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Measuring Oral Contraceptive Knowledge: A Review of Research Findings and Limitations

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Abstract

Objective—Poor oral contraceptive (OC) knowledge may contribute to premature OC discontinuation and unintended pregnancy. Yet, to understand relationships between OC knowledge and contraceptive behavior, knowledge must be adequately measured. This review evaluates the findings and methodological limitations of research in which OC knowledge has been measured.

Methods—We performed a systematic review of primary research from January 1965 to January 2009. Studies were audited for study characteristics, purpose for measuring OC knowledge, key findings and measurement properties including administration method, knowledge domains, reliability, validity, health literacy and cultural sensitivity.

Results—We reviewed 21 studies: 18 cohort studies, including one psychometric evaluation, and three randomized trials. Results on OC knowledge outcomes were variable. Measures were largely self-administered survey ($n = 15$) and lacked assessment of all OC knowledge domains. Information on measures' characteristics, reliability, validity, health literacy and cultural sensitivity was limited.

Conclusion—Existing OC knowledge measures lack critical psychometric elements, leading to inconsistent and unreliable findings.

Practice Implications—Poor OC knowledge measurement precludes identifying counseling needs and developing interventions for contraceptive behavior change. Future research considerations include: measurement information in publications, psychometric evaluations, formal reliability/validity techniques, and attention to all OC knowledge domains, health literacy and cultural sensitivity.

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I confirm all personal identifiers have been removed or disguised so the persons described are not identifiable and cannot be identified through the details of the story.

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1. Introduction

The oral contraceptive pill (OC) is the most popular form of reversible contraception [1,2], yet half of new users will discontinue within the first year [3]. Approximately one million annual unintended pregnancies are related to OC method failure, misuse or discontinuation [1,3].

OC use is believed to be influenced by a variety of cognitive, behavioral and social factors. Behavioral science models such as the Theory of Reasoned Action and Social Cognitive Theory have shown that the understanding of information related to birth control pills (OC knowledge) is related to contraceptive behavior [4] and to other psychosocial factors that influence OC use [2-5,7,9-11]. These theoretical frameworks further predict that knowledge change is associated with behavior change [4]. Although researchers have frequently measured OC knowledge, whether improved OC knowledge equates to improved OC behavior remains to be clarified [7,10-30]. This may be related to how researchers are measuring OC knowledge. Ultimately, the quality of measurement determines interpretation of findings about the state of OC knowledge and about the relationship between knowledge and OC behavior.

We performed a systematic review to assess the state of OC knowledge measurement. We sought to answer the following questions. For what purposes have researchers measured OC knowledge and what are their key findings? What are the characteristics of existing OC knowledge measures and to what extent are reliability, validity, cultural sensitivity, and health literacy of these measures addressed?

2. Methods

We searched the following computerized databases: Medline, PubMed, PsychInfo, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Health and Psychosocial Instruments and Google Scholar®. We used the search terms “contraception,” “contraceptives” and “knowledge” in various combinations and with the synonymous terms: “birth control pills,” “oral contraceptive pills,” “hormonal contraception” and “combined contraceptive pills.” We combined these search terms with the following key words: measurement, survey, questionnaire, and instrument. We also examined retrieved articles’ references for relevant citations.

We limited articles to primary research reports written in English and published through January 2009 in peer-reviewed journals. We excluded editorials, articles in which OC knowledge was not a primary outcome and articles that did not differentiate OC knowledge measurement from measurement of knowledge of other methods.

We extracted information on population characteristics, sample size, study design, level of evidence [31], intervention strategies and other variables examined. We categorized studies by their primary purpose for measuring OC knowledge: to describe the state of and factors associated with knowledge; to examine associations between knowledge and behavior; to test an intervention to change knowledge; or to test a knowledge-based intervention to change behavior. We assessed related key findings within these categories.

Using a structured data abstraction form, we audited eligible articles for any information on the following specific measurement characteristics: the extent to which each of the six OC knowledge domains (risks, benefits, side effects, use, efficacy and mechanisms of action [1]) were assessed; administration method; measurement format; reliability; validity; health literacy; and cultural sensitivity. We attempted to contact authors who reported using structured OC knowledge questionnaires for additional details on reliability and validity, if

necessary. Due to heterogeneity of measures, analytic techniques, and results in the studies reviewed, we were unable to perform comprehensive statistical analyses or generate a composite score, but rather we provide a summary and critique of the measurement data abstracted based upon standard principles of research measurement [32]. To the extent possible, we used standardized guidelines for meta-analyses [33].

3. Results

We examined forty articles for inclusion. Under restrictive inclusion criteria, we reviewed 21 published analyses [7,10,12-30] derived from 17 separate research studies (Figure 1). Four pairs of articles, each based upon a single study/data set, were included since separate articles had different OC knowledge measurement purposes and findings [12,13; 21,22; 24,25; 27,28]. We refer to them as separate studies.

3.1 General Study Characteristics

Of the 21 studies included, most ($n = 18$) were cohort studies [7,10,12-20,22,23,25,27-30]. Two studies used qualitative designs [15,17], two tested knowledge-related interventions [23,25], and one was a psychometric evaluation [20]. Three studies were formal randomized controlled trials [21,24,26]. We found no meta-analyses.

We present selected characteristics of the studies in Table 1. Study settings varied, with primary care ($n = 7$) [20-26] and reproductive health practices ($n = 5$) being most common [10,16-19]. Seven teams did not specify racial demographics [12,13,20-23,29]. Sample sizes ranged from less than 50 [15,17,24,25] to 1239 [26].

Ten investigative teams focused on OC knowledge as the primary endpoint [10,12-14,18,24-26,29,30]. Twelve teams measured multiple variables, frequently including OC behavior [7,10,12,14,16-18,24-28].

3.2. Summary of Purposes for Measuring OC Knowledge and Key Findings

3.2.1. Descriptions of OC Knowledge ($n = 15$)—Fifteen studies measured OC knowledge to describe knowledge and factors associated with knowledge among diverse populations [7,10,12,13,15-20,22,27-30]. Nine teams reported overall poor knowledge [7,10,12,13,15-18,22,29]; six deemed knowledge sufficient [19,20,22,27,28,30]. In general, OC knowledge deficiencies existed in all six domains across these studies. However, what constituted deficient or adequate knowledge was not clearly defined in any study we reviewed.

Multiple demographic and reproductive health characteristics were associated with OC knowledge. Poorer knowledge was found in Hispanics compared to non-Hispanics [16], young college students compared to older students [13], and OC nonusers compared to users [7]. Gaudet et al. found that although knowledge of risks, benefits, and side effects domains was low, women reporting previous OC counseling had significantly higher knowledge than non-counseled women [29]. Similarly, Little et al. found that counseling was the strongest OC knowledge predictor with other predictors including education, prior emergency contraception use, greater years taking OCs, and greater valuing of pregnancy prevention [22]. Hansen and Skjeldestad reported that high OC knowledge was associated with sexual activity and contraceptive communication with peers/parents, rather than communication with, information from, or type of provider [30].

3.2.2. Associations Between OC Knowledge and Behavior ($n = 1$)—One research team examined whether OC knowledge was associated with pill-taking behavior [14]. In a

sample of 345 racially diverse adolescents, Moore and colleagues found that more than 40% of their sample held beliefs reflecting inaccurate knowledge of OC side effects and risks. Accuracy of OC beliefs was significantly associated with intentions to use and correct use at one year.

3.2.3. Interventions to Change OC Knowledge (n = 4)—Four investigative teams tested interventions to improve OC knowledge [21,23,25,26]. Studies evaluated written handouts [21,23,26], audio-tapes [26], health provider counseling [25], and provider question/answer sessions [21]. Three teams found interventions improved OC knowledge in at least one domain [21,23,26], with the greatest improvements in use [21,23,26], efficacy [21], and benefits [26]. Although knowledge and continuation were improved in the intervention groups receiving either educational brochures and/or audiotapes (n = 144), Deijen and Kornaat found overall low knowledge, with 26% knowing missed pill protocols [26]. Gilliam et al. did not find increased knowledge in 25 counseled adolescent African Americans despite increased motivation, confidence in avoiding pregnancy and self-perceived knowledge [25]. Knowledge was low for important questions, with 38% knowing missed pill protocols, 11% knowing benefits of the pill, and 5% knowing blood clot risks [25].

3.2.4. OC Knowledge-Based Interventions to Change Behavior (n = 1)—One team tested a knowledge-based intervention to change OC behavior [24]. In a longitudinal analysis of their pilot study evaluating an intervention to enhance pill continuation and knowledge, Gilliam and colleagues randomized 33 postpartum African American women to counseling, video, and written materials or to routine counseling alone. Among the 25 women with follow-up data, OC continuation was not improved in the intervention group despite increased OC knowledge that persisted over time [24].

3.3. Measurement Characteristics

3.3.1. OC Knowledge Domains—Only two research teams measured all six OC knowledge domains [14,18] (Table 2.). The most commonly measured domains were use (n = 16), side effects (n = 15) and risks and efficacy (n = 14). Assessment of benefits (n = 10) and mechanisms of action (n = 2) was limited.

3.3.2. Measurement Administration—Table 3 provides an overview of the measurement characteristics. Six articles contained some pertinent details on measurement methods, formatting, question content, or examples of questions [7,12,17,18,22,24]. Although self- (n = 15) or interview-administered survey methods (n = 2) or both (n = 4) were used to measure OC knowledge, problems inherent to these methods were seldom addressed. No teams reported double-checking for missing data. One article reported low response rates [23] and three reported notable loss to follow-up [23,24,26]; all other articles failed to comment on such study limitations.

3.3.3. Measurement Format—The most frequently used question format was multiple choice (n = 14). Other formats included alternate choice (True/False) (n = 16), question stems with answer lists (n = 9), and open-ended questions (n = 7). Fifteen teams used multiple formats [12-16,18-23,25-29]. Three articles lacked detail on question format [14,15,23].

The number of OC knowledge questions in study questionnaires ranged from four to over 50 (Table 3), with reported times of administration ranging from two to 45 minutes [16,18,21]. Three studies did not report the number of questions [17,23,26]. Six study questionnaires had ten or fewer OC knowledge questions [10,15,24,25,27,28].

We present selected examples of OC knowledge questions in Table 4. Question content was similar across studies. For example, knowledge of missed pill protocols was addressed in four of the 21 studies [12,16,20,29]. However, questions differed in type, wording, formatting, and answer choices.

3.3.4. Reliability and Validity—Thirteen teams commented, at least indirectly, on techniques relating to reliability [7,12,13,16,19,21-26,29,30] but details were limited. Five teams reported pilot-testing questionnaires but gave no information about its impact on reliability [10,14,18,27,28]. Qualitative investigators used administrator training to ensure concordance among raters [15,17,18]. Little and colleagues performed the only reliability statistics we reviewed [20].

Information on validity was similarly limited. Eight articles noted that questionnaires were previously used or based upon a known content source [7,17,18,19,21,22,24,26]. Five teams acknowledged formative/pilot research but gave little detail about processes used [10,24,25,27,28]. Four teams had experts review questionnaires but did not report on the structure of such processes [17,18,20,21]. Triangulation of methods was employed in the qualitative studies [15,17].

Little et al. offered the most comprehensive information on reliability and validity in their psychometric evaluation [20]. In addition to having good test-retest reliability (Spearman rank correlation 0.73), the authors based their questionnaire on previously used non-validated measures, obtained expert feedback, pilot-tested questions for content validity, and established construct validity through known group differences.

Although no formal psychometric testing or reliability statistics were provided, a secondary finding described by Merchant and colleagues' was that instrument question type and wording influenced knowledge responses among a cohort of women attending an emergency room [28].

3.3.5. Health Literacy—Four studies commented on health literacy relating to measurement of OC knowledge [18,25,27,28]. Reading level (Flesch-Kincaid score of 5.4) was given in Merchant et al.'s articles [27,28]. Gilliam et al. used large font size and three or less questions per page for readability [25]. Although Davis et al. found knowledge of OC use, mechanisms of action, and risks were positively associated with literacy levels, they did not specify reading level of their interviewer-administered questionnaire. They addressed comprehension through pilot-testing and multiple questionnaire revisions [18].

3.3.6. Cultural sensitivity—Three studies addressed cultural sensitivity of measurement [16-18]. Two studies had instruments available in English and Spanish [16,17] but translation processes were not described. Davis et al. reported pilot-testing and multiple revisions to enhance cultural sensitivity [18].

4. Discussion and Conclusion

4.1 Discussion

Most studies demonstrated that OC knowledge is poor, and that cognitive, behavioral and social factors are all associated with poor OC knowledge. Studies testing educational counseling interventions showed some improvements in knowledge, but results were inconsistent [21,23-26]. The single study of an educational intervention for behavior change found no improvement in OC continuation but was limited by small sample size [24].

Despite using standardized guidelines for conducting quality meta-analysis [33], we did not identify a gold-standard OC knowledge measure nor could we clearly define best practices for OC knowledge measurement. All studies reported using at least one strategy to ensure reliable and valid measurement, yet details on specific techniques were sparse. No study included all critical measurement properties. We found a single commendable psychometric evaluation [20]. However, it was limited by poor generalizability, a small sample and inability to establish criterion validity.

4.2 Conclusion

Poor OC knowledge may be an important target for educational and counseling interventions in family planning. However, significant limitations in current OC knowledge measurement impede adequate assessment of OC knowledge and related outcomes. Questionnaires assessing OC knowledge may have low sensitivity, low specificity or both, which decreases the statistical power to assess the relationship between OC knowledge change and behavior change. Thus, unreliable questionnaires facilitate an underestimation of interventions' effectiveness [32]. With the quality of existing evidence, appropriate inferences about the relationship between OC knowledge and behavior cannot be made.

4.3 Practice Implications

Based upon our findings, we offer several recommendations for future research.

First, use of standardized reporting guidelines for randomized trials and observational studies [34,35] would ensure publication of pertinent methodologic information and an improved ability to adequately assess the state of OC knowledge measurement. Useful measurement details include number of questions, administration time, question formatting, reading level, scoring, reliability and validity. Survey and interview questions can be made available to readers and included as manuscript tables or appendices.

In developing a gold-standard knowledge measure, the use of formal approaches for instrument development and psychometric evaluation are needed. Established techniques for instrument development can curtail measurement bias and ensure findings are reliable, valid, and can be accurately interpreted [32].

The most robust measure should assess multiple, if not all, OC knowledge domains to provide the most comprehensive assessment. However, tailored OC knowledge measures may be used to answer specific research questions in specific populations.

Consideration of health literacy is critical for comprehensible, accessible health care education and counseling [36,37] and for appropriate OC knowledge assessment, yet only four studies here reported on health literacy [18,25,27,28]. Others have noted the importance of health literacy assessment in family planning but have seldom addressed it in research study design [38,39]. Standardized techniques to improve instrument sensitivity to health literacy should be used when developing a gold-standard OC knowledge measure [40].

Additionally, culturally-sensitive measures are needed in family planning given the disproportionate rates of poor contraception and unintended pregnancy in minority populations [40-44], but only three studies reported on cultural measurement factors [16-18]. Cultural considerations for an OC knowledge gold-standard measure include gender, age, developmental stage, race, socioeconomic class, geographic location and sexual orientation [40,41]. Rigorous translation processes for instrument development must also be used when applying measures in linguistically-diverse samples [45].

In summary, reliable and robust measurement of OC knowledge is required to clarify the role of OC knowledge in contraceptive behavior. Our findings suggest that the first research challenge is to develop a gold standard OC knowledge measure through formal psychometric processes which adequately addresses all relevant knowledge domains, health literacy and cultural sensitivity. With a greater understanding of OC knowledge, we can identify interventions to improve OC knowledge and use, ultimately to promote positive family planning and health education outcomes.

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Figure 1.
Flow of Evidence Relating to Oral Contraceptive Knowledge Measurement

Table 1

Studies Measuring Oral Contraceptive Knowledge, by Purpose of Analysis

STUDY	SETTING	AGE, RACE/ETHNICITY	SAMPLE SIZE
Descriptions of OC Knowledge (Cross-sectional)			
Bryden 2001	college health Canada	18-29 -	124
Davis 2006	reproductive health U.S.	11-41 AA	400
Fletcher 2001	college health Canada	18-29 -	124
Gilliam 2004a	reproductive health U.S.	18-26 Hispanic	40
Kaskowitz 2007	reproductive health U.S.	- mixed	243
Little 1998 ^a	primary care Europe	18-44 -	180
Merchant 2006	emergency department U.S.	18-55 mixed	570
Merchant 2007	emergency department U.S.	18-55 mixed	570
Peremans 2000	school health Europe	17 Belgian	26
Rickert 1999	reproductive health U.S.	15-40 mixed	150
Sangi-Haghpeykar 2006	reproductive health U.S.	18-50 Hispanic	443
Tessler 1997	college health U.S.	- mixed	336
Characteristics Associated with OC Knowledge (Cross-sectional)			
Gaudet 2004	pharmacy Canada	13-49 -	649
Hansen 2007	school health Europe	16-19 -	688
Little 2001	primary care Europe	18-45 -	636

STUDY	SETTING	AGE, RACE/ETHNICITY	SAMPLE SIZE
Associations Between OC Knowledge and Behavior (Cross-sectional)			
Moore 1996	adolescent health U.S.	14-19 mixed	345
Interventions to Change OC Knowledge (Prospective)			
Deijen 1997	primary care Europe	15-45 -	1239
Gilliam 2003	primary care U.S.	17-24 AA	43
Little 1998 ^b	primary care Europe	18-45 -	636
Smith 1995	primary care Europe	17-44 -	449
Knowledge-based Interventions to Change Behavior (Prospective)			
Gilliam 2004 ^b	primary care U.S.	15-25 AA	33

(OC) oral contraception. (-) indicates not specified. (AA) African American.

Table 2

Oral Contraceptive Knowledge Domains, by Purpose of Analysis

Study	# of Domains	Domain					
		RISKS	BENEFITS	SIDE EFFECTS	USE	EFFICACY	MOA
Descriptions of OC Knowledge							
Bryden 2001	4	*	*	*		*	
Davis 2006	6	*	*	*	*	*	*
Fletcher 2001	1				*		
Gaudet 2004	4	*	*	*	*		
Gilliam 2004	5	*	*	*	*	*	
Hansen 2007	3	*		*		*	
Kaskowitz 2007	2	*		*			
Little 1998	4	*		*	*	*	
Little 2001	4	*		*	*	*	
Merchant 2006	1				*		
Merchant 2007	1				*		
Peremans 2000	3			*	*	*	
Rickert 1999	0						
Sangi-Haghpeykar 2006	3		*		*	*	
Tessler 1997	4	*	*	*		*	
Associations Between OC Knowledge and Behavior							
Moore 1996	6	*	*	*	*	*	*
Interventions to Change OC Knowledge							
Deijen 1997	4	*	*	*	*		
Gilliam 2003	5	*	*	*	*	*	
Little 1998	4	*		*	*	*	
Smith 1995	2				*	*	
Knowledge-Based Interventions to Change Behavior							
Gilliam 2004	5	*	*	*	*	*	
NUMBER OF STUDIES MEASURING EACH DOMAIN		14	10	15	16	14	2

(OC) oral contraception. (MOA) mechanism of action.

Table 3

Specific Oral Contraceptive Knowledge Measurement Characteristics, by Purpose of Analysis

STUDY	METHOD OF MEASUREMENT	QUESTION FORMAT	# OF QUESTIONS	TECHNIQUES USED RELATED TO RELIABILITY & VALIDITY
Descriptions of OC Knowledge				
Bryden 2001	survey	open-ended, lists, Y/N	28	-
Davis 2006	interview	open-ended, multiple choice, Y/N, vignettes	74	pilot-testing, interviewer training, questionnaire based upon known content source, content expert review
Fletcher 2001	survey	open-ended, lists, multiple choice, Y/N	28	-
Gaudet 2004	survey	multiple choice, Y/N	16	-
Gilliam 2004	interview	open-ended	-	interviewer training, content expert review, triangulation, questionnaire based upon known content source
Hansen 2007	survey	multiple choice	15	-
Kaskowitz 2007	survey	T/F, lists, multiple choice	21	questionnaire based upon known content source
Little 1998	survey	open-ended, lists, multiple choice, Y/N	32	questionnaire based upon known content source, content expert review, test-retest reliability
Little 2001	survey & interview	open-ended, lists, multiple choice, Y/N	32	questionnaire previously used
Merchant 2006	survey	multiple choice, agree/disagree	4	pilot-testing
Merchant 2007	survey	multiple choice, agree/disagree	4	pilot-testing
Peremans 2000	survey & interview	-	5	interviewer training, triangulation
Rickert 1999	survey	T/F	10	pilot-testing
Sangi-Haghpeykar 2006	survey	T/F, lists multiple choice	14	-
Tessler 1997	survey	lists, multiple choice	49	questionnaire previously used and based upon known content source
Associations Between OC Knowledge and Behavior				
Moore 1996	survey & interview	multiple choice, no details	2	pilot-testing
Interventions to Change OC Knowledge				
Deijen 1997	survey	T/F, lists multiple choice, Y/N	-	questionnaire based upon known content source
Gilliam 2003	survey	T/F, multiple choice	10	pilot-testing
Little 1998	survey & interview	open-ended, lists, multiple choice, Y/N	32	questionnaire based upon known content source, content expert review,
Smith 1995	survey	-	-	-
Knowledge-Based Interventions to Change Behavior				
Gilliam 2004	survey	T/F	10	pilot-testing, questionnaire based upon known content source

(OC) oral contraception. (-) not specified.

Table 4

Examples of Oral Contraceptive Knowledge Questions, by Knowledge Domain

AUTHOR	QUESTION FORMAT	QUESTION STEM	ANSWER
EFFICACY			
Little 1998, 1998, 2002	multiple choice	If you forget to take your pill at the usual time, how late can you take it and still be protected from becoming pregnant?	a. 6 hours b. 12 hours c. 18 hours d. 24 hours e. 36 hours f. not sure
Moore 1996	likert	I am likely to get pregnant using the pill.	seven point scale ranging from very likely (+3) to very unlikely (−3)
Sangi-Haghpeykar 2006	alternate choice	Pills are more effective than sterilization.	T F
SIDE EFFECTS			
Bryden 2001	lists	Which are possible side effects of the pill? Circle all that apply	-increased blood pressure -increased risk of ovarian cancer -increased risk of ectopic pregnancy -increased risk of pelvic inflammatory disease -increased risk of cervical cancer -increased risk of breast cancer -nausea -weight gain
Davis 2006	alternate choice, open-ended	Are there any side effects to birth control pills that you know of? If yes, what are the side effects?	Y N Don't know
Gaudet 2004	multiple choice	If I notice bleeding at a time other than my normal period while taking the pill, I will:	a. continue taking the pill and not call my doctor b. continue taking the pill and call my doctor c. stop taking the pill d. I don't know
Moore 1996	likert	The pill is likely to decrease sexual pleasure because of feel, taste or smell.	seven point scale ranging from very likely (+3) to very unlikely (−3)
USE			
Merchant 2006, 2007	multiple choice	How often should someone take birth control pills?	1. once a day 2. once a week 3. once a month 4. once every 6 months 5. I'm not really sure
Sangi-Haghpeykar 2006	alternate choice	Women should periodically take a break from pill use.	T F