated with increased odds of erectile dysfunction, orgasmic dysfunction, genital pain dysfunction and hypoactive sexual desire disorder, while women with such pain conditions had increased odds of lubrication dysfunction, genital pain dysfunction and hypoactive sexual desire disorder. Prior research among migraine patients has shown an increased prevalence of sexual dysfunctions in female patients and of erectile dysfunction in male patients.^{35–37} Our findings suggest that migraine or recurrent headaches may impact negatively on several domains of male sexual functioning.

Table 3. Sexual dysfunctions according to self-rated health among sexually experienced men and women, Denmark 2017–2018

	Erectile dysfunction*		Premature ejaculation dysfunction*		Orgasmic dysfunction*		Genital pain dysfunction*		Hypoactive sexual desire disorder [†]		ED _{IIEF-5} ^{‡,§}	
	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)
Men												
Self-rated health												
Very good or good	18,230 (5.7)	1 (ref)	18,106 (9.3)	1 (ref)	18,147 (3.2)	1 (ref)	18,189 (0.5)	1 (ref)	18,603 (2.4)	1 (ref)	17,474 (2.9)	1 (ref)
Neither good nor bad	3,031 (12.8)	2.60 (2.24–3.02)	2,986 (13.2)	1.48 (1.28–1.71)	3,018 (7.0)	2.57 (2.11–3.12)	3,010 (1.2)	2.73 (1.66–4.48)	3,363 (5.8)	2.14 (1.77–2.58)	3,046 (7.2)	2.18 (1.82–2.60)
Bad or very bad	849 (21.6)	3.94 (3.11–5.00)	832 (15.4)	1.66 (1.30–2.12)	839 (11.5)	3.89 (2.94–5.16)	840 (2.7)	6.38 (3.52–11.54)	1,010 (11.2)	3.89 (3.04–4.98)	874 (11.2)	2.80 (2.14–3.66)
Women												
	Lubrication dysfunction*		Orgasmic dysfunction*		Vaginal cramp dysfunction*		Genital pain dysfunction*		Hypoactive sexual desire disorder [†]		FSD _{FSFI-6} [‡]	
Self-rated health												
Very good or good	20,246 (8.4)	1 (ref)	20,225 (11.2)	1 (ref)	20,060 (0.6)	1 (ref)	20,187 (4.4)	1 (ref)	19,722 (8.0)	1 (ref)	16,956 (18.4)	1 (ref)
Neither good nor bad	3,221 (11.1)	1.65 (1.41–1.92)	3,229 (16.1)	1.64 (1.42–1.90)	3,202 (1.2)	2.09 (1.35–3.24)	3,222 (7.4)	2.13 (1.78–2.54)	3,345 (12.8)	1.81 (1.60–2.06)	2,632 (29.8)	1.71 (1.53–1.91)
Bad or very bad	1,168 (15.2)	2.29 (1.83–2.87)	1,160 (17.5)	2.25 (1.79–2.83)	1,142 (1.6)	2.88 (1.45–5.71)	1,154 (9.9)	3.20 (2.49–4.12)	1,308 (18.9)	2.96 (2.49–3.52)	938 (37.2)	2.26 (1.91–2.66)

ED_{IIEF-5} = moderate or severe erectile dysfunction, FSD_{FSFI-6} = female sexual dysfunction. N = number of participants (unweighted). (%) = proportion of participants with the given self-rated health who also had the specific sexual dysfunction (weighted). aOR = odds ratio adjusted for age in 10-y intervals, education, ability to pay household bills, partner status, smoking, alcohol consumption, weekly time spent on physical activity, and BMI.

*Within the last year among 22,238 sexually active men and 24,908 sexually active women.

[†]Within the last 4 wk among 22,976 men and 24,375 women with a spouse/partner.

[‡]Within the last 4 wk among 21,394 men and 20,526 women with a spouse/partner who had attempted sexual intercourse.

[§]Supplementary analysis for ED_{IIEF-5} restricted to 20,765 men who had attempted vaginal intercourse with a female spouse/partner within the last 4 wk gave similar results: aOR = 1 (ref) for “Very good or good”, aOR = 2.20 (1.84–2.64) for “Neither good nor bad” and aOR = 2.84 (2.16–3.72) for “Bad or very bad”.

Table 4. Sexual dysfunctions according to treatment for physical or mental health problems among sexually experienced men, Denmark 2017–2018

	Erectile dysfunction*		Premature ejaculation dysfunction*		Orgasmic dysfunction*		Genital pain dysfunction*		Hypoactive sexual desire disorder [†]		ED _{IIIEF-5≤11} [‡]	
	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)
Treatment for any long-lasting or severe physical disease												
Never	16,387 (5.3)	1 (ref)	16,300 (9.9)	1 (ref)	16,315 (3.2)	1 (ref)	16,362 (0.5)	1 (ref)	16,361 (2.5)	1 (ref)	15,443 (2.3)	1 (ref)
More than a year ago	2,291 (9.4)	1.48 (1.24–1.77)	2,262 (9.9)	1.01 (0.85–1.19)	2,286 (4.5)	1.39 (1.09–1.76)	2,285 (1.2)	2.45 (1.47–4.09)	2,502 (3.9)	1.39 (1.10–1.76)	2,308 (5.9)	1.89 (1.53–2.34)
Within the last year	3,103 (16.9)	2.53 (2.19–2.93)	3,037 (10.9)	1.13 (0.97–1.31)	3,079 (8.1)	2.52 (2.10–3.02)	3,065 (1.3)	3.30 (2.11–5.16)	3,771 (6.5)	1.99 (1.67–2.37)	3,329 (9.7)	2.23 (1.89–2.63)
Treatment for specific physical diseases within the last year												
Cardiovascular diseases [§]	1,339 (23.1)	2.62 (2.16–3.17)	1,298 (11.1)	1.22 (0.99–1.50)	1,323 (9.8)	2.44 (1.90–3.05)	1,314 (1.2)	2.28 (1.26–4.14)	1,799 (6.7)	1.53 (1.23–1.90)	1,538 (13.1)	1.94 (1.61–2.33)
Rheumatic diseases [§]	724 (17.0)	1.86 (1.45–2.39)	717 (12.7)	1.40 (1.08–1.82)	719 (7.3)	1.70 (1.21–2.39)	719 (1.2)	2.24 (1.00–5.02)	827 (5.7)	1.46 (1.06–2.02)	751 (8.4)	1.53 (1.14–2.05)
Asthma, other lung diseases and allergies	466 (11.6)	1.20 (0.84–1.72)	459 (9.2)	0.96 (0.66 to 1.40)	461 (8.3)	2.14 (1.45–3.16)	460 (1.0)	.	551 (5.9)	1.40 (0.95–2.05)	480 (7.0)	1.26 (0.87–1.84)
Pain conditions [§]	350 (15.6)	1.77 (1.22–2.57)	347 (12.7)	1.16 (0.79–1.69)	350 (11.7)	3.25 (2.18–4.84)	345 (3.9)	8.23 (4.12–16.47)	383 (7.3)	1.82 (1.19–2.79)	351 (7.3)	1.39 (0.90–2.15)
Diabetes	496 (27.9)	4.37 (3.19–6.00)	485 (13.1)	1.28 (0.94–1.74)	494 (11.6)	2.95 (2.11–4.12)	489 (1.0)	1.28 (0.46–3.55)	647 (9.2)	2.09 (1.56–2.80)	555 (15.9)	2.50 (1.90–3.27)
Gastrointestinal and liver diseases	262 (14.5)	1.92 (1.23–3.01)	261 (11.0)	1.15 (0.74–1.78)	262 (8.7)	2.19 (1.31–3.67)	262 (2.2)	3.86 (1.55–9.62)	299 (8.4)	2.44 (1.56–3.82)	258 (5.5)	1.00 (0.57–1.77)
Hyper- or hypothyroidism	78 (9.6)	0.56 (0.21–1.48)	77 (11.2)	1.18 (0.53–2.63)	78 (2.3)	.	78 (0)	.	103 (6.1)	1.24 (0.52–2.99)	86 (11.2)	1.60 (0.77–3.33)
Cancer	206 (28.1)	2.98 (1.94–4.57)	194 (14.9)	1.65 (1.03–2.66)	201 (10.4)	2.11 (1.22–3.65)	199 (1.0)	.	360 (15.0)	3.75 (2.71–5.18)	281 (21.0)	2.81 (2.02–3.92)
Skin diseases	154 (14.7)	2.39 (1.35–4.22)	152 (12.6)	1.27 (0.73–2.22)	153 (9.1)	2.19 (1.19–4.06)	152 (2.8)	.	189 (5.9)	1.55 (0.85–2.82)	174 (8.0)	1.50 (0.80–2.80)
Nervous system diseases	103 (29.7)	6.06 (3.19–11.50)	100 (18.4)	1.80 (1.01–3.20)	102 (12.5)	2.94 (1.38–6.25)	103 (1.6)	.	115 (11.4)	3.57 (1.83–6.97)	98 (14.8)	3.01 (1.54–5.87)
Benign prostatic hyperplasia	109 (34.4)	2.39 (1.32–4.34)	103 (20.6)	2.14 (1.23–3.73)	109 (14.3)	3.33 (1.71–6.50)	106 (0)	.	171 (11.4)	2.24 (1.32–3.82)	147 (19.0)	1.77 (1.11–2.82)
Other physical health problems [§]	433 (14.9)	1.75 (1.21–2.52)	422 (11.2)	1.12 (0.78–1.62)	428 (7.7)	2.19 (1.42–3.37)	428 (3.3)	5.70 (3.01–10.81)	464 (6.6)	1.79 (1.19–2.68)	422 (6.0)	0.94 (0.58–1.54)
Treatment for any mental health problem												
Never	17,306 (7.2)	1 (ref)	17,142 (9.7)	1 (ref)	17,213 (3.5)	1 (ref)	17,239 (0.6)	1 (ref)	18,463 (2.9)	1 (ref)	17,189 (4.0)	1 (ref)
More than a year ago	3,249 (7.2)	1.42 (1.20–1.69)	3,238 (10.6)	0.97 (0.84–1.12)	3,241 (4.9)	1.83 (1.49–2.25)	3,248 (1.1)	2.22 (1.44–3.42)	3,141 (3.9)	1.68 (1.36–2.08)	2,934 (2.7)	1.06 (0.83 to 1.36)
Within the last year	1,365 (8.0)	1.93 (1.52–2.46)	1,358 (12.5)	1.15 (0.93–1.41)	1,362 (8.1)	2.90 (2.22–3.78)	1,361 (1.5)	2.36 (1.25–4.45)	1,177 (6.4)	3.14 (2.38–4.14)	1,097 (3.7)	2.17 (1.53–3.07)

(continued)

Table 4. Continued

	Erectile dysfunction*		Premature ejaculation dysfunction*		Orgasmic dysfunction*		Genital pain dysfunction*		Hypoactive sexual desire disorder [†]		ED _{IIIEF-5≤11} [‡]	
	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)
Treatment for specific mental health problems within the last year												
Stress	668 (6.5)	1.50 (1.05–2.14)	669 (12.1)	1.06 (0.80–1.41)	665 (8.0)	2.45 (1.72–3.48)	669 (1.2)	1.97 (0.85–4.54)	602 (7.1)	3.29 (2.30–4.70)	566 (2.8)	2.02 (1.20–3.39)
Anxiety	541 (10.1)	2.62 (1.87–3.67)	539 (11.4)	1.09 (0.78–1.53)	540 (9.0)	2.96 (2.04–4.30)	542 (1.1)	1.67 (0.62–4.54)	469 (6.1)	2.42 (1.59–3.69)	425 (4.0)	2.14 (1.26 to 3.64)
Affective disorders [§]	430 (8.6)	1.79 (1.21–2.65)	428 (9.5)	0.83 (0.57–1.21)	432 (11.1)	3.14 (2.11–4.66)	430 (1.4)	1.44 (0.50–4.13)	366 (8.8)	3.70 (2.44–5.59)	344 (4.2)	2.21 (1.25–3.93)
Self-injury or suicide ideation and attempts	178 (8.9)	2.16 (1.19–3.92)	177 (12.7)	1.16 (0.65–2.06)	177 (13.4)	4.04 (2.22–7.36)	178 (2.6)	3.30 (1.09–9.97)	134 (8.1)	3.80 (1.86–7.75)	127 (5.6)	3.63 (1.68–7.86)
Posttraumatic stress disorder (PTSD)	97 (6.3)	1.36 (0.54–3.39)	97 (10.7)	0.99 (0.46–2.17)	96 (10.7)	3.06 (1.30–7.20)	96 (3.5)	.	91 (10.3)	4.49 (2.08–9.72)	85 (3.7)	.
Personality disorders	52 (7.4)	1.58 (0.45–5.57)	52 (24.6)	3.51 (1.40–8.80)	52 (4.1)	.	52 (2.2)	.	41 (2.3)	.	37 (0)	.
Attention deficit hyperactivity disorder (ADHD)	102 (7.7)	2.15 (0.97–4.78)	102 (16.8)	1.51 (0.81–2.81)	101 (6.6)	1.88 (0.71–4.97)	102 (3.5)	.	67 (5.5)	3.01 (1.10–8.22)	65 (2.8)	.
Obsessive compulsive disorder (OCD)	56 (4.8)	.	56 (17.1)	1.57 (0.65–3.78)	55 (4.9)	.	56 (2.7)	.	47 (1.4)	.	41 (0)	.
Eating disorders	16 (0)	.	16 (0)	.	16 (5.6)	.	16 (0)	.	16 (4.7)	.	15 (0)	.
Psychoses	56 (5.1)	.	55 (1.6)	.	55 (16.4)	4.10 (1.68–10.03)	56 (4.6)	.	43 (10.5)	3.40 (1.20–9.64)	37 (6.3)	.
Autism spectrum disorders	38 (9.4)	.	38 (18.7)	1.39 (0.49–3.91)	38 (9.4)	.	38 (2.2)	.	27 (10.9)	.	25 (0)	.
Other mental health problems	398 (8.3)	1.57 (1.01–2.43)	395 (14.0)	1.28 (0.89–1.82)	398 (8.9)	2.40 (1.56–3.68)	396 (1.5)	1.89 (0.70–5.08)	331 (6.2)	2.55 (1.53–4.25)	304 (4.5)	2.46 (1.34–4.53)

ED_{IIIEF-5≤11} = moderate or severe erectile dysfunction. N = number of participants (unweighted). (%) = proportion of participants with the given disease who also had the specific sexual dysfunction (weighted). aOR = odds ratio adjusted for age in 10-y intervals, education, ability to pay household bills, partner status, smoker status, weekly alcohol consumption, weekly time spent on physical activity, and BMI. Reference categories for specific health problems composed of participants who were never treated for the particular health problem in question.

*Within the last year among 22,238 sexually active men.

[†]Within the last 4 wk among 22,976 men with a spouse/partner.

[‡]Within the last 4 wk among 21,394 men with a spouse/partner who had attempted sexual intercourse.

[§]Cardiovascular diseases include the following: cardiac rhythm disorders, hypertension, apoplexia and other heart diseases. Rheumatic diseases include the following: back disorders, rheumatoid arthritis, osteoarthritis, osteoporosis and connective tissue disease. Pain conditions include the following: migraine or recurring headache and chronic pain conditions. Other physical health problems include the following: functional disorders, kidney diseases and unspecified diseases. Affective disorders include the following: depression unrelated to childbirth, depression in relation to childbirth and manic episodes.

Table 5. Sexual dysfunctions according to treatment for physical or mental health problems among sexually experienced women, Denmark 2017–2018

	Lubrication dysfunction*		Orgasmic dysfunction*		Vaginal cramp dysfunction*		Genital pain dysfunction*		Hypoactive sexual desire disorder†		FSD _{F5FI-6≤19} ‡	
	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)
Treatment for any long-lasting or severe physical disease												
Never	18,428 (8.1)	1 (ref)	18,413 (12.2)	1 (ref)	18,262 (0.6)	1 (ref)	18,372 (4.2)	1 (ref)	17,785 (9.2)	1 (ref)	15,218 (19.1)	1 (ref)
More than a year ago	2,115 (12.6)	1.54 (1.29–1.82)	2,112 (11.1)	1.12 (0.94–1.35)	2,103 (0.9)	1.69 (0.98–2.90)	2,112 (6.3)	1.61 (1.30–2.00)	2,140 (9.0)	1.08 (0.92–1.27)	1,804 (23.0)	1.10 (0.96–1.26)
Within the last year	3,708 (11.8)	1.47 (1.27–1.69)	3,707 (13.6)	1.29 (1.12–1.48)	3,663 (1.3)	2.15 (1.41–3.26)	3,695 (7.7)	2.07 (1.76–2.45)	4,070 (10.0)	1.25 (1.10–1.41)	3,194 (26.9)	1.19 (1.08–1.33)
Treatment for specific physical diseases within the last year												
Cardiovascular diseases§	857 (14.1)	1.24 (0.96–1.61)	854 (7.9)	1.07 (0.78–1.48)	846 (1.1)	1.38 (0.63–3.04)	851 (6.9)	1.38 (0.99–1.92)	1,080 (7.9)	1.05 (0.83–1.33)	783 (33.3)	1.15 (0.83–1.59)
Rheumatic diseases§	1,019 (12.7)	1.36 (1.08–1.71)	1,021 (12.3)	1.49 (1.18–1.90)	1,011 (1.9)	2.59 (1.42–4.71)	1,020 (8.0)	1.89 (1.44–2.47)	1,207 (10.4)	1.36 (1.11–1.65)	897 (28.9)	1.10 (0.92–1.32)
Asthma, other lung diseases and allergies	690 (12.4)	1.47 (1.10–1.96)	690 (13.6)	1.31 (0.98–1.75)	679 (1.2)	1.59 (0.68–3.69)	685 (8.8)	1.91 (1.41–2.59)	744 (9.6)	1.17 (0.91–1.52)	576 (24.8)	1.09 (0.88–1.37)
Pain conditions§	861 (11.1)	1.43 (1.10–1.87)	859 (13.5)	1.16 (0.89–1.49)	848 (1.3)	2.05 (0.95–4.41)	856 (8.4)	2.09 (1.56–2.79)	924 (13.2)	1.56 (1.24–1.94)	731 (26.0)	1.17 (0.96–1.42)
Diabetes	264 (11.3)	1.25 (0.78–2.01)	265 (10.6)	1.21 (0.77–1.92)	264 (2.2)	.	264 (8.1)	1.64 (0.96–2.81)	330 (9.9)	1.18 (0.79–1.76)	242 (28.8)	1.09 (0.80–1.50)
Gastrointestinal and liver diseases	392 (13.6)	1.80 (1.23–2.65)	392 (13.9)	1.35 (0.93–1.97)	384 (1.2)	.	391 (11.3)	2.89 (1.98–4.23)	437 (11.8)	1.42 (1.04–1.93)	331 (24.5)	1.09 (0.84–1.40)
Hyper- or hypothyroidism	444 (11.5)	1.20 (0.84–1.72)	445 (11.1)	1.18 (0.82–1.71)	441 (1.4)	1.90 (0.75–4.81)	444 (8.5)	1.82 (1.24–2.68)	497 (8.9)	1.02 (0.75–1.41)	379 (25.3)	1.03 (0.78–1.36)
Cancer	201 (19.4)	2.20 (1.38–3.53)	201 (10.1)	1.31 (0.67–2.55)	198 (1.2)	.	201 (14.1)	3.38 (2.02–5.64)	257 (9.6)	1.29 (0.86–1.94)	182 (42.5)	1.88 (1.35–2.60)
Skin diseases	256 (13.5)	1.21 (0.77–1.91)	257 (15.0)	1.45 (0.93–2.27)	253 (2.1)	2.36 (0.85–6.59)	254 (11.5)	2.51 (1.59–3.94)	268 (11.9)	1.29 (0.88–1.90)	199 (25.0)	0.98 (0.67–1.42)
Nervous system diseases	153 (11.6)	1.53 (0.84–2.78)	153 (14.3)	1.75 (0.97–3.16)	153 (0)	.	149 (4.9)	1.28 (0.57–2.92)	163 (15.0)	1.76 (1.11–2.78)	135 (30.2)	1.48 (1.00–2.19)
Gynecological diseases	196 (16.7)	3.08 (1.93–4.92)	201 (13.5)	1.23 (0.72–2.10)	198 (4.3)	7.90 (3.18–19.62)	201 (18.6)	7.25 (4.68–11.24)	192 (16.2)	1.94 (1.23–3.04)	163 (23.6)	1.32 (0.85–2.03)
Other physical health problems§	609 (8.7)	0.97 (0.70–1.35)	609 (11.7)	1.09 (0.80–1.47)	603 (1.1)	1.72 (0.67–4.46)	609 (6.3)	1.33 (0.92–1.91)	640 (11.3)	1.28 (0.98–1.67)	498 (25.4)	1.19 (0.95–1.49)

(continued)

Table 5. Continued

	Lubrication dysfunction*		Orgasmic dysfunction*		Vaginal cramp dysfunction*		Genital pain dysfunction*		Hypoactive sexual desire disorder†		FSD _{FSFI-6≤19} ‡	
	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)
Treatment for any mental health problem												
Never	14,492 (8.3)	1 (ref)	14,465 (10.1)	1 (ref)	14,369 (0.6)	1 (ref)	14,444 (4.3)	1 (ref)	14,911 (6.8)	1 (ref)	12,600 (20.5)	1 (ref)
More than a year ago	6,246 (10.0)	1.49 (1.32–1.69)	6,256 (12.9)	1.37 (1.22–1.54)	6,197 (0.9)	1.63 (1.10–2.43)	6,241 (5.6)	1.59 (1.36–1.85)	6,036 (12.3)	1.73 (1.56–1.93)	5,037 (20.9)	1.29 (1.17–1.42)
Within the last year	3,611 (10.8)	1.84 (1.37–1.83)	3,607 (19.8)	1.93 (1.67–2.22)	3,555 (1.2)	2.03 (1.25–3.27)	3,592 (6.9)	1.89 (1.58–2.27)	3,145 (16.8)	2.46 (2.17–2.79)	2,646 (22.1)	1.46 (1.30–1.65)
Treatment for specific mental health problems within the last year												
Stress	1,926 (10.5)	1.61 (1.33–1.95)	1,925 (19.0)	1.78 (1.50–2.12)	1,898 (1.5)	2.56 (1.55–4.21)	1,918 (6.3)	1.57 (1.25–1.98)	1,680 (16.9)	2.00 (1.72–2.33)	1,443 (20.7)	1.32 (1.13–1.53)
Anxiety	1,566 (11.6)	1.83 (1.49–2.24)	1,560 (20.9)	1.71 (1.41–2.07)	1,537 (1.4)	1.86 (1.02–3.39)	1,548 (7.0)	1.61 (1.25–2.06)	1,371 (17.8)	2.15 (1.82–2.54)	1,147 (23.4)	1.43 (1.22–1.68)
Affective disorders§	1,217 (13.4)	2.23 (1.79–2.77)	1,217 (22.8)	2.03 (1.64–2.50)	1,194 (1.1)	1.52 (0.79–2.91)	1,211 (7.6)	1.67 (1.29–2.20)	1,058 (21.3)	2.74 (2.30–3.27)	858 (25.0)	1.52 (1.26–1.82)
Self-injury or suicide ideation and attempts	420 (13.7)	2.17 (1.49–3.17)	417 (25.9)	1.68 (1.17–2.40)	408 (3.4)	4.44 (2.25–8.79)	414 (11.3)	2.19 (1.47–3.27)	312 (22.6)	2.61 (1.90–3.58)	266 (30.5)	1.89 (1.37–2.61)
Posttraumatic stress disorder (PTSD)	240 (13.1)	1.80 (1.14–2.83)	238 (18.3)	1.32 (0.84–2.08)	235 (1.5)	.	239 (7.7)	1.37 (0.77–2.44)	204 (17.9)	1.91 (1.28–2.84)	177 (24.0)	1.29 (0.87–1.90)
Personality disorders	229 (15.1)	2.46 (1.57–3.87)	227 (29.7)	2.24 (1.40–3.58)	220 (3.7)	4.02 (1.56–10.37)	227 (9.3)	2.21 (1.29–3.78)	171 (19.8)	2.17 (1.41–3.36)	146 (23.1)	1.41 (0.92–2.16)
Attention deficit hyperactivity disorder (ADHD)	172 (13.1)	1.75 (0.99–3.10)	171 (17.9)	0.87 (0.51–1.48)	170 (1.3)	.	172 (7.2)	1.92 (1.02–3.61)	129 (14.1)	1.59 (0.92–2.75)	116 (20.7)	1.28 (0.78–2.10)
Obsessive compulsive disorder (OCD)	173 (11.6)	1.42 (0.80–2.49)	171 (17.8)	0.76 (0.45–1.30)	168 (2.5)	.	170 (8.6)	1.70 (0.91–3.19)	141 (15.2)	1.64 (0.97–2.75)	125 (17.3)	1.02 (0.62–1.67)
Eating disorders	156 (13.8)	2.35 (1.30–4.25)	156 (24.8)	1.42 (0.76–2.64)	150 (3.5)	1.86 (0.56–6.18)	154 (12.3)	1.95 (1.06–3.57)	97 (18.8)	2.07 (1.17–3.66)	84 (21.1)	1.42 (0.77–2.62)
Psychoses	85 (16.1)	1.96 (0.93–4.15)	84 (29.0)	1.93 (0.92–4.02)	84 (3.8)	.	85 (10.7)	2.00 (0.84–4.73)	68 (17.6)	2.22 (1.1–4.43)	56 (16.6)	0.96 (0.47–1.96)
Autism spectrum disorders	47 (12.8)	1.44 (0.54–3.84)	45 (15.1)	0.61 (0.21–1.82)	48 (3.5)	.	46 (12.1)	2.58 (0.96–6.95)	43 (16.2)	2.03 (0.81–5.08)	31 (23.4)	1.54 (0.62–3.85)

(continued)

Table 5. Continued

	Lubrication dysfunction*		Orgasmic dysfunction*		Vaginal cramp dysfunction*		Genital pain dysfunction*		Hypoactive sexual desire disorder [†]		FSD _{F5F1-6≤19} [‡]	
	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)
Other mental health problems	974 (11.4)	1.71 (1.33–2.21)	975 (20.5)	1.82 (1.37–2.20)	953 (1.4)	1.80 (0.86–3.76)	970 (7.6)	1.92 (1.43–2.58)	819 (14.5)	1.70 (1.36–2.12)	697 (23.9)	1.42 (1.15–1.74)

FSD_{F5F1-6≤19} = female sexual dysfunction. N = number of participants (unweighted). (%) = proportion of participants with the given disease who also had the specific sexual dysfunction (weighted). aOR = odds ratio adjusted for age in 10-y intervals, education, ability to pay household bills, partner status, smoker status, weekly alcohol consumption, weekly time spent on physical activity, and BMI. Reference categories for specific health problems composed of participants who were never treated for the particular health problem in question.

*Within the last year among 24,908 sexually active women.

[†]Within the last 4 wk among 24,375 women with a spouse/partner.

[‡]Within the last 4 wk among 20,526 women with a spouse/partner who had attempted sexual intercourse.

§Cardiovascular diseases include the following: cardiac rhythm disorders, hypertension, apoplexia and other heart diseases. Rheumatic diseases include the following: back disorders, rheumatoid arthritis, osteoarthritis, osteoporosis and connective tissue disease. Pain conditions include the following: migraine or recurring headache and chronic pain conditions. Other physical health problems include the following: functional disorders, kidney diseases and unspecified diseases. Affective disorders include the following: depression unrelated to childbirth, depression in relation to childbirth and manic episodes.

Men with gastrointestinal and liver diseases had increased odds of erectile dysfunction, orgasmic dysfunction, genital pain dysfunction and hypoactive sexual desire disorder, whereas women with such diseases had increased odds of lubrication dysfunction, genital pain dysfunction and hypoactive sexual desire disorder. Although we did not have information about specific gastrointestinal disease diagnoses, our findings are compatible with a recent review of smaller studies in which an elevated prevalence of sexual dysfunctions was noted among patients with gastrointestinal diseases such as inflammatory bowel diseases and irritable bowel syndrome.³⁸

Stress was the most common mental health problem requiring treatment among both men and women in our study, and this condition was statistically significantly associated with most sexual dysfunctions. Men who had received treatment for stress within the last year had significantly increased odds of erectile dysfunction, orgasmic dysfunction and hypoactive sexual desire disorder, and women treated for stress had higher odds of all studied sexual dysfunctions. Research on stress as an independent risk factor for sexual dysfunctions is limited, whereas secondary emotional and relational distress is known to contribute to sexual problems in individuals with chronic and/or severe health problems.¹³

Among women, personality disorders were associated with significantly reduced odds of inter-personal sexual inactivity and with increased odds of most studied sexual dysfunctions. A recent literature review concluded that individuals with borderline personality disorder appear to experience sexual dysfunctions more often than individuals without such psychopathology. Clinical characteristics of individuals with borderline personality disorder, including sexualized and risk-seeking behaviors, may explain the lower odds of inter-personal sexual inactivity in this group, whereas increased rates of unstable personal relationships, distorted self-image and co-morbidity with depression and/or anxiety may explain their elevated odds of multiple female sexual dysfunctions.³⁹

For some physical and mental health problems we observed no or only weak associations with sexual dysfunctions, where previous clinical studies have suggested otherwise. In our study, for instance, women with diabetes were not significantly more likely than non-diabetic women to report lubrication dysfunction, a finding contrasted by smaller, clinical studies.⁴⁰ However, reports on the sexual functioning of women with diabetes exhibit considerable variability,⁴¹ and a limitation of our study is that we were unable to distinguish between participants with type 1 or type 2 diabetes, who might have different sexual challenges.⁴⁰

Participants who had received treatment for a psychotic condition within the last year displayed increased odds for only a limited number of sexual dysfunctions, including orgasmic dysfunction in men and hypoactive sexual desire disorder in both sexes. This is contrasted by clinical studies reporting increased rates of several sexual dysfunctions in psychotic patients.^{12,42} One possible explanation for this discrepancy is that individuals

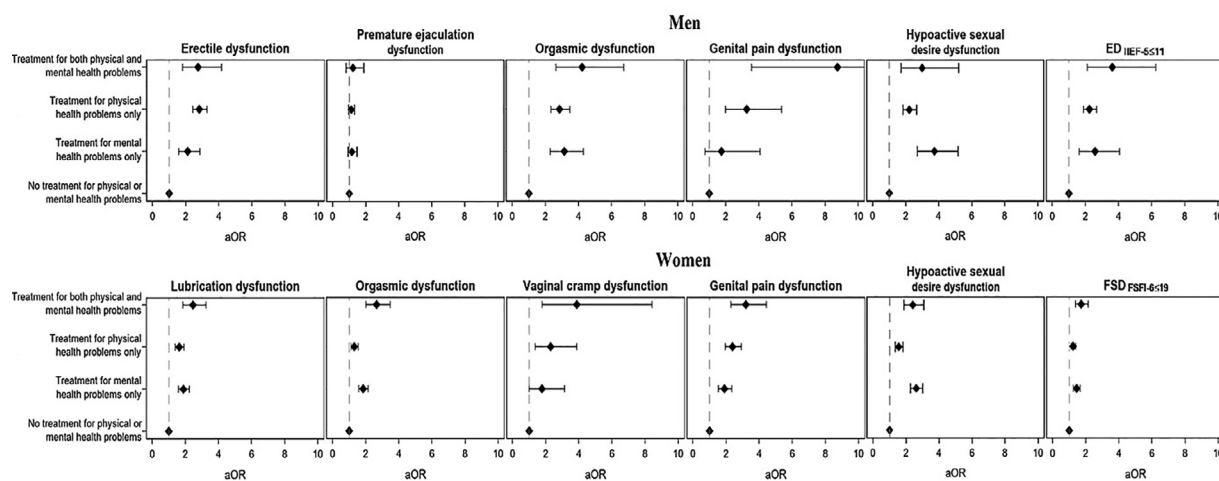


Figure 2. Adjusted odds ratios for sexual dysfunctions according to treatment for physical and mental health problems within the last year among sexually experienced men and women, Denmark 2017–2018. ED_{IIEF-5} ≤ 11 = moderate or severe erectile dysfunction, FSD_{FSFI-6} ≤ 19 = female sexual dysfunction. 95% confidence interval for genital pain dysfunction among men = (3.56–21.45). aOR = odds ratio adjusted for age in 10-y intervals, education, ability to pay household bills, partner status, smoker status, weekly alcohol consumption, weekly time spent on physical activity, and BMI. Reference categories for men and women composed of participants who were never treated for any long-lasting or severe physical disease or any mental health problem.

with severely intrusive health problems, such as current or recent psychotic episodes, may have been disproportionately incapable or unwilling to participate in our study. Despite the large size of our study population, only a limited number of participants reported recent treatment for psychotic conditions, thereby rendering associated odds ratios for sexual dysfunctions statistically unstable.

We observed only few statistically significant associations of physical or mental health problems with premature ejaculation dysfunction, possibly implying that underlying mechanisms differ fundamentally from those of other sexual dysfunctions.⁴³ Our findings contrast those of prior studies reporting increased rates of premature ejaculation dysfunction in patients with physical health problems,¹¹ endocrine disorders⁴⁴ and depression.⁴⁵ In the present, considerably larger, population-based dataset, 1 of only few statistically significant observations for premature ejaculation was that of markedly increased odds of this dysfunction among men with benign prostatic hyperplasia. This concurs with findings in a recent systematic review.⁴⁶

Synergy Between Physical and Mental Health Problems

Physical and mental health problems often co-exist due to shared underlying risk factors, disease-induced lifestyle changes and/or psycho-social reactions to somatic ill-health.⁴⁷ In the present study, we observed that participants who had received treatment within the last year for both a long-lasting or severe physical disease and a mental health problem had only slightly higher odds of inter-personal sexual inactivity and several of the studied sexual dysfunctions than participants who had received treatment only for a physical or a mental health problem.

It is well-established that the increased risk of sexual dysfunctions associated with physical health problems may, at least in part, be explained by accompanying mental health challenges such as distress, anxiety or anhedonia.¹³ However, our findings indicate that while associations between physical health problems and sexual dysfunctions may well be amplified by mental factors, the associations cannot be explained by long-lasting or severe mental co-morbidity that has necessitated treatment. Investigations with access to more detailed data about both physical and mental health issues are needed to clarify this matter.

Strengths and Limitations

Among the assets of our investigation is the size of the study cohort, the weighting procedure that ensured national representativeness and the detailed assessment of health-related variables, potential confounders and sexual outcomes. With over 60,000 sexually experienced participants, we believe our study provides a fair picture of the health-related correlates of inter-personal sexual inactivity and sexual dysfunctions among 15–89-year-old Danes. Our study analyzed a large number of health problems and a wide range of sexual dysfunctions, thereby generating new knowledge about less common and hitherto sparsely researched sexual dysfunctions, and we included internationally validated scoring instruments of sexual functioning to facilitate comparisons with other studies. Additionally, our ability to statistically adjust for possible confounding by a large number of variables, which in some cases yielded weaker, but more reliable estimates, is arguably another strength of our investigation.

The wide array of physical and mental health problems covered in our study provides clinically and public health relevant

knowledge about patient groups at high risk of sexual dysfunctions. Furthermore, the size of our dataset enabled us to restrict patient groups to those individuals who had active disease requiring treatment in the previous year, ensuring a certain level of current severity. It should be noted, however, that by using such a restrictive definition we may have missed some chronically ill participants who, for some reason, did not require active treatment within the last year. Also, we were unable to differentiate between less and more severe disease in our analyses.

Despite its size and national representativeness, our study was limited in some regards. Some disease categories and sexual dysfunctions comprised only relatively few participants, thus rendering associated odds ratios statistically unstable. To ensure the robustness of reported associations and avoid spurious results based on just a few observations, we only presented results when 5 or more cases of a particular sexual outcome were observed among individuals with the health problem in question. Nevertheless, because we conducted a comprehensive series of analyses including many different health problems and sexual outcomes, we cannot exclude the possibility that some of the observed statistically significant findings, particularly those based on limited numbers, may have occurred by chance.

The response rate (AAPOR response rate 1) achieved in Project SEXUS (34.6%) should be compared with identical measures of participation in other recent nationally representative sexuality studies.¹⁷ While modest in comparison with the AAPOR response rate 1 in the Natsal-3 survey from 2010 to 2012 with its slightly younger group of 15,162 Britons aged 16–74 years (55.1%),⁴⁸ our response rate compares favorably with identically calculated response rates in the ASHR-2 sex survey in Australia with its 20,127 participants aged 16–69 years (24.5%) and a recent sex survey in Sweden, which included 15,186 participants aged 16–84 years (30.5%).^{49,50} Nonetheless, the modest response rate could have produced biased odds ratios, if invited individuals with the most severe health problems were systematically less likely to take part in our study. To the extent such differential non-participation occurred, our reported odds ratios may be somewhat conservative.

The possible impact of inaccurately reported health problems and sexual outcomes also deserves attention. By asking participants to tick off whether or not they had received recent treatment for 1 or more diseases on a predefined list, we consider it likely that the accuracy of reported health problems is high, and that any misclassification would likely be non-differential, which would tend to produce conservative odds ratios. Likewise, while most sexual dysfunctions were assessed by measures that have not been formally validated, we also included internationally validated and frequently used IIEF-5 and FSFI-6 instruments to capture male and female sexual dysfunctions, respectively. Reporting of sexual outcomes is likely to have occurred independently of the health status of study participants, implying that any misreporting may have tended to produce conservative odds ratios.

Finally, except for hypoactive sexual desire disorder all analyses regarding sexual dysfunctions were restricted to sexually active individuals. This deserves attention, because sexual dysfunctions may plausibly be more frequent among sexually inactive individuals. It should be noted, however, that our fully adjusted analysis revealed only modestly higher odds of inter-personal sexual inactivity among individuals with a broad range of specific health problems. This reduces, but does not eliminate, the possibility that our results linking health problems with sexual dysfunctions may be conservatively estimated due to our inability to include sexual dysfunctions among sexually inactive individuals in the calculations.

CONCLUSION

In conclusion, our study of 60,958 sexually experienced, 15–89-year-old Danish men and women provides population-based evidence of strong associations of poor self-rated health and a range of physical and mental diseases with inter-personal sexual inactivity and sexual dysfunctions. Hopefully, our findings will lead to heightened awareness among healthcare professionals, public health promoters and researchers concerning hitherto underappreciated sexual challenges among individuals with poor health.

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Mikkel K. Bahnsen: Conceptualization, Methodology, Software, Formal Analysis, Investigation, Writing – Original Draft, Writing – Review & Editing, Visualization; Morten Frisch: Conceptualization, Methodology, Investigation, Resources, Writing – Review & Editing, Visualization, Supervision, Project Administration, Funding Acquisition; Christian Graugaard: Conceptualization, Methodology, Investigation, Resources, Writing – Review & Editing, Visualization, Supervision, Funding Acquisition; Mikael Andersson: Methodology, Software, Validation, Formal Analysis, Data Curation, Writing – Review & Editing; Josefine B. Andresen: Conceptualization, Methodology, Investigation, Writing – Review & Editing.

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