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Sexual health in men with COPD: testosterone deficiency, erectile dysfunction and prediction using routine clinical indices

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Article

Keywords: Chronic obstructive pulmonary disease, erectile dysfunction, testosterone deficiency syndrome, symptom burden, quality of life

Posted Date: May 26th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9370294/v1

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Additional Declarations: Competing interest reported. Ane Lopez-Gonzalez has received speaker fees from AstraZeneca, Chiesi, GlaxoSmithKline and CSL Behring. Cristina Aljama has received speaker fees from FAES farma, Chiesi, AstraZeneca, Zambon, GSK and CSL Behring. Galo Granados has received speaker fees from AstraZeneca, Boehringer Ingelheim, Chiesi, Zambon and GlaxoSmithKline. Beatriz Abascal-Bolado has received speaker fees from AstraZeneca, Chiesi, Sanofi, MSD, Menarini and GlaxoSmithKline. Carlos Amado Diago has received speaker or consulting fees from Boehringer Ingelheim, Pfizer, AstraZeneca, Novartis, Chiesi, Faes Farma, Esteve, GSK and Bial. Eva Cabrera has received speaker fees from Boehringer Ingelheim, GSK, Menarini and Chiesi. Alicia Marín Tapia has received speaker fees from Chiesi, Faes Farma, GSK. Elsa Naval has received speaker fees from GSK, AstraZeneca, Chiesi, Menarini, Zambon. Rosa Malo de Molina has received speaker fees from AstraZeneca, Chiesi and GlaxoSmithKline. Miriam Barrecheguren has received speaker fees from CSL Behring, Grifols, Chiesi, AstraZeneca, GlaxoSmithKline and Sanofi and consulting fees from CSL Behring, Grifols and GlaxoSmithKline. Marc Miravitlles has received speaker fees from AstraZeneca, Boehringer Ingelheim, Bial, Chiesi, Cipla, GlaxoSmithKline, Glenmark Pharmaceuticals, Menarini, Kamada, Takeda, Zambon, Tabuk Pharmaceuticals, CSL Behring, Specialty Therapeutics, Sanofi/Regeneron, Grifols and Novartis, consulting fees from AstraZeneca, Atriva Therapeutics, BEAM Therapeutics, GondolaBio, Chiesi, GlaxoSmithKline, CSL Behring, Ferrer, Korrobio, Menarini, Mereo Biopharma, Specialty Therapeutics, Takeda, Novartis, Novo Nordisk, Roche, Sanofi/Regeneron, Zambon, Zentiva and Grifols and research grants from Grifols . Cristina Esquinas has received honoraria during the last 3 years for scientific advice and scientific activities from Chiesi and CSL Behring. The remaining authors report no conflicts of interest.

Abstract

Sexual health impairment, including erectile dysfunction (ED) and testosterone deficiency syndrome (TDS), is common in men and particularly prevalent in chronic obstructive pulmonary disease (COPD). The aim of this study was to assess their prevalence and clinical correlates in COPD. Cross-sectional, multicentre study, including men aged 40–75 years with stable moderate-to-severe COPD. ED was measured by the International Index of Erectile Function (IIEF-5). Biochemical and symptomatic TDS were evaluated through serum testosterone levels and the Aging Males' Symptom Scale (AMSS). Associations and predictors of severe ED were analysed. Forty-four men were included (mean age of 65.9 years and FEV1% 50.4%. ED was present in 81.8%, 54.5% severe ED. Biochemical TDS was identified in 70.5%, 54.5% reported severe symptoms. ED affected all IIEF-5 domains, with greater involvement of subjective domains. ED severity correlated strongly with COPD Assesment Test (CAT), comorbidities, psychological distress and systemic inflammation, but not with lung function or testosterone levels. Higher CAT, comorbidity burden and psychological distress independently predicted severe ED. ED and TDS are highly prevalent in COPD. ED relates more to symptom burden, comorbidities and psychological distress than to lung function or testosterone. Routine clinical indices, such as CAT, may help identify high risk patients, supporting routine sexual health assessment into COPD care.

Introduction

Chronic obstructive pulmonary disease (COPD) is a highly prevalent, progressive, high-burden disease characterised by airflow obstruction and persistent respiratory symptoms. The global prevalence in adults above 40 years of age is around 10–13% but varies widely between settings [1, 2].

Beyond its respiratory implications, COPD is increasingly recognised as a systemic disease due to its numerous extrapulmonary comorbidities [3]. These include cardiovascular diseases, osteoporosis, diabetes, anxiety, depression and skeletal muscle dysfunction. All these can have a severe impact on the patients' quality of life and on the healthcare costs, highlighting the need for a comprehensive management approach [4].

Among the less frequently discussed comorbidities in COPD are erectile dysfunction (ED) and testosterone deficiency syndrome (TDS). ED is defined as the persistent inability to achieve or maintain an adequate and necessary erection for satisfactory sexual activity [5]. Its prevalence is difficult to determine, as different studies use different definitions and diagnostic tools. However, some studies have described a prevalence in general population as high as 20% in males aged between 20 and 75 [6]. On the other hand, TDS is characterised by low serum testosterone levels together with symptoms such as reduced libido, fatigue and mood changes, and remains largely underdiagnosed in COPD [7].

Both conditions may coexist with COPD due to plausible shared physiological and psychological factors, including endothelial dysfunction, oxidative stress, systemic inflammation and chronic hypoxia [8]. Smoking and other comorbidities frequently present in COPD, such as diabetes and obesity, are well-established contributors to vascular damage and therefore, may exacerbate ED in COPD [7, 9]. Moreover,

certain COPD treatments might influence erectile function through testosterone depletion and autonomic alterations [9]. Psychological factors, such as anxiety, and decreased self-esteem further reinforce the bidirectional impact between COPD and these conditions.

Despite these plausible connections, sexual health aspects are seldom investigated in the routine care of respiratory patients. Few studies have analysed ED and TDS in COPD [8], with heterogeneous definitions or without simultaneous evaluation of COPD-related symptoms and comorbidity burden. This leaves important gaps in relation to its prevalence, interaction and clinical relevance in men with COPD. Furthermore, the diagnosis of ED and TDS in men with COPD may be clinically relevant, since these disorders can serve as symptomatic markers and affect patients' quality of life. Early detection and appropriate management could significantly improve symptom burden in men with COPD. To our knowledge, no previous study has examined ED and TDS in COPD while simultaneously exploring their relationship with symptom burden and disease severity.

The aim of this study was to analyse the prevalence of ED and TDS in COPD patients and their relationship with lung disease severity and symptoms. Secondarily, we compared clinical characteristics between severe and non-severe ED and explored a clinically applicable risk-stratification approach to identify patients in high-risk of severe ED.

Methods

Design of the study

This was an observational, cross-sectional, multicentre study performed in respiratory outpatient clinics from six hospitals in Spain. This study was approved by the Ethics Committee of the Vall d'Hebron University Hospital of Barcelona (Spain), as the coordinating centre and by all the other participating centres. All patients provided written informed consent.

Participants

Eligible patients were men aged 40 to 75 years, smokers or former smokers with an exposure of more than 10 pack-years, a confirmed diagnosis of moderate to severe COPD, confirmed by spirometry with an airflow obstruction defined by a post-bronchodilator forced expiratory volume in the first second [FEV1]/forced vital capacity [FVC] ratio ≤ 0.7 and FEV1 (%) predicted of 30–80% [10]. Participants had to be clinically stable, defined as having no COPD exacerbations in the two months prior to enrolment.

The exclusion criteria were: patients unable to complete the study questionnaires at the investigator's discretion, those with a prior diagnosis of ED or TDS and who were receiving pharmacological treatment for this indications (such as phosphodiesterase-5 inhibitors), chronic home oxygen therapy, or chronic respiratory insufficiency. Furthermore, patients with an estimated life expectancy of less than one year, according to the investigator's assessment, were excluded.

Variables and measures

We collected sociodemographic characteristics, clinical history, medication and laboratory data (biochemistry, haematology and hormones). Blood samples were obtained in the early morning (between 8am and 10 am) after an overnight fast. A single test was performed; all hormonal parameters (total testosterone, sex hormone binding globulin (SHBG), luteinising hormone (LH) and follicle-stimulating hormone (FSH)), were measured using standardised immunoassay methods at each laboratory site. All determinations were based on this sample, consistent with the cross-sectional design.

Erectile function was evaluated with the International Index of Erectile Function (IIEF-5), a validated five-item questionnaire measuring the domains of erectile function, orgasmic function, sexual desire, intercourse satisfaction, and overall satisfaction [11]. Each item is scored from 1 to 5, providing a total score ranging from 5 to 25 points, with lower scores indicating more severe ED. This severity is categorised using established cut-offs: severe (5–7), moderate (8–11), mild-to-moderate (12–16), mild (17–21) and no ED (22–25). For the purposes of inferential analysis and risk stratification, the primary analytical split classified participants as having severe (IIEF-5 < 7) versus non-severe ED (IIEF-5 ≥ 7). Additionally, a descriptive grading of all five severity categories was used to characterise the whole distribution of ED within the cohort.

Testosterone status was assessed through both biochemical and symptomatic measures. Biochemical TDS was defined as a total serum testosterone levels < 250 ng/dL, corresponding to the commonly accepted threshold [12]. Symptomatic TDS was evaluated using the Aging Males' Symptoms Scale (AMSS), a validated questionnaire designed to evaluate physical, psychological, and sexual symptoms associated with testosterone deficiency in aging men [13]. The AMSS consists of 17 items scored from 1 to 5, with higher scores indicating greater symptom burden. A total score > 26 is suggestive of testosterone deficiency, and this threshold was used to define symptomatic TDS, which was further classified as mild (27–36 points), moderate (37–49 points) and severe (> 50 points). In this study, prevalence estimations are presented separately for biochemical and symptomatic TDS, while associations between testosterone and clinical variables were analysed using both biochemical values and AMSS scores. Lower urinary tract symptoms were evaluated using the International Prostate Symptom Score (IPSS), which ranges from 0 to 35, classifying symptoms as mild (0–7), moderate (8–19), or severe (20–35) [14].

Lung function tests were performed by qualified staff following international recommendations and guidelines [15]. The severity of COPD was classified using the GOLD criteria, being moderate COPD defined by an FEV1(%) 50–80% and severe COPD by an FEV1(%) 30–50% [16]. Exercise capacity was assessed using the six-minute walk test (6MWT), recording the total walking distance and oxygen saturations during the test [17].

The impact of the disease and symptoms was determined using the COPD assessment test (CAT), which is a validated, short, self-administered questionnaire that measures the impact of the disease in patients with 8 questions that ranges from 0 to 40, with higher scores indicating a greater disease

burden [18]. Dyspnoea was assessed using the modified Medical Research Council (mMRC) dyspnoea scale [19]. The COPD severity score with prognostic value for exacerbations and mortality was assessed using the BODEx index [20]. The health-related quality of life was assessed using the EuroQoL 5-Dimension 5-Level (EQ-5D-5L) [21], which evaluates five dimensions of health status (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) across five severity levels.

Psychological symptoms were explored through the Hospital Anxiety and Depression Scale (HADS), a self-administered questionnaire consisting of two subscales (HADS-A for anxiety and HADS-D for depression), each containing 7 items scored on a 0–3 Likert scale. The total score for each subscale ranges from 0 to 21, with higher scores indicating greater symptom severity [22].

Finally, the presence of comorbidities was registered using the Charlson Comorbidity Index (CCI), a validated scoring system to quantify the burden of chronic diseases [23]. A higher CCI score is indicative of greater comorbidity and worse prognosis. Metabolic syndrome was determined as in the definition by the Interim Joint Statement [24].

Statistical Analysis

Continuous variables were summarised as means and standard deviations (SD). The distribution of variables was assessed using the Kolmogorov–Smirnov test. Categorical variables were presented as absolute frequencies and valid percentages.

Sociodemographic and clinical characteristics were compared based on the presence or absence of severe ED. For continuous variables, the independent-samples Mann–Whitney U test was applied. For categorical variables, the Chi-square test (χ^2) was employed, or Fisher's exact test when expected frequencies were < 5. Linear correlations between quantitative variables were assessed using Spearman's correlation tests.

The agreement between biochemical TDS (testosterone < 250 ng/dL) and symptomatic TDS (AMSS > 27) was carried out using the Kappa test.

Two different multivariable logistic regression models with backward stepwise selection were developed to identify variables independently associated with the presence of severe ED. The first model included clinical, lung disease severity and andrological variables as independent factors and the second one was performed without the andrological information For both multivariable models, variables with a p-value < 0.25 in univariable analyses were entered. Multiple imputation was used to handle missing data. Results are presented as odds ratios (ORs), 95% confidence intervals (CIs), and p-values. Quantitative variables independently related to severe ED were recoded into dichotomous variables based on clinically defined cut-off points in order to develop a final model to predict severe ED. The combination of predictors in the final models was used to calculate the probability of ED. The Hosmer–Lemeshow goodness-of-fit test was used to assess model´s calibration. Receiver Operating Characteristic (ROC) curves were generated

to evaluate the predictive performance of the final models. For all statistical tests, p-values < 0.05 were considered statistically significant. All analyses were performed using RStudio (version 4.3).

Results

Population

A total of 55 men with a diagnosis of COPD were enrolled. Of these, 44 men completed the IIEF-5 questionnaire and formed the primary analysis set (used for the analyses involving erectile function, its prevalence and severity correlations and comparisons). In this cohort, the mean age was 65.1 (SD: 7.1) years, with a mean smoking history of 56 (SD: 31.7) pack-years. The mean FEV1% predicted was 50.4% (SD: 19.1%) and mean DLCO% predicted of 56.4% (SD: 20.6%). The mean number of exacerbations in the previous year was 1.6 (SD: 2.2), with 58.5% of patients experiencing at least one exacerbation in that period.

Regarding comorbidities, hypertension was the most prevalent, present in 65% of participants. Followed by dyslipidaemia (45%), obstructive sleep apnoea syndrome (OSA) (16%) and depressive symptoms (10%). The mean body mass index (BMI) was 29.2 (SD: 5.9) kg/m², with the mean waist circumference of 103.7 (SD: 16.5) cm. Full descriptive characteristics are summarized in Table 1.

Prevalence of TDS in COPD

Endocrinological assessment revealed that the mean serum total testosterone level was 208.3 ng/dL (SD: 181.9) and biochemical TDS was present in 31 participants in the overall cohort (70.5%). Based on the AMSS questionnaire, available only in 33 patients, a symptomatic TDS was observed in 25 of them (75%), 18 (54.5%) exhibited severe TDS symptoms. Detailed endocrine and clinical characteristics according to testosterone status are available in Table 2.

Relationship between biochemical TDS and clinical symptoms of TDS (AMSS score)

The relationship between biochemical testosterone deficiency and TDS related symptoms was evaluated in the subgroup of 33 patients with available AMSS questionnaire. When comparing patients with and without biochemical TDS, no significant differences were observed in the distribution of AMSS-based symptom severity. In the biochemical TDS group (n=21), 71.4% manifested mild to severe symptoms and 28.6% were asymptomatic. Among the patients without biochemical TDS (n=12), 83.3% showed moderate to very severe symptoms, while 16.7% had minimal symptoms (p = 0.443).

There was no significant agreement between testosterone levels and AMSS-defined symptom severity (Kappa = -0.128), indicating a poor concordance between biochemical testosterone deficiency and patient- reported symptoms (see Table 3).

Prevalence of ED in COPD and characteristics of patients with different degrees of ED

Erectile dysfunction (ED) was highly prevalent among the primary analysis set affecting 36/44 participants (81.8%). The distribution of ED severity according to the descriptive grading was: mild ED 4 (9%), mild to moderate 2 (4.5%) and moderate 6 (13.5%) and severe 24 (54.5%). Figure 1 shows the overall distribution of the IIEF-5 total and domains in the cohort.

When comparing different degrees of ED; men with severe ED were older than those with milder or without ED (67.3 years vs 62.6 years, p=0.049). They also had a significantly higher dyspnoea severity (mMRC ≥2: 70.8% vs. 25%, p = 0.004), a greater BODEx score (3.94 vs 1.1, p= 0.001) and a substantially higher impact of COPD disease (CAT score: 22.2 vs. 9.5, p < 0.001). However, there were no significant differences in lung function tests (FEV1 (%) nor DLCO (%)) and pharmacological treatments (Table 1).

Beyond respiratory disease, men with severe ED also presented higher comorbidity burden and more pronounced depressive symptoms. However, cardiovascular risk factors and metabolic syndrome were common in both groups, without significant differences between groups (Table 1 and 2).

The differences in IIEF-5 total score and individual domains between patients with severe and non-severe ED were more pronounced in subjective domains related to sexual desire and satisfaction (Figure 3).

Correlations across IIEF-5 domains

Multiple clinical and analytical variables, such as age, BMI and FEV1 showed significant correlations with the IIEF-5 domains. Interestingly, systemic inflammation, measured by C-reactive protein (CRP), showed the strongest correlation, associated with poorer sexual function both in the IIEF-5 total score (r=-0.498, p=0.001) and in each of the domains.

Regarding endocrine markers, significant negative correlations were observed for gonadotropic hormones (LH and FSH), with higher serum levels associated with worse sexual functions (r=-0.517, p <0.001 and r= -0.354, p= 0.022, respectively for IIEF-5 total score), a pattern compatible with compensated or decompensated primary hypogonadism (Table 2). However, when analysing total testosterone levels, there was no significant relationship with any erectile function domain.

In our cohort, respiratory and psychological symptom burden and comorbidities were identified as major determinants of ED. Variables such as CAT (r=-0.724, p < 0.001), mMRC (r=-0.571, p<0.001), BODEx (r=-0.608, p= 0.001) and Charlson index (r= -0.315, p=0.048) correlated negatively, with higher scores associated to worse ED. And finally, higher HADS score correlated with lower sexual function (r=-0.453, p= 0.006), with greater impact on the subjective domains of satisfaction than on physical erectile function. Correlation coefficients are shown in Table 4. Figure 2 illustrates the strongest correlations between ED and COPD burden and psychological status.

Factors associated to severe ED: multivariable analysis

Several clinical variables were associated with severe ED by multivariable logistic regression analysis (Table 5). Two alternative models were constructed to account for collinearity between related clinical

variables and to evaluate alternative multivariable model specifications.

In the first model, greater COPD symptom burden and impaired mental health status emerged as independent factors associated with severe ED. In the second model, which prioritised symptom based clinical indices, both CAT score, HADS and comorbidity burden remained independently associated with severe ED. Predictive formulas derived from both models were used to estimate the probability of severe ED; in the absence of any risk factors the probability of having severe ED was 4.8%, and it was increasingly higher with each factor, reaching 91.2% when all three factors were combined. Both models showed identical predictive performance, with good discrimination (area under the receiver operating characteristic curve 0.87; 95% CI: 0.77–0.97) and adequate calibration (Hosmer–Lemeshow goodness-of-fit test p = 0.563).

Discussion

Our results revealed that ED is very frequent in COPD, affecting to more than 80% of men with moderate to severe COPD, with more than half of them reporting severe ED. Our findings underlined the high TDS rates in the group, with two-thirds having total testosterone levels below 250 ng/dL and over half reporting severe or very severe symptoms. Even though biochemical TDS and androgen deficiency-related symptoms were common, total testosterone serum levels were not directly associated with ED severity. However, ED was associated with respiratory symptom burden, COPD severity, comorbidity load, depressive symptoms and systemic inflammation. Multivariable analyses identified disease severity indices (CAT score), comorbidity burden and psychological distress as independent predictors of severe ED, whereas more objective variables, such as lung function tests and circulating testosterone levels, were not independently associated. All these findings support the idea that ED in COPD is a multifactorial condition closely linked to global disease impact rather than airflow limitation or hormonal deficiency exclusively.

Taken together, these results underscore the potential for using simple and routinely assessed clinical parameters, such as the CAT, HADS scores and Charlson Comorbidity Index, to identify patients at high risk for severe ED. These scores are very commonly used in respiratory clinics, they could be used to screen these sexual health problems, helping to recognise them early and enabling integrated care.

The prevalence of ED in our cohort was in line with previous reports, such as the 74.6% identified in the recent meta-analysis and systematic review by Alcalá-Rivera N et al., estimating almost three times higher risk of ED compared with general population [25]. Also, the DECODED found a rate of 87%, with moderate to severe ED in over two-thirds of the cohort [26]. However, the prevalence of patients with severe ED in our study was higher than in previous research [27]. This could be due to differences in respiratory disease severity, in clinical settings, or in the population characteristics as we did not include mild cases of COPD. All these data confirm that ED is not only highly prevalent in COPD, but also frequently severe, particularly in those patients with advanced disease.

Testosterone deficiency has been recognised as a frequent comorbidity in COPD. A cross-sectional study reported hypogonadism in 41.8% of men with COPD, compared with 10% in age-matched controls, with low total testosterone levels more commonly observed in patients with more severe airflow obstruction [28]. However, aligning with our observation, previous studies in men with TDS and ED have shown weak or absent correlations between total testosterone levels and AMSS scores, this highlights the limitations of serum testosterone alone in reflecting androgen-related symptoms [29]. Reinforcing the idea that androgen-related symptoms in COPD are influenced by factors beyond circulating testosterone levels, including chronic disease burden and systemic inflammation.

To our knowledge, no previous studies have analysed and compared individual IIEF- domains and different clinical, analytical and functional variables in patients with COPD. Higher CRP levels correlated more strongly with all domains of the IIEF-5; while other studies that have reported correlation with inflammatory markers have identified TNF-α [30]. Studies comparing the IIEF-5 with hormonal variables in stable patients have shown heterogeneous and inconsistent results [30, 31]. This evidence suggests that ED in COPD may preferentially affect subjective and psychosocial dimensions of sexual health rather than isolated physical erectile capacity.

Several prior studies corroborate the observed association between age, symptom burden, comorbidities and mental health status with the severity of ED in COPD. Turan et al. reported that the severity of ED was associated with higher mMRC scores and worse mental health [32]. Similarly, an earlier study found that more severe ED in COPD was related with higher (worse) CAT scores [26]. Interesting findings were reported in BRED study, also associating the severity of ED with worse BODEx index and mMRC score [33]. However, in contrast to our findings, they found a significant association with FEV1. All these results could support the idea that ED in COPD might be more linked to multifactorial and systemic impact of the disease instead of isolated respiratory parameter deterioration.

So far, multivariable approaches have been used in only a small number of studies to find out which factors are independently associated with ED in people with COPD. In the DECODED study, logistic regression analyses identified higher CAT and mMRC scores as associated factors with mild-to-moderate ED, although the analysis was limited to less severe patients with COPD and did not include comorbidity burden [26]. In a longitudinal Korean COPD cohort, regression models showed that age, socioeconomic status and health perception were associated with ED over time, reinforcing the multifactorial nature of sexual dysfunction in COPD [34]. In contrast, our study advances current evidence by identifying multidimensional clinical indices and comorbidity burden as independent predictors of severe ED. This approach integrates respiratory symptoms and systemic disease impact, offering a pragmatic and clinically applicable model for risk stratification.

Our study has some limitations, its cross-sectional nature of the study does not allow to establish causality through the analysis of independent predictors of severe ED, it does propose a novel and practical approach that offers new insights with direct applicability in clinical practice in respiratory clinics. Despite the relatively small sample size and the exclusion of patients with prior diagnosis of ED,

TDS or COPD with very severe respiratory disease, which could lead to an underestimation of the true prevalence, the study's multicentre design and systematic clinical, hormonal, functional and psychological collection method facilitate a multifactorial and comprehensive approach to ED. The simultaneous evaluation of ED (studying the effect in different individual domains of IIEF-5), TDS and their clinical determinants in COPD, has been, to our knowledge, the first study to analyse globally the male sexual health in this group of patients.

Conclusions

Erectile dysfunction is highly prevalent in men with moderate to severe COPD, and frequently severe, confirming sexual dysfunction as a clinically relevant but often missed comorbidity. Testosterone deficiency, both biochemical and symptomatic, is also common in this population; however, serum total testosterone levels were not independently associated with ED severity. ED was primarily related to respiratory symptom burden, overall disease severity, comorbidities, mental health status and systemic inflammation, supporting multifactorial origin and psychological influence.

Importantly, routinely used clinical indices such as the CAT score, HADS score and Charlson comorbidity index emerged as practical predictors of severe ED, emphasizing their potential role in identifying patients at high risk in routine respiratory practice. These outcomes support the integration of sexual health assessment into the multidimensional management of COPD and suggest that ED may represent an additional marker of global disease impact and patient-reported burden rather than isolated hormonal or sexual impairment.

Declarations

Acknowledgements

Ane Lopez-Gonzalez is a recipient of SOCAP (Catalan Society of Pulmonology) and of SEPAR (Spanish Society of Pneumology and Thoracic Surgery) 2025 Research Fellowship. Cristina Aljama is a recipient of a SOCAP (Catalan Society of Pulmonology) 2024–2025 Research Fellowship.

Author contributions statement

Conceptualization: A.L-G., C.A, M.M., M.B. and C.E.; Methodology: A.L-G., C.A, M.M., M.B. and C.E.; Investigation: All (A.L-G., C.A, G.G., B.A-B., CA. A., E.C., A. OP., A. MT., L.RP., E.N., R. M., A. N., M.M., M.B. and C.E.); Resources: A.L-G., C.A., M.M.; Data curation: A.L-G., C.A, M.M., M.B. and C.E.; Writing— original draft preparation and writing—review and editing: All; Visualisation: All; Supervision: M.M, M.B. and C.E.; Project administration: A.L-G., C.A, M.M., M.B. and C.E. All authors have read and agreed to the published version of the manuscript.

Additional information

Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author (Dr Miriam Barrecheguren, miriam.barrecheguren@vallhebron.cat) on reasonable request.

Competing interests

Ane Lopez-Gonzalez has received speaker fees from AstraZeneca, Chiesi, GlaxoSmithKline and CSL Behring. Cristina Aljama has received speaker fees from FAES farma, Chiesi, AstraZeneca, Zambon, GSK and CSL Behring. Galo Granados has received speaker fees from AstraZeneca, Boehringer Ingelheim, Chiesi, Zambon and GlaxoSmithKline. Beatriz Abascal-Bolado has received speaker fees from AstraZeneca, Chiesi, Sanofi, MSD, Menarini and GlaxoSmithKline. Carlos Amado Diago has received speaker or consulting fees from Boehringer Ingelheim, Pfizer, AstraZeneca, Novartis, Chiesi, Faes Farma, Esteve, GSK and Bial. Eva Cabrera has received speaker fees from Boehringer Ingelheim, GSK, Menarini and Chiesi. Alicia Marín Tapia has received speaker fees from Chiesi, Faes Farma, GSK. Elsa Naval has received speaker fees from GSK, AstraZeneca, Chiesi, Menarini, Zambon. Rosa Malo de Molina has received speaker fees from AstraZeneca, Chiesi and GlaxoSmithKline. Miriam Barrecheguren has received speaker fees from CSL Behring, Grifols, Chiesi, AstraZeneca, GlaxoSmithKline and Sanofi and consulting fees from CSL Behring, Grifols and GlaxoSmithKline. Marc Miravitlles has received speaker fees from AstraZeneca, Boehringer Ingelheim, Bial, Chiesi, Cipla, GlaxoSmithKline, Glenmark Pharmaceuticals, Menarini, Kamada, Takeda, Zambon, Tabuk Pharmaceuticals, CSL Behring, Specialty Therapeutics, Sanofi/Regeneron, Grifols and Novartis, consulting fees from AstraZeneca, Atriva Therapeutics, BEAM Therapeutics, GondolaBio, Chiesi, GlaxoSmithKline, CSL Behring, Ferrer, Korrobio, Menarini, Mereo Biopharma, Specialty Therapeutics, Takeda, Novartis, Novo Nordisk, Roche, Sanofi/Regeneron, Zambon, Zentiva and Grifols and research grants from Grifols . Cristina Esquinas has received honoraria during the last 3 years for scientific advice and scientific activities from Chiesi and CSL Behring. The remaining authors report no conflicts of interest.

Ethics approval and consent to participate

This study was performed in line with the principles of the Declaration of Helsinki. This study was approved by the Ethics Committee of The Vall d'Hebron Hospital (Barcelona, Spain) (number PR(AG)386/2016) and all patients provided written informed consent.

Funding Sources

This research received no external funding.

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Tables

Tables 1 to 5 are available in the supplementary files section

Figures

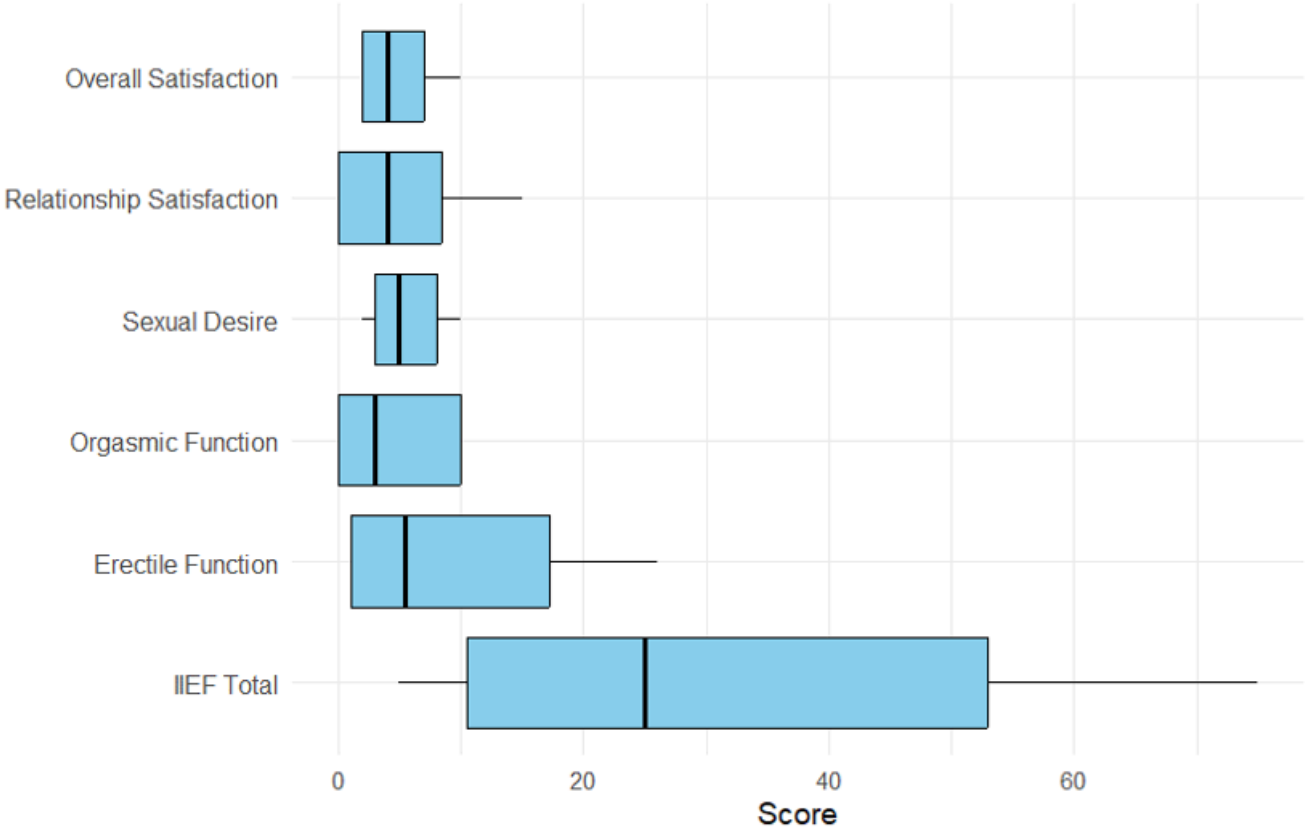


Figure 1

Distribution of IIEF-5 total score and individual domain scores in the overall COPD cohort.

Footnote: Box plots represent the median and interquartile range, with whiskers indicating the minimum and maximum values. Lower scores indicative worse sexual function across domains.

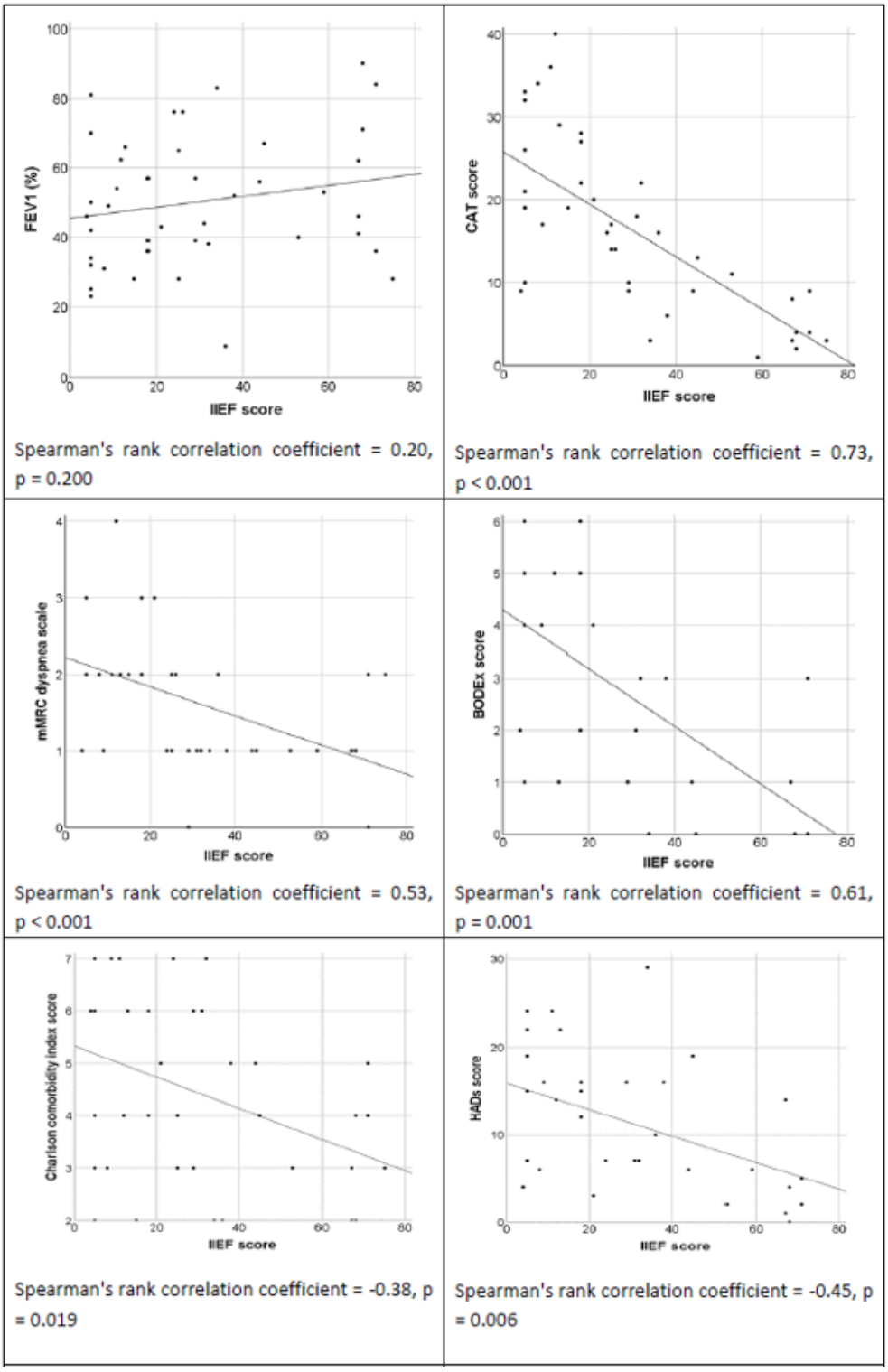


Figure 2

Scatterplot IIEF-5 scores vs. FEV1, CAT score, mMRC dyspnoea score, BODEx index and EQ-5D utility score.

Footnote: Scatterplots show the relationship between IIEF-5 total score and (A) FEV1 (% predicted), (B) CAT score, (C) mMRC dyspnoea scale, (D) BODEx index, (E) EQ-5D utility score and (F) HADS total score.

Spearman's rank correlation coefficient (p) and corresponding p-values are shown for each panel. Higher IIEF-5 scores indicate better erectile function.

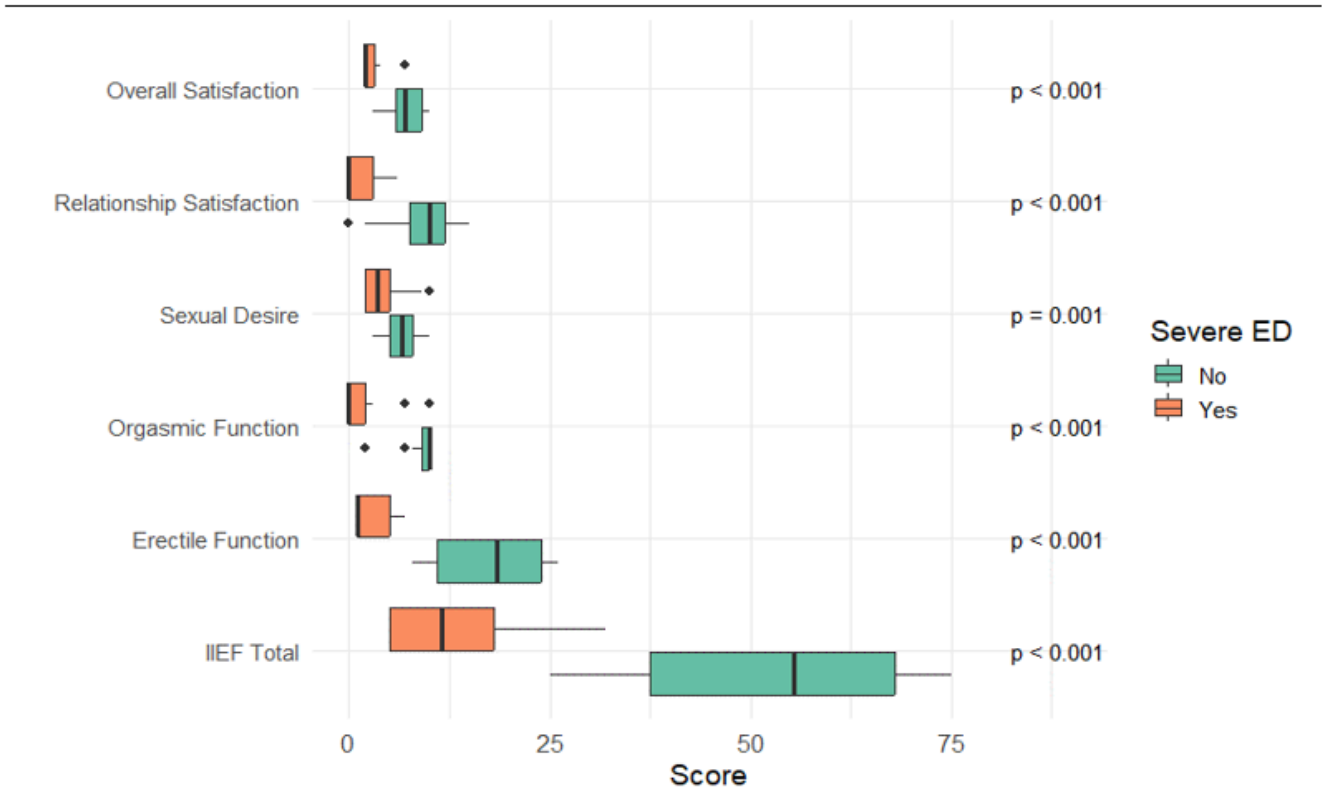


Figure 3

Comparison of IIEF-5 total score and individual domains between patients with severe and non-severe ED.

Footnote: Abbreviation: ED: Erectile dysfunction; IIEF-5: International Index of Erectile Function.

Patients were classified according to severe ED (IIEF-5 < 7) and non-severe ED (IIEF-5 ≥7). Box plots represent median and interquartile range. Severe ED was associated with significantly lower scores across all IIEF-5 domains.

Figures and tables can be referenced in LaTeX using the ref command, e.g. Figure 1 and Table 1.

Supplementary Files

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