In Search of Mobile Applications for Urogynecology Providers

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Introduction: Thousands of medical applications (apps) are available for mobile devices. Finding accurate, health care provider–centered apps may be time consuming and frustrating for urogynecologists. The objective of this study was to identify and evaluate urogynecology (urogyn) apps using a modified APPLICATIONS scoring system.

Materials and Methods: Urogyn apps were identified from the Apple iTunes and Google Play Stores using the following 10 MeSH terms: *urogynecology, incontinence, prolapse, urinary tract infection, pelvic surgery, fecal incontinence, defecation disorder, voiding disorder, urethral diverticulum*, and *fistula*. Patient-centered and inaccurate apps were excluded. The remaining apps were evaluated with a modified APPLICATIONS scoring system, which included both objective and subjective criteria to determine each app's ability to aid in clinical decision making and to provide informational data. Objective rating components were price, paid subscription, literature referenced, in-app purchases, Internet connectivity, advertisements, text search field, interplatform compatibility and incorporated images, figures, videos, and special features. Subjective rating components were ease of navigation and presentation.

Results: Our search yielded 133 and 235 apps in the Apple iTunes and Google Play Stores, respectively. Only 8 apps (4 of which were in both stores) were determined to be accurate and useful; these were evaluated using the modified APPLICATIONS scoring system. The top-rated app was Practical Urology.

Conclusion: Few accurate clinical decision-making and informational apps exist for urogynecologists. Apps varied by comprehensiveness and quality. This study highlights the importance of systematically reviewing and rating medical apps. It also emphasizes the need for developing accurate apps for urogynecologists that improve health care provider performance and patient outcomes.

Key Words: (alphabetized) urogynecology apps, smartphone, smartphone apps, iPhone apps, android apps

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Smartphone technology has created a new medium for accessing medical information through medical applications or "apps." Cummings et al[1] showed that 77% of medical students, residents, and faculty used at least 1 medical app in their day-to-day practice for medical reference or current guidelines. Smartphone usage allows easy access to health care information and more efficient communication, which could reduce medical errors and improve interdisciplinary decision making. Thousands of medical apps are available for smart mobile devices; however, identifying accurate and high-quality apps poses a challenge to health care providers. Despite the growing reliance on medical apps, their accuracy and verifiability remain unmonitored.[2]

In the field of urogynecology, more recently designated as female pelvic medicine and reconstructive surgery (FPMRS), studies have reviewed the use of individual apps as trainee teaching tools, references for physicians, and resources for patient education and treatment.[3] Asklund et al[4] evaluated the effect of a novel mobile app for pelvic floor muscle training on stress urinary incontinence. Women randomized to mobile app usage reported decreased symptom severity and better adherence to pelvic floor muscle training than women who were not provided with the app.[4] Recently, the University of California, San Francisco, Urology Department released a urinary incontinence app to help patients track their urinary function and document their Kegel exercises.[5] Gonka and Kim[6] reviewed FPMRS apps in the Apple iTunes Store and found that most of these apps focused on either patient education, on providing anatomical models and videos, or on patient wellness, providing voiding diaries and exercise trackers.

There have been no studies in the FPMRS literature that review app accuracy and usefulness for urogynecologists. One survey study showed that 49% of responding British urologists used urological apps. Most of the respondents reported poor app quality, needing app peer review and validation.[7] Similarly, Stevens et al[8] reviewed smartphone apps for urolithiasis and found them to be both inaccurate and outdated. The authors recommended regulatory oversight by recognized urologic organizations to improve the usefulness of the apps.[8]

Farag et al[9] demonstrated that less than 15% of 1800 apps were considered potentially useful to obstetrics and gynecology (ob-gyn) providers. The APPLICATIONS scoring system was developed Chyjek et al[10] to filter irrelevant and inaccurate apps and has been used in subsequent studies analyzing apps for ob-gyn subspecialties. The APPLICATIONS scoring system provides quantitative scores that highlight the strengths and weaknesses of each app and allow for comparison between them. Sudol et al[11] focused on FPMRS patient-centered apps and identified 4127 apps in the iTunes store using FPMRS search terms. Only 23 apps met the eligibility criteria for FPMRS patient-centered apps, and these were evaluated using the APPLICATIONS scoring system to identify the most helpful and accurate apps for patients.[11] Although this study offers guidance on specific apps that providers can recommend to their patients, these apps are not necessarily helpful in the clinical practice of urogynecology. The aim of this study was to identify and evaluate provider-centered apps for urogynecologists using a modified APPLICATIONS scoring system.

MATERIALS AND METHODS

This study received institutional review board exemption, as human subjects were not involved in the research. The following were the 4 stages of this study: (1) identify apps relevant to urogyn by searching the Apple iTunes Store and the Google Play Store, (2) categorize apps according to intended audience and purpose,

TABLE 1. The APPLICATIONS Scoring System

Component	Score	Description
App comprehensiveness	3	1 point for each measure of comprehensiveness
Price	1	0 = priced, 1 = free
Paid subscription	1	0 = required, 1 = not required
Literature used	1	0 = no references, 1 = references used
In-app purchase	1	0 = present, 1 = absent
Connectivity	1	0 = Internet required, 1 = Internet not required
Advertisements	1	0 = present, 1 = absent
Text search field	1	0 = no search field, 1 = search field present
Inter-device compatibility	1	0 = iPhone or iPad; Android Phone or Android Tablet, 1 = iPhone and iPad; Android Phone and Android Tablet
Other components		
Images/figures	1	0 = absent, 1 = present
Videos	1	0 = absent, 1 = present
Special features	1	0 = absent, 1 = present
Navigation ease	1	0 = ease of navigation score <3, 1 = ease of navigation score ≥3
Subjective presentation	1	0 = subjective presentation score <3, 1 = subjective presentation ≥3
Total	16	

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(3) eliminate inaccurate apps, and (4) score apps using a modified APPLICATIONS scoring system.

A list of urogyn-specific medical subject headings (MeSH terms) was created using chapter titles of Walter and Karram's *Urogynecology and Reconstructive Pelvic Surgery* textbook.[12] These terms were searched in the Apple iTunes Store twice on April 13, 2016, and January 15, 2018, and twice in the Google Play Store on July 24, 2016, and January 15, 2018. The following 10 MeSH terms were searched: *urogynecology, incontinence, prolapse, urinary tract infection, pelvic surgery, fecal incontinence, defecation disorder, voiding disorder, urethral diverticulum,* and *fistula.*

All the apps that resulted from a search of these MeSH terms were then categorized and classified as described by Farag et al.[9] Apps were screened for patient-centered language and nonmedical jargon, and any apps considered to be patient centered were excluded. All apps that were identified as student centered, commercial product advertisements, non-English, private office or hospital advertisement, provider locator, gaming, conference, student-centered simulator, and non–ob-gyn were also excluded. Finally, the remaining apps that were not specific to urogyn were excluded.

The urogyn-centered apps were then classified into the following subcategories: interactive database, glossary/dictionary, topic-specific information, search engine, provider-centered simulators, and calculators. Journal apps and books were not rated, as they were electronic versions of paper publications and often required a subscription. Dictionary apps were excluded, as they included non–urogyn-specific terms. The rest of the apps, subsequently referred to as "urogyn apps" were downloaded.

The information and references cited within the apps were checked by urogyn specialists (S.W. and R.K.) to ensure that the material provided was correct and consistent with current recommendations and practice standards endorsed by national urogynecology organizations. Inaccurate apps were excluded.

The download date, developer or seller, version, interplatform compatibility (iPhone, iPad, Android phone, and Android tablet), and price were documented for the accurate urogyn apps. Each app was then scored using the APPLICATIONS scoring system (Table 1). The APPLICATIONS scoring system is described elsewhere and includes 9 objective categories and 3 subjective categories.[9] The first objective category was app comprehensiveness. App comprehensive scores were dependent on the purpose of the urogyn apps. The apps were divided into informational apps, clinical decision-making apps, or both. Apps determined to be informational apps were given points for including epidemiology, etiology/pathophysiology, histology/pathology, clinical presentation, treatment, follow-up care, prevention, and prognosis, as shown in Table 2. Apps determined to be clinical decision-making apps were given points for including clinical decision support systems, clinical treatment guidelines, disease diagnosis aids, differential diagnosis aids, medical calculators, laboratory test ordering, laboratory test interpretation, and medical examinations, as outlined by Ventola[2] and shown in Table 3.

One point was awarded for each of the following: being free, not requiring a paid subscription, citing literature, not requiring in-app purchases, usable without Internet, not having advertisements, being available on all searched platforms (iPhone, iPad, Android phone, Android tablet), and having a text search field. Three points were awarded for including "other components": images, videos, and special features. The remaining 2 points were given for navigation ease and subjective presentation. These 2 subjective

TABLE 2. Informational Apps Scoring Criteria

Informational Apps
1 point for the inclusion of 1–3 of the following topics, 2 points for the inclusion of 4–6 of the following topics, and 3 points for the inclusion of 7–9 of the following topics
• Epidemiology
• Etiology/pathophysiology
• Histology/pathology
• Clinical presentation
• Diagnosis/staging
• Treatment
• Follow-up care
• Prevention
• Prognosis

TABLE 3. Clinical Decision-Making Apps Scoring Criteria

Clinical Decision-Making Criteria	Description
Clinical decision support systems	Active knowledge system that uses 2 or more items of patient data to generate case-specific advice
Clinical treatment guidelines	Recommends how to treat a specific disease process
Disease diagnosis aids	Constellation of symptoms focused to 1 diagnosis
Differential diagnosis aids	Constellation of symptoms providing you with range of diagnoses
Medical calculators	Provides a numerical output with 1 or more inputs
Laboratory test ordering	Recommends lab tests for initial workup of a symptom(s)
Laboratory test interpretation	Clarifies laboratory test result
Medical examinations	Physical examination aid

A score of 0 was assigned if the app had no clinical decision-making capacity; a score of 1 was assigned if the app included 1–2 criteria; a score of 2 was assigned if the app included 3 to 5 criteria; and a score of 3 was assigned if the app included 6 to 8 criteria.

components were evaluated on a Likert scale (1 = poor, 2 = below average, 3 = average, 4 = above average, and 5 = excellent). An average rating of less than 3 received no points, and an average rating of 3 or greater received 1 point.

Each app could receive a maximum of 16 points. The 5 authors independently scored each app from September 14, 2016, to September 22, 2016. The app scores were then discussed as a group to determine interobserver variability in the objective components. All discrepancies were reconciled for an eventual 100% agreement.

RESULTS

Using the 10 urogyn-related MeSH terms, 133 apps and 235 apps were identified in the Apple iTunes and Google Play Stores, respectively. Of the 368 apps, 356 were excluded due to aforementioned criteria. Of the 12 remaining urogyn apps, 4 were identified as inaccurate apps and excluded. The final 8 (2.1%) apps were found to be both useful and accurate to urogyn providers and available for rating. The APPLICATIONS scores and characteristic information are shown in Figures 1 and 2.

To validate the APPLICATIONS scoring system and account for interobserver difference, the 5 authors independently rated each. The median score on the APPLICATIONS scoring system

was 12, with the lowest app scoring 9 points and the highest apps receiving 13 points, from a possible total score of 16 points. The objective component reporting error rate was 14 (7.7%) of 182, and the authors independently assigned the same score to a given objective component of an app 92.3% of the time.

The 8 apps were divided into informational apps and clinical decision-making apps. Four apps were assigned to both categories: AUGS Now, AUGS Pop-Q, Pop-Q, and Practical Urology.

Practical Urology received the highest score in both the informational app category and clinical decision-making app category. This app had a complete list of urology and urogynecology topics, which was subjectively easy to navigate. It also had access to calculators and patient questionnaires to aid in clinical evaluation and approach. Practical Urology is supported by Google Play and Apple platforms.

DrawMD, AUGS Pop-Q, and Pop-Q were interactive apps that allowed the provider to draw clinical scenarios to communicate with patients. These apps were evaluated as informational apps although the Pop-Q app and the AUGS Pop-Q app were also evaluated as clinical decision-making apps. The Pop-Q app and the AUGS Pop-Q app were both developed in consultation with Patrick Culligan, MD, and both earned more points for allowing physicians to alter pictures and e-mail them to their patients to

App Icon	Apps Found	Developer	iPhone	iPad	Google Play	App Comprehensiveness	Price Score	Paid Subscription	Literature Referenced	In-app purchases	Connectivity	Advertisements	Text Search Field	Interplatform Compatibility	Images/Figures	Videos	Special Features	Navigation ease	Subjective presentation	APPLICATIONS Score
	Practical Urology	Urologia Practica CB	1	1	1	3	0	1	1	1	1	1	0	1	1	0	1	1	1	13
	AUGS Pop-Q	American Urogynecologic Society	1	0	0	2	1	1	1	1	0	1	0	0	1	1	1	1	1	12
	AUGS NOW	Results Direct	1	1	1	3	1	0	1	1	0	1	1	1	0	0	1	1	1	12
	Pop-Q	Boston Scientific	0	1	0	2	1	1	1	1	0	1	0	0	1	1	1	1	1	12
	Show Me OAB	Astellas Pharma US	0	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	11
	drawMD Female Pelvic Surgery	Visible Health, Inc	0	1	0	1	1	1	1	0	1	1	0	0	1	0	1	1	1	10
	Anatomy for Pelvic Floor Surgery (3D)	Medscience Animations Studio Inc.	1	1	1	1	0	1	1	1	1	1	0	1	1	0	1	0	0	9
	iURO Pelvic Floor Lite	URO Developments	1	1	0	1	1	1	0	0	0	1	0	0	1	1	1	1	1	9

FIGURE 1. Characteristics and APPLICATIONS scores of 8 informational urogyn apps.

App Icon	Apps Found	Developer	iPhone	iPad	Google Play	App Comprehensiveness	Price Score	Paid Subscription	Literature Referenced	In-app purchases	Connectivity	Advertisements	Text Search Field	Interplatform Compatibility	Images/Figures	Videos	Special Features	Navigation ease	Subjective presentation	APPLICATIONS Score
	Practical Urology	Urologia Practica CB	1	1	1	3	0	1	1	1	1	1	0	1	1	0	1	1	1	13
	AUGS Pop-Q	American Urogynecologic Society	1	0	0	2	1	1	1	1	0	1	0	0	1	1	1	1	1	12
	AUGS NOW	Results Direct	1	1	1	3	1	0	1	1	0	1	1	1	0	0	1	1	1	12
	Pop-Q	Boston Scientific	0	1	0	2	1	1	1	1	0	1	0	0	1	1	1	1	1	12

FIGURE 2. Characteristics and APPLICATIONS scores of 4 clinical decision making urogyn apps.

help with pelvic floor education. The AUGS Pop-Q app is available for the iPhone, and the Pop-Q app is available for the iPad.

AUGS Now is an app developed by the American Urogynecologic Society with resources for urogynecologists. This app had access to a social media page and an event and career center to facilitate connections among the urogynecology community. This app earned both clinical decision-making and informational points for having a risk calculator, clinical practice guidelines, committee opinions, and position statements. This app was supported by both Apple and Google Play platforms.

iURO Pelvic Floor, Show Me OAB, and Anatomy for Pelvic Surgery were all informational apps that earned lower scores for limited benefit and use for urogynecologists.

The popularity index listed under the description of each app in the app store was somewhat associated with the APPLICATIONS score. The popularity index was highest for Practical Urology, iURO Pelvic Floor, and AUGS NOW.

DISCUSSION

In this study, only 2.1% of initially identified 368 apps were considered accurate and useful to urogynecologists, consistent with the issues of app overload and app inaccuracy in mobile health technology.[13] Without a systematic and stringent review process, urogynecologists can mistakenly download and use inaccurate apps, potentially hindering knowledge base and patient care.

The APPLICATIONS scoring system has been used to review multiple categories of apps and is the most widely used in the ob-gyn literature.[10,14–16] Components of the scoring system are adjusted to the types of apps being evaluated. For example, both the clinical decision-making criteria and the informational criteria were used to evaluate the comprehensiveness component in this study.

The study is limited to the apps that were available for download in the Apple iTunes and Google Play during our search. About 89% of health care providers use these platforms, with a dominant proportion using iPhones versus Android phones (69% vs 19.9%, respectively).[17] Searching other available platforms could have decreased ascertainment bias but was beyond the scope of this study.

Given the fast-paced nature of app development, other factors limit our analysis. First more apps may have been created since the initial search of this study, and thus, we performed a second more recent search. Second, some apps may have been removed from the stores by the time of publication. Third, with the inherent lag time that exists from app search, app review, and app scoring, disseminated information loses exigency with passing time.

We identified only 8 useful and accurate clinical decision-making and informational apps. These apps varied by comprehensiveness and quality, highlighting the need for a committee of urogynecologists to identify and evaluate urogyn apps for correct and practical information. Our study also emphasizes the need for the development of more accurate and useful apps for urogynecologists to improve health care provider performance.

REFERENCES

1. Cummings E, Borycki EM, Roehrer E. Issues and considerations for healthcare consumers using mobile applications. *Stud Health Technol Inform* 2013;183:227–31.

2. Ventola CL. Mobile devices and apps for health care professionals: uses and benefits. *P T* 2014;39(5):356–364.

3. Barbour K. Review of the POP Q Pelvic Organ Prolapse assessment app. *iMedicalApps* 2013:1–6.

4. Asklund I, Nystrom E, Sjostrom M, et al. *Neurourol Urodynam* 2016;9999:1–8.

5. Wu B. UCSF Urology dept releases Kegel exercises app to help treat urinary incontinence. Available at: http://www.imedicalapps.com/wp-content/uploads/2016/02/kegel-nation-app.png. 2016.

6. Gonka J, Kim J. The role of information technology (Apps) in FPMRS. *Curr Urol Rep* 2015;16(2):5.

7. Dempster NJ, Risk R, Clark R, et al. Urologists' usage and perceptions of urological apps. *J Telemed Telecare* 2014;1–4.

8. Stevens DJ, McKenzie K, Cui HW, et al. Smartphone apps for urolithiasis. *Urolthiasis* 2014.

9. Farag S, Chyjek K, Chen KT. Identification of iPhone and iPad applications for obstetrics and gynecology providers. *Obstet Gynecol* 2014;124:941–945.

10. Chyjek K, Farag S, Chen KT. Rating pregnancy wheel applications using the APPLICATIONS scoring system. *Obstet Gynecol* 2015;125(6):1478–1483.

11. Sudol NT, Adams-Piper E, Perry R, et al. In search of mobile applications for patients with pelvic floor disorders. *Female Pelvic Med Reconstr Surg* 2017; doi: 10,1097/SPV.

12. Walters MD, Karram M. *Urogynecology and Reconstructive Pelvic Surgery.* 4th ed. Philadelphia: Elsevier Saunders; 2013.

13. Wallace S, Mehta S, Farag S, et al. Identifying and rating urogynecology applications using the APPLICATIONS scoring systems. *Obstet Gynecol* 2017;129:72S.

14. Shaia KL, Farag S, Chyjek K, et al. A evaluation of mobile applications for reproductive endocrinology and infertility providers. *Telemed J E Health* 2016;23(3):1–5.

15. Perry R, Lunde B, Chen KT. An evaluation of contraception mobile applications for providers of family planning services. *Contraception* 2016; 93(6):539–544.

16. Farag S, Fields J, Pereira E, et al. Identification and rating of gynecologic oncology applications using the APPLICATIONS scoring system. *Telemed J E Health* 2016;22(12):1001–1007.

17. Black Book 2014: *Top ranked virtualized & native mobile EHR applications* 2014.