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# Effect of theory-based contraception comics on subjective contraceptive knowledge: a pilot study☆,☆☆,★

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ABSTRACT

*Objectives:* We assessed the effect on subjective knowledge of a pilot educational comic decision aid about contraceptive methods.
*Study design:* We designed four comics (www.birthcontroltales.com), each about a different contraceptive method choice. The comics employ a theoretical framework, and the methods addressed were injection, intrauterine device, implant and combined hormonal contraceptives (including pill, patch and ring). The study population included young women presenting to a college student health clinic whose preferred language is English. Participants had not used the contraceptive method described in the comic and viewed the comics in color printed copy. We assessed contraception subjective knowledge using a pretest/posttest six-question survey with Likert scale responses before and after exposure to the comics. Surveys conducted during the participants' visit also measured participant satisfaction with the comic and participant sexual history.
*Results:* A total of 120 individual participants divided into groups of 30 each viewed one of four separate comics. Across the four groups, the difference in the pretest/posttest scores of the six-question subjective knowledge survey indicated a 72% average increase (p value<.001).
*Conclusion:* Comics about contraceptive methods can be a communications tool that increases subjective knowledge of contraceptive methods. Comics that model contraceptive choice decision processes can increase individual subjective knowledge of the contraceptive method mechanism, effect, usage, side effects, feasibility and benefits. Possessing subjective knowledge of contraceptive methods can influence contraceptive initiation and use and therefore has potential implications for changing contraceptive attitudes and behavior.
*Implications:* Contraceptive method comics should be further examined in other clinic settings with broader demographic populations to glean the effect on patient decision and contraceptive behavior. Integration of the comics into a contraceptive counseling practice can be assessed in an observational trial. Additionally, studies should also consider testing long-term patient behavior, and both patient and provider satisfaction.


## 1. Background

Unintended pregnancy is defined as pregnancy that is either unwanted or mistimed and is often related to women's unmet need for consistent and effective contraceptive methods [1,2]. The risks of unintended pregnancy include harm on both maternal and fetal health [3]. In the United States, unintended pregnancy is declining overall due to the availability of contraceptives but is highest among women that are ages 18–29, black, less educated and poor [1]. The analysis by Frost et al. of data from a national survey of young adults (ages 18–29) elucidated the critical role of contraceptive method knowledge in unintended pregnancy prevention [4]. This research showed that consistent use of effective contraceptive methods relates to both subjective and objective knowledge of contraceptive methods [4]. Subjective knowledge of

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**Table 1**
Theoretical underpinnings for comic development

| Objective | Comic design | Comic content | Construct | Theoretical basis |
|---|---|---|---|---|
| Social Cognitive Theory | Contraceptive method decision empowerment | Interactive information about side effects, benefits | Bust myths and fears through the narrative comic | Situational learning |
| Social Cognitive Theory | Knowledge | Element of fun, learning from friends or peers | Modeling with peer experts and peer experiences | Observational learning |
| Health Belief Model | Inform individual consideration of contraceptive benefits compared to potential risks and side effects | Narrative persuasion | Embed the discussion of "effectiveness, feasibility, and other advantages…to prevent pregnancy"[8] benefits of contraceptive methods in a realistic scenario | Perceived benefits |
| Health Belief Model | Inform individual consideration of the possibility of pregnancy | Overarching theme of pregnancy as a choice | Portrayal of sexually active heterosexual women and real contraceptive effectiveness | Perceived threat |
| Health Belief Model | Audience of contraceptive seeking patients | NA | Models women successfully obtaining methods and overcoming side effects and risks | Perceived barrier |
| Elaboration Likelihood Model | Identification with character and topic involvement | Topic engagement | Issue involvement | Central processing |

contraceptive methods refers to someone's belief about their state of knowledge of contraceptive methods. For example, recognizing the typical use failure rate of the oral contraceptive pill to be 7% is an example of objective knowledge, whereas the belief that one knows how effective oral contraceptive pills are is an example of subjective knowledge [5]. Within the Health Belief Model (HBM) paradigm, subjective knowledge contributes to individuals' self- efficacy in contraceptive decisions as well as their understanding of perceived benefits and barriers [6]. Subjective knowledge correlates positively with decision confidence and with willingness to act, and can therefore contribute to contraceptive method uptake in a clinical setting [7,17]. Additionally, the HBM construct of perceived benefit can determine one's method choice based on knowledge of contraceptive method effectiveness [5,8].

Printed education materials that utilize cartoon images increase contraceptive knowledge across varying populations [9]. Compared to other health education communications efforts, comics are a viable strategy for subjective knowledge gain [10]. Comics are a type of health information edutainment, a communications strategy that combines entertainment and educational information to increase knowledge and to inform attitude and behavior [11]. Comics can boost topic engagement and influence young adults' knowledge, attitudes and perceptions about their sexual health [12–14].We evaluated participant satisfaction with a contraceptive comic and measured the comic's effect on subjective contraceptive knowledge among a convenience sample of women (18–29 years of age) recruited from a college student health clinic. We hypothesized that our educational comics would improve subjective knowledge about the featured contraceptive methods.

## 2. Methods

### 2.1. Comic design

We collaborated with an illustrator experienced in medical cartoons to create four comics with an average of 22 panels each (www.birthcontroltales.com) based on a behavioral health framework (Table 1). Stakeholder contributions informed the comic design and content, and each of the four digital comics focuses on one type of contraceptive method: injection, intrauterine device (IUD), implant and combined hormonal contraceptives (addressing pill, patch and ring). First, the PI, an obstetrician-gynecologist with experience in family planning settings, developed the IUD comic in collaboration with a medical education graphic artist. The IUD comic was tested in a small cohort of patients ($n$=5) and primary care physicians ($n$=5) to review the comic design, readability and narrative. These responses informed the development of the final four comics examined presently (unpublished). (See Figs. 1–3.)

Participants viewed the comics in color printed format. The comics include subject matter about contraceptive methods relevant for those seeking contraceptives within a narrative design [15]. These essential attributes, or knowledge domains, are effectiveness, mechanism, use, side effects and social norms [15]. A chart format proven to increase knowledge represented the relative method effectiveness [9]. Social Cognitive Theory (SCT) and HBM constructs were the basis for the comic content and narrative design. Specifically, the SCT constructs incorporated were outcome-expectation, self-efficacy, observational learning and modeling, cultural norms and knowledge through communication (Table 1) [8]. The HBM constructs applied were perceived risks, perceived barriers and perceived benefits [8]. These theoretical constructs are effective in contraceptive use (including barrier methods) interventions and unintended pregnancy prevention interventions [16].

### 2.2. Study design

The Obstetrics and Gynecology Department at the University of California Los Angeles (UCLA) conducted this study with UCLA institutional review board approval. We screened a convenience sample of patients


**Fig. 1.** Excerpt from IUD comic.

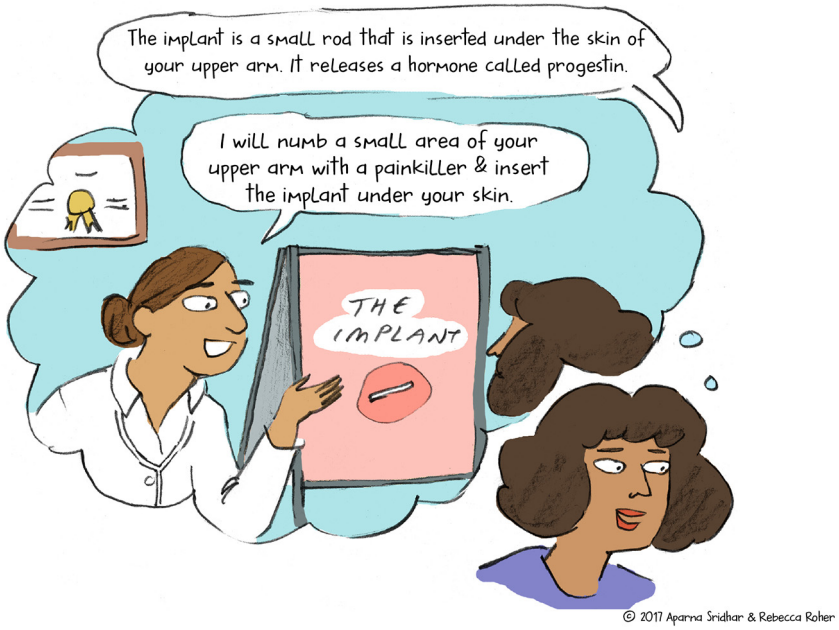


**Fig. 2.** Excerpt from implant comic.

presenting for reproductive health services at a college student clinic to participate. Eligible participants were 18–29-year-old heterosexual women with English as a preferred language. To detect an improvement with 80% power (p=.05, SD=2) in the mean subjective knowledge score using a paired *t* test, we used a sample of 120 individual participants divided into groups of 30 for the 4 separate comics.

Participants completed screening questions before viewing the comic. Screening questions about previous contraceptive use helped to ensure participants did not have experience with the contraceptive method featured in the comic they viewed. Once eligible, they completed demographic questionnaires and a contraceptive knowledge pretest. There was no time limit for reviewing the printed copy of the comic. After reading the comic, participants completed a contraceptive knowledge posttest. The subjective knowledge portion of the survey was designed to understand the overall perceived knowledge as well as the mechanism of action, usage, effectiveness, side effects and benefits of each method being tested in the comic. Additional survey questions in the postsurvey measured participant satisfaction with the comic, prior contraceptive use and descriptive demographic information (Table 2). The 15 satisfaction survey questions queried topics such as word clarity, length, and the perceived purpose and use of comic.

### 2.3. Statistical analysis

We evaluated the difference in participant subjective knowledge before and after exposure to the comics. The subjective knowledge categorical data were dichotomized then tested for difference between the two time points using a McNemar paired *t* test for each test question. Individual participants served as their own matched pair across the pre and post time points by employing the pretest scores as the control and the posttest as the intervention group. Subjective knowledge is

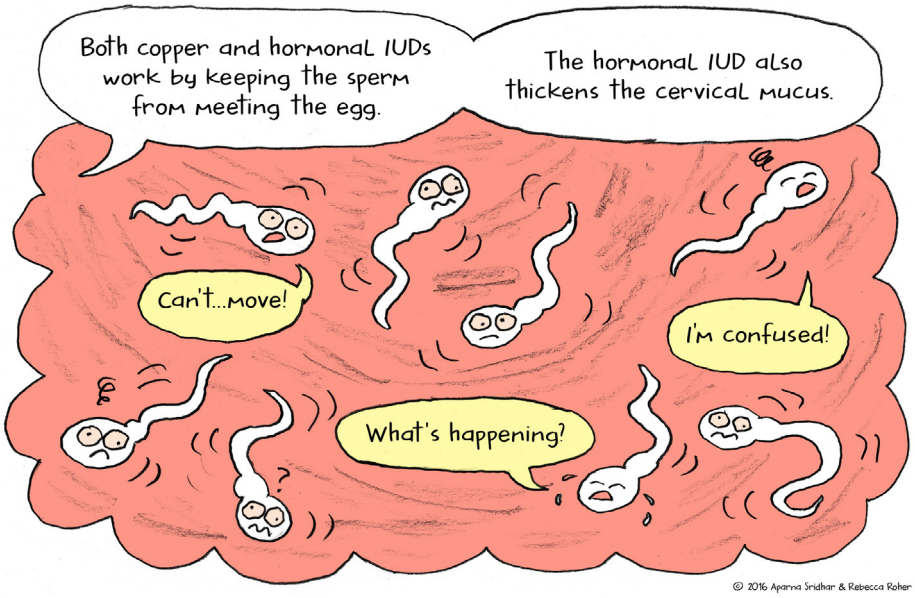


**Fig. 3.** Excerpt from the IUD comic describing mechanism of action.

**Table 2**
Participant demographics divided by contraceptive comic method study group

| Variable name | Injection ($n$=30) N (%) | IUD ($n$=30) N (%) | Implant ($n$=30) N (%) | Combined hormonal ($n$=30) N (%) |
|---|---|---|---|---|
| Age in years, mean (SD) | 21.8 (3.1) | 21.6 (2.2) | 21 (2.7) | 20.8 (2.5) |
| Ethnicity | | | | |
| Hispanic or Latina | 11 (36.7%) | 10 (33.3%) | 9 (31%) | 10 (34.5%) |
| Not Hispanic or Latina | 19 (63.3%) | 20 (66.7%) | 20 (69%) | 19 (65.5%) |
| Race | | | | |
| Native Hawaiian/Pacific Islander | 1 (3.3%) | 1 (3.4%) | 1 (3.3%) | 0 (0%) |
| Black/African American | 1 (3.3%) | 8 (27.6%) | 1 (3.3%) | 3 (23.3%) |
| White | 12 (40.0%) | 14 (48.3%) | 13 (43.3%) | 4 (13.3%) |
| Asian | 5 (16.7%) | 6 (20.7%) | 10 (33.3%) | 16 (53.3%) |
| Other | 11 (36.7%) | 0 (0%) | 5 (16.7%) | 7 (23.3%) |
| Education | | | | |
| Grade 12 or GED | 15 (50%) | 13 (43.3%) | 22 (73.3%) | 17 (56.7%) |
| Technical school | 1 (3.3%) | 1 (3.3%) | 1 (3.3%) | 0 (0%) |
| AA degree | 4 (13.3%) | 2 (6.7%) | 6 (20.0%) | 3 (10.0%) |
| College graduate | 6 (20.0%) | 10 (33.3%) | 1 (3.3%) | 7 (23.3%) |
| Postgraduate or Professional degree | 4 (13.3%) | 4 (13.3%) | 0 | 2 (6.7%) |

the percent that "agrees" or responds "I know about" the contraceptive method and is divided by time points (Table 4). All statistical analyses were performed in the R Statistical Computing Environment (R Development Core Team, 2007, [18]).

## 3. Results

Nearly 60% of the patients approached by study staff consented to participate, and 120 participants completed full surveys for analysis. The mean age of the participants was 21 years old (SD=2.5). The time spent reviewing the comics ranged from 4 to 13 min. As we conducted the study in our student health clinic, the majority of the participants were undergraduate (56%) and graduate (24%) students. Most participants identified themselves as Latina (33.9%), Asian (37.8%) and white (31.1%). Three (2.25%) of the participants reported a previous pregnancy. The most common prior contraceptive methods used across the sample were male condoms and the pill (Table 3).

### 3.1. Primary objective results

The pretest/posttest comparison indicates an increase of 71.6% on average in the overall participant contraceptive method subjective knowledge after exposure to the comic (p value<.001; Table 4). Perceived knowledge of domains of contraceptive mechanism, effect, usage, side effects, feasibility and benefits increased after reviewing the contraceptive comics (p value<.001–.013; Table 4). The increase in contraceptive side effect subjective knowledge was evident (p value<.001) for IUD (70%), injection (83.4%) and the implant (73.3%) methods. We did not measure this variable for the combined hormonal methods because they have varying usage patterns.

### 3.2. Secondary objective results

The responses to the participant satisfaction question "What best describes your general reaction to the comic?" indicate that more than 75% of the participants "really like" the comic. All participants agreed with the answer choice that the main purpose of the comic was "to inform women about contraceptive methods." More than 80% of the readers found the comics easy to understand with clear language. The majority (85%) of participants either "strongly liked" or "liked" the color scheme, images and layout of the comic.

## 4. Discussion

The pilot examination of educational contraceptive comics demonstrates their potential in contraceptive method education interventions. Future inquiry in educational contraceptive method decision support should build on these findings as well as the limitations of this study. While subjective knowledge gain is useful, our study results do not necessarily translate to the outcomes of retention of objective knowledge or contraceptive method behavior. Additional investigation of the subjective knowledge domains for combined hormonal contraception is warranted. Due to the exploratory nature of the study and the funding source, it was not feasible to collect information regarding retention of objective knowledge or eventual participant behavior. However, our comic can advance the extant empirical insight of the role of subjective knowledge and contraceptive use behavior applied as a foundation on which HBM and SCT theories can be adopted [6]. When a young woman considers her contraceptive method with confidence in herself and her understanding of the benefits, risks and outcomes, she is better able to make an informed decision [4]. The subjective knowledge acquired and behavior modeled from a contraceptive comic can contribute to the agency to discuss potential contraceptive options with peers and to seek contraceptive initiation.

Future application of this intervention should include other study populations. The present study population characteristics differ from those with higher proven unintended pregnancy risk that could benefit most [2]. Further work should also test the comic generalizability across languages to fulfill the needs of all community health settings. An additional audience-related limitation is the selection bias of the study participants.

**Table 3**
Prior contraceptive use by contraceptive comic method study group

| Prior contraceptive use | Injection group ($n$=30) N (%) | IUD group ($n$=30) N (%) | Implant group ($n$=30) N (%) | Combined hormonal group ($n$=30) N (%) |
|---|---|---|---|---|
| Implant | 4 (13%) | 6 (20%) | 0 | 3 (10%) |
| IUD | 7 (23%) | 0 | 5 (16%) | 7 (23%) |
| Injection | 0 | 4 (13%) | 3 (10%) | 1 (3%) |
| Pill | 16 (53%) | 19 (63%) | 13 (43%) | 0 |
| Ring | 1 (3%) | 1 (3%) | 1 (3%) | 0 |
| Patch | 0 | 0 | 1 (3%) | 0 |
| Male condom | 22 (73%) | 20 (66%) | 17 (56%) | 15 (50%) |

**Table 4**
Analysis of subjective knowledge domains survey scores by contraceptive method group

| Subjective knowledge domain* | Pretest (%) | Posttest (%) |
|---|---|---|
| **IUD** | | |
| Overall knowledge | 7 | 70 |
| Mechanism of action | 50 | 87 |
| Effectiveness | 60 | 97 |
| Use | 50 | 97 |
| Side effects | 27 | 97 |
| Benefits | 43 | 97 |
| **Implant** | | |
| Overall knowledge | 0 | 87 |
| Mechanism of action | 53 | 100 |
| Effectiveness | 60 | 100 |
| Use | 30 | 100 |
| Side effects | 20 | 93 |
| Benefits | 63 | 96 |
| **Birth control pill** | | |
| Overall knowledge | 10 | 73 |
| **Birth control ring** | | |
| Overall knowledge | 0 | 73 |
| **Birth control patch** | | |
| Overall knowledge | 3 | 77 |
| **Injection** | | |
| Overall knowledge | 0 | 70 |
| Mechanism of action | 23 | 93 |
| Effectiveness | 30 | 100 |
| Use | 33 | 97 |
| Side effects | 13 | 97 |
| Benefits | 30 | 93 |

* Subjective knowledge was measured with a five-item survey for the IUD, injection and implant, a one-item survey for the pill, patch and ring. All p values were <.05.

There may be "healthy worker bias" in a group of college-educated participants that are adapted to seeking reproductive healthcare.

The results of the present study yield insight into important direction for contraceptive method education and decision aid interventions. More than half of the study participants indicated that the best dissemination strategy for the comic is a combination of print media, a website and a mobile application. Keeping their suggestion in mind, we have developed a website (www.birthcontroltales.com) and mobile application links on the website to disseminate the comics free of cost. It is our hope that the educational tool we produced can support providers across many geographic areas with varying levels of access and resources to decrease unintended pregnancy rates.

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## References

[1] Singh S, Sedgh G, Hussain R. Unintended pregnancy: worldwide levels, trends, and outcomes. Stud Fam Plan 2010;41(4):241–50. https://doi.org/10.1111/j.1728-4465.2010.00250.x.

[2] Finer L, Zolna M. Declines in unintended pregnancy in the United States, 2008–2011. N Engl J Med 2016;374(9):843–52. https://doi.org/10.1056/NEJMsa1506575.

[3] McCrory C, McNally S. The effect of pregnancy intention on maternal prenatal behaviours and parent and child health: results of an Irish cohort study. Paediatr Perinat Epidemiol 2013;27(2):208–15. https://doi.org/10.1111/ppe.12027.

[4] Frost JJ, Lindberg LD, Finer LB. Young adults' contraceptive knowledge, norms and attitudes: associations with risk of unintended pregnancy. Perspect Sex Reprod Health 2012;44(2):107–16. https://doi.org/10.1363/4410712.

[5] Hadar L, Sood S, Fox CR. Subjective knowledge in consumer financial decisions. J Mark Res 2013;50:303–16. https://doi.org/10.1509/jmr.10.0518.

[6] Brown W, Ottney A, Nguyen S. Breaking the barrier: the health belief model and patient perceptions regarding contraception. Contraception 2011;83(5):453–8. https://doi.org/10.1016/j.contraception.2010.09.010.

[7] Hadar L, Sood S. When knowledge is demotivating: subjective knowledge and choice overload. Psychol Sci 2014;25(9):1739–47. https://doi.org/10.1177/0956797614539165.

[8] Hall KS. The health belief model can guide modern contraceptive behavior research and practice. J Midwifery Womens Health 2012;57(1):74–81. https://doi.org/10.1111/j.1542-2011.2011.00110.x.

[9] Steiner MJ, Trussell J, Mehta N, Condon S, Subramaniam S, Bourne D. Communicating contraceptive effectiveness: a randomized controlled trial to inform a World Health Organization family planning handbook. Am J Obstet Gynecol 2006;195(1):85–91. https://doi.org/10.1016/j.ajog.2005.12.053.

[10] Muzumdar JM, Pantaleo NL. Comics as a medium for providing information on adult immunizations. J Health Commun 2017;22(10):783–91. https://doi.org/10.1080/10810730.2017.1355418.

[11] Slater MD, Rouner D. Entertainment — education and elaboration likelihood: understanding the processing of narrative persuasion. Commun Theory 2002;12(2):173–91. https://doi.org/10.1111/j.1468-2885.2002.tb00265.x.

[12] Ingrand I, Verneau A, Silvain C, Beauchant M. Prevention of viral hepatitis C: assessment of a comic strip-based information campaign targeting adolescents. Eur J Pub Health 2004;14(2):147–50. https://doi.org/10.1093/eurpub/14.2.147.

[13] Carnaghi A, Candinu M, Castelli L, Kisner J, Bragantini C. The best way to tell you to use a condom: the interplay between message format and individuals' level of need for cognition. AIDS Care 2007;19:3 432–440. https://doi.org/10.1080/09540120600582013.

[14] Edgar T, Volkman JE. Using communication theory for health promotion: practical guidance on message design and strategy. Health Promot Pract 2012;13(5):587–90. https://doi.org/10.1177/1524839912450879.

[15] Wyatt KD, Anderson RT, Creedon D, Montori VM, Bachman J, Erwin P, et al. Women's values in contraceptive choice: a systematic review of relevant attributes included in decision aids. BMC Womens Health 2014;14(1):28. https://doi.org/10.1186/1472-6874-14-28.

[16] Lopez LM, Tolley EE, Grimes DA, Chen M, Stockton LL. Theory-based interventions for contraception. Cochrane Database Systs Rev 2013(8). https://doi.org/10.1002/14651858.CD007249.pub4 [Art. No.: CD007249].

[17] Flynn LR, Goldsmith RE. A short, reliable measure of subjective knowledge. J Bus Res 1999;46(1):57–66. https://doi.org/10.1016/S0148-2963(98)00057-5.

[18] R Core Team. R: a language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing; 2013.