Prevalence and correlates of erectile dysfunction in Salvador, northeastern Brazil: a population-based study

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Our objectives were to determine the prevalence of erectile dysfunction (ED) in Brazil and to explore potential sociodemographic, medical, and lifestyle correlates. A cross-sectional, population-based, household survey was conducted in Salvador, Bahia, Brazil. Cluster samples of representative households were randomly selected for interviews. Of 654 eligible subjects, 602 (92%) participated. A structured questionnaire was administered by trained interviewers. ED was categorized as 'none', 'mild', 'moderate', or 'severe' according to the ability to 'attain and/or maintain an erection satisfactory for sexual intercourse'. All data were obtained by self-report. The age-adjusted prevalence of ED was 39.5% (minimal 25.1%, moderate 13.1%, severe 1.3%). Prevalence and severity increased with age. Having never been married, diabetes, depression, or prostate disease and current depressive or lower urinary tract symptoms were significantly ($P < 0.05$) associated with increased prevalence. Medical, sociodemographic, and lifestyle variables associated with ED may alert physicians to patients at risk for ED and offer insight to its etiology.
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Introduction

Erectile dysfunction (ED) is defined as the inability to achieve or maintain an erection sufficient for satisfactory sexual function.[1] Approximately half of men aged 40–70 y are said to have some degree of ED.[2] Increasing age has been consistently associated with higher prevalence of ED.[3] As populations age, prevalence can be expected to rise. In addition, a number of sociodemographic factors (education, income, marital status), medical conditions (hypertension, diabetes, heart disease, benign prostatic hyperplasia [BPH], prostate cancer, renal failure, depression), and lifestyle factors (smoking, alcohol consumption, physical exercise) have been correlated with ED in some studies.[2,4–13]

Public awareness of ED and a willingness to address it have increased following the availability of sildenafil citrate (Viagra®) in 1998. Epidemiological data on the prevalence and correlates of ED in specific populations can provide information on the extent of the problem as well as helping to identify men at increased risk. The converse is also true: men who present to their physicians with ED can be examined for medical conditions (often asymptomatic) associated with ED. Most studies of ED have been conducted in the USA and Europe.[2,4,14–20] As part of the Cross-National Study of Erectile Dysfunction, we have undertaken the first population-based study of the prevalence and correlates of ED in Brazil.

Methods

The study was a cross-sectional, population-based, household survey conducted from January to June 1998, in Salvador, Bahia state in northeastern Brazil. Salvador is the third largest city in Brazil, with a racially diverse population of 2.3 million.

Study population and sampling frame

Cluster samples of households were drawn from census tracts representing all 16 administrative

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zones in Salvador. Each zone contributed subjects to the total sample proportional to the age distribution of men in that zone. Trained, certified interviewers went in person to households identified in the cluster sample. At each home, they explained the study, determined whether an eligible man (aged 40 – 70 y) lived in the household, recruited eligible subjects, and administered the questionnaire. If more than one man was eligible, the man with the birthday most closely following the interview date was selected. When an eligible man was identified but not immediately available, a folder describing the study was delivered and a follow-up meeting was scheduled. Of the 667 men in the appropriate age groups identified, 13 were ineligible due to psychiatric disorder or inability to communicate with the interviewer due to hearing impairment or stroke sequelae, and 52 men refused to participate. Thus, the total study population was 602 men, and the overall response rate was 92%.

Study instrument

A structured questionnaire, containing approximately 40 items, was administered in person to each subject. The interview took 25 – 30 min to complete. All data were collected by self-report only.

ED was assessed by a single question derived directly from the National Institutes of Health (NIH) Consensus Conference definition of ED as 'the inability to attain and/or maintain penile erection sufficient for satisfactory sexual intercourse':[1]

Using the following categories, how would you describe yourself?

(a) Always able to get and keep an erection adequate for satisfactory intercourse.
(b) Usually able to get and keep an erection adequate for satisfactory intercourse.
(c) Sometimes able to get and keep an erection adequate for satisfactory intercourse.
(d) Never able to get and keep an erection adequate for satisfactory intercourse.

These correspond, respectively, to no ED, mild ED, moderate ED, and severe ED.

The questionnaire also included potential medical, anthropometric, sociodemographic, and health-related covariates of ED. Current depression was assessed by the shortened (5-item) Center for Epidemiologic Studies Depression Scale (CES-D), with scores ranging from 5 to 20, and higher scores denoting more depressive symptoms.[21] Lower urinary tract symptoms (LUTS) were measured by the International Prostate Symptoms Score (IPSS), and classified as absent or mild (IPSS $\leq$ 7), moderate (8 – 19), or severe (20 – 35).[22] Smokers were classified as former or current smokers and included men who

smoked cigarettes, cigars, or a pipe. Alcohol drinkers included men who reported any drinking of wine, beer, or spirits. The degree of physical activity was classified by the subject himself as 'less than average', 'average', or 'more than average' depending on the amount and frequency of physical activity performed both at work and during leisure time. For this analysis, men were considered sedentary if they had less than average physical activity, and active otherwise. Subjects were considered sexually active if they reported at least one episode of sexual intercourse during the preceding 6 months or other forms of sexual activity, including masturbation.

Analysis and statistical methods

The characteristics of the study population are presented by number and percent for each variable. Data were analyzed with SAS statistical software.[23] ED was dichotomized as 'none' or 'mild' versus 'moderate' or 'severe' in all bivariate and multivariate analyses. For each independent variable, crude and age-adjusted bivariate odds ratios (ORs) and 95% confidence intervals (CIs) were calculated; statistical significance (2-tailed *P*-value < 0.05) was assessed by χ^2 for categorical variables and by Student's *t*-test and analysis of variance (ANOVA) for continuous variables. In the logistic regression, full models were fitted, and then nonsignificant (*P* > 0.1) variables were eliminated in a stepwise backward elimination algorithm, least significant first, to determine the final model. Exceptions were made for the medical variables, which were forced into the model as being of primary interest in the study.

Results

Table 1 presents selected demographic, medical, and lifestyle characteristics of the study population. Their mean age was 51 y, 82.6% were married or living with a partner, 70.9% were currently employed, and 46.5% had a primary school education or less. They were racially diverse: 19.2% white, 13.9% black, and 63.9% of mixed race. One third of those surveyed currently used tobacco, two thirds currently consumed alcohol, and the vast majority (91.0%) consumed caffeinated beverages. Nearly all responders were sexually active, with 96.8% reporting sexual intercourse in the past 6 months. A history of comorbid conditions was not rare: 5.3% of the population had a history of diabetes; 24.9%, of hypertension; 7.7%, of heart disease; 8.0%, of ulcer; 5.8%, of depression; and 7.5%, of any prostate disease (defined as BPH, prostatitis, any prostate surgery, or prostate cancer).

Table 1 Selected sociodemographic, medical, and lifestyle characteristics of the study population ($n = 602$)

Characteristic	n (%)
Sociodemographics	
Age (y)	
40−49	312 (51.8)
50−59	170 (28.2)
60−70	120 (19.9)
Race	
White	115 (19.2)
Black	83 (13.9)
Mixed	383 (63.9)
Other	18 (3.1)
Marital status	
Married or living with partner	497 (82.6)
Divorced, widowed, separated	70 (11.6)
Never married	35 (3.1)
Education	
Post-secondary school	97 (16.1)
Secondary school (some or graduate)	225 (37.4)
Primary school graduate	88 (14.6)
Primary school not completed	192 (31.9)
Religious affiliation (any)	493 (81.9)
Currently employed	427 (70.9)
Medical	
Diabetes	32 (5.3)
Hypertension	150 (24.9)
Heart disease	46 (7.7)
Ulcer	48 (8.0)
Depression	35 (5.8)
Prostate disease (any)	45 (7.5)
IPSS	
Mild (≤ 7)	426 (70.9)
Moderate (8−19)	136 (22.6)
Severe (≥ 20)	39 (6.5)
CES-D score	
5−10	492 (81.7)
11−15	95 (15.8)
16−20	15 (2.5)
Lifestyle	
Sexually active (last 6 months)	583 (96.8)
Tobacco use	
Former	429 (71.3)
Current	193 (32.1)
Alcohol consumption	411 (68.3)
Caffeine consumption	548 (91.0)
Physical activity	
Sedentary	52 (8.6)
Active	550 (91.4)

IPSS = International Prostate Symptoms Score; CES-D = Center for Epidemiologic Studies Depression Scale.

Prevalence

The age-adjusted (standardized to the year 2000 age distribution of men in Brazil) prevalence of any degree of ED was 39.5% (minimal 25.1%, moderate 13.1%, severe 1.3%). Figure 1 shows that the prevalence of any ED (minimal, moderate, or severe) increased with age, from 30.8% in men aged 40−49 y to 43.5% in men aged 50−59 y to 56.7% in men aged 60−70 y. Although the prevalence of moderate and severe ED increased with age, from 9.9% at age 40−49 y to 11.8% at age 50−59 y to 31.7% at age
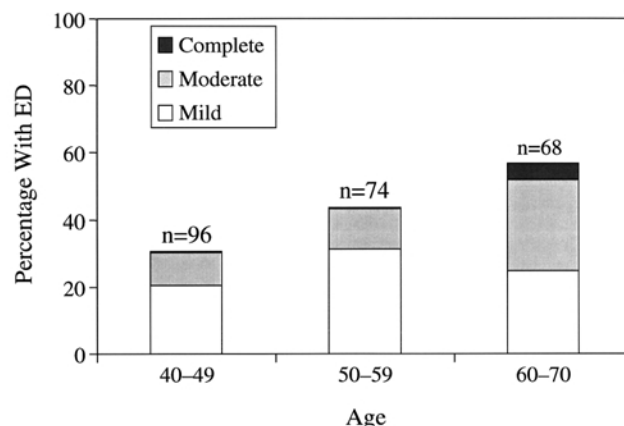

Figure 1 Severity of erectile dysfunction by age, Bahia, Brazil.

60−70 y, no pattern was discernable with mild ED (see Figure 1).

Bivariate age-adjusted associations

The age-adjusted bivariate associations between ED and potential covariates are shown in Table 2, comparing no ED plus mild ED to moderate plus severe ED, estimated by logistic regression.

Among sociodemographic variables, only never having been married, compared to being married or living with a partner, was significantly associated with moderate or severe ED (odds ratio = 4.08, 95% confidence interval, 1.82−9.15). Education, religious affiliation, race, employment status, and income were not significantly associated with ED.

A history of diabetes (OR = 3.79, 95% CI, 1.73−8.31), any prostate disease (OR = 2.55, 95% CI, 1.19−5.46), and depression (OR = 5.81, 95% CI, 2.79−2.12) was significantly associated with ED, whereas history of hypertension, heart disease, and ulcer was not. Similarly, medications for diabetes (OR = 5.44, 95% CI, 2.18−13.55) and depression (OR = 3.60, 95% CI, 1.51−8.59) were associated with moderate or severe ED. Current LUTS, as measured by the IPSS, were also associated with ED: for moderate LUTS, OR = 2.14 (95% CI, 1.26−2.63); for severe LUTS, OR = 5.86 (95% CI, 2.82−12.17). Depressive symptoms, as measured by the 5-item shortened CES-D, had an OR of 1.15 (95% CI, 1.08−1.24) for each unit increase on the scale.

Of lifestyle factors, both alcohol consumption (OR = 0.54, 95% CI, 0.37−0.87) and physical activity (OR = 0.27, 95% CI, 0.14−0.51, compared to sedentary) had inverse associations with ED, whereas caffeine consumption had a positive association (Table 2). Neither current nor former smoking was associated with ED in our population.

Table 2 Age-adjusted bivariate prevalence odds ratios for moderate or severe ED versus no or mild ED: sociodemographic, medical, and lifestyle characteristics

Characteristic	OR (95% CI)[a]
Sociodemographics	
Marital status	
Married or living with partner	1 (referent)
Divorced, widowed, separated	1.52 (0.78 – 2.96)
Never married	4.08 (1.82 – 9.15)*
Education	
Post-secondary school	1 (referent)
Secondary school (some or graduate)	1.63 (0.71 – 3.71)
Primary school graduate	1.67 (0.72 – 3.87)
Primary school not completed	1.51 (0.67 – 3.37)
Race	
White	1 (referent)
Black	0.63 (0.25 – 1.56)
Mixed	1.13 (0.63 – 2.05)
Other	1.30 (0.32 – 5.23)
Religious affiliation (any)	0.69 (0.39 – 1.22)
Currently employed	0.82 (0.49 – 1.37)
Medical	
Diabetes	3.79 (1.73 – 8.31)*
Diabetes medication	5.44 (2.18 – 13.55)*
Hypertension	1.35 (0.82 – 2.23)
Hypertension medication	1.46 (0.77 – 2.75)
Heart disease	0.90 (0.40 – 2.60)
Heart medication	1.46 (0.54 – 3.92)
Ulcer	0.95 (0.40 – 2.24)
Ulcer medication	2.23 (0.24 – 20.60)
Depression	5.81 (2.79 – 12.12)*
Depression medication	3.60 (1.51 – 8.59)**
Prostate disease (any)	2.55 (1.19 – 5.46)***
Hormone treatment	4.10 (0.35 – 48.08)
IPSS	
Mild (≤ 7)	1 (referent)
Moderate (8 – 19)	2.14 (1.26 – 2.63)**
Severe (≥ 20)	5.86 (2.82 – 12.17)*
CES-D (1 unit increase)	1.15 (1.08 – 1.24)*
Lifestyle	
Tobacco use	
Former	1.12 (0.66 – 1.91)
Current	0.96 (0.58 – 1.60)
Alcohol consumption	0.54 (0.37 – 0.87)***
Number of caffeinated beverages per week	3.36 (1.01 – 11.23)***
First quartile	1 (referent)
Second quartile	1.32 (0.63 – 2.73)
Third quartile	2.42 (1.21 – 4.85)***
Fourth quartile	2.60 (1.31 – 5.19)**
Physical activity	0.27 (0.14 – 0.51)*

[a]Odds ratio (95% confidence interval).
*$P < 0.001$; **$P < 0.01$; ***$P < 0.05$.
ED = erectile dysfunction; OR = odds ratio; CI = confidence interval; IPSS = International Prostate Symptoms Score; CES-D = Center for Epidemiologic Studies Depression Scale.

Multivariate model

Correlates significant in the age-adjusted bivariate analyses were entered into a multivariate logistic regression model, and by stepwise backward elimination, nonsignificant variables ($P > 0.1$) were eliminated one by one to arrive at the final model. All medical conditions, being of *a priori* interest,

Table 3 Multivariate logistic regression model, prevalence odds ratios for moderate or severe ED versus no or mild ED

Characteristic	OR (95% CI)[a]
Age (1 year)	1.06 (1.03 – 1.10)*
Marital status	
Married or living with partner	1 (referent)
Divorced, widowed, separated	2.13 (1.02 – 4.43)**
Never married	4.05 (1.69 – 9.68)***
Diabetes	3.72 (1.56 – 8.88)***
Hypertension	0.91 (0.50 – 1.65)
Heart disease	0.39 (0.13 – 1.11)
Ulcer	1.02 (0.40 – 2.61)
Depression	5.28 (2.23 – 12.50)*
Prostate disease (any)	2.14 (0.90 – 5.06)
IPSS	
Mild (≤ 7)	1 (referent)
Moderate (8 – 19)	1.83 (1.03 – 3.27)**
Severe (≥ 20)	3.60 (1.56 – 8.30)***
Physical activity	0.41 (0.19 – 0.87)**

[a]Odds ratio (95% confidence interval).
*$P < 0.001$; **$P < 0.05$; ***$P < 0.01$.
ED = erectile dysfunction; OR = odds ratio; CI = confidence interval; IPSS = International Prostate Symptoms Score.

were retained in the model regardless of significance. The final model is shown in Table 3.

Age and marital status were the only sociodemographic variables significant in the multivariate model. Age was a very strong correlate of ED, OR = 1.06 (95% CI, 1.03 – 1.10) for each increasing year of age. Being separated, divorced, or widowed (OR = 2.13, 95% CI, 1.02 – 4.43) and having never been married (OR = 4.05, 95% CI, 1.69 – 9.68) were positively correlated with ED.

For the medical variables, only history of a condition was entered into the model because concomitant medications were too highly correlated with the indication for treatment to be entered separately. In this model, history of diabetes (OR = 3.72, 95% CI, 1.56 – 8.88) and depression (OR = 5.28, 95% CI, 2.23 – 12.50) had significant positive correlations with ED. Current depression, as measured by the CES-D, was no longer significant after history of depression was included. Conversely, current prostate symptoms remained significant (moderate LUTS, OR = 1.83, 95% CI, 1.03 – 3.27; severe LUTS, OR = 3.60, 95% CI, 1.56 – 8.30), whereas history of prostate disease did not (see Table 3).

Among the lifestyle variables, only physical activity remained significant: active men had a significantly lower prevalence of ED (OR = 0.41, 95% CI, 0.19 – 87) compared with sedentary men.

Health-seeking attitudes and behaviors with respect to ED

At the end of the interview, subjects were asked about their attitudes toward seeking medical care for

ED. First, they were asked whether, if they had ED, they would feel comfortable consulting a doctor or other health professional, and 90% said they would. However, of the 89 men actually reporting moderate or severe ED, only 17 (19.1%) had been treated.

Discussion

The epidemiology of ED had not been well studied in the past. The introduction of an oral agent for the treatment of ED, sildenafil, in April 1998, raised interest in ED among men and their physicians, and demonstrated how little information was available about diverse populations worldwide. We undertook the first study of the prevalence and correlates of ED in Brazil as part of the Cross-National Study of Erectile Dysfunction, an international, population-based study carried out in Brazil, Italy, Japan, and Malaysia.[24] As in all other surveys to date, including the other countries of the Cross-National Study, the National Health and Social Life Survey (NHSLS),[4] and the Massachusetts Male Aging Study (MMAS),[2] increasing age is correlated with both increasing prevalence of ED overall and with increasing severity. This remains true after controlling for all other significant correlates of ED.

In the individual countries in the Cross-National Study, age-adjusted prevalence of ED (mild, moderate, and severe) was 81.1% in Japan, 69.8% in Italy, and 62.1% in Malaysia, all higher than the 39.9% we found in Brazil.[24] These differences may reflect actual population differences, differences in the prevalence of correlates of ED, differences in age distribution across countries, and/or cultural differences in the perceptions of and attitudes toward ED. Study methodology may also be a factor: although a common questionnaire was used and data were all analyzed in the same way, the principal investigator in each country chose the most appropriate method to administer the questionnaire. In Japan, self-administered mail-in questionnaires were used; in Italy, a telephone survey was used; and in Malaysia, a combination of telephone and in-person interviews was used, whereas we used in-person interviews exclusively. The MMAS found an overall ED prevalence of 52% in a sample of highly educated, white suburban Boston men aged 40–70 y. However, the MMAS had no direct measure of ED, depending, instead, on a derived variable constructed post hoc in a clinical convenience sample.[25] A large population-based survey in Brazil,[26] using the same ED assessment we employed, reported a prevalence of 18% for complete/moderate ED in men aged 40–70 y.

The NHSLS, a population-based survey of USA adults aged 18–59 y,[4] found that, in the age groups overlapping our study, 11% of men aged 40–49 y and 18% of men aged 50–59 y reported having trouble 'maintaining or achieving an erection'; how this definition correlates with ours is unclear.

Erectile dysfunction is, in large part, a vascular disease,[6–9] an etiology that suggests an association between ED and cardiovascular disease. We found a significantly higher prevalence of ED in men with a history of diabetes but not with hypertension or heart disease. In the MMAS, treated, but not untreated, diabetes, hypertension, and heart disease were significantly associated with ED in age-adjusted bivariate analyses, but no multivariate model was offered. Because medical history was obtained by self-report, asymptomatic conditions such as hypertension are almost certainly under-reported by men unaware that they have these conditions. Such nondifferential misclassification would bias ORs toward the null.

As shown in previous studies,[27,28] prostate disease and higher scores on the IPSS were independently associated with ED in bivariate age-adjusted models, whereas only moderate and severe LUTS remained significant in the multivariate analysis. We believe this reflects the correlation between the two variables when entered simultaneously into the logistic regression model. This is also reflected in the fact that a history of depression, but not current depression as measured by the CES-D, was significantly associated with ED in the multivariate model, whereas both were significant in bivariate age-adjusted analyses. Despite the correlation between ED and depression being well documented,[10,13] the causal relationship between both is sometimes imprecise and most probably bidirectional, that is, ED may follow depression and depression may be a consequence of this sexual dysfunction.

Alcohol consumption was significantly inversely correlated with ED in our population in the bivariate, but not the multivariate, model. Alcohol was also associated with ED in the Health Professionals Follow-up Study,[12] which found that moderate drinkers (one to two drinks per day) had a lower prevalence of ED than either nondrinkers or heavy drinkers. The MMAS, however, found a slightly elevated prevalence of ED with alcohol consumption.[2] Active men (compared to sedentary men) had a significantly lower prevalence of ED in both bivariate and multivariate analyses in our study and in the Health Professionals Follow-up Study,[12] suggesting that positive behavioral changes may prevent or lessen the severity of ED. Caffeine consumption was also significantly correlated with ED in our population in the bivariate, but not the multivariate, model. Diokno et al[5] have found that the consumption of at least one cup of coffee per day was significantly associated with a higher potency rate in men. Smoking (either current or former) was not associated with ED in our population. The association between ED and current smoking is difficult to detect in cross-sectional studies; neither

the Health Professionals Follow-up Study[12] nor the MMAS[2] found any association between ED and smoking, but some studies have found smoking to be independently associated with ED.[11]

When asked whether, hypothetically, they would feel comfortable consulting a health professional about ED, a high percentage of subjects (90%) said they would, but this was not reflected in the actual behavior of men with moderate or severe ED, of whom only 19% had actually been treated. Similarly, in a study of 1240 men, Chew et al found that only 55 of 488 participants with ED (11.6%) had received treatment, although 90% of them had experienced the problem for more than 12 months.[16] Educating physicians and laymen about the potential for treating ED would, we believe, lead to better treatment of this distressing condition.

Strengths and limitations

The unique strengths of this study are the large, population-based sample and the high response rate: 92%. This extraordinarily high response was accomplished by rigorous training of interviewers, who were selected based on gaining high response rates and interpersonal skills displayed in previous surveys. These interviewers maintained inperson contact with subjects at all stages and thoroughly followed up all eligible men identified in the sampling frame. This allowed us to accurately determine the prevalence and degree of ED with confidence in the representative nature of the sample. We were also able to explore potential sociodemographic, medical, and lifestyle correlates of ED. The use of a single question, based strictly on criteria enunciated by the NIH Consensus Conference on Impotence, allowed accurate determination of ED by self-report.

The major limitation of the study is that, as a cross-sectional questionnaire survey, all data collection was limited to self-report. Asymptomatic medical conditions, such as hypertension and diabetes, are often unknown by the subject and consequently under-reported, which is likely to result in nondifferential misclassification and attenuation of the prevalence ORs.

Conclusions

In Brazil, as in other countries, ED is a very common condition, increasing in prevalence and severity with age. Correlates of ED identified in our population are consistent with some, but not all, other studies of ED in different populations. Future research should be directed to actual measurements of potential medical correlates of ED, especially those that are frequently asymptomatic or under-diagnosed (for example, hypertension and diabetes). In addition, population-based incidence studies are needed to test some of the hypotheses generated by the cross-sectional associations found here.

Our data show that only about one-sixth of the men with moderate or severe ED are being treated, although the majority say they would seek such treatment if they had ED. Physicians need to be aware of men's possible reluctance to discuss ED and to initiate discussions accordingly. Correlates of ED identified here can aid physicians in evaluating individual patients with ED, or in patients presenting with ED, can encourage examination for potential comorbid conditions.

Acknowledgements

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