

## PERSPECTIVE



## Clinical Research

# Mobile health: a promising tool for the management of male patients with lower urinary tract symptoms suggestive of benign prostatic hyperplasia

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Mobile health (mHealth) has been defined by the Global Observatory for eHealth of the World Health Organization as “medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants, and other wireless devices” [1]. It is considered by many authors as a key tool for the implementation of patient-centered care and has been widely adopted in many countries worldwide [1]. Typically, mHealth involves the adoption of smartphone applications that may assist in the diagnosis, monitoring and/or treatment of health conditions. The main goal of mHealth is to facilitate and make more efficient patient care, reducing time and costs related to diagnosis and treatment. The COVID-19 pandemic represented a relevant “stress test” for the capabilities of mHealth and has greatly favored its development. Nowadays, growing evidence supports the use of mHealth in a wide range of urological conditions.

Patients suffering from lower urinary tract symptoms suggestive of benign prostatic hyperplasia (LUTS/BPH) represent a promising clinical setting for the adoption of mHealth technologies. Preliminary evidence exist demonstrating its role in administering questionnaires, tracking symptoms, providing information/education, and monitoring side effects of treatments (Table 1).

Early data published in 2014 supported the validity and the reliability of a smartphone version of the International Prostate Symptom Score (IPSS) as no significant differences were found between the electronic and the conventional paper version of the questionnaire across all LUTS severity groups and patients' preference for the smartphone version was higher as it was judged more feasible [1].

However, the value of remote management of patients with LUTS/BPH mainly emerged during the COVID-19 pandemic when the capabilities of mHealth technologies in administering questionnaires, tracking symptoms, providing information/education, and monitoring side effects of treatments have been of great clinical interest [2–9].

In 2022, Liu et al. published the results of a study evaluating the reliability of an audiovisual electronic version of the Visual Prostate

Symptom Score, based on a mobile light app [5]. The full-understanding rates in patients aged > 70 and < 70 years were 50% and 64.1%, respectively without statistically significant differences. Moreover, no significant difference emerged in the evaluation of LUTS when comparing the conventional and the electronic versions of the Visual Prostate Symptom Score [5].

In the same year, Kim et al. assessed the usefulness of an acoustic uroflowmetry-based mobile app voiding diary (Healthy Bladder-Voiding Diary, Soundable Health, Inc.) by comparing it with a conventional paper-based voiding diary. The app demonstrated favorable findings in terms of preference, convenience, preference, satisfaction and compliance and also showed reliable correlation with a conventional paper-based voiding diary [6].

The MyBPHCare app was tested to monitor male LUTS by recording several variables such as comorbidities, IPSS score, International Index of Erectile Function-15 (IIEF-15) score, 36-Item Short Form Health Survey score [7]. Moreover, patients could record their daily medication intake after a reminder generated by the app and physicians could monitor patients' compliance to medication. Interestingly, the app also allowed patients and physician to interact through an integrated messaging system. Compliance reached 95% within the first 45 days and all patients expressed their satisfaction after 1 month [7].

Similarly, the PERSONAL mobile app was tested for tracking LUTS severity and side effects of medical therapy in older men with favorable results [8, 9].

In conclusion, mHealth represents an attractive opportunity for LUTS/BPH care. The incorporation of mHealth into the clinical management of patients could reshape the current paradigms of diagnosis, monitoring, and therapy. The clearest evidence that emerges from the literature is that when traditional tools for the assessment of LUTS/BPH are converted into electronic versions that can be used via mobile apps: they remain usable, reliable and are often preferred by patients, even if they are elderly. The main advantages that can reasonably be expected from the introduction of mHealth in the management of patients with LUTS/BPH include the possibility of remote diagnosis and monitoring of

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**Table 1.** Available studies investigating mobile health in male patients suffering from lower urinary tract symptoms suggestive of benign prostatic hyperplasia.

Study	Country	App	Sample size (n)	Age, yr Mean (SD)	Main findings	Limitations acknowledged by authors
Kim, 2014 [3]	Korea	Smartphone version of the IPSS	1581	58.4 (7.2)	No differences between the paper and the smartphone versions of the IPSS in terms of total score and each item of the IPSS score across all LUTS severity groups. Feasibility: 48.0% stated that the smartphone version was more feasible, 26.5% stated that the paper version was more feasible, and 19.0% stated that both of the versions were feasible. Preference: 51.8% preferred the smartphone version, 20.2% preferred the paper version, and 22.5% showed no preference.	Only participants who had smartphones could participate.
Morselli, 2020 [4]	Italy	MyBPHCare (Ydeal, Portugal)	24	60 (55–64) <sup>o</sup>	Compliance: 95% within the first 45 days. 58.3% of patients requested clarifications/info via messenger. All patients expressed their satisfaction after one month.	Small sample size. No control group and mid-term follow up.
Lee, 2021[5]	USA	PERSONAL	19	70 (7)	On a scale from 1 (strongly disagree) to 5 (strongly agree), the participants agreed that: <ul style="list-style-type: none"> <li>- the app was easy to use (4.3 ± 1.0)</li> <li>- they could imagine people learning to use it quickly (4.2 ± 0.9)</li> <li>- they felt confident using the app (4.4 ± 0.8)</li> </ul> 58% of the participants reported that the app could help people like them manage their urinary symptoms	Black or African American participants not recruited. Inclusion of highly educated participants with a high socioeconomic status. Use of detailed baseline and follow-up questionnaires.
Wang, 2021 [6]	USA	PERSONAL	19	70 (7)	9 patients felt that the app changed their perception of their health or LUTS management: 8 reported increased awareness of symptoms and 1 was able to adjust his fluid intake to improve LUTS.	Need for less structured interviews in more diverse patient populations.
Liu, 2022 [7]	China	EPSS	79	70.4 (6.6)	Full-understanding rates in patients aged >70 and < 70 years were 50% and 64.1%, respectively ( $p = 0.206$ ). Significant correlation between EPSS, VPSS and assessment by urology specialists.	Some relevant clinical data were not present (ongoing medical treatments, comorbidities, urine flow rates, and postvoiding residuals). Patients were not divided between first-visit and follow-up group.
Kim, 2022 [8]	Korea	Healthy Bladder-VD (Soundable Health, Inc.)	78	55 (40–65) <sup>o</sup>	Higher scores in the convenience and satisfaction area were reported by patients using the mobile app VD compared to those using the paper-based VD. Overall preference for using the mobile app instead of the paper-based VD: 9 out of 10 (7.82 ± 2.68). Good correlation between the two methods for nocturnal urine volume, nocturnal polyuria index, total number of voids, number of nocturnal voids, and maximal bladder capacity.	Background noise.

App Application, BPH Benign Prostatic Hyperplasia, EPSS Electronic Version of VPSS, IPSS International Prostate Symptom Score, LUTS Lower Urinary Tract Symptoms, PC Personal Computer, PERSONAL Placebo-Controlled, Randomized, Patient-Selected Outcomes, N-of-1 Trials, SD Standard Deviation, VD Voiding Diary, VPSS Visual Prostate Symptom Score, <sup>o</sup>Median (range).

symptoms and side effects of drugs with a reduction in access to healthcare facilities and the consequent costs. The follow-up of patients undergoing recently approved minimally invasive procedures could represent a further promising field of interest [10]. Further advantages include: the presence of a dedicated tool for communication between physician and patient; the ability to promote behavioral and dietary modifications (or “to administer” other treatments) through a certified channel; the improvement of compliance with controls and therapy thanks to an integrated calendar and alarm system; the creation of a large database useful for research purposes. However, the role of mHealth for the management of LUTS/BPH is still in its infancy. The evidence is suboptimal as it mainly derives from small samples with short follow-up and characterized by a significant heterogeneity in terms of inclusion criteria, methodology adopted, and outcomes assessed. Furthermore, relevant issues such as privacy and cybersecurity should be carefully addressed. Social barriers represent a further concern for the concrete usability of this tool. There is still a significant disparity in access to technology between rural and urban centers and elderly patients often feel uncomfortable with modern technologies. Finally, the involvement of experts in the development, regulation and dissemination of mobile apps is highly desirable. At the same time, future well-designed studies are needed to increase the evidence and allow scientific societies to provide specific recommendations on the topic.

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## AUTHOR CONTRIBUTIONS

FF, CM and MC: conceptualization and supervision; NL, CDN, MDS and DA: writing.

## COMPETING INTERESTS

The authors declare no competing interests.

## ADDITIONAL INFORMATION

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