

ORIGINAL ARTICLE

Prevalence and risk factors for erectile dysfunction and lower urinary tract symptoms in Russian Federation men: analysis from a national population-based multicenter study

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An analysis of prevalence and associated common risk factors of ED and lower urinary tract symptoms (LUTS) was performed in Russian Federation by cross-sectional multicenter survey. International Index of Erectile Function (IIEF) score and International Prostate Symptom Score (IPSS) were used for data collection in 1225 men between 20 and 77 years interviewed in six regions of Russian Federation. In addition, each participant's social, demographic, lifestyle, sexual and medical history was taken with special emphasis on risk factors for ED. Upon the basis of IIEF erectile domain score interpretation, ED was found in 530 (48.9%) men, consisting of mild and mild to moderate, moderate and severe ED in 375 (34.6%), 78 (7.2%) and 77 (7.1%) respondents, respectively. According to IPSS assessment, LUTSs were present in 649 (59.9%) responders; inclusive 370 (34.2%), 216 (19.9%) and 63 (5.8%) men with mild, moderate and severe LUTS, respectively. Men with both ED and LUTS shared common co-morbidities and lifestyle risk factors with age-adjusted odds ratio between 1.2 and 5.2. In logistic regression model ($R^2 = 0.361$), the strongest associated with ED factor found was IPSS symptom score, followed by hypertension, IPSS-related quality of life, age, diabetes mellitus, obesity and unmotivated fatigue.

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INTRODUCTION

ED and lower urinary tract symptoms (LUTSs) are highly prevalent age-dependent clinical complaints in men with large negative impact on the social and psychological well-being in men and their partners. Cologne Male Survey¹ demonstrated 19.2% prevalence rate of ED and increase from 2 to 53% in men at fourth and fifth decade of life, respectively. Boyle *et al.*² in UrEpiK study found ED in 21% of men with gradual and significant linear increase with age. In systemic review, Prins *et al.*³ showed substantial variations of ED prevalence rates between countries ranged from 2 to 9% in men younger than 40 years old and from 18 to 86% for men after their eighties.

Adequate nervous, vascular and endocrine systems functioning in combination with normal regulation of local metabolism in cavernous tissue are considered valuable prerequisites of erection. Several risk factors were found associated with ED including cardiovascular disease (CVD), hypertension, diabetes mellitus, dyslipidemia, low testosterone level and pelvic surgery.^{4–7} ED was found to predict CVD disease development and progression within 2–5 years time interval; as a result identification of ED allows early prevention of CVD complications.^{8,9}

In adult men, LUTS comprising storage, voiding and post-micturition symptoms are common complaints of multivariate origin often related to underlying bladder dysfunction and secondary to development of benign prostate hyperplasia or other

factors affecting urinary tract.¹⁰ The prevalence varies, LUTSs may develop in 15–60% of men older than 40 years of age and both up to 30% of men after the age of 65 years.^{11,12} Risk factors of ED development including hypertension, CVD, hyperlipidaemia, diabetes, obesity, inflammation and hypogonadism were also found in association with LUTSs.^{6,13,14}

Epidemiologic studies demonstrated considerable evidence that ED and LUTS in men are strongly linked independent of co-morbidities and age.^{15,16} The odds ratio for ED in men with severe LUTS was 8.90 in MSAM-7 [ref. 6] and as high as 28.7 in men from Turkey.¹⁷ UK men with storage and voiding LUTS visiting general practices had odds ratio of 4.0 for simultaneous presence of ED. Shiri *et al.*¹⁸ have shown ED influences the subsequent incidence of LUTS with relative risk as 2.3. Demir *et al.*¹⁹ confirmed that ED was the most significant predictor of severe LUTS in multiple logistic regression analysis.

The association between ED and LUTS suggests common pathogenic mechanisms including reduced NO-cGMP signaling, increased RhoA-ROCK signaling, autonomic hyperactivity, pelvic atherosclerosis, chronic inflammation and steroid hormone unbalance.¹⁵ Both ED and LUTS were included in the list of factors associated with metabolic syndrome and subsequent risk of CVD and type 2 diabetes mellitus development.²⁰ Early diagnosis of ED and LUTS and modification of risk factors by interdisciplinary care could reduce the likelihood and delay their onset.²¹ Multivariate

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nature of both pathological conditions justifies close co-operation of primary care physicians, urologists, cardiologists, endocrinologists and physicians caring for elderly people accordingly to prevalence rates in each particular country. No population-based study of ED and LUTS in men in Russian Federation was presented so far. To investigate the prevalence and associated common risk factors of ED and LUTS in Russian Federation, an analysis of results from questionnaire-based multicenter survey has been performed.

MATERIALS AND METHODS

Study population

A cross-sectional anonymous survey²² enrolled 1225 men between 20 and 77 years (mean age 42.8 ± 14.1 years) randomly interviewed between June 2011 and January 2012 in six regions of Russian Federation (338 men in Central region, 201 men in North-Western region, 200 men in Siberian region, 199 men in Southern region, 199 men in Volga region and 88 men in Ural region). The subjects were patients presenting to hospitals and outpatient departments for any kind of illness and men visiting non-medical institutions (cultural centers, marts and so on). Office and hospital urologists were trained to administrate the questionnaires in person with the respondents.

Study instruments

The questionnaire consisted of the following parts:

1. Social and demographic information, including age, height, weight.
2. General health and associated diseases, including coronary artery disease, hypertension, diabetes mellitus, overweight and obesity, prior surgical interventions in small pelvis area (due to prostate, urinary bladder or rectum disease), neurological disorders (parkinsonism, multiple sclerosis and so on), psychiatric illnesses, chronic stress, depression and unmotivated fatigue, partnership problems, LUTS measured in points of International Prostate Symptom Score (IPSS)²³ and L_{IPSS} (IPSS-related specific quality of life). The degree of LUTS measured by IPSS was stratified as no LUTS (0 points), mild LUTS (1–7 points), moderate LUTS (8–19 points) and severe LUTS (20–35 points).
3. Lifestyle, including smoking, drinking and drug abuse. Smokers and alcohol drinkers were classified by consumption (number of cigarettes per day, ml per week of vodka, ml per week of beer, respectively).
4. Sexual function including age of sexual activity start (masturbations, pollutions), age of regular sexual activity start, age of married life start, paternity status and number of children, number of sexual intercourses per week, age of discontinuation of sexual activity, International Index of Erectile Function (IIEF) score²⁴ and domain scores within IIEF score: IIEF erectile function (IIEF EF) domain score, IIEF orgasmic function domain score, IIEF sexual desire domain score, IIEF intercourse satisfaction domain score, IIEF overall satisfaction domain score. The presence and degree of ED based on the IIEF EF domain score was determined following Rosen *et al.*²⁵ recommendations (0–10 points—severe ED, 11–16 points—moderate ED, 17–25 points—mild and mild to moderate ED, >25 points—no ED).

Data processing

Data on completed questionnaires were entered into a computerized database and analyzed with *IBM SPSS Statistics 19* statistical software (IBM East Europe/Asia Ltd., Moscow, Russia). The prevalence of ED and LUTS was calculated by dividing the number of respondents with ED and LUTS by their total number. Statistical significance of correlations was assessed by two-sided tests: the non-parametrical correlation coefficient τ_B (Kendall's tau), χ^2 test (ϕ —coefficient and Kramer's V); the risk factors for ED were studied by calculation of the odds ratio (OR), ED risk determinants were found by logistic regression analysis.

RESULTS

A total of 1083 questionnaires were correctly filled and evaluable, 142 (11.6%) sets were found ineligible because of incomplete fulfillment or mutually exclusive answers. The responders mean age was 42.8 years; age distribution in the study was similar to the

Table 1. Demographics, sexual history, co-morbidities, lifestyle, IPSS, L_{IPSS} , IIEF score and IIEF EF, IIEF OF, IIEF SD, IIEF IS and IIEF OS domain scores of 1083 Russian men

Age (years), mean ± s.d.	42.8 ± 14.1
Height, mean ± s.d.	177.1 ± 7.0
Weight, mean ± s.d.	82.0 ± 12.4
BMI, mean ± s.d.	26.2 ± 3.7
Coronary artery disease, <i>n</i> (%)	106 (9.8%)
Hypertension, <i>n</i> (%)	317 (29.3%)
Diabetes mellitus, <i>n</i> (%)	67 (6.2%)
Obesity, <i>n</i> (%)	158 (14.6%)
Prior surgical interventions in pelvis, <i>n</i> (%)	81 (7.5%)
Neurological disorders, <i>n</i> (%)	13 (1.2%)
Psychiatric illnesses, <i>n</i> (%)	10 (0.9%)
Chronic stress, <i>n</i> (%)	291 (26.9%)
Depression, <i>n</i> (%)	119 (11.0%)
Unmotivated fatigue, <i>n</i> (%)	219 (20.2%)
Partnership problems, <i>n</i> (%)	99 (9.1%)
IPSS, mean ± s.d.	5.0 ± 7.0
L_{IPSS} mean ± s.d.	2.1 ± 2.0
Smoking, <i>n</i> (%)	510 (47.1%)
Number of cigarettes per day, mean ± s.d.	15.8 ± 7.9
Alcohol consumption, <i>n</i> (%)	672 (62.0%)
Vodka ml per week, mean ± s.d.	320.3 ± 327.1
Beer ml per week, mean ± s.d.	1815.5 ± 1543.7
Age of sexual activity start, mean ± s.d.	14.4 ± 2.3
Age of regular sexual activity start, mean ± s.d.	19.1 ± 2.7
Age of married life start, mean ± s.d.	23.4 ± 3.3
Paternity, <i>n</i> (%)	757 (69.9%)
Number of children, mean ± s.d.	1.2 ± 1.1
Number of sexual intercourses per week, mean ± s.d.	3.2 ± 2.7
Age of discontinuation of sexual activity, mean ± s.d.	57.5 ± 8.7
IIEF score, mean ± s.d.	55.7 ± 16.7
IIEF EF domain score, mean ± s.d.	23.3 ± 7.5
IIEF OF domain score, mean ± s.d.	8.3 ± 2.8
IIEF SD domain score, mean ± s.d.	6.5 ± 1.8
IIEF IS domain score, mean ± s.d.	10.1 ± 3.6
IIEF OS domain score, mean ± s.d.	7.5 ± 2.3

Abbreviations: BMI, body mass index; IPSS, International Prostate Symptom Score; L_{IPSS} , Quality of life related to IPSS; IIEF, International Index of Erectile Function score; IIEF EF, IIEF erectile function; IIEF OF, IIEF orgasmic function; IIEF SD, IIEF sexual desire; IIEF IS, IIEF intercourse satisfaction; IIEF OS, IIEF overall satisfaction.

one presented by Russian population census. Demographic, sexual history, co-morbidities and lifestyle data of the interviewees are presented in Table 1.

Eighty-one (7.5%) men (mean age 61.3 years) reported no sexual activity during 4 weeks before answering the survey. The frequency of sexual intercourse decreased with age, men canceled their sexual activity at mean age of 57.5 years. Upon the basis of IIEF EF score interpretation, ED was found in 530 (48.9%) men, consisting of mild and mild to moderate, moderate and severe ED in 375 (34.6%), 78 (7.2%) and 77 (7.1%) respondents, respectively (Figure 1). The prevalence of ED increased with age after the third decade of life (Figure 2), whereas ED was less common in 21- to 40-year-old men compared with younger ones. Men younger than 21 years had mild and mild to moderate ED only, portions of men reporting moderate and severe ED were found consistently larger in every subsequent age group till seventieth, severe ED affected the majority of men aged 71–80 years.

The degree of ED was positively correlated with increasing age ($\tau_B = 0.362$; $P < 0.001$), weight ($\tau_B = 0.055$; $P < 0.001$) and body mass index (BMI; $\tau_B = 0.106$; $P < 0.001$). Co-morbidity of ED with coronary artery disease ($\tau_B = 0.218$; $P < 0.001$), hypertension

($\tau_B=0.303$; $P < 0.001$), diabetes mellitus ($\tau_B=0.145$; $P < 0.001$), obesity ($\tau_B=0.119$; $P < 0.001$), prior surgical interventions in pelvis ($\tau_B=0.225$; $P < 0.001$), IPSS ($\tau_B=0.398$; $P < 0.001$), L_{IPSS} ($\tau_B=0.362$; $P < 0.001$), chronic stress ($\tau_B=0.074$; $P=0.004$), unmotivated fatigue ($\tau_B=0.119$; $P < 0.001$), depression ($\tau_B=0.128$; $P < 0.001$), partnership problems ($\tau_B=0.073$; $P=0.004$), vodka consumption ($\tau_B=0.065$; $P=0.006$), age of sexual activity start ($\tau_B=0.153$; $P < 0.001$), age of regular sexual activity start ($\tau_B=0.138$; $P < 0.001$), age of married life start ($\tau_B=0.105$; $P < 0.001$), number of children ($\tau_B=0.214$; $P < 0.001$) was revealed. Inverse correlations with ED were discovered for beer consumption ($\tau_B=0.116$; $P < 0.001$), number of sexual intercourses per week ($\tau_B=0.319$; $P < 0.001$) and paternity status ($\tau_B=0.203$; $P < 0.001$).

According to IPSS assessment, LUTS were present in 649 (59.9%) responders; inclusive 370 (34.2%), 216 (19.9%) and 63 (5.8%) men with mild, moderate and severe LUTS, respectively (Figure 3). Similar to ED, the prevalence of LUTS increased with age (Figure 4); however, this trend in LUTS became evident after fortieth. Another parallel of LUTS with ED was demonstrated among interviewees younger than 21 years; they had more prevalent LUTS vs men aged 21–40 years. After age of 21 year LUTS were less pronounced in comparison with older men in

every subsequent age group. Severe LUTS were dominant in men of the eighth decade of life.

Similar to ED, the degree of LUTS measured by IPSS questionnaire were positively correlated with age ($\tau_B=0.424$; $P < 0.001$), BMI ($\tau_B=0.119$; $P < 0.001$), coronary artery disease ($\tau_B=0.231$; $P < 0.001$), hypertension ($\tau_B=0.240$; $P < 0.001$), diabetes mellitus ($\tau_B=0.158$; $P < 0.001$), obesity ($\tau_B=0.151$; $P < 0.001$), prior surgical interventions in pelvis ($\tau_B=0.259$; $P < 0.001$), depression ($\tau_B=0.126$; $P < 0.001$), partnership problems ($\tau_B=0.092$; $P=0.001$), age of sexual activity start ($\tau_B=0.131$; $P < 0.001$), age of regular sexual activity start ($\tau_B=0.143$; $P < 0.001$), age of married life start ($\tau_B=0.118$; $P < 0.001$), number of children ($\tau_B=0.220$; $P < 0.001$). IPSS was negatively correlated with height ($\tau_B=0.152$; $P < 0.001$), number of sexual intercourses per week ($\tau_B=0.355$; $P < 0.001$), paternity status ($\tau_B=0.225$; $P < 0.001$), beer consumption ($\tau_B=0.156$; $P < 0.001$), smoking ($\tau_B=0.095$; $P < 0.001$) and number of cigarettes taken per day ($\tau_B=0.098$; $P < 0.001$).

The age-adjusted OR between ED, LUTS and the potential covariates were calculated and presented in Table 2.

In step-wise logistic regression model ($R^2=0.361$), the strongest associated with ED factor found was IPSS, followed by

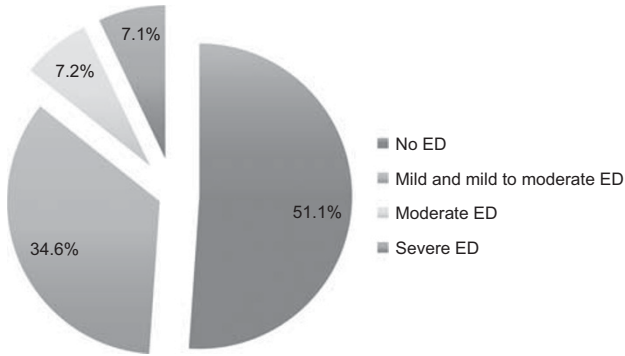


Figure 1. International Index of Erectile Function erectile function domain score questionnaire results (no ED >25, mild and mild to moderate ED = 17–25, moderate ED = 11–16, severe ED = 0–10) in 1083 Russian men.

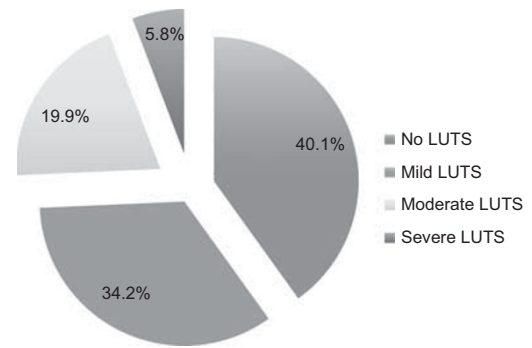


Figure 3. International Prostate Symptom Score (IPSS) questionnaire results (no lower urinary tract symptoms (LUTS), IPSS = 0; mild LUTS, IPSS = 1–7; moderate LUTS, IPSS = 8–19; severe LUTS, IPSS = 20–35) in 1083 Russian men.

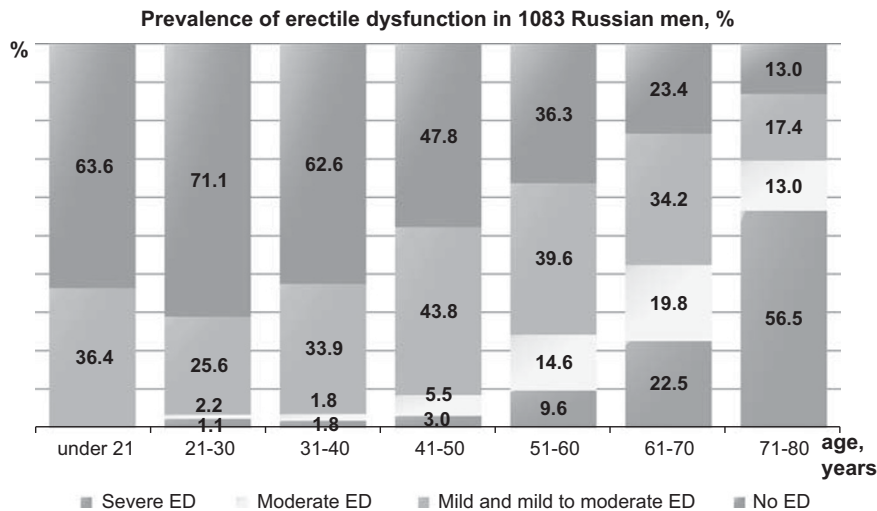


Figure 2. Association of 1083 Russian men' age with ED prevalence and prevalence of ED categories according to the International Index of Erectile Function erectile function domain score questionnaire (no ED >25, mild and mild to moderate ED = 17–25, moderate ED = 11–16, severe ED = 0–10).

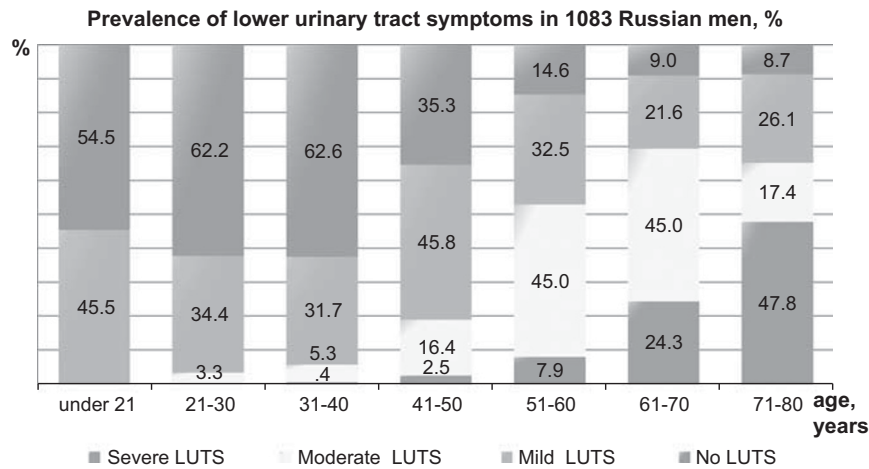


Figure 4. Association of 1083 Russian men' age with lower urinary tract symptoms (LUTS) prevalence and prevalence of LUTS categories according to the International Prostate Symptoms Score questionnaire (No LUTS=0, mild LUTS=1–7, moderate LUTS=8–19, severe LUTS=20–35).

Table 2. Incidence and age-adjusted odds ratios for ED and lower urinary tract symptoms in 1083 Russian men in relation to co-morbidities and lifestyle risk factors

Characteristic	ED, n (%)	ED, OR (95% CI)	LUTS, n (%)	LUTS, OR (95% CI)
BMI > 25	52.5	1.21 (0.95–1.53)	53.9	1.48 (1.16–1.88)
Coronary artery disease	16.2	5.16 (3.12–8.53)	14.0	4.56 (2.60–7.98)
Hypertension	44.0	4.38 (3.28–5.85)	37.9	3.12 (2.31–4.21)
Diabetes mellitus	10.2	4.71 (2.54–8.74)	8.8	4.08 (2.06–8.09)
Obesity	20.0	2.41 (1.69–3.44)	20.0	3.63 (2.37–5.58)
Surgical interventions in pelvis	12.1	4.33 (2.50–7.50)	11.6	9.32 (4.02–21.61)
LUTS vs no LUTS	76.4	4.10 (3.16–5.33)	—	—
ED vs no ED	—	—	62.4	4.10 (3.16–5.33)
Depression	14.0	1.83 (1.24–2.71)	14.2	2.49 (1.59–3.90)
Partnership problems	11.9	1.94 (1.26–2.97)	12.2	2.87 (1.73–4.76)
Beer consumption	35.8	0.69 (0.54–0.88)	36.1	0.64 (0.50–0.81)
Having children	77.9	2.15 (1.64–2.80)	76.9	2.27 (1.74–2.96)

Abbreviations: BMI, body mass index; CI, confidence interval; LUTS, lower urinary tract symptoms; OR, odds ratio.

Table 3. Logistic regression analysis of risk factors for ED in 1083 Russian men

Risk factor	Odds ratio (95% confidence interval)	P-value
IPSS	1.077 (1.046–1.109)	< 0.001
Hypertension	2.283 (1.632–3.193)	< 0.001
L _{IPSS}	1.188 (1.098–1.285)	< 0.001
Age	1.016 (1.004–1.029)	0.010
Diabetes mellitus	2.177 (1.096–4.326)	0.026
Obesity	1.576 (1.049–2.368)	0.029
Unmotivated fatigue	1.425 (1.009–2.013)	0.044

hypertension, L_{IPSS}, age, diabetes mellitus, obesity and unmotivated fatigue (Table 3).

DISCUSSION

Aim of this first performed on population of Russian men cross-sectional questionnaire-based study was to determine prevalence and risk factors for ED and LUTS. Recruitment of health-care professionals (office and hospital urologists) to administrate the questionnaires in person with the respondents resulted in high response rate and low number of inquiry forms found ineligible. In contrast to some other studies assessing ED by just a single

question, we used validated, sensible and reliable study instruments both for ED and LUTS (IIEF and IPSS questionnaires). The major limitation of our study design was sampling of responders in medical and non-medical institutions, the selection bias can therefore not be excluded even if the interviewees and Russian men population age distribution were found similar.

The study shows that ED is common among Russian men, with IIEF-estimated prevalence of 48.9%. Although this value lies within the range of those previously reported, it is higher than the prevalence data of recently published European studies using similar definitions of ED.^{3,26–28} Our data in consistence with all large-scale epidemiological studies on ED have shown the dramatic increase of ED with age, more than 75% of Russian men in their sixties reported on some form of ED. Proposed reasons for that have encompassed age-related changes in endothelial function, steroid hormone decline and co-morbidity.²⁹ In line with reports of the previous studies, our data confirm that ED is an important indicator of risk for associated underlying disease;^{4,30} coronary artery disease, high blood pressure, diabetes mellitus and obesity were correlated to the presence of ED with OR between 2 and 5 (Table 2). High prevalence of co-morbidity associated with ED (Table 1) is among the possible explanations of substantial ED in the interviewed group. As paternity was three times more common in men after fortieth than in respondents younger than 30 years old, we believe

higher ED prevalence in interviewees who have got children was also determined by their age.

Positive correlations of ED with sexual history parameters (higher age of sexual activity start, age of regular sexual activity start and age of married life start) might reflect the respondents' testosterone concentration as both male sexual interest driver and important determinant of normal erectile function.³¹ In parallel with previous reports,³² this hypothesis might also be confirmed by significant co-morbidity of ED in Russian men with other hypogonadism-related conditions: hypertension, diabetes, obesity, depression and suggests future research aimed toward detection of testosterone deficiency rate in Russian men population.

Pelvic surgery is known as common cause of ED in men. Post-radical prostatectomy ED has been well documented and widely discussed,³³ while depending upon the type, other pelvic surgical interventions might also result in postoperative ED with prevalence ranging from 8 to 82%.³⁴ Even if the kind of surgery was not specified in our study, it was recorded in 12.1% of respondents and recognized as important risk factor ED with OR of 4.33 (Table 2).

Psychogenic component due to psychologic or interpersonal factors³⁵ is well-known contributor to pathophysiology of ED.³⁶ Our study confirms the role of chronic stress and unmotivated fatigue as ED important covariates; depression and partnership problems were correlated to the ED with OR of 1.83 and 1.94, respectively. High prevalence of ED found in patients under the age of 21 years corresponds with report of Rynja *et al.*,³⁷ and believed to have mainly psychogenic origin and depends on possible inaccuracy of IIEF questionnaire in this particular age group.

The discussion of lifestyle role in the development of ED is controversial. In our study, smoking as well-known major health hazard was found to have high prevalence rate of 47.1% with mean number of 15.8 cigarettes per day. In recently published systemic review, smoking was found to increase the risk of ED,³⁸ however, some authors^{39,40} and our data failed to demonstrate such an association. High prevalence of ED in patients with alcohol dependence has been widely reported,⁴¹ however, the recent studies refute the link between ED and alcohol consumption reporting a protective association of alcohol on erectile function in men.⁴² This controversy was illustrated in our study by negative impact of vodka drinking and positive effect with OR of 0.69 for beer consumption on erectile function of Russian men.

Our findings demonstrated high prevalence of LUTS in Russian males with strong positive correlation of the IPSS with age. Only 40.1% of the interviewees reported no LUTS at all (IPSS = 0), more than 90% of men have got LUTS in their seventh decade of life. Recently published reviews drawn on community-based and clinical data demonstrated consistent association between ED and LUTS. Regarding this match common pathophysiological mechanisms including alteration of the nitric oxide—cyclic guanosine monophosphate pathway, enhancement of RhoA—Rho-kinase signaling, autonomic adrenergic hyperactivity and pelvic atherosclerosis have been hypothesized and supported by associations of both ED and LUTS with diabetes, lipid disorders, metabolic syndrome and major cardiac diseases. In concordance with that the step-wise logistic regression analysis performed in our study indicated LUTS to have the strongest impact on erectile function in Russian men followed by high blood pressure, diabetes mellitus and obesity as independent ED risk factors. These findings in conjunction of the results of other trials justify recommendation that patients seeking consultation for either ED or LUTS should always be screened for the other condition, and co-diagnosis would ensure that patient management accounts for possible co-morbidities and associated conditions.²¹

CONCLUSION

The present study reports for the first time presents high prevalence of ED and LUTS in Russian Federation, confirms the link between ED and LUTS and in support of concept of their shared pathogenesis justifies the need of co-diagnosis and patient management according to all possible co-morbid and associated conditions.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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