BPH Flow meter links

https://pubmed.ncbi.nlm.nih.gov/9839573/
The ICS-'BPH' Study: uroflowmetry, lower urinary tract symptoms and bladder outlet obstruction 1998
Objective: To explore the relationship between uroflow variables and lower urinary tract symptoms (LUTS): to define performance statistics (sensitivity, specificity, positive and negative predictive values) for maximum urinary flow rate (Qmax) with respect to bladder outlet obstruction (BOO) at various threshold values; and to investigate the diagnostic value of low-volume voids.
Patients and methods: The study comprised 1271 men aged between 45 and 88 years recruited from 12 centres in Europe, Australia, Canada, Taiwan and Japan over a 2-year period. Symptom questionnaires, voiding diaries, uroflowmetry and pressure-flow data were recorded. The relationship between uroflow variables and symptoms, Qmax and BOO, and the diagnostic performance of low volume voids were analysed.
Results: The relationship between symptoms and uroflow variables was poor. The mean difference between home-recorded and clinic-recorded voided volumes was -48 mL. Qmax was significantly lower in those with BOO (9.7 mL/s for void 1) than in those with no obstruction (12.6mL/s; P<0.001) and Qmax was negatively correlated with obstruction grade (Spearman's correlation coefficient -0.3, P<0.001), even when controlling for the negative correlation between age and Qmax (Spearman's partial correlation coefficient -0.29, P<0.001). A threshold value of Qmax of 10 mL/s had a specificity of 70%, a positive predictive value (PPV) of 70% and a sensitivity of 47% for BOO. The specificity using a threshold Qmax of 15 mL/s was 38%, the PPV 67% and the sensitivity 82%. Those voiding <150 mL (n=225) had a 72% chance of BOO (overall prevalence of BOO 60%). In those voiding >150 mL the likelihood of BOO was 56%. The addition of a specific threshold of 10 mL/s to these higher volume voiders improved the PPV for BOO to 69%.

Conclusion: While uroflowmetry cannot replace pressure-flow studies in the diagnosis of BOO. it can provide a valuable improvement over symptoms alone in the diagnosis of the cause of lower urinary tract dysfunction in men presenting with LUTS. This study provides performance statistics for Qmax with respect to BOO: such statistics may be used to define more accurately the presence or absence of BOO in men presenting with LUTS, so avoiding the need for formal pressure-flow studies in everyday clinical practice, while improving the likelihood of a successful outcome from prostatectomy. This study also shows that low-volume uroflowmetry can provide useful diagnostic information and that, as such, the data from such voids should not be discarded.

https://pubmed.ncbi.nlm.nih.gov/36338622/
The diagnostic value of non-invasive methods for diagnosing bladder outlet obstruction in men with lower urinary tract symptoms: A meta-analysis 2022

https://pubmed.ncbi.nlm.nih.gov/19468441/
The penile cuff test: A clinically useful non-invasive urodynamic investigation to diagnose men with lower urinary tract symptoms 2009

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7273551/
Modern best practice in the management of benign prostatic hyperplasia in the elderly 2020

https://pubmed.ncbi.nlm.nih.gov/8749951/
Maximum flow rate--the single uroflowmetric parameter in clinical trials for benign prostatic hyperplasia? 1995

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8303027/
BPH nomogram using IPSS, prostate volume, peak flow rate, PSA and median lobe protrusion for predicting the need for intervention: development and internal validation 2021

https://pubmed.ncbi.nlm.nih.gov/23904378/
Urine flow acceleration is superior to Qmax in diagnosing BOO in patients with BPH 2013

https://pubmed.ncbi.nlm.nih.gov/19024540/
Data analysis of the objective observation parameters of benign prostatic hyperplasia patients accepting different treatment regimens 2008
Results: The prostate volume of the watchful waiting group was 33.0 ml, significantly smaller then those of the drug treatment and operation groups (40.1 and 65.5 ml respectively, both P < 0.01); the Qmax of the watchful waiting group was 17.1 ml/s, significantly higher than those of the drug treatment and operation groups (12.4 and 9.1 ml/s respectively, both P < 0.01), and the urinating volume of the watchful waiting group was 332 ml, significantly more than those of the drug treatment and operation groups (247 and 188 ml respectively, both P < 0.01). The serum PSA of the operation group was 5.44 ng/ml, significantly higher than those of the watchful waiting and drug treatment groups (1.53 and 1.99 ng/ml respectively, both P < 0.01); and the residual urine volume of the operation group was 208 ml, significantly higher than those of the watchful waiting and drug treatment groups (21 and 45 ml respectively, both P < 0.01). There were no significant differences in the serum PSA and residual urine volume between the drug treatment and watchful waiting groups.

Conclusions: Prostate volume, PSA, Qmax, average flow rate, urinating volume, and residual urine volume are important influential factors influencing the treatment option of BPH. Data analysis of the objective observation parameters will be helpful in clinical decision making.

https://pubmed.ncbi.nlm.nih.gov/35905485/
UPDATE - Canadian Urological Association guideline: Male lower urinary tract symptoms/benign prostatic hyperplasia 2022
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9343161/

https://www.healthline.com/health/overactive-bladder/frequent-urination-women
According to the Urology Care Foundation, frequent urination is when you need to go at least 8 times in a 24-hour period.

https://www.urologyhealth.org/urology-a-z/o/overactive-bladder-(oab)

https://bjui-journals.onlinelibrary.wiley.com/doi/full/10.1111/bju.11617

https://www.ncbi.nlm.nih.gov/books/NBK562310/
Urodynamic Testing and Interpretation 2023

https://pubmed.ncbi.nlm.nih.gov/459016/
Male peak urinary flow rate: relationships to volume voided and age 1979
We performed 126 studies of replicate voiding in 7 individuals and 552 observations in normal, abnormal or treated male populations with a disposable device that measures peak flow and volume voided. These observations have led us to suggest that a voided volume of 150 ml. be used as the minimum acceptable volume for studies of male subjects in which peak flow is used to define normal versus abnormal voiding. At volumes greater than 150 ml. a straight line describes the relationship between volume voided and peak flow as accurately as the previously suggested hyperbolic curve. Increasing age of men again reveals progressive decrease in peak flow rate no matter what volume is voided. Comparison of peak flow rate, volume voided and age by 3-dimensional graphing was attempted but was found unsuccessful for clinical use. However, 3 biaxial linear graphs may be used to chart effectively the 3 parameters (age, volume and peak flow) and thereby judge normality or abnormality of peak flow rate for any age and volume voided
Qmax in men [43]:

<10 ml/s: likely obstructed

10 to 15 ml/s: equivocal

>15 ml/s: likely unobstructed

REAL-WORLD ASSESSMENT OF THE 2-SECOND RULE FOR QMAX MEASUREMENT DURING UROFLOWMETRY BASED ON PATIENT-GENERATED DATA USING AN AUDIO-BASED SMARTPHONE APPLICATION
Maximum flow rate (Qmax) is a key measurement during uroflowmetry workup for lower urinary tract symptoms. However, it is well known that artifacts occurring during urination introduce errors in Qmax. The “2-second rule” is a method to correct artifact and measure the highest flow rate maintained for at least 2 seconds (Qmax_2 Sec). We attempt to analyze the impact of adjusted Qmax in patient diagnosis by comparing Qmax_2 Sec and conventional Qmax (Qmax_Con) based on a large set of data generated using an audio-based uroflowmetry smartphone application.

METHODS:
510 men who visited the urology clinic at University of Texas Southwestern Medical Center between Aug 2020 and May 2022 downloaded the “proudP" application on their smartphones. During urination, the patient places his phone 3 feet away from the toilet and urinates directly into the toilet. The device captures sound and generates a uroflowmetry flow curve and parameters including Qmax, using a proprietary algorithm. Qmax_2 Sec is computed from the flow curve in accordance with the definition of the 2-second rule. A total of 24,225 proudP results from 475 volunteers were analyzed after excluding 21 subjects with unknown birth dates, 1,869 inapplicable recordings, and 5,137 recordings with voided volume (VV) less than 150 mL.

RESULTS:
Among 24,225 proudP cases, 49.6% of cases demonstrated artifact (ΔQmax_Con-Qmax_2 Sec) greater than 1mL/sec. Most were in the range of Δ1.0-1.9 mL/s (41.2%) while 8.5% and 2.4% of cases showed artifact of >2 mL/s and >3 mL/s, respectively. Application of Qmax_2 Sec downgraded 18.8% of cases to a category worse than that determined by Qmax_Con, suggesting potential under-diagnosis of obstruction. While application of Qmax_Con identified 33.9% and 10.5% of potentially obstructed (10 mL/s-15 mL/s) or obstructed (<10 mL/s) cases, respectively, those increased to 37.2% and 15.5%, respectively, when Qmax_2 Sec was applied.

CONCLUSIONS:
An innovative audio-based uroflowmetry application is subject to similar artifacts as with in-office uroflowmeters. This leads to overestimation of Qmax and false increases in the mean/median which may impact clinical care. In the case of the application, the artifact can be electronically corrected applying the 2-second rule.