Title

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Journal

Urology, 83(2)

ISSN

0090-4295

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Publication Date

2014-02-01

DOI

10.1016/j.urology.2013.08.047

Peer reviewed

Published in final edited form as:
Urology. 2014 February ; 83(2): 312–319. doi:10.1016/j.urology.2013.08.047.

Lower Urinary Tract Dysfunction in Male Iraq and Afghanistan War Veterans: Association With Mental Health Disorders: A Population-based Cohort Study

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Abstract

OBJECTIVE—To determine the prevalence and correlates of lower urinary tract symptoms (LUTS) among returned Iraq and Afghanistan veterans; in particular its association with mental health diagnoses and medication use.

METHODS—We performed a retrospective cohort study of Iraq and Afghanistan veterans who were new users of U.S. Department of Veterans Affairs health care. Mental health diagnoses were defined by International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM) codes from medical records. LUTS was defined by ICD-9-CM code, use of prescription medication for LUTS, or procedure for LUTS. We determined the independent association of mental health diagnoses and LUTS after adjusting for sociodemographic and military service characteristics, comorbidities, and medications.

RESULTS—Of 519,189 veterans, 88% were men and the mean age was 31.8 years (standard deviation ± 9.3). The overall prevalence of LUTS was 2.2% (11,237/519,189). Veterans with post-traumatic stress disorder (PTSD) were significantly more likely to have a LUTS diagnosis, prescription, or related procedure (3.5%) compared with veterans with no mental health diagnoses (1.3%) or a mental health diagnosis other than PTSD (3.1%, P <.001). In adjusted models, LUTS was significantly more common in veterans with PTSD with and without other mental health disorders vs those without mental health disorders (adjusted relative risk [ARR] = 2.04, 95% confidence interval [CI] = 1.94–2.15) and in veterans prescribed opioids (ARR = 2.46, 95% CI = 2.36–2.56).

CONCLUSION—In this study of young returned veterans, mental health diagnoses and prescription for opioids were independently associated with increased risk of receiving a

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Financial Disclosure: The authors declare that they have no relevant financial interests.

diagnosis, treatment, or procedure for LUTS. Provider awareness may improve the detection and treatment of LUTS, and improve patient care and quality of life. UROLOGY 83: 312—319, 2014.

Manifestations of lower urinary tract symptoms (LUTS) include storage (eg, increased daytime frequency, incontinence), voiding (eg, weak stream, hesitancy), and post-micturition (eg, dribbling) symptoms. LUTS can negatively impact health-related quality of life in men and women, including work productivity, social and family relationships, and sleep quality.[1,2] The prevalence of LUTS is predicted to grow in the coming decades as the population ages.[3]

Previous research has demonstrated an association between depression/anxiety and LUTS, although the direction of the causal pathway is not well-elucidated and may be bidirectional.[4–7] In multiple cross-sectional studies that varied by gender, race/ethnicity, and source population, mental illness, particularly depression was associated with an increased risk of LUTS.[2,7] A prospective study of Finish men showed a unidirectional effect of depressive symptoms increasing the incidence of moderate or severe nocturia by 2.8 times compared to men who were not depressed.[4] Another prospective longitudinal study examining urinary incontinence in women supported a unidirectional relationship and found that major depression led to increased odds of incident incontinence.[8] Previous research has also demonstrated an association between post-traumatic stress disorder (PTSD) and LUTS.[6] In particular, several studies have shown that patients with a history of physical or sexual abuse have an increased prevalence of LUTS.[6,9] The mechanisms underlying the association between mental illness and LUTS likely include several disparate, but interrelated psychological and physiologic pathways.[6]

Over 2 million Americans have served in the Iraq and Afghanistan conflicts (Operation Iraqi Freedom [OIF], Operation Enduring Freedom [OEF], and Operation New Dawn [OND]) and over half of the 1.5 million who are eligible for Department of Veterans Affairs (VA) health care have enrolled in VA care upon returning from deployment.[10] Over half of the VA-enrolled OEF/OIF/OND veterans have received one or more mental health diagnoses, the most common of which is PTSD, followed by depression.[11] Nevertheless, the association of mental health disorders and LUTS in veterans has received minimal study despite the fact that benign prostatic hypertrophy (BPH) and LUTS were the most common primary and secondary out-patient urologic diagnoses made among users of VA facilities.[12]

The main purpose of this study was to determine the prevalence and correlates of LUTS among a national sample of male and female Iraq and Afghanistan veterans. Although LUTS is thought to predominantly occur in older men and women, we hypothesized that because of the high prevalence of mental health problems among younger Iraq and Afghanistan veterans and the probable association of mental health problems and LUTS, the prevalence of LUTS would be higher than in other age-matched populations. We also hypothesized that in comparison with veterans with other mental health diagnoses, those with PTSD would have significantly higher rates of LUTS.

METHODS

Study Population

We identified the study population using the VA National OEF/OIF/OND Roster, an accruing database of veterans who have returned from recent military service in Iraq and Afghanistan and have enrolled in the VA health care system. We examined administrative data from 744,135 Iraq and Afghanistan veterans who entered VA health care from October 7, 2001, to March 31, 2010, (after their most recent deployment) and were followed for 2 years until March 31, 2012. The final study population consisted of 519,189 OEF/OIF/OND veterans. We excluded veterans with <2 years of follow-up time before the study end date of March 31, 2012 (n = 213,033). We also excluded veterans ≥65 years (n = 87) and those with psychiatric prescriptions, but no psychiatric diagnosis (n = 9230). Patients with an International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) code for prostate or bladder cancer (prostate cancer: 185, V104.6; bladder cancer: 188.0, 188.1, 188.2, 188.3, 188.4, 188.5, 188.8, 188.9, 189.3, 233.7, 236.7, 239.4, V76.3, V105.1, V165.2) (n = 740) were excluded as malignancy workup and treatment may result in increased LUTS diagnoses, use of LUTS medications, and LUTS-related diagnostic procedures. In addition, we excluded those with spinal cord injuries because of the high degree of concomitant bladder dysfunction (n = 1072). Finally, we excluded patients with incomplete information on key covariates (n = 784). The study was approved by the Committee on Human Research, University of California, San Francisco and the Human Research Protection Program at the San Francisco VA Medical Center.

Data Source

The VA OEF/OIF/OND Roster contains demographic and military service information. The Roster was linked to 2 other national administrative databases: (1) the VA National Patient Care Database to obtain information on VA clinic visits and associated clinical diagnoses and procedures, and (2) the VA Decision Support System to obtain detailed pharmacy records.

Study Variables

Dependent Variables—*LUTS Diagnosis Codes, Medications, and Procedures*. Through medical literature review and consensus of co-authors (BNB, BEC, KHS), we identified ICD-9-CM codes that represented LUTS (Table 1). We identified medications prescribed to treat LUTS through VA pharmacies during the study period: alpha 1 adrenergic antagonists (doxazosin, tamsulosin, terazosin), 5-alpha reductase inhibitors (finasteride, dutasteride), and anticholinergics (oxybutynin, tolterodine). Prazosin, a nonspecific alpha blocker commonly used to treat PTSD-related nightmares, was not included because it could produce misclassification bias. We determined whether patients had 1 or more of the following procedures that are associated with LUTS: cystoscopy (52000), urodynamics (51727, 51728, 51729, 51797, 51784, 51785, 51741), and transurethral resection of the prostate (52450, 52601, 52648). Because LUTS diagnoses have a relatively low prevalence and may not be consistently coded in the medical record, we created a binary composite outcome variable for LUTS (yes/no) that captured ≥1 of the following: LUTS diagnostic codes, prescription medications for LUTS, or LUTS-associated procedures.

Independent Variables—We identified mental health diagnoses using ICD-9-CM diagnoses (290–319) corresponding to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) classifications.[13] Mental health diagnoses were categorized into 3 mutually exclusive groups: (1) no mental health diagnosis, (2) mental health diagnoses excluding PTSD, and (3) PTSD diagnoses with or without other mental health diagnoses. We did not create a separate category for PTSD alone because the vast majority of individuals with PTSD have comorbid mental health disorders and clinicians working in the large number of specialized PTSD clinics in the VA may not always code comorbid disorders.[14] To adjust for potential confounding, we included sociodemographic information (eg, age, race/ethnicity, and marital status), military service information including component type (Active Duty vs National Guard or Reserve), branch of service, rank (officer vs enlisted), and number of deployments (1 vs ≥2). In addition, we used ICD-9-CM clinical diagnoses to adjust for comorbid conditions that have been associated with LUTS and mental health diagnoses,[15,16] alcohol use disorders (303, 305.00–305.03), substance use disorders (304, 305.20–305.93), smoking (305.1), diabetes mellitus (250, 357.2), and hypertension (401–405); and prescription medications that may contribute to LUTS (ie, antidepressants, antipsychotics, and opioids for chronic pain). Opioid use was defined as receiving a prescription opioid medication for more than 30 days.

Statistical Analysis

We used descriptive statistics to characterize the population. Generalized estimating equations using a Poisson distribution and robust error variance were used to model the relative risk of LUTS, with psychiatric medication use as a time-varying covariate to account for veterans initiating and stopping medications during the study period.[17] The models were then adjusted for sociodemographic, military service, comorbid disease, and opioid medication use. As a sensitivity analysis, we adjusted for the number of primary care clinic visits to control for effects of increased medical care utilization in patients with mental health disorders. The adjustment did not produce clinically important changes in the risk estimates. We chose a *P* value of <.01 as our threshold for statistical significance, given the large sample size. Analyses were conducted using SAS software 9.3 (SAS Institute Inc, Cary, NC) and STATA 12.1 (Statacorp, College Station, TX).

RESULTS

Of 519,189 Iraq and Afghanistan veterans, 88% were men and the mean age was 31.8 years (standard deviation ± 9.3), 53% were non-white, 45% were married, 42% had served in the National Guard/Reserve forces, and 36% had served ≥2 deployments. A substantial proportion had been prescribed antidepressants (26%), opioid medications (7%), and antipsychotics (6%) (Table 1).

The overall prevalence of the composite LUTS outcome among all veterans was 2.2% (11,237/519,189). The prevalence of LUTS outcome increased with age for both men and women (Table 2). Overall, compared with veterans aged 18–24, those aged 55–64 were 7.4 times (6.85–8.01, *P* <.001) more likely to have a LUTS diagnosis.

The prevalence of LUTS diagnosis, prescription, or related procedure was significantly higher in veterans with PTSD with and without other mental health diagnoses (3.5%) compared with veterans with no mental health diagnoses (1.3%) or a mental health diagnosis other than PTSD (3.1%, P <.001, Table 3). Table 4 demonstrates that veterans with PTSD have over 2 times the risk for LUTS than those with no mental health disorders after adjusting for potential multiple sociodemographic factors, military service characteristics, comorbid conditions, and medication use. The risk for LUTS was only slightly higher in veterans with PTSD than in those with a mental health diagnosis other than PTSD. In the fully adjusted model, compared with veterans with non-PTSD mental health diagnoses, those with PTSD had a 6% increased risk of having an LUTS outcome. Of all other covariates analyzed, prescription opioid use was the covariate most strongly associated with the composite LUTS outcome.

COMMENT

To our knowledge, this is the first report of the prevalence and correlates of LUTS in a large population of returned Iraq and Afghanistan veterans enrolled in VA health care program. Among this population of relatively young veterans (mean age of 32 years), those with mental health diagnoses had a significantly increased risk of receiving a LUTS diagnosis, being prescribed medication for LUTS, and undergoing procedures to evaluate or treat LUTS. In fully adjusted models, both men and women veterans with PTSD were more than twice as likely to have LUTS using the composite outcome than veterans without mental health disorders. However, risk of LUTS among veterans with PTSD was only slightly higher than for veterans with other mental health diagnoses.

The overall prevalence of LUTS in our cohort, defined by LUTS diagnostic codes, or LUTS-related prescription use or procedures or any combination thereof, was lower than in similar aged populations that assessed LUTS with ICD-9 coding[18] or self-administered questionnaires.[19,20] For example, based on over 1 million health care seeking men and women in Taiwan, the prevalence of LUTS coded by insurance claims among 18–29 year olds was 4.3%, whereas in this veteran cohort aged 18–34 years, only 1.3% had a LUTS outcome. In a random sample of healthy Norwegian men aged 20–29 years, 4.1% reported moderate or severe LUTS (defined as an International Prostate Symptom Score ≥8). These discrepancies in prevalence may reflect the sensitivity of the outcome measures, a resistance of veterans to discuss urinary problems, or a true difference in prevalence. Despite differences in prevalence in the present cohort, it is noteworthy that veterans with PTSD were more than twice as likely to have LUTS using the composite outcome than veterans without mental health disorders.

Previous population-based investigations have demonstrated an association between mental illness and LUTS[2,7,21] and 2 prospective studies suggest mental illness promotes LUTS and not vice versa.[4,8] In the largest published study on mental health disorders and urinary incontinence in female veterans, investigators performed a cross-sectional study of 968 women with a mean age of 38 years old from 2 midwestern U.S. VA Medical Centers.[22] PTSD (odds ratio [OR] = 1.8, 95% confidence interval [CI] = 1.0–3.1), but not depression (OR = 1.2, 95% CI = 0.73–2.0) was associated with urgency/mixed urinary incontinence.

Similarly, we found increased risk of LUTS in women with PTSD; however, we also found that patients with mental health diagnoses excluding PTSD had nearly a two-fold increased risk of LUTS. The prior study used validated self-report instruments to classify and better characterize urinary complaints, which corroborated our findings based on administrative data. In another case-control study of female VA enrollees, patients referred to a LUTS clinic (n = 121) were compared to those seen in a primary care clinic (n = 1298). The LUTS evaluation group was associated with higher rates of psychiatric comorbidities (64.5% vs 25.9%, P <.001) and sexual trauma history (49.6% vs 20.1%, P <.001) when compared to the primary care group.[23]

A number of possible biological mechanisms may explain the relationship between mental illness and LUTS. Serotonin (5-hydroxytryptamine [5-HT]) has been implicated in the pathogenesis of PTSD, depression, and LUTS.[6] 5-HT is a monoamine neurotransmitter that is downregulated in the cerebrospinal fluid and blood of depressed patients.[6] Strong evidence for 5-HT's role in the pathophysiology of depression comes from the use of selective 5-HT uptake inhibitors to successfully treat depression. In animal models of depression, down-regulation of 5-HT produces increased urinary frequency and ablating 5-HT neurons causes overactive bladder.[6] One dual 5-HT/norepinephrine uptake inhibitor, duloxetine, which increases 5-HT and norepinephrine availability, has been shown to increase bladder capacity and sphincter tone without interfering with the normal micturition cycle in animal models.[24] In clinical trials in humans, duloxetine (approved for the treatment of depression and anxiety) has demonstrated modest benefit for treatment of overactive bladder,[25] postprostatectomy incontinence,[26] and female stress incontinence.[27]

Another mechanism explored by researchers that may explain the relationship between mental illness and LUTS involves corticotropin-releasing factor (CRF).[6,28] CRF regulates both endocrine and autonomic reactions to stress. In addition, CRF is a neuromodulator in the micturition pathway from Barrington's nucleus (pontine micturition center) to the preganglionic parasympathetic neurons in the lumbosacral spinal cord, which mediates the micturition reflex. Data from animal models examining CRF role in voiding have been conflicting with some demonstrating that increased CRF release in response to stress may cause cystometric overactivity,[28] whereas others have shown minimal direct effect of CRF on LUTS symptoms.[29]

In addition to examining the association of mental health diagnoses and LUTS, we evaluated several other sociodemographic and medical factors. Our data showed that patients receiving prescription opioids were significantly more likely to have LUTS. Limited research exists on the role opioids play in the development of LUTS. Opioids may interact with sacral cord receptors causing parasympathetic outflow inhibition leading to detrusor hypocontractility. The relationship of opioids to LUTS may also represent confounding by indication in which chronic pain (for which opioids are prescribed) has an independent association with LUTS. In addition, prescription opioid use has been associated with mental health problems in Iraq and Afghanistan veterans.[30] Future research is needed to tease apart these interrelated covariates in regard to LUTS.

Some limitations should be considered in evaluating our findings. Our measures were based on administrative, pharmacy, and procedural code data, which may have failed to capture some clinical or subclinical problems that might have otherwise been detected through validated self-report instruments. Thus, we were unable to investigate the effect of mental illness on different subtypes of LUTS, such as overactive bladder or urinary hesitancy. In addition, use of administrative data may have caused us to miss prevalent LUTS in this population. LUTS may be underreported during clinical encounters both because young predominantly male veterans fail to report lower urinary tract problems because of embarrassment and because clinicians do not routinely ask younger patients about LUTS. In addition, our findings in this treatment-seeking population of Iraq and Afghanistan veterans may not generalize to other veterans, either those from prior eras, or those who receive care outside of the VA system, although the VA provides care to the majority of recently returned combat veterans.[10] However, in a sensitivity analysis, adjustment for health services utilization did not appreciably change the relative risk of LUTS. Finally, because this was a cross-sectional design, we were not able to infer causality. Future prospective longitudinal studies are needed to determine the direction of the association between mental health problems and LUTS as well as the impact of mental health treatment on physical outcomes, such as LUTS. Moreover, basic science and translational studies with animal models may help to further elucidate the complex neuroendocrine underpinnings that may drive the relationship between mental health problems and LUTS.

CONCLUSION

In this study of relatively young returning veterans, having a mental health diagnosis increased the risk of receiving a diagnosis, treatment, or procedure for LUTS. Provider awareness of this association may improve future treatment and patient care.

Acknowledgments

We gratefully acknowledge the sacrifices of the men and women who have served our country during war.

Funding Support: This research was supported, in part, by grants from the National Institute for Health (NIH) grant K12DK083021 (BNB), the Mental Illness Research and Education Clinical Center (MIRECC) of the US Veterans Health Administration (DB), the Department of Veterans Affairs (VA) Health Services Research and Development (HSR&D) Research Enhancement Award Program at the San Francisco VA Medical Center (KHS), and an NIH/NHLBI grant K23 HL 094765-01 (BEC). This manuscript is the result of work supported with resources and the use of facilities at the Veterans Administration Medical Center, San Francisco, California.

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Table 1

Association of mental health diagnostic category with lower urinary tract symptoms among 519,189 Iraq and Afghanistan male veterans in veterans affairs health care from 2001–2010

Any LUTS Diagnoses, Related Procedure, or Prescription (n = 519,189)	Total (n = 519,189)	No LUTS Outcome (n = 507,952)	Any LUTS Outcome† (n = 11,237)	
	No.	No. (%)	No. (%)	RR (95% CI)
Demographics				
Gender				
Female	62,849	60,844 (96.8)	2005 (3.2)	
Male	456,340	447,108 (98.0)	9232 (2.0)	0.63 (0.60–0.67)***
Age				
18–24	142,899	141,136 (98.8)	1763 (1.2)	
25–34	200,397	197,139 (98.4)	3258 (1.6)	1.32 (1.24–1.40)***
35–44	114,965	112,012 (97.4)	2953 (2.6)	2.08 (1.96–2.21)***
45–54	51,226	48,850 (95.4)	2376 (4.6)	3.76 (3.54–4.00)***
55–64	9702	8815 (90.9)	887 (9.1)	7.41 (6.85–8.01)***
Race and/or ethnicity				
Non-white	277,098	270,871 (97.8)	6227 (2.2)	
White	242,091	237,081 (97.9)	5010 (2.1)	0.92 (0.89–0.96)***
Marital status				
Married	234,065	227,797 (97.3)	6268 (2.7)	
Never married	260,864	256,795 (98.4)	4069 (1.6)	0.58 (0.56–0.61)***
Divorced, widowed, or other	24,260	23,360 (96.3)	900 (3.7)	1.39 (1.29–1.48)***
Residence				
Rural	192,466	188,069 (97.7)	4397 (2.3)	
Urban or suburban	310,648	303,944 (97.8)	6704 (2.2)	0.94 (0.91–0.98)**
Military service				
Military branch				
Army	315,739	308,389 (97.7)	7350 (2.3)	
Air Force	62,080	60,682 (97.7)	1398 (2.3)	0.97 (0.91–1.02)
Marines	73,090	72,088 (98.6)	1002 (1.4)	0.59 (0.55–0.63)***
Navy	68,280	66,793 (97.8)	1487 (2.2)	0.94 (0.89–0.99)**
Military component				
Active duty	299,351	293,794 (98.1)	5557 (1.9)	
Reserve/National Guard	219,838	214,158 (97.4)	5680 (2.6)	1.39 (1.34–1.44)***
Military rank				
Enlisted	475,415	465,280 (97.9)	10,135 (2.1)	
Officer	43,774	42,672 (97.5)	1102 (2.5)	1.18 (1.11–1.26)***
Number of deployments				

Any LUTS Diagnoses, Related Procedure, or Prescription (n = 519,189)	Total (n = 519,189)	No LUTS Outcome (n = 507,952)	Any LUTS Outcome† (n = 11,237)	
	No.	No. (%)	No. (%)	RR (95% CI)
Single deployment	333,245	326,033 (97.8)	7212 (2.2)	
Multiple deployment	185,944	181,919 (97.8)	4025 (2.2)	1.00 (0.96–1.04)
Other health problems and medications				
Depression				
No	404,009	397,702 (98.4)	6307 (1.6)	
Yes	115,180	110,250 (95.7)	4930 (4.3)	2.74 (2.64–2.84)***
PTSD				
No	382,435	376,043 (98.3)	6392 (1.7)	
Yes	136,754	131,909 (96.5)	4845 (3.5)	2.12 (2.04–2.20)***
Diabetes				
No	510,641	499,955 (97.9)	10,686 (2.1)	
Yes	8548	7997 (93.6)	551 (6.4)	3.08 (2.84–3.35)***
Hypertension				
No	459,217	451,223 (98.3)	7994 (1.7)	
Yes	59,972	56,729 (94.6)	3243 (5.4)	3.11 (2.98–3.23)***
Antipsychotic medication				
No	488,675	479,067 (98.0)	9608 (2.0)	
Yes	30,514	28,885 (94.7)	1629 (5.3)	2.72 (2.58–2.86)***
Antidepressant medication				
No	385,497	379,837 (98.5)	5660 (1.5)	
Yes	133,692	128,115 (95.8)	5577 (4.2)	2.84 (2.74–2.95)***
Opioid medication				
No	486,251	477,259 (8.2)	8992 (1.8)	
Yes	32,938	30,693 (93.2)	2245 (6.8)	3.69 (3.52–3.85)***
Primary care visits				
0	126,717	126,269 (99.6)	448 (0.4)	
1	90,268	89,491 (99.1)	777 (0.9)	2.43 (2.17–2.73)***
2–5	176,437	172,952 (98.0)	3485 (2.0)	5.59 (5.06–6.16)***
6+	125,767	119,240 (94.8)	6527 (5.2)	14.68 (13.34–16.15)***

CI, confidence interval; LUTS, lower urinary tract symptoms; PTSD, post-traumatic stress disorder; RR, risk ratio.

** $P < .01$

*** $P < .001$.

† LUTS associated ICD-9 codes: psychogenic genitourinary malfunction, unspecified (306.50), other genitourinary malfunction arising from mental factors (306.59), hypertonicity of bladder (596.51), low bladder compliance (596.52), other functional disorder of bladder (596.59),unspecified disorder of bladder (596.9), urinary obstruction, unspecified (599.60, 599.69), hypertrophy (benign) of prostate with urinary obstruction and other LUTS (600.01, 600.21, 600.91), nodular prostate with urinary obstruction (600.11), prostatitis (601.0, 601.1, 601.4, 601.8, 601.9), urinary retention (788.20), incomplete bladder emptying (788.21), urinary frequency (788.41), nocturia (788.43), urinary hesitancy (788.64), straining on urination

(788.65), urinary incontinence (788.30–788.39, 788.91), splitting of urinary stream (788.61), weak urinary stream (788.62), and urinary urgency (788.63).

Table 2

Aggregate lower urinary tract symptoms outcomes among 519,189 Iraq and Afghanistan male and female veterans in veterans affairs health care from 2001 to 2010, stratified by age and gender

	Total (n = 519,189)	Any LUTS Outcome (n = 11,237)	
Variables	**No.**	**No. (%)**	**RR (95% CI)**
Female			
18–24	18,732	400 (2.1)	
25–34	27,040	675 (2.5)	1.17 (1.03–1.32)*
35–44	11,430	554 (4.8)	2.27 (2.00–2.58)***
45–54	4997	327 (6.5)	3.06 (2.66–3.53)***
55–64	650	49 (7.5)	3.53 (2.65–4.70)***
Male			
18–24	124,167	1363 (1.1)	
25–34	173,357	2583 (1.5)	1.36 (1.27–1.45)***
35–44	103,535	2399 (2.3)	2.11 (1.98–2.25)***
45–54	46,229	2049 (4.4)	4.04 (3.77–4.32)***
55–64	9052	838 (9.3)	8.43 (7.76–9.17)***

Abbreviations as in Table 1.

* $P < .05$

*** $P < .001$.

Table 3

Lower urinary tract symptoms outcomes among 519,189 Iraq and Afghanistan male veterans in veterans affairs health care from 2001 to 2010, stratified by mental health status

	No MH Diagnosis (ref) (n = 299,459)	MH Diagnosis w/o PTSD (n = 82,976)	PTSD (Including Other MH Diagnoses) (n = 136,754)	Total (n = 519,189)
Variables	**No. (%)**	**No. (%)**	**No. (%)**	**No. (%)**
LUTS diagnoses, related procedure, or prescription†	3812 (1.3)	2580 (3.1)***	4845 (3.5)***	11,237 (2.2)
LUTS diagnosis†	1941 (0.6)	1414 (1.7)***	2397 (1.8)***	5752 (1.1)
Urinary agents†	1836 (0.6)	1266 (1.5)***	2497 (1.8)***	5599 (1.1)
5-Alpha reductase inhibitor	243 (0.1)	141 (0.2)***	210 (0.2)***	594 (0.1)
Alpha-1 adrenergic inhibitor‡	1,301 (0.5)	764 (1.1)***	1,647 (1.3)***	3712 (0.7)
Anticholinergics‡	427 (0.1)	466 (0.6)***	775 (0.6)***	1668 (0.3)
One or more LUTS-related procedures†	1092 (0.4)	847 (1.0)***	1533 (1.1)***	3472 (0.7)

MH, mental health; other abbreviations as in Table 1.

*** *P* <.001 with "No MH Diagnosis" as the referent group.

† Patients may have multiple diagnoses, medications prescribed, or procedures; accordingly, the number of unique patients reported for the category totals will be lower than the sum of the individual items in that category. The same holds true for the overall total.

‡ Denominator for male-specific drugs and procedures is 263,676 men without any mental health diagnosis, 69,062 men with mental health diagnoses not including PTSD, and 123,602 men with mental health diagnoses including PTSD.

Table 4

Association of mental health diagnostic category with lower urinary tract symptoms among 519,189 Iraq and Afghanistan male veterans in veterans affairs health care from 2001 to 2010

	Base Model	Adjusting for Demographics†	Adjusting for Comorbid Conditions†
Variables	**ARR (95% CI)**	**ARR (95% CI)**	**ARR (95% CI)**
MH diagnoses			
No MH diagnosis	1.00	1.00	1.00
MH diagnoses without PTSD	1.93 (1.83–2.03)***	2.11 (2.00–2.22)***	1.99 (1.89–2.11)***
PTSD (including other MH diagnoses)	1.85 (1.76–1.94)***	2.29 (2.17–2.41)***	2.15 (2.04–2.27)***
Antidepressant or antipsychotic medication (time-varying covariate)	1.30 (1.24–1.37)***	1.19 (1.13–1.25)***	1.15 (1.09–1.21)***
Opioid medication	2.58 (2.45–2.72)***	2.55 (2.42–2.68)***	2.42 (2.30–2.55)***
Gender			
Female		1.00	1.00
Male		0.59 (0.56–0.62)***	0.56 (0.54–0.59)***
Race and/or ethnicity			
Non-white		1.00	1.00
White		0.91 (0.88–0.95)***	0.95 (0.91–0.99)**
Military rank			
Officer		1.00	1.00
Enlisted		1.09 (1.02–1.16)**	1.04 (0.97–1.11)
Military component			
Reserve/National Guard		1.00	1.00
Active Duty		1.02 (0.98–1.07)	1.03 (0.98–1.08)
Military branch			
Army		1.00	1.00
Air Force		1.02 (0.95–1.10)	1.01 (0.94–1.08)
Marines		1.19 (1.09–1.30)***	1.17 (1.07–1.27)***
Navy		1.02 (0.94–1.12)	1.02 (0.94–1.12)
Number of deployments			
Single deployment		1.00	1.00
Multiple deployments		0.98 (0.95–1.02)	0.99 (0.95–1.03)
Age			
18–24		1.00	1.00
25–34		1.28 (1.20–1.36)***	1.25 (1.17–1.33)***
35–44		2.20 (2.05–2.37)***	1.99 (1.85–2.14)***
45–54		4.24 (3.93–4.58)***	3.55 (3.28–3.84)***
55–64		9.29 (8.44–10.22)***	7.20 (6.52–7.94)***
Marital status			
Never married		1.00	1.00

	Base Model	Adjusting for Demographics†	Adjusting for Comorbid Conditions†
Variables	**ARR (95% CI)**	**ARR (95% CI)**	**ARR (95% CI)**
Married		1.04 (0.99–1.09)	1.03 (0.98–1.08)
Divorced, widowed, or other		1.10 (1.01–1.19)**	1.09 (1.01–1.18)*
Other health problems			
Hypertension			1.70 (1.62–1.78)***
Diabetes mellitus			1.24 (1.14–1.36)***
Additional mental health comparisons			
PTSD (including other MH DX) vs MH DX w/o PTSD	0.96 (0.91–1.01)	1.08 (1.03–1.14)**	1.08 (1.02–1.13)**

ARR, adjusted relative risk; DX, diagnosis; other abbreviations as in Tables 1 and 3.

*P <.05

**P <.01

***P <.001.

†All variables are adjusted for antidepressant and antipsychotic medication use as time-varying covariates.