RESEARCH ARTICLE

A Survey of Male Sexual Functioning in the General Population in the Northern Netherlands

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Abstract

Aim. To describe age-related male sexual functioning in a representative Dutch general population using internationally accepted and validated questionnaires.

Material and Methods. A random selection of 1404 men from the general populations in the Netherlands were asked to participate. Men primarily completed the International Index of Erectile Function (IIEF), but also provide medical history, details of daily activities, the Body Image Scale, the SF-36 Health Survey, the Hospital Anxiety and Depression Scale, and the Multidimensional Fatigue Inventory. Participants' representativeness was assessed by comparison with data from the Dutch Central Agency for Statistics and the Dutch Health Monitor. Main outcome measurements were the age-related domain scores of the IIEF.

Results. Responses were obtained from 333 of 1404 men (24%). Participant characteristics were broadly comparable to those of the Dutch population, except for underreporting homosexuals, immigrants, age <40 years and mid-level educations. Overall, 39% of respondents were sexually inactive, and inactivity increased significantly with advancing age. All IIEF domain scores decreased markedly with increasing age, except for overall satisfaction. The prevalence rates of mild and severe erectile dysfunction were 22% and 5%, respectively, and both increased significantly with advancing age.

Conclusion. Four of the IIEF domain scores (i.e., erectile function, orgasmic function, sexual desire, and intercourse satisfaction) decrease with increasing age, whereas the overall satisfaction domain scores remain stable throughout life.

Keywords. Sexual functioning; age-related sexual functioning; sexual dysfunction; sexual satisfaction; male; general population

1. Introduction

In the 1940s, the zoologist Alfred Kinsey (1894–1956) was the first to perform large-scale quantitative research into human sexuality.[1] Kinsey aimed to neutralize the potential for sexual prejudice in the many case histories that had preceded his work, notably by Freudians, through the use of large cohorts. Today, much higher life expectancies and declines in social taboos mean that individuals are more likely to ask their physician for advice and treatment regarding sexual problems or changes in sexual functioning. In this respect, health care professionals must

know the "natural" effects of aging on sexual function to provide effective reassurance about normal aging processes and to be able to determine when a sexual complaint merits medical evaluation.

The National Institutes of Health (NIH) define erectile dysfunction as "the inability to achieve or maintain an erection sufficient for satisfactory sexual performance".[2] However, definitions in questionnaires used to obtain information on erectile function vary considerably, hindering our ability to compare prevalence rates. There is also a scarcity of age-specific and severity-specific prevalence

data for erectile dysfunction, with limited information about relevant comorbidity.[3] The advent of effective oral therapies for erectile dysfunction (ED) has stimulated the development of efficacy instruments for measuring erectile and sexual dysfunction and has led to many clinical trials into male sexual functioning. To date, however, a major barrier to the provision of effective psychosexual counseling remains the lack of data about sexual functioning by age in the general population.

We aimed to gain a better understanding of age-related male sexual function in a large representative Dutch population, using internationally accepted and validated questionnaires.

2. Material and methods
2.1 Study design

We compiled a representative sample of adult men from a general population in the north of the Netherlands. Because age is a major determinant of sexual function, men were grouped into four age categories (20–40, 40–65, 65–80, and 80+ years old), with numbers per group predetermined by matching to the normal age distribution in the Dutch population. To ensure a representative sample, data were collected from four mid-sized towns (one per province). Local civil authorities provided a random selection of inhabitants per age category for us to approach. We used broadly the same study design as employed in a previous evaluation of female sexual functioning.[4]

In September 2012, we sent an explanatory letter to potential participants by post and informed them about how their address was received, the methods employed

to ensure anonymity, and the purpose of the study. The study questionnaires were enclosed, and the men were asked to complete them in pen and return them by post within 2 months in a pre-stamped envelope. To maximize the response rate, the study goals were advertised in the local press. Anonymity meant that no reminders were sent. We only analyzed sexual functioning in participants who had some level of sexual activity that included intercourse with a partner in the month before assessment, see figure 1. Approval was granted by an appropriate medical ethics committee.

2.2 Questionnaires

In addition to completing the IIEF and questionnaires for describing quality of life, all participants were asked to provide details about their characteristics, medical histories, daily activities, body image, general health, well-being, and fatigue (see the supplement for a summary of the questionnaires used).

The International Index of Erectile Function (IIEF) was developed and validated by Rosen (1997),[5] and in 1999, was recommended by the 1st International Consultation on Erectile Dysfunction as the efficacy endpoint of choice for clinical trials in ED.[6] It is a 15-question, multidimensional, self-administered questionnaire.[5] A score of 0–5 is awarded to each of the 15 questions that examine the five domains of male sexual function: erectile function, orgasmic function, sexual desire, intercourse satisfaction, and overall satisfaction (see Table 1). The IIEF is limited by providing only superficial psychosexual and relationship assessments, which are both important in male sexual dysfunction.
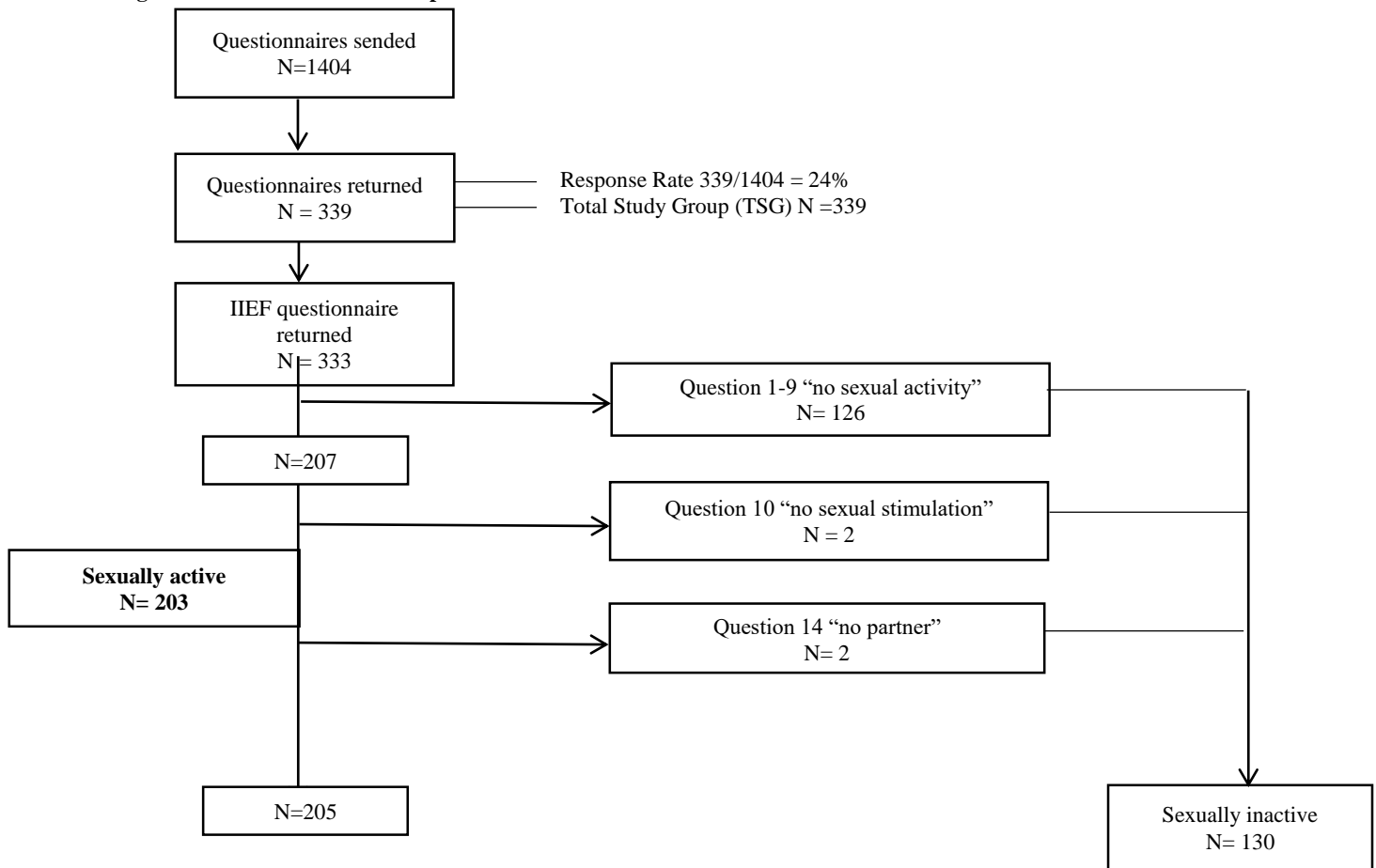
Figure 1. Flowchart of inclusion process

Table 1. Maximum potential score per IIEF domain

Function domain	Questions	Maximum score possible
A. Erectile function	1, 2, 3, 4, 5, 15	30
B. Orgasmic function	9, 10	10
C. Sexual desire	11, 12	10
D. Intercourse satisfaction	6, 7, 8	15
E. Overall satisfaction	13, 14	10

Legend: IIEF, International Index of Erectile Function.

The *SF-36 Health Survey* is a questionnaire for assessing general health that consists of 36 questions organized into 8 multi-item scales: physical functioning, role limitations due to physical health problems, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems, and general mental health.[7] There are standardized response choices per item, and all scale scores are converted to a 0–100 scale, with higher scores indicating higher levels of functioning or well-being.

The 14-item *Hospital Anxiety and Depression Scale (HADS)* is used to report well-being. Developed by Zigmond et al. in 1983, this scale aims to detect emotional disorders among patients in medical and

surgical departments.[8] The questionnaire comprises a 7-item anxiety subscale and a 7-item depression subscale, each with four response options that are scored 0–3. The total anxiety and depression subscale scores are the sum of these (range, 0–21), with scores of 0–7 indicating no anxiety/depression, scores of 8–10 indicating doubtful or possible anxiety/depression, and scores of 11–21 indicating probable anxiety/depression.

The *Body Image Scale (BIS)* is a brief, validated questionnaire for assessing changes in body image among patients with cancer, suitable for use in clinical trials.[9] In the current study, however, we excluded questions related to the effect of cancer or cancer treatment (i.e., five of the ten questions). This abridged version of the BIS has not been validated.

The *Multidimensional Fatigue Inventory (MFI)* is a 20-item self-report instrument designed to measure fatigue.[10] Items are rated on scales from 1 to 5, with the total score calculated as the sum of all scores (range, 20–100). Higher scores indicate higher levels of fatigue.

2.3 Outcomes

The primary outcome measures were the IIEF five domain scores by age category. Secondary outcomes were change in sexual function by age, sexual inactivity by 10-year age category, and change in sexual activity by age.

2.4 Statistical analysis

We evaluated the reliability of each questionnaire by calculating Cronbach alpha values. Descriptive statistics were used to present the personal and medical data for all participants and for the sexually active participants separately. Participant representativeness was evaluated by comparing basic characteristics with those recorded in the Dutch Central Agency for Statistics 2012 and the Dutch Health Monitor 2012.[11,12] The general health scores were compared with those of a national Dutch sample,[7] and the MFI and HADS scores were compared with normative data from a German study.[13,14] Personal and tobacco/alcohol use data were compared by χ^2 tests, whereas fatigue, anxiety/depression, and general health data were compared by unpaired *t*-tests.

We assessed male sexual functioning among sexually active men by calculating the medians (5th and 95th percentiles) and means (standard deviation [SD]) of each IIEF domain score. If a man did not answer all questions within a domain, the score was considered missing. To assess the change in sexual function by age, we used one-way analysis of variance for continuous data and χ^2 tests for dichotomous data (i.e., low sexual function). The percentages of men reporting no sexual activity during the measurement period are reported with 95% confidence intervals. Finally, χ^2 tests were used to assess the change in sexual activity by age.

All statistical analyses were performed using IBM SPSS for Windows, Version 22.0 (IBM Corp., Armonk, NY, USA).

3. Results
3.1 Response

We sent 351 questionnaires per town (1404 in total), distributed as follows: 103 to

men aged 20–40 years, 148 to men aged 40–65 years, 83 to men aged 65–80 years, and 17 to men aged 80 years and older. Figure 1 shows the study flowchart. Overall, 339 returned their questionnaires (24% response rate), with response rates of 11%, 26%, and 34% in the 20–40, 40–65, and 65+ year age groups, respectively. Sexually active men aged >80 years were excluded because of the small sample (n = 1). Sexually active responders almost always completed the full IIEF questionnaire (99%), with responses only missing to three questions.

3.2 Representativeness of the study population

The demographic characteristics of the overall (n = 339) and sexually active (n = 203) cohorts are given in Table 2. Most respondents identified as heterosexual (98%) and were native to the Netherlands (99%). The median age was 61 (20–91) years. Data for both marital status and religion were comparable with those reported by the Dutch Central Agency. The response rate was lower among men aged 20–40 years (11%), and men with high and low educational levels were overrepresented.[11] As shown in Table 3, alcohol and tobacco use were comparable to that reported in the Dutch Health Monitor data.[12]

The Cronbach alpha coefficients for the shortened BIS, the MFI, the HADS, and the SF-36 were 0.86, 0.94, 0.90, and 0.94, respectively. The mean BIS score was 0.78 among 335 men and showed a tendency to decrease during life, indicating that men reported fewer body image concerns as they aged. Compared with German normative data, the mean total MFI score among 301 men was 2.6 points higher in this study (p = 0.02),[13] but the percentages with mild anxiety, severe anxiety and severe depression were comparable.[14] However, significantly fewer men with mild depression responded (p = 0.008). Finally, the mean total SF-36 score was comparable to that in a national Dutch normative sample.[7]

Table 2. Characteristics of participants in comparison with men from the Dutch Central Agency for Statistics

	SAG (N = 203)	TSG (N = 339)	DCA 2012	p-value*
Age				
median, range, y	55 (24–84)	61 (20–91)	–	
5th percentile, y	28	31	–	
95th percentile, y	77	80	–	
Age, category	n(%)	n (%)	%	$\chi^2 = 13.9$ df = 3
20–40 y	36 (18)	46 (14)	32	p = 0.003
40–65 y	107 (54)	151 (45)	46	
65–80 y	52 (26)	113 (34)	16	
80+ y	5 (3)	24 (7)	5	
Missing	3	5	–	
Nationality	n (%)	n (%)	%	$\chi^2 = 20.4$ df = 1
Dutch	198 (99)	329 (99)	79	*p* < 0.0001
Other	2 (1)	3 (1)	21	
Missing	3	7	–	
Marital status**	n (%)	n (%)	%	$\chi^2 = 0.0$ df = 1
Living with partner	180 (90)	281 (84)	84	p = 1.00
Living alone	20 (10)	54 (16)	16	
Missing	3	4	–	
Sexuality	n (%)	n (%)		
Heterosexual	192 (98)	313 (98)	–	
Homosexual	2 (1)	3 (1)	–	
Bisexual	2 (1)	3 (1)	–	
Missing	7	20	–	
Educational level***/****	n (%)	n (%)	%	$\chi^2 = 11.6$ df = 2
	62 (31)	119 (36)	26	p = 0.003
Low education	69 (35)	104 (31)	54	
Intermediate education	68 (34)	109 (33)	19	
High education	4	7	0.7	
Missing				
Religion	n (%)	n (%)	%	$\chi^2 = 0.18$ df = 1
No religion	94 (47)	157 (47)	50	p = 0.67
Any religion	109 (53)	175 (53)	50	
Missing	4	7		

Legend: DCA, Dutch Central Agency 2012; SAG, sexually active group; SD, standard deviation TSG, total study group.

Percentages are valid percentages round off on whole values in our study group.

* TSG vs DCA

** *Living alone*: persons with a one-person household. These persons can have a relationship without living together.

***Low education: primary school, lower vocational education, intermediate secondary education. *Intermediate education*: higher secondary education, pre-university secondary education, intermediate vocational education. *High education*: higher vocational education, university education.

****Educational level of Dutch Central Agency of Statistics indicated for men between 15 and 65 years old.

Table 3. Comparison of medical characteristics between the SAG and DHM

	SAG (N = 203)	TSG (N = 339)	DHM 2012[†]	p-value*
Intoxicants	n (%)	n (%)	%	
Smoking	50 (29)	71 (27)	26	
Mean ± SD, amount per week	73 ±49.8	77 ± 62.9		$\chi^2 = 0.03$ df = 1
Range, amount per week	3–200	3–350		p = 0.87
Alcohol consumption	167 (95)	245 (95)	88	
Mean ± SD, amount per week	9.2 ± 8.4	10 ± 8.8		$\chi^2 = 3.15$ df = 1
Range, amount per week	1–70	1–70		p = 0.076
Drugs	0 (0)	2 (1)		
Missing	28 (14)	80 (24)		
Morbidity	n (%)	n (%)	%	
None	84 (43)	109 (34)	–	
Disease				
Asthma/bronchitis/COPD	20 (10)	35 (11)	8	
Hypertension	28 (14)	65 (20)	17	
Cardiac disease	15 (8)	34 (10)	–	
Skin disease	6 (3)	11 (3)	–	
DM type 1	2 (1)	5 (2)	6 (all DM)	
DM type 2	8 (4)	24 (7)	6 (all DM)	
Back problems	**	26 (8)	11	
Stroke	**	9 (3)	1	
Chronic bowel disease	6 (3)	10 (3)	4	
Psychiatric disease	8 (4)	20 (6)	–	
Malignancy	11 (6)	26 (8)	2	
Missing	9 (4)	14 (4)		
5-item BIS				
Mean score	0.69	0.78		
Missing, n	2	4		
MFI		TSG (N = 339)	Schwarz 2003	p-value**
Mean score	39.0	42.0	39.4	*p = 0.02*
Missing, n	18	38	–	
HADS		TSG (N = 339)	Hinz 2011	p-value***
Anxiety				
Score ≥ 8, percentage	12.1	12.1	18.1	$\chi^2 = 1.41$ df = 1 p = 0.24
Score ≥ 11, percentage	4.0	4.5	5.2	$\chi^2 = 0.00$ df = 1 p = 0.99
Missing, n	4	8	–	
Depression				
Score ≥ 8, percentage	7.6	9.9	23.9	$\chi^2 = 6.95$ df = 1 p = 0.008
Score ≥ 11, percentage	2.0	3.7	9.6	$\chi^2 = 2.77$ df = 1 p = 0.096
Missing, n	6	17	–	
General Health (SF-36)		TSG (N = 339)	Aaronson 1998	p-value****
Mean score	84.0	81.9	79.5	*p = 0.09*
Missing, n	7	42	–	

Legend: BIS, Body Image Scale; COPD, Chronic Obstructive Pulmonary Disease; DHM, Dutch Health Monitor; DM, Diabetes Mellitus; HADS, Hospital Anxiety/Depression Scale; MFI, Multidimensional Fatigue Inventory; SAG, Sexually active group; SD, standard deviation TSG, Total study group.

[†]Men ≥19 yr; *TSG vs DHM; **TSG vs Schwarz 2003; ***TSG vs Hinz 2011; ****TSG vs Aaronson 1998.

3.3 Sexually inactive population

Overall, 39% reported no sexual activity (including penetration with a partner). The percentage of sexually inactive men increased from 50 years and increased exponentially from 70 years. The percentages of sexually inactive men per 10-year age category are shown in Table 4.

Table 4. Sexual inactivity in the study population

Age (yr)	20–30	30–40	40–50	50–60	60–70	70–80	80+	p-value *
Number active	12	27	38	48	48	26	1	
Number inactive	3	9	9	19	30	45	13	
Number with missing data	0	0	0	0	4	1	1	
Sexually inactive	20.0%	25.0%	19.1%	28.4%	38.5%	63.4%	92.9%	$\chi^2 = 18$ df $= 6$; $p<0.0001$
95% CI of proportion	7%–45%	14%–41%	10%–33%	19%–40%	28%–50%	52%–74%	69%–99%	

Legend: CI, confidence interval.
* P-value for change over age

3.4 Male sexual functioning among sexually active men

The mean IIEF domain scores of the sexually active men in the study group are shown in Table 5, as compared against the initial validation group.[5] Erectile function, orgasmic function, and sexual desire scores were comparable to those in the initial validation group.[5] However, the intercourse satisfaction (0.7 higher) and overall satisfaction (0.4 lower) scores were significantly different in our study group. Cronbach's α for the total IIEF score was 0.91.

Almost all domain scores of the IIEF indicated decreasing sexual function with advancing age (Table 6, Figure 2–7). For example, the overall prevalence rates of mild ED (score <25) and severe ED (score < 14) were 22% and 5%, respectively. Both increased with age (p = 0.000), with mild ED most notable from age 60 years and severe ED was most notable from age 70 years (Table 6, Figure 2). There was also an increased variation in erectile and orgasmic function among sexually active men associated with aging (Figure 2, 3). Finally, although all domain scores decreased significantly with age, this was not the case for the overall satisfaction domain, which remained stable throughout life (p = 0.155) (Table 6, Figure 6).

Table 5. IIEF Domain scores among sexually active men in the total study group

Domain	Mean ± SD N = 203	Mean ± SD * N = 109	P-value
Erectile function	26.7 ± 5.2	25.8 ± 7.6	0.22
Orgasmic function	9.2 ± 1.8	8.8 ± 2.9	0.13
Sexual desire	6.9 ± 1.6	7.0 ± 1.8	0.61
Intercourse satisfaction	11.3 ± 2.1	10.6 ± 3.9	0.04
Overall satisfaction	8.2 ± 1.6	8.6 ± 1.7	0.04

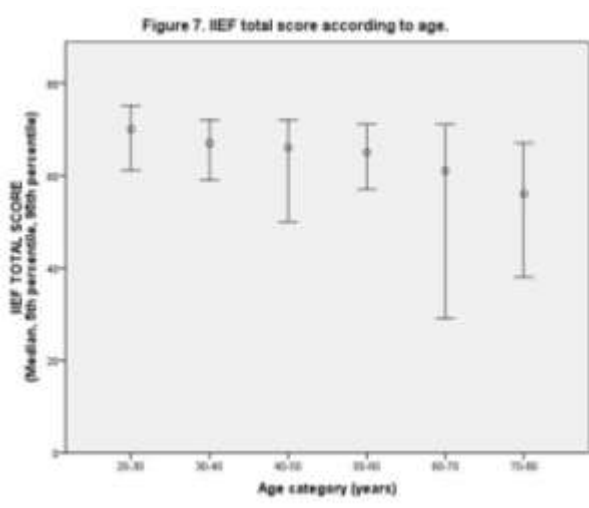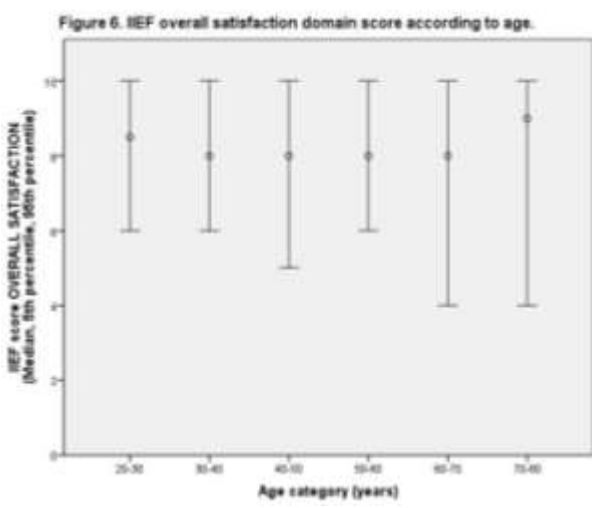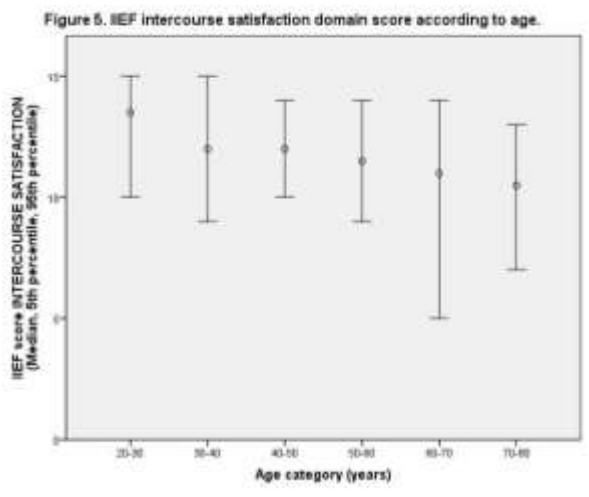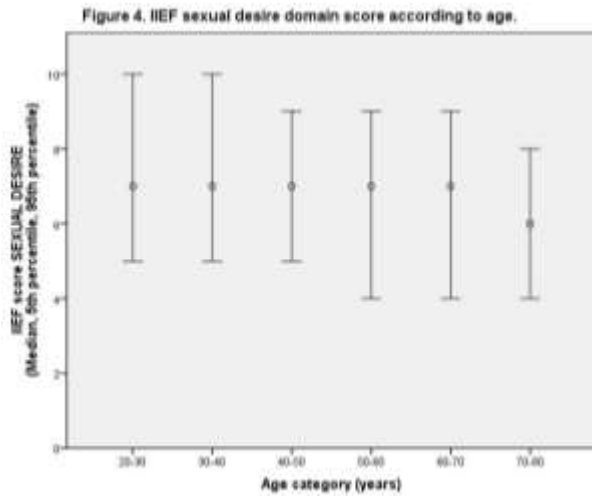Legend: IIEF, International Index of Erectile Function; SD, standard deviation.
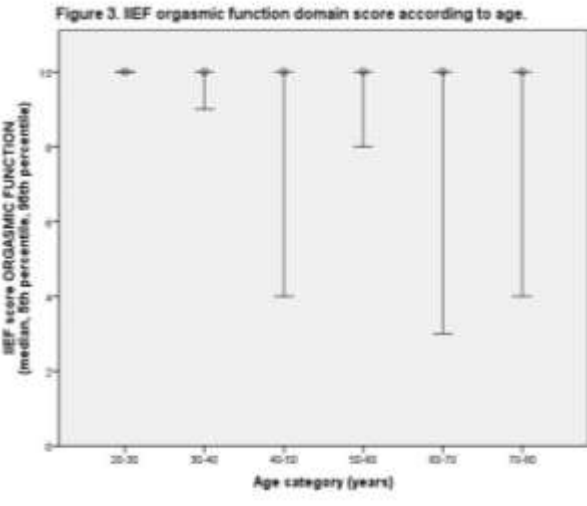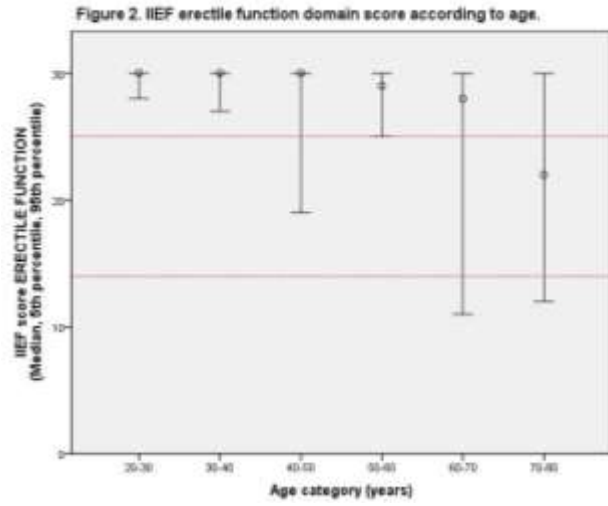* Data for Rosen et al. (1997)

Table 6. IIEF domain scores among sexually active men, stratified by age

Age (yr)	20–30	30–40	40–50	50–60	60–70	70–80	p-value*
Erectile function							
N (missing)	12 (0)	27 (0)	37 (1)	48 (0)	48 (0)	26 (0)	
Median	30.0	30.0	30.0	29.0	28.0	22.0	
5th perc.	28.0	25.8	18.9	21.7	10.5	10.7	
95th perc.	–	30.0	30.0	30.0	30.0	30.0	
Mean	29.6	29.4	28.6	28.3	24.5	21.4	F = 16.2; df = 5; p = 0.000
SD	0.8	1.2	3.1	2.3	6.3	6.6	
Score < 25							χ^2 = 184.856 df = 5;p = 0.000
N (%)	0 (0)	1 (4)	4 (11)	3 (6)	22 (46)	15 (58)	
Score <14							χ^2 = 88.338 df = 5;p = 0.000
N(%)	0 (0)	0 (0)	0 (0)	0 (0)	4 (8)	6 (23)	
Orgasmic function							
N (missing)	12(0)	27 (0)	38 (0)	48 (0)	48 (0)	26 (0)	
Median	10.0	10.0	10.0	10.0	10.0	10.0	
5th perc.	10.0	7.2	4.0	8.0	3.0	4.0	
95th perc.	10.0	10.0	10.0	10.0	10.0	10.0	
Mean	10.0	9.8	9.4	9.7	8.4	8.4	F = 5.54; df = 5; p = 0.000
SD	0.0	0.8	1.6	0.8	2.5	2.1	
Sexual desire							
N (missing)	12 (0)	27 (0)	38 (0)	48 (0)	48 (0)	26 (0)	
Median	7.0	7.0	7.0	7.0	7.0	6.0	
5th perc.	5.0	5.0	4.95	4.0	4.0	2.7	
95th perc.	–	10.0	9.1	9.6	9.0	9.3	
Mean	7.5	7.5	7.1	6.9	6.8	6.2	F = 2.39; df = 5; p = 0.039
SD	1.2	1.7	1.3	1.7	1.5	1.6	
Intercourse satisfaction							
N (missing)	12 (0)	27 (0)	37 (1)	48 (0)	47 (1)	26 (0)	
Median	13.5	12.0	12.0	11.5	11.0	10.5	
5th perc.	10	7.2	9.6	9.0	4.4	4.4	
95th perc.	–	15.0	14.0	14.0	14.0	13.0	
Mean	13.2	11.8	11.9	11.6	10.4	10.0	F = 7.92; df = 5; p = 0.000
SD	1.6	1.97	1.6	1.4	2.5	2.2	
Overall Satisfaction							
N (missing)	12 (0)	27 (0)	38 (0)	48 (0)	48 (0)	26 (0)	
Median	8.5	8.0	8.0	8.0	8.0	9.0	
5th perc.	6.	6.0	4.95	4.9	3.5	4.0	
95th perc.	–	10.0	10.0	10.0	10.0	10.0	
Mean	8.8	8.3	7.97	8.5	7.8	8.5	F = 1.62; df = 5; p = 0.155
SD	1.3	1.2	1.6	1.6	1.8	1.7	

Legend: IIEF, International Index of Erectile Function; SD, standard deviation.

* p-value for change over age

Figure 2. IIEF erectile function domain score according to age.

Figure 3. IIEF orgasmic function domain score according to age.

Figure 4. IIEF sexual desire domain score according to age.

Figure 5. IIEF intercourse satisfaction domain score according to age.

Figure 6. IIEF overall satisfaction domain score according to age.

Figure 7. IIEF total score according to age.

4. Discussion

We found that 39% of men were sexually inactive, and that this rate increased significantly with age, especially from 70 years. All IIEF domain scores showed clear decreases with increasing age, yet the overall satisfaction domain score remained stable. The prevalence rates of mild and severe ED were 22% and 5%, respectively, increasing significantly with age.

Kinsey reported that age was the main determining factor for the frequency of coitus in men, observing that there was a decline from a frequency of 2.24 per week at age 26–30 years to 0.30 per week at age 66–70 years.[1] We also showed that there were significant decreases in almost all IIEF domain scores and a significant increase in sexual inactivity with advancing age. However, given that the overall satisfaction domain remained stable, it may be that sexual expectations change as men grow older. The same pattern was also evident in our study of female sexual functioning using similar methodology.[4] Therefore, this may represent a coping mechanism with age.

The IIEF was tested by Rosen et al. (1997) in a series of 111 men with sexual dysfunction and 109 age-matched healthy volunteers.[5] The mean scores for erectile function (25.8), orgasmic function (8.8), and sexual desire (7.0) were comparable with those of the control scores in that research.[5] However, the scores for intercourse (0.7 higher) and overall satisfaction (0.4 lower) were significantly different in our study group. We could find no literature about the minimal clinically important differences (MCID) of these domain scores, but we note that Rosen et al. estimated an MCID score of 4 for the EF domain.[15]

The prevalence of mild and severe ED increased significantly with age in our study. Kinsey reported that the prevalence of ED in his large sample was 42%, and that there was a negative correlation with age.[1] However, most respondents reported an interest in sexual behavior, and only 306 and 4108 of the 15,781 men were aged >55 and >25 years, respectively; therefore, this study overrepresented young men, suggesting selection bias by age. Modern probability sampling techniques have since been incorporated in studies. The Massachusetts Male Aging Study comprised 1709 men aged 40–70 living in the Boston area from 1987 to 1989 at baseline and reported an overall prevalence of 52% for minimal, moderate, or complete impotence.[16]

In 2002, Dutch investigators systematically reviewed 23 studies (15 from Europe, 5 from the USA, 2 from Asia, and 1 from Australia) reporting the prevalence of ED in population-based studies.[3] Major drawbacks identified were the absence of age groups, the degree of ED severity, and unclear nomenclature in terms of mild/partial/minimal, moderate/intermediate, and complete/severe ED. Prins et al. concluded that the prevalence rates of ED varied considerably as a consequence, but that all studies showed a linear increase in prevalence with advancing age.[3] Based on 24 studies published in the period 1993–2003, the 2nd International Consultation on Sexual Dysfunction in 2004 estimated that the prevalence rates of ED were 1%–9% in those aged <40 years and 2%–30% in those aged 40–59 years, with some populations also showing differences between the 40–49 and

50–59 year age groups.[17]

A review about the incidence, prevalence, and natural history of ED in 2013 also concluded that the prevalence varied widely between studies due to differences in the age ranges, populations, definitions, methods for identifying ED, methods for identifying patients, and symptom durations.[18] They reported median ED prevalence rates of 6%, 16%, 32%, and 44% in men aged <40–49, 50–59, 60–69, and 70–79 years, respectively. Finally, a large-scale Dutch study of 17,000 people aged 18–80 years showed that 11% of the male respondents had at least one sexual problem that occurred often or always and caused "considerable" or "very much" distress.[19] ED (6%) and premature ejaculation (3%) were most commonly reported by men, and sexual problems were most prevalent in the >70 year age group.

4.1 Strengths and shortcomings

We made several efforts to mitigate the limitations of previous research. First, to the best of our knowledge, this is the largest study on male sexual functioning in a representative Western population to use internationally accepted and validated tools. Second, we used a standardized definition of ED as <25 points on the 30-point erectile function domain of the IIEF. Third, we gathered data about male sexual functioning from a demographic sample matching a northern Dutch population with a clear data collection strategy. Fourth, the representativeness of the sample was evaluated by comparing participant characteristics against national reference databases. Fifth, we validated the reliability

of each questionnaire to avoid measurement bias. Except for the abridged version of the BIS (excluding questions about cancer), which had not been validated previously, the reliability of each questionnaire was high (Cronbach's $\alpha > 0.80$).

Characteristics were comparable to those reported by the general Dutch Central Agency, except for the underreporting by immigrants and men aged <40 years, and except for the differences in education. Underreporting by men aged <40 years was marked and resulted from a low response rate that was not seen previously in a female group of the same age.[4] The underreporting by immigrants might relate to the uneven distribution of immigrants throughout the Netherlands or to a response bias due to language and cultural barriers. Response bias likely accounts for the higher proportion of individuals with high educational levels (educated persons are more likely to participate),[20] whereas the overrepresentation of individuals with low educational levels might be explained by variation in the definitions used. For example, the Lifelines cohort study in the Netherlands showed that there was an underrepresentation of individuals with low educational levels when using elementary education as the standard.[21] Notably, however, the educational levels were similarly distributed to those in our previous study among women.[4]

A frequent problem with sexual research is the low response rate to questionnaires, which can result in selection bias that can influence results.[22] Although this study had a low response rate of 24%, it was similar to that reported in other studies on sexual functioning.[19,23]

Questionnaires were added for intoxicant use, mental health, fatigue, well-being, and general health because these can affect sexual function.[24] Data for tobacco/alcohol use, anxiety, severe depression, and general health were comparable to reference data. Compared to the data of Schwarz et al., the MFI score in our population was marginally higher (2.6 points), indicating greater fatigue. However, this could be explained by the older mean age of our population (59 versus 49 years), with fatigue increasing linearly with age.[13,25] Also, a 2.6-point increase is unlikely to meet MCID requirements given that systemic lupus erythematosus requires an MFI score difference of 14.3 for an MCID.[26]

It was also shown that significantly fewer men suffered from mild depression compared with the reference data ($p = 0.008$). This was expected because depression is age dependent and the mean age of our study population was higher than that reported by Hinz et al. (59 years versus 50 years).[14] However, another Dutch study found no evidence for a clinically relevant linear relationship between age and HADS total or subscale scores.[27] The mean HADS depression score of our total study group was 1.5 points lower than that reported by Hinz et al., consistent with MCID estimates in COPD that require a range from -1.7 to -1.5 points.[28] There may be a difference in depression scores between countries because the same difference was also seen for female participants in our previous research.[4,14] In other Dutch research, the reference data for the mean HADS depression score was 4.3, though this was reported in a general population with a mean age of 68.4 years and 56% female participants.[27]

A final point is that the IIEF itself is a limited tool. Although it provides detail about erections, it offers no more than superficial assessments of the other domains of male sexual function. It fails to differentiate between the types of sexual desire and between premature ejaculation and other male orgasm disorders. In addition, the IIEF is not suitable for sexually inactive men or for men who do not primarily engage in heterosexual vaginal intercourse. Should these criteria change, a small percentage of our study group could be defined as sexually active. These shortcomings of the IIEF mean that we cannot describe men who have sex without vaginal penetration or without a partner.

4.2 Conclusion

Except for overall satisfaction, which remains stable throughout life, all IIEF domains decrease with increasing age, suggesting that sexual expectations decrease as men grow older. The prevalence of mild and severe ED, based on the international validated questionnaire IIEF, vary by age category from rates of 0%–58% and 0%–23%, respectively, and significantly increase with increasing age. This study provides important reference data to help better understand age-related male sexual function in the general population. We conclude that these data will be suitable not only for use when counseling men about age-specific sexual function but also for upcoming clinical studies into male sexual functioning by age category.

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