ORIGINAL RESEARCH—OUTCOMES ASSESSMENT

Assessment of Sexual Health in Aging Men in Europe: Development and Validation of the European Male Ageing Study Sexual Function Questionnaire

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ABSTRACT

Introduction. Assessment of male sexual dysfunction has been the focus of substantial scientific effort. Less research has focused on the development of instruments for the measurement of sexual functioning in aging men.

Aims. The aims of this study were: (i) to characterize the psychometric properties of a new brief, reliable, and valid measure of male sexual functioning for use in a large population survey of middle-aged and elderly European men; and (ii) specifically, to determine whether the new instrument, the European Male Ageing Study–sexual function questionnaire (EMAS–SFQ), discriminates between men with high and low levels of circulating testosterone (T) (total T, free T, and bioavailable T).

Method. One thousand six hundred men aged 40–79 years completed the self-administered EMAS–SFQ, the Beck depression inventory, and provided a blood sample for assessment of sex hormones. Eighty-five men aged 35–74 years completed the EMAS–SFQ twice, 2 weeks apart to examine the test–retest reliability of the instrument.

Main Outcome Measures. Scores on the EMAS–SFQ in relation to age and T levels.

Results. Principal component analysis showed that the EMAS–SFQ had four distinct domains (overall sexual functioning [OSF], masturbation, sexual functioning-related distress, and change in sexual functioning). The instrument demonstrated excellent internal and test–retest reliability, as well as convergent, divergent, and discriminant validity. Men with the lowest levels of total, free, and bioavailable T reported lower OSF scores compared to men with the highest T levels.

Conclusions. The EMAS–SFQ is a valid and reproducible instrument, sensitive to age and T levels. It should be suitable for the assessment of sexual health in population samples of men in epidemiological studies of aging.

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Key Words. Male Sexual Function; Middle-Aged and Elderly Men; Aging; Testosterone

Introduction

Assessment of male sexual function has been the focus of substantial scientific research over the past number of decades [1–10]. Most of this work has concentrated on the identification, measurement, and treatment of erectile dysfunction [11–17]. Other research has been concerned with assessing sexual dysfunction more generally as a secondary aim in clinical studies of hypogonadism and testosterone (T) replacement (reviewed in Isidori et al. [3]; Soran and Wu [5]). These studies have used several validated instruments such as the international index of erectile function (IIEF), the brief sexual function inventory (BSFI), the male sexual health questionnaire (MSHQ), the Derogatis sexual functioning inventory (DSFI), and the structured interview on erectile dysfunction (SIEDY) [16–20]. However, these instruments have largely focused on the identification of sexual functioning problems or sexual dysfunction in specific patient groups such as those receiving treatment for prostate cancer, chemotherapy for lymphoproliferative disorders, men experiencing lower urinary tract symptoms, or men receiving phosphodiesterase-5 inhibitors for erectile dysfunction.

There are generally two types of instruments for assessing sexual dysfunction: structured interviews (SIs) and self-report questionnaires (SRQs; for review, see Corona et al. [11]). Both usually comprise a set of standardized, written probe questions requiring a finite number of responses, driven by an interviewer (SIs) or by the subjects themselves (SRQs). The latter (SRQs) allows more time and privacy for the respondent to organize and develop answers to sensitive questions. The former (SIs) can help achieve a better patient–physician relationship, and reduce the risk of misunderstandings [11]. There are a number of weaknesses in the instruments currently in use. First, few of the instruments have been specifically developed for administration in large, population-based studies of non-patient samples; and of the existing survey measures, none assess *all* of the aspects of sexual functioning (e.g., the IIEF, BSFI, and MSHQ [17–19] do not assess frequency of sexual intercourse or masturbation [M]). Second, several of the existing instruments are also relatively detailed (e.g., the DSFI [20] comprises 200 items), hence not suitable for use in large population-based studies, and none provide summary scores indicative of overall sexual functioning (OSF) useful in analyzing multidisciplinary epidemiological data. Third, many of the items included in the existing measures are not appropriate for use in elderly men from the general population as opposed to patients seeking medical attention in hospital clinics for sexual or genital–urinary complaints. Fourth, none of the published measures include a subjective assessment of changes in sexual functioning (compared to 1 year earlier) or incorporate an evaluation of whether men are distressed or worried by their current level of sexual (dys)function. The latter is particularly noteworthy given that sexual function is an important component of quality of life, and diminished sexual functioning has been found to be associated with psychological distress, marital problems, and general ill health [21–23].

The European Male Ageing Study (EMAS) is a multicenter population-based study of aging in men aged 40–79 years. The central research objective of EMAS is to investigate the effects of aging-related decline of endocrine functions (e.g., decrease in circulating T) on physical, psychological, and sexual function. One of the challenges was the development of a sexual function instrument for use in general population samples of middle-aged and elderly men across Europe. In this article, we describe the development and validation of a sexual function instrument designed specifically to be used in EMAS: the EMAS–sexual function questionnaire (EMAS–SFQ). Our spe-

cific aims were: (i) to characterize the psychometric properties of the EMAS–SFQ; and (ii) to determine whether the new instrument discriminates between men with high and low levels of circulating T (total, free, and bioavailable), and is sensitive to age.

Methods

Participants and Design

EMAS is a prospective study of male aging, funded by the European Union 5th Framework Program, "Quality of Life and Management of Living Resources." There are two phases: a cross-sectional survey undertaken between 2003 and 2005 and a follow-up investigation for 2007–2009. Men aged 40–79 years were recruited from population registers for participation in EMAS in eight European centers (Florence [Italy], Leuven [Belgium], Lodz [Poland], Malmö [Sweden], Manchester [UK], Santiago de Compostela [Spain], Szeged [Hungary], and Tartu [Estonia]). Stratified random sampling was used with the aim of recruiting equal numbers of men into each of four age bands (40–49, 50–59, 60–69, and 70–79 years). Participants were invited by letter to participate in a wide range of assessments (cf. Lee et al. [24]). They were invited to complete an optional questionnaire on sexual function (EMAS–SFQ). Of the 3,369 subjects recruited to EMAS, 3,112 completed the EMAS–SFQ. To ensure confidentiality and encourage participation, the SFQ was self-completed in private and then placed in a sealable envelope by the participants without scrutiny by the researchers. Participants also completed an interviewer-assisted questionnaire, which included the Beck depression inventory. A morning (before 10:00 AM) fasting blood sample was obtained and serum was stored at –80°C. From the 3,112 subjects who completed the EMAS–SFQ, we selected a random sample of 200 subjects from each center to assess the performance of the EMAS–SFQ (referred to as the EMAS–1,600 sample).

In addition to this sample, test–retest reliability was assessed by recruiting a separate population sample of middle-aged and elderly men from Leeds, UK (referred to as the validation sample). Eighty-five men aged between 35 years and 74 years responded to newspaper, Internet, and public advertisements to take part in a study requiring completion of the EMAS–SFQ twice, 2 weeks apart to examine the test–retest reliability of the instrument. In order to assess convergent and divergent validity, the BSFI [18,25], the Beck depression inventory [26], the Marlowe Crowne social desirability scale [27], and an item assessing satisfaction with general (nonsexual) relationship with partner (see question 20, Appendix) were also administered.

EMAS–SFQ

Development

A comprehensive review of the literature relating to the assessment of sexual functioning in men was conducted, and an expert panel evaluated existing questionnaires. As outlined in the Introduction, none of the existing questionnaires were concerned with assessing levels of distress or worry relating to current sexual functioning or evaluating changes in sexual functioning. Therefore, questions relating to these domains of sexual functioning were added. An initial pool of 35 items was identified measuring all aspects of sexual functioning (i.e., frequency of sexual behavior, sexual desire/libido, erectile function, orgasmic function, M, satisfaction, sexual-function-related distress [SFD], change in sexual function [CSF]). This initial pool of items formed the basis of a pilot questionnaire that was distributed to a random sample of men across each of the EMAS study centers (n = 194). Linguistic validation of the instrument was performed by the study centers in each country including forward and backward translations of the items before the pilot questionnaire was distributed. An item analysis of the initial 35 items was conducted on participant responses, resulting in the removal of 18 items as they exhibited poor psychometric properties. Following the procedures outlined by Rust and Golombok [28], items were excluded if they had: limited distributions (i.e., responses were heavily skewed), low face validity (i.e., items were measuring aspects of sexual dysfunction beyond the scope for a nonpatient population) or were considered inappropriate for use in elderly men from the general population, low completion rate resulting in a large amount of missing data, low discriminant validity (i.e., items that were unrelated to age and/or sex hormones), and low item–total correlation coefficients (i.e., items that had low correlations with the rest of the scale). However, similar to Mykletun et al. [25], one of the items from the initial pool that assessed overall sexual satisfaction (question 19) was not included in the principal component analysis of the EMAS–SFQ (see the following) because it did not measure a specific aspect of sexual function (e.g., erection, intercourse). Instead, it was included in the convergent

and divergent validity analyses (described as follows). The final EMAS–SFQ consisted of 16 items, and assessed sexual functioning, SFD, and change in sexual functioning compared to 1 year earlier (see Appendix). The Appendix contains 20 items including the 16 EMAS–SFQ items plus the single-item assessment of erectile dysfunction used in the Massachusetts male aging study (MMAS), two items on satisfaction, and one question relating to relationship status.

Hormone Measurements

T and sex-hormone-binding globulin (SHBG) concentrations were measured by the Modular E170 platform electrochemiluminescence immunoassays (Roche Diagnostics, Mannheim, Germany). All hormone measurements were performed in a single laboratory (General Laboratory, Azienda Ospedaliero-Universitaria Careggi, Florence, Italy). Free T levels were derived from total T, SHBG, and albumin concentrations, and bioavailable T was derived from total T and SHBG [29]. Within- and between-assay coefficients of variation for T were 1.05 and 3.72%, and 1.70 and 3.18% for SHBG, respectively. Detection limits of the respective assays were 0.07 nmol/L and 0.35 nmol/L.

Statistical Analysis

Conventional psychometric analyses were conducted to examine the reliability and validity of the EMAS–SFQ. First, the factor structure of the questionnaire was investigated, using a principal component analysis with a varimax rotation, to identify the underlying domains of the instrument. Second, the internal reliability and test–retest reliability of the subsequent domains were examined using Cronbach's alpha and intra-class correlations, respectively. Third, discriminant validity was explored by examining whether the instrument could reliably distinguish between men with low and high levels of T, and between different characteristics of the study sample (e.g., older vs. younger men). Thus, we compared the scores of men with the highest and lowest levels of total T, free T, and bioavailable T while controlling for the effect of age using analysis of covariance (ANCOVA). Low hormone levels were defined as values below the 2.5th percentile, and high levels were defined as values above 97.5th percentile. In the total T analyses, the low group had T levels less than 7.0 nmol/L, and the high group had T levels greater than 29.50 nmol/L. In the free and bioavailable T analyses, the low groups had T levels less than 140 pmol/L and 2.99 nmol/L, and the high groups had T levels greater than 500 pmol/L and 12.0 nmol/L, respectively. We also tested the EMAS–SFQ's ability to discriminate between the different EMAS age bands (see the following). The results of these analyses will allow us to determine whether the EMAS–SFQ is sensitive to the effects of age and T levels. Finally, convergent and divergent validity was explored to assess the degree of correspondence with existing reliable and valid instruments in similar (convergent) or different (divergent) domains. In the current context, the relationship between the EMAS–SFQ and the BSFI for urology, the Beck depression inventory, a measure of social desirability, satisfaction with overall sex life, and satisfaction with general (non-sexual) relationship with partner was examined. As an additional test of convergent validity, the relationship between the EMAS–SFQ and the single-item assessment of erectile dysfunction (presence or absence; question 10) used in the MMAS [30] was also explored. Statistical analyses were performed using SPSS version 13 (SPSS Inc., Chicago, IL, USA).

Results

Participants

The mean age of the 1,600 EMAS participants was 59.4 (10.6 standard deviation [SD]) years with 365 (22.8%) aged 40–49 years, 462 (28.9%) aged 50–59 years, 435 (27.2%) aged 60–69 years, and 338 (21.2%) aged 70–79 years. Compared to those recruited to EMAS but who did not participate in this analysis, the 1,600 participants did not differ in terms of age ($t = 1.47$, not significant [ns]) or total T levels ($t = 1.67$, ns). The mean age of the validation sample of 85 men was 47.5 years (9.4 SD). The mean age of the low total T group was 62.0 years (range 42–80 years) and 56.8 years (range 44–79 years) in the high T group. The mean age of the low free T group was 66.2 years (range 44–80 years) and 49.6 years (range 40–75 years) in the high T group, and the mean age of the low bioavailable T group was 65.9 years (range 43–80 years) and 47.7 years (range 40–67 years) in the high T group. The mean ages were significantly different between the high and low total T ($P < 0.05$), free T ($P < 0.001$), and bioavailable T ($P < 0.001$) groups. Therefore, the effect of age was controlled in these group analyses as described in the Statistical Analysis section.

Factor Analysis

The 16-item EMAS–SFQ had a Kaiser–Meyer–Olkin measure of sampling adequacy of 0.87 and a

Table 1 Principal component analysis with a varimax rotation of the European Male Ageing Study (EMAS)–sexual function questionnaire (SFQ): factor loadings

EMAS–SFQ items	Factor 1	Factor 2	Factor 3	Factor 4
Worried or distressed by current level of sexual drive/desire?	0.84			
Worried or distressed by frequency of sexual activities?	0.84			
Worried or distressed by ability to have an erection?	0.83			
Worried or distressed by current orgasmic experience?	0.83			
Worried or distressed by frequency of morning erections?	0.68			
Compared with a year ago, sexual drive/desire changed?		0.80		
Compared with a year ago, frequency of sexual activities changed?		0.78		
Compared with a year ago, ability to have erection changed?		0.78		
Compared with a year ago, has the orgasmic enjoyment changed?		0.70		
Compared with a year ago, frequency of morning erections changed?		0.68		
How often do you think about sex?			0.70	
How many times have you attempted sexual intercourse?			0.82	
How often do you engage in kissing, fondling, petting, etc.?			0.76	
How often did you have the feeling of orgasm or climax?			0.65	
How frequently did you awaken with a full erection?			0.51	
How often do you masturbate?				0.89
Eigenvalue	3.47	3.07	2.61	1.21
Percentage variance explained	21.66	19.19	16.29	7.55

significant Bartlett's test of sphericity (7800.71; $P < 0.001$), indicating that this data set was appropriate for the application of factor analysis. Therefore, a principal component analysis with a varimax rotation was performed to investigate the factor structure of the questionnaire items. As shown in Table 1, four factors (or domains) with eigenvalues greater than 1.0 emerged (range 1.21–3.47) accounting for 64.7% of the variance. The first and second domains were clearly associated with worry or distress related to OSF ("SFD") and with perceptions of change in sexual functioning compared to 1 year earlier ("CSF"), respectively. Domain 3 was associated with the frequency of all aspects of sexual functioning and was labeled "OSF." Domain 4 comprised the single item relating to frequency of "M," and indicated that this domain of sexual functioning is distinct from OSF. Domain scores were computed by summing the scores for individual items from each factor, apart from the single item score for M. The domain score ranges, descriptive statistics, and intercorrelations are shown in Table 2, and the final questionnaire in the Appendix. It is noteworthy that the intercorrelations are moderate indicating that each domain is measuring a different aspect of sexual functioning in men. In addition, as predicted, the relationship between the OSF and SFD domains is negative, signifying that men with lower sexual functioning scores report higher levels of distress or worry.

Please note that 112 men did not have a partner in the EMAS–1,600 sample. Independent sample t tests showed that men without partners masturbated significantly more frequently than men with partners ($t = 3.70$; $P < 0.01$). However, the result of the factor analysis was identical when men without partners were excluded; therefore, these men were retained in the analyses.

Scale Reliability

Internal consistency of the subscales was assessed using Cronbach's alpha, and test–retest reliability in the validation sample was evaluated using intra-class correlations. The alphas for the OSF, SFD, and CSF subscales were 0.80, 0.88, and 0.86, respectively. The intra-class correlation coeffi-

Table 2 European Male Ageing Study–sexual function questionnaire domains: descriptive statistics and intercorrelations

Domain	Score range	Mean	Standard deviation	OSF	M	SFD	CSF
OSF	0 to 33	16.51	6.92	—			
M	0 to 7	1.01	1.47	0.24*	—		
SFD	0 to 20	2.05	3.24	–0.28*	0.03	—	
CSF	–10 to 10	–1.41	2.62	0.39*	0.11*	0.40*	—

*$P < 0.001$.
OSF = overall sexual functioning; M = masturbation; SFD = sexual-function-related distress; CSF = change in sexual functioning.

Table 3 Discriminant validity of European Male Ageing Study–sexual function questionnaire in men with high and low levels of total testosterone (T), free T, and bioavailable T

	High total T		Low total T		
Domain	Mean	SD	Mean	SD	*P* value*
Total T (nmol/L)	32.62	3.29	5.56	1.41	<0.000
OSF	17.04	5.77	12.48	6.82	<0.01
M	1.24	1.77	0.60	1.07	NS
SFD	2.43	3.50	2.82	3.95	NS
CSF	–1.65	2.77	–2.21	2.60	NS
	High free T		Low free T		
Free T (pmol/L)	540.0	50.0	100.0	30.0	<0.000
OSF	20.09	5.17	11.41	7.26	<0.01
M	1.65	1.69	0.40	0.87	<0.02
SFD	1.20	2.10	2.75	3.69	NS
CSF	–0.46	1.69	–2.35	2.70	<0.01
	High bioavailable T		Low bioavailable T		
Bio T (nmol/L)	13.09	1.02	1.73	0.99	<0.000
OSF	21.04	4.69	12.13	7.43	<0.01
M	1.76	1.73	0.62	1.04	<0.07
SFD	1.43	2.10	2.33	3.37	NS
CSF	–0.36	1.78	–2.02	2.60	NS

*Group differences assessed using analysis of covariance controlling for age.
SD = standard deviation; OSF = overall sexual functioning; M = masturbation; SFD = sexual-function-related distress; CSF = change in sexual functioning.

cients between scores at time 1 and time 2 were high for the OSF (0.84), M (0.93), SFD (0.82), and CSF (0.74) subscales.

Discriminant Validity

First, the results of the ANCOVA showed (Table 3) that men with low levels of total T, free T, and bioavailable T reported significantly lower scores on the OSF domain compared to men with high levels of T ($P < 0.01$). For the M domain, men with low levels of free T reported significantly lower scores ($P < 0.02$) compared to men with high levels, with a trend toward significance in the predicted direction in total T and bioavailable T groups. No differences were found between the total and bioavailable T groups for scores on the SFD or CSF domains. However, men with low levels of free T reported significantly greater decrements in their OSF in the last year ($P < 0.01$) compared to men with high levels. Thus, the EMAS–SFQ was able to discriminate between men with high and low levels of total T, free T, and bioavailable T within the physiological range. This provides evidence that the EMAS–SFQ is sensitive to different levels of circulating T.

Second, the results for age showed a significant main effect on each of the EMAS–SFQ domains (Table 4). For the OSF domain, each age group was found to be significantly different from each other ($P < 0.001$) with the highest scores reported by men aged between 40 years and 49 years, and the lowest scores reported by men aged 70–79 years. For the

Table 4 Discriminant validity and descriptive statistics for European Male Ageing Study (EMAS)–sexual function questionnaire across age bands (EMAS subjects, $n = 1,600$)

	EMAS age bands							
	OSF*		M†		SFD‡		CSF§	
Age bands (years)	Mean	SD	Mean	SD	Mean	SD	Mean	SD
40–49	20.42	4.83	1.44	1.70	1.27	2.32	–0.40	1.71
50–59	18.40	5.51	1.15	1.51	2.23	3.31	–1.23	2.22
60–69	14.57	6.79	0.83	1.33	2.55	3.71	–1.96	2.85
70+	10.34	6.77	0.55	1.12	2.07	3.30	–2.30	3.32

*All age bands significantly different from each other.
†All age bands significantly different from each other except 60–69 years and 70+ years.
‡The 40–49 years band significantly different from all other.
§The 40–49 and 50–59 years age bands significantly different from all other bands and each other. The 60–69 years and 70+ years are not significantly different.
OSF = overall sexual functioning; M = masturbation; SFD = sexual-function-related distress; CSF = change in sexual functioning; SD = standard deviation.

Table 5 Convergent and divergent validity: correlations (*r*) with other related and unrelated variables

Variable	EMAS–SFQ domains			
	OSF *r*	M *R*	SFD *r*	CSF *R*
BSFI domains†				
Sexual drive	0.44***	0.32**	–0.49***	–0.09
Erection	0.55***	0.32**	–0.73***	–0.39***
Ejaculation	0.44***	0.31**	0.71***	–0.04
Problem assessment	0.47***	0.28*	0.80***	–0.32**
Social desirability scale†	–0.11	0.05	0.01	0.01
Beck depression inventory‡	0.33***	–0.09**	0.30***	–0.25***
Satisfaction with sex life‡	0.31***	–0.08**	–0.42***	0.29***
Erectile dysfunction‡§	–0.56***	–0.09**	0.43***	–0.41***
Satisfaction with general relationship	0.10**	–0.02	–0.11***	0.07*

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.
†Coefficients obtained from validation sample.
‡Coefficients obtained from EMAS.
§Point biserial correlation coefficients (0 absence, 1 presence of erectile dysfunction).
Data from validation sample ($n = 85$) and EMAS ($n = 1,600$).
EMAS–SFQ = European Male Ageing Study–sexual function questionnaire; OSF = overall sexual functioning; M = masturbation; SFD = sexual-function-related distress; CSF = change in sexual functioning.

M domain, again each age group scored significantly differently from each other with the exception of the 60–69 years group and the 70 and over group ($P < 0.001$) such that men in the younger age groups reported a greater frequency of M compared to men in the older groups. For the SFD domain, men aged 40–49 years reported significantly lower levels of distress compared to the other age bands ($P < 0.001$). However, no other differences were observed between the groups. Finally, men aged 40–49 and 50–59 years reported significantly lower decreases in OSF within the last year compared to men aged 60–69 and 70+ years. Taken together, these findings indicate the EMAS–SFQ possesses good discriminant validity, it is sensitive to age, and it is able to reliably distinguish between high and low levels of circulating T.

Convergent and Divergent Validity

Table 5 shows the pattern of correlations and indicates, as predicted, that the EMAS–SFQ domain coefficients are generally higher with conceptually similar constructs (e.g., BSFI), and lower with conceptually dissimilar constructs (e.g., depression, social desirability, satisfaction with general [non-sexual] relationship). In addition, the (point biserial) correlation coefficients show that the presence of erectile dysfunction is significantly associated with lower OSF and M scores, and higher levels of SFD and greater negative changes in sexual functioning within the last year.

Discussion

The EMAS–SFQ is a 16-item self-administered questionnaire designed to provide a single-score assessment of OSF together with a measure of SFD and an evaluation of changes in sexual functioning compared to a year ago. The results of the principal component analysis showed that the EMAS–SFQ has four distinct domains. Two domains are concerned with sexual functioning (OSF and M), one with SFD, and one with CSF. It is noteworthy that M is separate from OSF suggesting that it should be considered as a separate entity in the global, overall assessment of sexual health. However, it is an important aspect that is frequently not included in measures of male sexual functioning. As a result, less is known about age-related changes in M or the role of T deficiency in this aspect of male sexual behavior. Indeed, to this end, Corona et al. have recently developed ANDROTEST, an SI for the screening of hypogonadism in patients with sexual dysfunction, which includes two items relating to M [31].

The psychometric properties of the EMAS–SFQ were found to be excellent, and show that the single score for OSF provides a good indicator of global functioning. Moreover, the OSF score was found to be significantly associated with the well-validated measure of erectile dysfunction from the MMAS [30] and with the single-item measure of satisfaction with overall sex life. This is important for two reasons. First, these findings indicate that the OSF score has good convergent validity. Second, they highlight the need for future research on overall sexual health in aging men to include not only the 16-item EMAS–SFQ, but also these additional, brief measures of erectile dysfunction and sex life satisfaction.

The EMAS–SFQ was also found to demonstrate good reliability and validity in a large sample

of European men aged 40–79 years. In the current analyses, psychometric validation was addressed in four main areas: (i) internal reliability; (ii) test–retest reliability; (iii) convergent and divergent validity; and (iv) discriminant validity. The performance of the EMAS–SFQ in each of these areas was shown to be excellent, and as such this new measure is appropriate for use in epidemiological research in populations of aging men from the community (cf. Rust and Golombok [28]; O'Connor et al. [32]; Rosen et al. [17]). Of particular note are the findings relating to the discriminant validity of the measure. The instrument was found to be sensitive to different age bands with the highest scores observed in the youngest age group, as well as being able to distinguish between men with low and high levels of circulating T. The OSF domain score was found to exhibit a linear relationship with age such that scores between each of the 10-year age bands were found to be significantly different from each other. This is a further demonstration of the suitability of this new measure for use in large, community-based prospective studies such as the EMAS.

The age-related findings for SFD are interesting and require further comment. The results indicated that the levels of distress or worry reported by men in each age band were relatively low (range 1.27–2.55; maximum scale score = 20) with the lowest scores observed in the youngest age group. This is not surprising given that the EMAS–SFQ is primarily aimed at assessing normal age-related sexual function (rather than dysfunction), and men aged 40–49 years are likely to be content with their OSF. In addition, the pattern of findings suggests that the relationship between age and SFD may not be linear such that men aged 50 years or over do not experience incremental increases in distress even though there is progressive decline in sexual function.

Finally, this article also aimed to examine whether this new instrument could distinguish between men with high and low levels of circulating T in a physiologically meaningful manner. We found that the EMAS–SFQ was able to reliably discriminate between individuals with low and high total, free, and bioavailable T levels in the anticipated direction. In particular, for all three measures of circulating T, men with the lowest levels exhibited significantly lower OSF scores compared to men with the highest levels. However, few T-related differences were found between the groups for SFD and CSF. The latter finding may indicate that circulating T levels are less important than other factors such as age, for the maintenance of these aspects of sexual functioning in middle-aged and elderly men. It is also possible that low levels of T are not related to CSFs or distress because basal levels of sexual behavior may have stabilized previously over several years.

In conclusion, the EMAS–SFQ is a valid, reproducible instrument for the assessment of sexual health in population samples of European men and should be considered as an important new instrument specifically developed for epidemiological studies of aging in the male population.

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Appendix

EMAS Sexual Function Questionnaire (EMAS–SFQ)

Please circle the one response that best describes you IN THE LAST MONTH.

1. Please tick one statement that best describes your circumstances.
   1. I have been living with my wife.
   2. I have been living with my partner.
   3. I have a sexual partner but we did not live together.
   4. I do not have a sexual partner.
2. How often did you think about sex? This includes times of just being interested in sex, daydreaming, or fantasizing about sex, as well as times when you wanted to have sex.
   0. Not at all
   1. Once in the last month
   2. 2–3 times in the last month
   3. Once a week
   4. 2–3 times a week
   5. 4–6 times a week
   6. Once a day
   7. More than once a day
3. Are you worried or distressed by your current level of sexual drive/desire?
   0. Not at all worried or distressed
   1. A little bit worried or distressed
   2. Moderately worried or distressed
   3. Very worried or distressed
   4. Extremely worried or distressed
4. Compared with a year ago, has your sexual drive/desire changed?
   +2. Increased a lot
   +1. Increased moderately
   0. Neither increased nor decreased
   –1. Decreased moderately
   –2. Decreased a lot

If you did NOT have a sexual partner in the LAST MONTH, please skip questions 5 and 6 and go straight to question 7.

5. How many times have you attempted sexual intercourse?
   0. Not at all
   1. Once in the last month
   2. 2–3 times in the last month
   3. Once a week
   4. 2–3 times a week
   5. 4–6 times a week
   6. Once a day
   7. More than once a day
6. Apart from when you attempted sexual intercourse, how frequently did you engage in activities such as kissing, fondling, petting, etc.?
   0. Not at all
   1. Once in the last month
   2. 2–3 times in the last month
   3. Once a week
   4. 2–3 times a week
   5. 4–6 times a week
   6. Once a day
   7. More than once a day

7. How often did you masturbate?
   0. Not at all
   1. Once in the last month
   2. 2–3 times in the last month
   3. Once a week
   4. 2–3 times a week
   5. 4–6 times a week
   6. Once a day
   7. More than once a day

8. Are you worried or distressed by the overall frequency of your sexual activities (including intercourse, kissing, etc., and masturbation)?
   0. Not at all worried or distressed — Skip question 8A and go straight to question 9
   1. A little bit worried or distressed
   2. Moderately worried or distressed
   3. Very worried or distressed
   4. Extremely worried or distressed

8A. If you are worried or distressed by the current frequency of your sexual activities, do you consider it to be
   1. Too frequent
   2. Not frequent enough

9. Compared with a year ago, has the overall frequency of your sexual activities changed?
   +2. Increased a lot
   +1. Increased moderately
   0. Neither increased nor decreased
   –1. Decreased moderately
   –2. Decreased a lot

It is common for men to experience erectile problems. This may mean that one is not always able to get or keep an erection that is rigid enough for satisfactory activity (including sexual intercourse and masturbation). In the LAST MONTH:

10. You are
   1. Always able to keep an erection which would be good enough for sexual intercourse
   2. Usually able to get and keep an erection which would be good enough for sexual intercourse
   3. Sometimes able to get and keep an erection which would be good enough for sexual intercourse
   4. Never able to get and keep an erection which would be good enough for sexual intercourse

11. Are you worried or distressed by your current ability to have an erection?
   0. Not at all worried or distressed
   1. A little bit worried or distressed
   2. Moderately worried or distressed
   3. Very worried or distressed
   4. Extremely worried or distressed

12. Compared with a year ago, has your ability to have an erection changed?
   +2. Increased a lot
   +1. Increased moderately
   0. Neither increased nor decreased
   –1. Decreased moderately
   –2. Decreased a lot

13. When you had sexual stimulation, how often did you have the feeling of orgasm or climax?
   0. No sexual intercourse/masturbation
   1. Almost never/never
   2. A few times (much less than half the time)

3. Sometimes (about half the time)
4. Most of the time (much more than half the time)
5. Almost always/always

14. Are you worried or distressed by your current orgasmic experience?
    0. Not at all worried or distressed
    1. A little bit worried or distressed
    2. Moderately worried or distressed
    3. Very worried or distressed
    4. Extremely worried or distressed

15. Compared with a year ago, has the enjoyment of your orgasmic experience changed?
    +2. Increased a lot
    +1. Increased moderately
    0. Neither increased nor decreased
    –1. Decreased moderately
    –2. Decreased a lot

16. How frequently did you awaken with full erection?
    0. Not at all
    1. Once in the last month
    2. 2–3 times in the last month
    3. Once a week
    4. 2–3 times a week
    5. 4–6 times a week
    6. Once a day
    7. More than once a day

17. Are you worried or distressed by the frequency of your morning erections?
    0. Not at all worried or distressed
    1. A little bit worried or distressed
    2. Moderately worried or distressed
    3. Very worried or distressed
    4. Extremely worried or distressed

18. Compared with a year ago, has the frequency of your morning erections changed?
    +2. Increased a lot
    +1. Increased moderately
    0. Neither increased nor decreased
    –1. Decreased moderately
    –2. Decreased a lot

19. How satisfied have you been with your overall sex life?
    0. Very dissatisfied
    1. Moderately dissatisfied
    2. About equally satisfied and dissatisfied
    3. Moderately satisfied
    4. Very satisfied

20. How satisfied have you been with your general (nonsexual) relationship with your partner?
    1. Very dissatisfied
    2. Moderately dissatisfied
    3. About equally satisfied and dissatisfied
    4. Moderately satisfied
    5. Very satisfied