Feasibility and acceptability of home use of a smartphone-based urine testing application among women in prenatal care

OBJECTIVE: Recent advances in smartphone camera quality and image-recognition algorithms make smartphone applications increasingly useful for patient care.[1] Particularly, the potential future shortage of obstetricians in the Unites States[2] suggests that such technologies could be valuable additions to obstetric care. Urine dipstick analysis, obtained at most prenatal visits, presents opportunity for self-testing via smartphone. We assessed feasibility and acceptability of the Dip.io (Healthy.io, Tel Aviv, Israel) smartphone-based urinalysis application/testing kit among individuals in prenatal care. Dip.io clinical trials prior to class II FDA approval in 2018[3] demonstrated high (99%) reproducibility and accuracy compared to standard urine dipstick.

STUDY DESIGN: In 2017, we recruited a convenience sample of pregnant adults for a pilot study of 1-time use of the Dip.io application (iOS- and Android-compatible) and test kit, in conjunction with a prenatal visit. The kit includes collection cup, dipstick, and color board for image capture. After informed consent in clinic, participants downloaded the application to their smartphone and took the test kit home. Participants were to self-collect and dip a urine specimen

TABLE
Use of a smartphone-based urine dipstick application among a sample of women seeking prenatal care: Sample demographics (consented vs completed) and feasibility outcomes

A. Demographic characteristics	Consented (n = 179) n (%)	Completed (n = 150) n (%)
Age		
Mean (SD), years	28.1 (5.8)	28.2 (5.9)
18–25 years	67 (37.4%)	54 (36.0%)
26–35 years	92 (51.4%)	78 (52.0%)
36–45 years	20 (11.2%)	18 (12.0%)
Highest level of education		
<9 years	4 (2.2%)	3 (2.0%)
9–12 years	68 (38.0%)	56 (37.3%)
Over 12 years	105 (58.7%)	90 (60.0%)
Unknown	2 (1.1%)	1 (0.7%)

B. Feasibility outcomes	n	(% Among those consented (n = 179)	Among those attempting (n = 156)
Number attempting to complete test	156	87.2	(100)
Number completing test by 48 hours	150	83.8	96.2
Completed by 24 hours, no follow-up call	93	52.0	59.6
Completed by 48 hours, after 1 follow-up call	53	29.6	44.0
Completed by 48 hours, after 2 follow-up calls	4	2.2	2.6
Total completing survey	139	77.7	89.1
Attempted, unable to complete	6	3.4	3.8
Did not complete test within 48 hours	23	12.8	N/A
Submitted results outside 48 hours window	4	2.2	N/A
Never submitted results / did not report attempt	19	10.6	N/A

N/A, not applicable.

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the next morning, and submit a camera image of dipstick and color board according to in-app instructions. The app then opened a brief acceptability survey, which asked about ease of use, preference for self-testing vs clinic testing, and problems encountered. Participants not submitting an image within 24 hours received reminder calls. The primary outcome was feasibility, assessed as the proportion of participants submitting an interpretable image within 48 hours. Acceptability (secondary) outcomes included ease of use, testing preference, and proportion experiencing a problem with the test. We used descriptive statistics, and χ^2 analyses were used for comparisons between groups. The Johns Hopkins institutional review board approved the study, which was funded by Dip.io.

RESULTS: After piloting study procedures, we enrolled 179 participants; 156 (87.2%) attempted the test. Of these, 150 (96.2%) successfully submitted image data, and 139 of those 150 (92.6%) completed the survey. The majority (93/150, 62.0%) submitted an image within 24 hours, and 57 of 150 (38.0%) submitted between 24 and 48 hours.

The Table shows demographics and feasibility outcomes. Total test completion was similar across age and education levels. Individuals with >12 years of education vs fewer (72.7% vs 52.7%, $P = .03$), and those aged 26–45 years vs 18–25 years (68.8% vs 41.8%, $P = .01$), were more likely to complete the test without a reminder. Of 139 completing the acceptability survey, most (96.0%) found the app very easy or easy to use. Most (62.6%) preferred at-home self-testing, while 10.1% preferred in-clinic testing. Eight (5.3%) reported problems (internet connectivity, n = 3; image quality, n = 2; or test kit complaints, n = 3); all successfully submitted an image.

CONCLUSION: Participants found smartphone-based dipstick testing to be feasible and acceptable, and largely preferred self-testing. Integration of day-of-visit home testing into clinic protocols and electronic health records could streamline visits for patients and providers. Smartphone technologies may also offer novel ways to improve access for those with limited resources, increase convenience, and enhance patients' ownership over their health care. These pilot results may not be generalizable; future research could focus on younger individuals, those with lower health literacy, and individuals with high-risk pregnancies. ■

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Routine screening of pregnant women for Zika virus in the setting of local transmission—Miami–Dade County, Florida, 2016–2017

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OBJECTIVE: On July 29, 2016, the Florida Department of Health (FDOH) announced that active transmission of Zika virus (ZIKV) had been detected in a 1-square-mile area of Miami–Dade County. Centers for Disease Control and Prevention (CDC) guidance recommended ZIKV testing for asymptomatic pregnant women with an epidemiological link to that area,[1] with testing recommendations expanded to include additional areas as identified. Miami–Dade was considered a Zika cautionary area through June 2, 2017, and screening was recommended for women in Miami–Dade who conceived up to 8 weeks after that date.[2,3] From August 3, 2016, through July 2017, ZIKV testing was available to