Abstract

Objectives: Clinicians and researchers need an accurate tool assessing contraceptive knowledge in order to understand the effectiveness of teaching efforts. However, most widely used indices are outdated. The objective of this study is to create an evidence-based assessment tool and determine its validity and reliability for measuring contraceptive knowledge.

Study design: The study team developed the 25-question multiple-choice tool entitled the Contraceptive Knowledge Assessment (CKA). Expert reviewers examined content validity and semistructured patient interviews acquired feedback on subject matter and comprehension. A two-tiered approach explored criterion validity via (1) comparison with the gold standard (Contraceptive Knowledge Inventory) and (2) comparison between groups with lower and higher contraceptive knowledge. Repeat testing after 2–4 weeks evaluated test–retest reliability.

Results: Six experts and seven patients provided feedback on the initial CKA. One hundred two reproductive-aged male and female patients and 27 medical students completed the final CKA with an overall mean patient score of 9/25 (36%). The mean score on the CKA was higher than the mean score on the gold standard (9.1 vs. 5.8, p<.001). Patients scored lower on the CKA than did medical students (9.1 [36.4%] vs.19.4 [77.6%), p<.005). There were no differences within patients’ results with repeat testing over time (p=.667).

Conclusions: The CKA is a valid and reliable tool to measure a patient’s level of knowledge regarding contraception. This research tool may allow for the assessment of baseline knowledge, educational gaps, and improvement after an intervention. Knowledge may be lower than previous studies suggest, signifying need for improved education on contraception and better understanding of the relationship between knowledge and behavior change.

Implications: The CKA provides an evidence-based, reliable, and validated assessment of contraceptive knowledge. This modern tool may help to determine the effectiveness of interventions to improve education on contraception.

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1. Introduction

Unintended pregnancy remains a public health crisis in the United States. These pregnancies are at risk for adverse outcomes, including maternal and fetal morbidity and mortality [1–3]. Access to family planning services decreases unintended pregnancy by helping couples gain control of their fertility, yet high rates persist [1,2]. Over half of all unintended pregnancies result from misuse and discontinuation of effective contraceptives [3–5]. Patients interested in avoiding pregnancy may be unable to do so because they lack basic knowledge regarding the safety, efficacy or use of different contraceptive methods [2–15]. Contraceptive knowledge is especially low in high-risk groups, including minorities and young adults [5–7,10,11]. Many investigators argue that improving education on contraception will lessen the burden of unintended pregnancies [1–18]. A valid and reliable method to assess contraceptive knowledge is necessary in order to demonstrate whether specific educational interventions improve...
understanding, and ultimately impact behavioral and clinical outcomes [6,9,12–14,17–19].

The “Contraceptive Knowledge Inventory,” (CKI) published in 1976 in the *Handbook of Sexually-Related Measures*, is a well-established research index for measuring overall contraceptive knowledge [20]. Question domains cover reproductive physiology, mechanisms of action and use of different contraceptives with an emphasis on barrier and natural family planning methods. While the CKI demonstrated reliability and validity on original publication and remains a standard research metric used then and today [21–23], much of its content is now irrelevant. For example, numerous methods mentioned are either no longer available in the United States (e.g., Lippes Loop), rarely used (e.g., diaphragm and cervical cap), or not recommended (e.g., douching). The CKI includes incorrect data, like intrauterine devices (IUDs) acting as “abortifacients,” a claim disputed by the American College of Obstetricians and Gynecologists (ACOG) [24]. Additionally, it was initially validated in a small sample of 21 college students, a group that does not reflect the general population’s health literacy. While other instruments exist, many lack thorough or documented psychometric validation processes on publication, which leads to inconsistent and unreliable findings [12,13,17]. Researchers and clinicians need an updated inventory to more accurately capture patient data.

The goal of this study is to design and establish validity and reliability of a novel assessment tool for measuring contraceptive knowledge, the Contraceptive Knowledge Assessment (CKA). We hypothesize that (1) the CKA will better reflect knowledge as compared to the gold standard (CKI), (2) patients’ scores on the CKA will remain constant over time and (3) people with higher expected baseline contraceptive knowledge will score better on the CKA as compared to those with lower expected baseline knowledge.

2. Materials and methods

There were four phases to the study design: (1) instrument (CKA) development, (2) content validity, (3) criterion validity and (4) test–retest reliability (Fig. 1).

2.1. Instrument development (phase 1)

The research team developed the CKA using evidence-based resources on contraception (Fig. 1, phase 1), including major scientific publications from the Society of Family Planning, ACOG and the Centers for Disease Control. The CKA includes 25-multiple choice questions reflecting a comprehensive variety of topics in contraception including reproductive physiology, mechanisms of action, efficacy, side effects, medical contraindications, common misconceptions, sexually transmitted diseases and emergency contraception. Topics overlap those covered by the CKI while expand on modern dimensions of comprehensive contraceptive care deemed important by the research team and evidenced by the literature [6,8–10,13,14]. Questions reflect both male and female contraceptives. An option to select “I do not know” is included for each question in order to decrease uneducated guessing or skipping items. A readability scale calculated that all questions and answer choices were below a Flesch–

![Fig. 1. Study phases.](image-url)
2.2. Content validity (phase 2)

After initial tool development, the study team examined content validity of the CKA through discussions with both clinicians and patients (Fig. 1, Phase 2). First, clinical experts provided peer-review for medical accuracy, including two fellowship-trained family planning physicians, two general obstetrician gynecologists, and two reproductive health educators. Then semistructured interviews with seven patients selected via convenience sample provided feedback on the tool’s language, format and ease of administration. Inclusion criteria for all patients in the study were English-speaking, literate men and women aged 15 to 45 years old attending a large public ambulatory care center in New York City. Clinic attendants comprise an ethnically diverse group of medically underserved and uninsured urban patients. The sample specifically included adolescents from ages 15 to 18 as they represent a vital population for assessing knowledge and preventing unintended pregnancy [1,5–7]. The study also included men in order to broaden generalizability and encourage an active role for contraceptive decision making. Study involvement remained voluntary and anonymous. The study team reviewed all verbal and written feedback, transcribed it for brief thematic analysis, and incorporated changes to the CKA through consensus to draft a final version (Appendix 1).

2.3. Criterion validity (phase 3)

A two-pronged approach explored criterion validity (Fig. 1, phase 3). We first compared the CKA to the gold standard by having patients complete both the CKA and the CKI at one time-point and comparing test scores. The study team recruited patients meeting inclusion criteria via convenience sampling from the internal medicine clinic, and purposely not the obstetrics and gynecology clinic, as those patients receive contraceptive counseling that could bias the results. Patients completed the CKA in a waiting area or a private room if requested. A member of the study team monitored patients for use of outside sources of information or other bias the results. Patients completed the CKA in a waiting area or a private room if requested. A member of the study team monitored patients for use of outside sources of information, and performed continuous quality control to ensure that instruments were complete upon return, defined as 25 discernable responses. The order of administration of the CKA and CKI alternated between patients in order to decrease likelihood of information bias. A sample size calculation estimated 27 patients would detect a medium correlation effect (rho=0.73) with power of 0.80.

We further examined criterion validity by having medical students complete the CKA in order to compare groups with presumed lower and higher contraceptive knowledge (Fig. 1, phase 3). A student member of the study team recruited preclinical medical student participants from the New York University (NYU) School of Medicine. We estimated an approximately 35% difference in scores between higher and lower knowledge groups; a sample size of 27 per group would allow detection of a 37% difference in scores.

2.4. Test–retest reliability (phase 4)

Lastly, patients completed the CKA twice over a short period of time to assess test–retest reliability (Fig. 1, phase 4). In order to avoid question recall, repeat testing was conducted 2–4 weeks after initial administration. A sample size of 27 would detect a small correlation effect (rho=0.5) with a statistical power of 0.80. We expected an approximately 50% attrition rate due to the short follow-up window and the baseline “no-show” rate at the ambulatory clinic, and therefore recruited 60 participants to achieve the final sample size. A separate cohort of patients completed phase 4 in order to avoid influencing their retest results by concurrently taking the CKA, while patients in phase 3 were used for both the gold standard and high-low knowledge comparisons.

The study team entered data into REDCap and analyzed results using Stata v.13. Student’s t test was used to compare overall mean scores and percentages after equal variances were verified via variance testing. The institutional review boards of the NYU School of Medicine and Bellevue Hospital Center provided ethical approval for this study.

3. Results

The expert reviewers confirmed that all contents in the initial CKA were medically accurate. Semistructured patient interviews reported the overall length as appropriate and format as readable. Most described the questionnaire as “easy” or “simple,” while some thought a high school education was necessary to score well. Patients thought the language included “clear” terminology, while one patient was unfamiliar with “fibroid” and “hormone.” Two patients knew what an “IUD” was only after describing it as the “T;” this colloquialism was also incorporated into the final CKA. Overall, patients reported appropriate language, content and applicability so minimal changes were required.

One hundred thirty participants completed the finalized CKA, including 103 patients and 27 medical students (Fig. 2). One incomplete patient CKA from phase 3 was excluded from the final analysis due to a missing page. Of the 102 patients, the overall mean score was 9.0 out of 25 questions (36% correct), with a range from 0 to 19 (SD 4.4). Patients scored similarly in each study arm, with a mean score of 10.3 in the feedback group (n=7), 9.1 in the test–retest group (n=35), and 8.7 in the test–retest group (n=60). Time to completion ranged from 5 to 20 min, with most participants finishing within 10 min.

Patients scored higher on the CKA than the gold standard CKI. In this study arm (n=35), the mean score on the CKI was 5.8 (23.2%, range 0–12, SD 3.6) vs. 9.1 (36.4%) on the CKA (p<.001; Fig. 2). To examine the influence of incorrect or outdated items on the CKI, four questions were dropped...
for an adjusted analysis; with the incorrect questions removed, the adjusted scores were recalculated. There was no difference in the percentage correct between the adjusted and unadjusted CKI (24.8% vs. 23.2%, \( p = .61 \)), and both versions differed from the CKA score (\( p = .0007 \) and \( p = .0018 \), respectively).

We then compared patient scores (\( n = 35 \)) to medical student scores (\( n = 27 \)) in order to evaluate the impact of higher and lower contraceptive knowledge. Medical students scored higher than patients, with medical student mean score of 19.4 (77.6%, range 13–23, SD 2.5) and patient mean score of 9.1 (36.4%) (\( p < .005 \); Fig. 3).

In the test–retest study arm, 60 patients completed the initial assessment and 27 patients completed the follow-up within 2–4 weeks for retesting (45%). The loss to follow-up rate was 55%, similar to the baseline clinic “no show” rate. Among the patients retested, there was no difference between their initial mean score [10.2 (40.8%, SD=3.8)] and their repeat mean score [10.4 (41.6%, SD=4.3)], respectively (\( R = 0.79, p = .667 \)). Patients who did not return for retesting scored lower than did patients who did return on their initial test scores, respectively [7.5 (30.0%) vs. 10.2 (40.8%), \( p = .02 \)].

4. Discussion

There is a large unmet need to educate patients about contraception [1–11,14–17]. Significant knowledge gaps exist regarding the effectiveness of contraceptive methods and misperceptions are common [4,8,23]. Improving knowledge about contraception is one of many strategies in decreasing overall rates of unintended pregnancy and other poor reproductive health outcomes [2–11,14,15,26].

The CKA demonstrates reliability for measurement of contraceptive knowledge among reproductive aged men and women. It has been validated in a lower literacy population with most questions at the fifth–sixth-grade reading level. Questions span areas of known knowledge limitations (including long-acting reversible contraceptives, emergency contraception, common myths and efficacy rates) prioritizing its function for both research and clinical practice [6,8,10,11,15,29,30].

Patients scored better on the CKA compared with the gold standard CKI. While a new tool should score similarly to the gold standard in order to establish criterion validity, the CKI contains obscure and outdated questions. It was the opinion of the study team that the CKA should reflect practical knowledge. Therefore, the study team adhered to a goal of
creating a relevant, modern tool rather than matching the preexisting tool.

While prior studies demonstrate contraceptive knowledge scores in the 50% range [6,8,10,11,15,28], our patients scored 36%. Although demographics of our study population were not recorded, the overall clinic population includes individuals with the highest rates of unintended pregnancy, including patients of low-income, limited education, racial/ethnic minorities and young adults, which may help to explain lower scores [1,2], Question design can also contribute to lower scores; no “true-false” or “agree-disagree” questions were used, which are associated with higher percentage correct [31]. The option “I do not know” was marked as incorrect; while this likely decreased uneducated guessing, it may also contribute to lower scores if those questions had been guessed correctly.

Although acceptable for a psychometric evaluation, this study had a small sample size. Additionally, 55% of patients did not return for retesting. At the study institution, a high attrition rate is common; in order to obtain adequate power, the study team captured a larger initial sample. We found no difference between patients’ scores who were retested, supporting the CKA’s reliability; however, we cannot be certain that loss to follow-up did not influence the correlation results. Interestingly, we did note a difference in scores between patients who did and did not return for retesting. This may signify that patients less likely to follow-up have lower levels of contraceptive knowledge, reinforcing our need for a better understanding of the complex forces contributing to health education and clinical outcomes.

Though behavioral science models demonstrate that change in knowledge can be associated with change in behavior, researchers have been challenged to demonstrate if increasing knowledge on contraception leads to an actual increase in contraceptive use [11–13]. Some studies have shown that educational interventions can effectively increase contraceptive knowledge [4,6,7,9,11,14], although more research is needed to clarify relationships between education and clinical effects [7,9,12–14,16–18,27]. Ultimately, the quality of the knowledge measurement tool determines the interpretation of findings. A recent systematic review of 21 studies could not identify a preeminent contraceptive knowledge measure [12]. Most lacked validation methods and efforts to consider health literacy were rare. Additional publications support this need for better quality measurement tools [9,12–14,16–18].

In summary, the CKA serves as a valid and reliable research tool to measure contraceptive knowledge. It contains evidence-based, practical, modern questions on contraceptives with simple terminology. Its potential use includes helping clinicians and researchers to demonstrate an impact of their educational interventions on contraceptive understanding. We encourage further CKA evaluation in larger samples, different languages and diverse settings. With better ways to capture change in knowledge, the link between education, behavior change and clinical outcomes of unintended pregnancy may be better elucidated.

Appendix 1. Contraceptive Knowledge Assessment

Select only ONE answer for each question.

1. When during a woman’s cycle is she most likely to become pregnant?
   a. During her period (start of cycle)
   b. 3 days after her period ends
   c. Two weeks before her next period starts
   d. 3 days before she gets her period (end of cycle)
   e. I don’t know

2. How long can sperm stay alive in a woman’s body?
   a. 1–3 h
   b. 24 h
   c. 3–5 days
   d. 7–10 days
   e. I don’t know

3. Which of the following choices is TRUE about pregnancy?
   a. You cannot become pregnant the first time you have sex
   b. You cannot become pregnant if you have sex standing up
   c. You cannot become pregnant if you do not have an orgasm
   d. None of the above are true
   e. I don’t know

4. Which of the following choices is TRUE about withdrawal, or the “pull-out” method?
   a. Semen may be released before ejaculation
   b. Withdrawal works as well as condoms at preventing pregnancy
   c. Withdrawal can protect against some sexually transmitted diseases (STDs)
   d. Withdrawal works as well as the birth control pill at preventing pregnancy
   e. I don’t know

5. Which birth control method guarantees you will not become pregnant?
   a. None
   b. Using a condom every time you have sex
   c. Douching, showering, or bathing immediately after sex
   d. “Pulling out” before ejaculation
   e. I don’t know

6. Which is the only birth control method that helps prevent infections?
   a. The birth control pill
   b. Male and female condoms
   c. Depo-Provera (“the shot”)
   d. The IUD (intrauterine device, the “T”)
   e. I don’t know
7. All of the following are TRUE about using male condoms EXCEPT:
   a. You should use water-based lubricants with spermicide
   b. Wear two condoms to be extra safe
   c. Prevent air bubbles by holding the condom tip when putting it on
   d. Check the expiration date and keep them in a cool and dry environment (i.e. not in a wallet or in a car)
   e. I don’t know

8. Hormonal birth control comes in which of the following forms?
   a. Pills taken by mouth
   b. Patch worn on the skin
   c. Ring placed in the vagina
   d. All of the above
   e. I don’t know

9. Which one is NOT a benefit of hormonal birth control?
   a. Improvement of diabetes
   b. Improvement of acne
   c. Reduction in menstrual cramps and bleeding problems like anemia
   d. Decreased risk of ovarian and uterine cancer
   e. I don’t know

10. How long should the vaginal ring (NuvaRing) stay in place before changing it?
    a. 1 day
    b. 1 week
    c. 3 weeks
    d. 1 month
    e. I don’t know

11. Which of the following can make hormonal birth control less effective?
    a. Seizure (epilepsy) medicine
    b. HIV medicine
    c. Herbal supplements
    d. All of the above
    e. I don’t know

12. What is the main way that birth control pills work?
    a. It prevents the ovary from releasing the egg (ovulation)
    b. It prevents sperm from entering the uterus
    c. It prevents the fertilized egg from implanting in the uterus
    d. It prevents the embryo from growing past a certain size
    e. I don’t know

13. Birth control pills can have which of the following ingredients?
    a. Testosterone
    b. Estrogen
    c. Magnesium
    d. Calcium
    e. I don’t know

14. You should NOT use the birth control pill if you have any of the following:
    a. Fibroids
    b. Drink alcohol
    c. Currently taking antibiotics
    d. None: it is safe to use the birth control pill in all of these situations
    e. I don’t know

15. How long after a woman stops using birth control can she become pregnant?
    a. Immediately
    b. 1 month
    c. 3 months
    d. 6 months
    e. I don’t know

16. If you forget to take one birth control pill and remember the next day, what should you do?
    a. Throw the missed pill away and then continue the following day from where you left off
    b. Take the rest of the week’s pills at once and then start the placebo (“reminder”) week
    c. Take two pills then continue
    d. Throw the missed pill away and wait 1 month to start a new pack
    e. I don’t know

17. Which of the following is FALSE about Depo-Provera (the “shot”)?
    a. It is administered every 3 months
    b. Gradual weight gain is possible
    c. It might take a few months after stopping to become pregnant
    d. It cannot be used while breastfeeding
    e. I don’t know

18. Which of the following birth control methods may be reversed if you decide you want to become pregnant?
    a. Tubal ligation (“tying your tubes” or “cutting your tubes”)
    b. Essure coils
    c. Vasectomy
    d. IUD (intrauterine device)
    e. I don’t know

19. Which birth control method is not easily noticed by a partner?
    a. The IUD (intrauterine device)
    b. The vaginal ring
    c. Male condom
    d. Female condom
    e. I don’t know

20. A doctor places an IUD (intrauterine device) in what part of the body?
    a. Fallopian tube
    b. Uterus
    c. Cervix
    d. Vagina
    e. I don’t know
21. Which method of birth control is the best at preventing pregnancy?
   a. The IUD (intrauterine device)
   b. Depo-Provera (“the shot”)
   c. Male Condom
   d. Withdrawal (“pull-out method”)
   e. They are all equally effective
   f. I don’t know

22. Which choice is FALSE about IUDs (intrauterine devices)?
   a. Women of all ages may get an IUD
   b. Women who have never had a baby may get an IUD
   c. Women can have an IUD put in right after having a baby or having an abortion
   d. Women cannot get an IUD if they have ever had a sexually transmitted disease (STD)
   e. I don’t know

23. A doctor places the birth control implant (Nexplanon) in what part of the body?
   a. Thigh
   b. Vagina
   c. Arm
   d. Buttock
   e. I don’t know

24. How soon after sex must the “morning after pill” (or Plan B) be used to be effective?
   a. 1 h
   b. 24 h
   c. 5 days
   d. 20 days
   e. I don’t know

25. How can you get the emergency contraceptive pill called Plan B (or “the morning-after pill”)?
   a. If under age 18, you cannot get it, even with a prescription
   b. If under age 21, you must have your parent go with you to the doctor for a prescription
   c. All women must have a prescription, no matter her age
   d. You can buy it at the pharmacy, without a prescription, no matter what age
   e. I don’t know

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