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Improving Acne Vulgaris Knowledge in Adolescents: Computer-Based Tutorial versus
Handout

A Thesis Submitted to the
Yale University School of Medicine
In Partial Fulfillment of the Requirement for the
Degree of Doctor of Medicine

by

Ohenewaa Larbi Ahima

2010

Abstract

IMPROVING ACNE VULGARIS KNOWLEDGE IN ADOLESCENTS: COMPUTER-BASED TUTORIAL VERSUS HANDOUT

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Given the choice, adolescents would most likely prefer a computer-based tutorial (CBT) on acne vulgaris rather than a handout with the same information. The aims of the study were to assess pre- and post-test preference of either a handout or CBT on acne among adolescents, and to assess adolescents' knowledge of acne before and after the intervention. One hundred ten patients ages 13 to 17 participated in the study. All subjects completed a pretest questionnaire about preference of either a CBT or handout, and to assess baseline knowledge of acne. Subjects were then randomized to either the CBT or handout. Immediately after the intervention, subjects completed preference and acne knowledge questionnaires to assess change in knowledge. One month later a posttest was given and subjects completed the same acne knowledge questionnaire to assess knowledge retention. In the pretest sixty-seven percent of subjects preferred the CBT versus 33% for the handout ($p = 0.0006$). Posttest preference for the CBT was 68% versus 31% for the handout ($p = 0.0002$). Each group liked their medium of tutorial ($p = 0.085$). More subjects in the CBT group than the handout group felt the pictures were adequate ($p = 0.0003$). Likewise, more subjects in the CBT group than the handout group felt the tutorial was easy to understand ($p = 0.02$). Adolescent patients prefer to learn about acne with a CBT rather than a handout. Both CBT and handout tutorial are equally beneficial in significantly improving short- and moderate-term knowledge about acne among adolescent patients.

Acknowledgements

I would like to thank my mentor and thesis advisor, Richard Antaya, MD, for his encouragement, guidance and support from the beginning to the end, and for helping me to develop an understanding of the subject.

I am indebted to James Dziura Ph.D., M.P.H., without whom the statistical analyses of the data collected would have been impossible.

I thank my husband Rexford Ahima MD, my parents Patience and Samuel Larbi, and my siblings- Pauline Afua Brobbey, Yaw Opare Larbi MD, and Akosua Korantemaa Larbi- for their love and support throughout my studies in medical school.

To Michelle Gilbert Ph.D. and the late John Middleton Ph.D., Emeritus Professor of Anthropology, for being such wonderful and caring friends.

This thesis is dedicated to my children, Osei and Opare Ahima, for enriching my life and teaching me about the important things in life.

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Introduction

Acne vulgaris is the most common skin disease in the United States, affecting almost 85% of people ages 12-25 years old (1). Both males and females develop acne in approximately equal proportions (2). The age of onset of acne is between 10-14 years and usually resolves by age 20-25 years (2). However, there are some patients in whom acne persists into their 40s and 50s. Although acne is not a life-threatening condition it can lead to many psychosocial issues including depression, refusal to participate in social events, obsession with appearance, low self-esteem, and anger (3,4).

Success in treating acne depends on several factors including an accurate diagnosis, appropriate treatment, and most importantly patient adherence. The pathogenesis of acne is generally well-understood and is easy to diagnose. There are many effective treatment options for acne, including topical and oral medications. In spite of the ease of diagnosis and availability of treatment options, according to Hillary Baldwin, “a well-thought out acne regimen is only as good as the frequency with which it is used” (5). Nonadherence is one of the major reasons why acne treatments fail. The reasons for nonadherence are multifactorial including the nature of the disease itself, the treatment plan, the patient, and the clinician (5). The chronic nature of acne makes nonadherence a common occurrence. Adherence to multiple topical antibacterial treatments, for example, has been estimated at 20-30% in an observational study of patients with acne (6). Isotretinoin adherence is estimated to be 87.5% during the first treatment, but this number drops to 60.5% during subsequent treatments (6). Adolescents in particular are susceptible to nonadherent

behavior because they have limited experience with the health benefits of long-term compliance (5).

There are multiple ways of approaching the problem of nonadherence. These include taking the patients' preferences and lifestyle into consideration when choosing the drug regimen, education about how to use the medications, addressing expectations of treatment including the limitations, and dispelling misconceptions about acne. Adolescents' knowledge about acne is limited. One study showed that patients believed acne was caused by hormones, genetics, diet, poor skin hygiene, and infection (7). Forty-nine percent of patients surveyed in the study believed that acne was curable, 17% believed it was incurable, and 37% did not know. In spite of these misconceptions seventy-one percent of patients reported obtaining information about acne from their family physician, and others from sources including magazines (44%), television (44%), parents (31%), and friends (28%) (7). It therefore appears that adolescents' misinformation about acne is not due to lack of interest but rather that the information they receive is often inadequate and not applied (8,9).

Typical methods of patient education involve either physician-patient discussions or handouts, both of which are reasonably helpful. With many physicians having less time to spend with patients, there is an increasing dependence on handouts for patient education. Studies show that handouts are often not read by patients. In one study, of the 90% of women who received a patient package insert on the oral contraceptive pill, only 61% read it entirely (10). Research has shown that audiovisual presentations are considerably more effective than traditional methods of patient education in improving

patient knowledge (11). In a recent study, adolescents had significant improvement in knowledge about sun protection and acne after a one-hour computer-based tutorial (12). In another study, both audio-visual computerized presentation and a written handout showed significant increase in short and long-term knowledge in adolescent patients with acne (13). However, in the latter study, the computer tutorial was not interactive. Adding an interactive component could have potentially made the information being conveyed more interesting and effective. Since computer use is very common among teenagers in the United States an interactive electronic educational program on acne may be a better and more interesting way of delivering information than handouts in this population. This would also ensure that adolescents actually receive the intended information. There are a few tutorials and websites available on the internet for adolescents about acne but majority lack adequate information and are either developed by lay people or affiliated with pharmaceutical companies. There is a need therefore for an objective physician-developed tutorial to adequately inform adolescents about acne. Since adolescents have a relatively short attention span the tutorial will have to be interactive and engaging while still having the ability to answer common questions that patients have as well as to address the myths and misconceptions about acne.

Hypothesis and aims of study

The hypothesis for this study is that, when given the choice, adolescents ages 13-17 years would prefer an interactive computer-based tutorial (CBT) on acne rather than a handout with the same information.

The primary aims of the study were to (a) design a handout about acne vulgaris for adolescents ages 12-17. (b) To develop an interactive CBT on acne based on the information presented in the handout. (c) To determine whether adolescents prefer to learn about acne with an interactive CBT or a handout. (d) To assess baseline acne knowledge in adolescents and to assess the immediate posttest and one-month posttest acne knowledge acquired via the interactive CBT and handout. The secondary aim was to assess patient adherence to medication by self-report one month posttest.

Methods

Patients and setting

The study and all related materials were approved by the Yale School of Medicine Human Investigation Committee.

We recruited subjects from ages thirteen to 17 years old seen for treatment of acne vulgaris at Yale Dermatology Associates, and the Yale Adolescent Clinic at the Primary Care Center, New Haven, Connecticut, between February 2008 and September 2008. The subjects were either new or returning for follow-up. Informed consent to participate in the study was obtained from parents and informed assent from all the subjects. All enrolled subjects received a pretest consisting of demographic questions, preference of either a CBT or handout if given the choice, and 20 questions to assess baseline knowledge about acne (Appendix A). Upon completion of the pretest, subjects were randomized to receive either the CBT or the handout with the flip of a coin. A post test consisting of the same twenty questions was administered immediately after the intervention to determine if one medium was more effective than the other with conveying the same information (Appendix B). At this time the subjects were asked for feedback about the medium of education they received, including the educational format they would have preferred- CBT versus handout-, and whether they like to get feedback while learning (Appendices D and E). There were eleven questions on the evaluation of the CBT and handout in the form of a Likert scale (Appendices D and E). At approximately one after the intervention, we conducted a phone interview follow-up (one month follow up) which included the same twenty baseline questions as the pre- and

immediate post tests to determine retention of the information learned, as well as subjective questions to assess patient adherence to medications (Appendix C). The pretest, immediate post test, and one-month follow-up questionnaires were modifications of questions used in a prior study (13).

The design of the CBT and the handout incorporated strategies proven to be effective in maximizing the understanding of educational material such as writing at sixth to eighth grade reading level, including pictures, and simplifying our take-home messages about the causes and treatment of acne (5,14,15). The layout of the handout was done in a pamphlet form using Microsoft Publisher. The handout was designed to answer questions that adolescents may have about the causes of acne, and included two diagrams on the pathogenesis of acne. The questions included in the handout were: (I) What is acne? (II) Why should I care about acne? (III) Isn't acne something that only teenagers get? (IV) Is it true that junk food and dirty skin cause acne? (V) What makes acne worse? (VI) How is acne treated? (VII) How do I use these medications? (VIII) How should I care for my skin? (IX) What should I expect when using the medications? (X) How long does it take for the medications to work? (XI) Can acne be cured? These questions were chosen because we wanted to educate adolescents about the etiology of acne, the importance of seeking early treatment, and to address the common myths about acne. In addition, we wanted to provide adolescents information about the proper use of acne medications, expectations during treatment including the side effects, and the limitations of treatment. These topics are important since it has been suggested that improving patients' understanding of acne and its treatment could potentially increase medication adherence (6,16) .

The CBT was designed with the assistance of Yale Media Services. The narration of the CBT was a nearly verbatim reproduction of the information in the handout, but also included more pictures and two cartoon videos to show the etiology of acne, and the correct method of application of topical acne medication for the face. The design of the CBT featured an interactive portion where subjects got the opportunity to answer six questions with instant feedback. The questions were: (I) Only teenagers get acne. True or false? (II) That chocolate you ate yesterday gave you the pimple on your forehead today. True or false? (III) Applying acne medications over all areas that have ever had acne is the proper way to get rid of pimples. True or false? (IV) I have been using my acne medication for 3 weeks and my acne is worse. This means my medication is not working. True or false? (V) Acne medications are like magic potions that will make my skin look better overnight. True or false? (VI) Acne cannot be cured. True or false? These questions were chosen to reinforce the topics covered during the narration of the CBT.

We designed the images used in both the CBT and handout with the help of the medical illustrators at Yale Media Services.

Data Analysis

The pretest, immediate posttest, 1-month follow-up, and preference data were entered in Microsoft Excel. For the baseline subject characteristics in the pretest questionnaire, mean and standard deviation for age, knowledge about acne and self-assessment of acne severity were calculated in Microsoft Excel, and the results compared by t-test. The rest of the data for baseline subject characteristics were analyzed by chi-square test, with the statistically significant difference set at $P \leq 0.05$ level. Immediate Posttest evaluation of the CBT and handout were analyzed by chi-square test or the Mantel-Haenszel chi-square test with the statistically significant difference set at $P \leq 0.05$ level. The overall subject preference for the CBT and handout pretest and immediate posttest was analyzed by chi-square with the statistical significance set at $P \leq 0.05$ level. The preference for either the CBT or handout was further analyzed according to the two randomized groups using Fisher's exact test in GraphPad Prism, with the statistical significance set at $P \leq 0.05$ level. The total score and corresponding standard deviation for acne knowledge for pretest, immediate posttest, and 1-month follow-up were analyzed using GraphPad Prism by two-way ANOVA using repeated measures of analysis, with the statistically significant difference set at $P \leq 0.05$ level. The answers to the twenty individual questions in the pretest, immediate posttest, and 1-month follow-up questionnaires were analyzed by chi-square test, with the statistical significance adjusted using Bonferroni correction. The statistical significance was set at $P \leq 0.05$ level.

Results

One hundred ten subjects were recruited for the study. The pretest, immediate post test and preference questionnaires were completed by all 110 subjects. Six subjects were lost to follow up, and one parent asked for a subject to be removed from the study. For the 1-month follow-up, there was a total of 103 subjects.

There were no statistical differences in demographics between the CBT and handout groups (Table 1). The CBT group had 62 subjects, with 30 males and 32 females. The handout group had 48 subjects with 25 males and 23 females. The mean age for both groups was 15 ± 1.45 years. In the CBT group, 83% of the subjects were white, 8% black and 8% Hispanic. In the handout group, 83% were white, 4% black and 13% Hispanic. In the CBT group parents were cited as the primary source of information by 77% of the subjects. Other sources were physicians (74%), television (40%), magazines (37%), friends (37%), the internet (29%), school (24%), and relatives other than parents (19%). In the handout group physicians and parents were the primary source of information for 69% of the subjects. Other sources were television (50%), magazines (40%), the internet (35%), friends (21%), relatives other than parents (19%), and school (13%) (Table 1).

Even though subjects cited physicians as one of their primary sources of information, most of them did not feel they had adequate information about acne. Self-rated knowledge about acne in the CBT group was 2.68 ± 0.59 out of 4, and 2.5 ± 0.71 out of 4 in the handout group. In both groups, subjects' concern about acne seemed to be approximately one point higher than their self assessment of acne severity. Self-

assessment of acne severity in the CBT group was 1.7 ± 0.81 out of 4, whereas concern about acne was rated 2.6 ± 0.81 out of 4. In the handout group, subjects' self assessment of acne severity was rated 1.9 ± 0.84 , while concern about acne was rated 2.6 ± 0.86 out of 4 (Table 1).

Majority of patients in both groups had sought medical treatment for their acne before- 89% in the CBT group and 75% in the handout group (Table 1). This is because referrals from primary care physicians were the source of our pool of subjects.

The preferred medium for learning in both randomized groups pretest was the computer; 76% in the CBT group and 60% in the handout group (Table 1). Twenty-four percent of subjects in the CBT preferred reading printed material versus 38% in the handout group (Table 1). Majority of subjects in both groups- 55% in CBT group and 67% in handout group- chose reading and listening as their best mode of learning (Table 1).

Table 1: Baseline Subject characteristics

	CBT Group N = 62	Handout Group N = 48	P
Age (years)	15 ± 1.45	15 ± 1.45	1.0*
Sex (M/F)			
n	30/32	25/23	0.57
(%)	(48/52)	(52/48)	
Ethnicity (W/B/H)			
n	52/5/5	40/2/6	0.28
(%)	(84/8/8)	(83/4/13)	
Source of acne information			
• Magazines: n (%)	23 (37)	19 (40)	0.73
• Television: n (%)	25 (40)	24 (50)	0.29
• Internet: n (%)	18 (29)	17 (35)	0.45
• Parents: n (%)	48 (77)	33 (69)	0.51
• Other relatives: n (%)	12 (19)	9 (19)	0.87
• Friends: n (%)	23 (37)	10 (21)	0.04
• Physician: n (%)	46 (74)	33 (69)	0.68
• School: n (%)	15 (24)	6 (13)	0.07
Knowledge about acne: (rating 1-4)	2.68 ± 0.59	2.5 ± 0.71	0.15*
Self assessment of acne severity: (rating 1-4)	1.7 ± 0.81	1.9 ± 0.84	0.21*
Concern about acne: (rating 1-4)	2.6 ± 0.81	2.6 ± 0.86	1.0*
Previous medical care for acne: n (%)	55 (89)	36 (75)	0.27
Preferred medium for learning			
• Print: n (%)	15 (24)	18 (38)	0.08
• Computer: n (%)	47 (76)	29 (60)	0.17
• Other: n (%)	0	1 (2)	0.16
Best mode of learning			
• Reading: n (%)	13 (21)	8 (17)	0.52
• Listening: n (%)	15 (24)	8 (17)	0.27
• Reading and listening: n (%)	34 (55)	32 (67)	0.28

Values are mean ± standard deviation (SD) for age, knowledge about acne, and self-assessment of acne.
*Compared by t-test. The rest of the data was analyzed by chi square test.

Overall there was no statistical difference between the subjects randomized to the CBT and handout with regard to the demographics, source of information on acne, knowledge about acne, and preferred mode of learning.

Immediate posttest evaluation of both the CBT and the handout showed that majority of subjects like to get feedback while learning, even though there was not a statistical difference between the two randomized groups (Table 2). Subjects in either group generally believed that the tutorial they received helped them to understand the pathogenesis of acne, the pictures helped them to understand acne, made them feel they could take charge of their acne, and felt it prepared them to have a discussion with their dermatologist about the treatment options available (Table 2). Neither group felt the tutorial was too long or boring, and most subjects in either group answered that overall they liked the tutorial (Table 2). In spite of these similarities, there were two significant differences between the CBT and handout groups: Even though both groups of subjects generally agreed that the pictures in the tutorials helped them to understand acne, more subjects in the CBT group felt the number of pictures were adequate compared to subjects in the handout group ($p= 0.0003$) (Table 2). Likewise, more subjects in the CBT group than the handout group felt the tutorial was easy to understand ($p= 0.02$).

Table 2: Immediate Post-test evaluation of CBT and handout on acne

	CBT group N=62 n (%)	Handout group N=48 n (%)	p
Like to get feedback while learning?			
• Yes	54 (87)	39 (81)	0.723
• No	8 (13)	8 (17)	
Before the tutorial I did not know much about acne			
• Strongly agree	3 (5)	4 (8)	0.233 ⁱ
• Agree	19 (34)	18 (38)	
• Either agree or disagree	16 (26)	12 (25)	
• Disagree	18 (29)	14 (29)	
• Strongly disagree	4 (6)	0	
Tutorial helped me to understand acne			
• Strongly agree	18 (29)	13 (27)	0.708 ⁱ
• Agree	39 (63)	31 (65)	
• Either agree or disagree	5 (8)	3 (6)	
• Disagree	0 (0)	1 (2)	
• Strongly disagree	0 (0)	0 (0)	
Tutorial helped me to understand the treatment of acne			
• Strongly agree	13 (21)	11 (23)	0.409 ⁱ
• Agree	41 (66)	33 (69)	
• Either agree or disagree	56 (10)	4 (8)	
• Disagree	2 (3)	0 (0)	
• Strongly disagree	0 (0)	0 (0)	

ⁱ Mantel-Haenszel Chi-Square test was performed to get the p value.

Table 2 (Continued): Immediate Post-test evaluation of CBT and handout on acne

	CBT group N=62 n (%)	Handout group N=48 n (%)	p
Pictures helped me to understand acne			
• Strongly agree	13 (21)	9 (19)	0.148 ⁱ
• Agree	37 (60)	27 (56)	
• Either agree or disagree	11 (18)	5 (10)	
• Disagree	1 (2)	6 (13)	
• Strongly disagree	0	1 (2)	
There were not enough pictures			
• Strongly agree	0 (0)	4 (8)	0.0003 ⁱ
• Agree	3 (5)	12 (25)	
• Either agree or disagree	17 (27)	8 (17)	
• Disagree	28 (45)	21 (44)	
• Strongly disagree	14 (23)	3 (6)	
Tutorial was too long			
• Strongly agree	4 (6)	2 (4)	0.886 ⁱ
• Agree	7 (11)	8 (17)	
• Either agree or disagree	22 (35)	12 (25)	
• Disagree	24 (39)	24 (50)	
• Strongly disagree	5 (8)	2 (4)	
Tutorial was boring			
• Strongly agree	1 (2)	3 (6)	0.391 ⁱ
• Agree	9 (15)	4 (8)	
• Either agree or disagree	16 (26)	17 (35)	
• Disagree	31 (50)	22 (46)	
• Strongly disagree	5 (8)	2 (4)	
Tutorial was difficult to understand			
• Strongly agree	0 (0)	0 (0)	0.020 ⁱ
• Agree	0 (0)	1 (2)	
• Either agree or disagree	1 (2)	5 (10)	
• Disagree	31 (50)	26 (54)	
• Strongly disagree	30 (48)	16 (33)	

ⁱ Mantel-Haenszel Chi-Square test was performed to get the p value.

Table 2 (Continued): Immediate Post-test evaluation of CBT and handout on acne

	CBT group N=62 n (%)	Handout group N=48 n (%)	p
Tutorial made me feel I could take charge of my acne			
• Strongly agree	12 (19)	5 (10)	0.359 ⁱ
• Agree	29 (47)	26 (54)	
• Either agree or disagree	19 (31)	14 (29)	
• Disagree	2 (3)	3 (6)	
Strongly disagree	0 (0)	0 (0)	
Tutorial prepared me to have discussion about treatment choices with my dermatologist			
• Strongly agree	8 (13)	8 (17)	0.766 ⁱ
• Agree	25 (40)	18 (38)	
• Either agree or disagree	21 (34)	16 (33)	
• Disagree	8 (13)	6 (13)	
• Strongly disagree	0 (0)	0 (0)	
Overall I liked the tutorial			
• Strongly agree	15 (24)	7 (15)	0.085 ⁱ
• Agree	35 (56)	26 (54)	
• Either agree or disagree	11 (18)	13 (27)	
• Disagree	1 (2)	2 (4)	
• Strongly disagree	0 (0)	0 (0)	

The immediate post-test evaluations of CBT versus handout groups were analyzed by chi square test or Mantel-Haenszel Chi-Square test. Each group liked their medium of presentation of the tutorial. More subjects in the CBT group felt the pictures were adequate compared to subjects in the handout group. Similarly, more subjects in the CBT group than the handout group felt the tutorial was easy to understand.

ⁱ Mantel-Haenszel Chi-Square test was performed to get the p value.

Overall pretest subject preference for the CBT was significantly higher than that for the handout ($p= 0.0006$) (Table 3A). Likewise, overall immediate posttest preference for the CBT was significantly higher than for the handout ($p= 0.0002$) (Table 3A). In the pretest CBT group 73% of subjects preferred the computer and 27% preferred the handout. In the pretest handout group 60% preferred the computer and 40% preferred the handout. There was no statistical difference between these preferences in the pretest groups (Table 3B). Interestingly, analysis of subjects' preference immediately posttest showed a statistical difference between the two randomized groups ($p= <0.0001$). In the immediate posttest CBT group, preference for the computer increased to 89% with preference for the handout decreasing to 11%. In the immediate posttest handout group, however, the results of the preference were the opposite: Preference for the computer decreased to 41%, whereas preference for the handout increased to 56% (Table 3B).

Table 3A: Overall Subject Preference for CBT or handout before and immediately after acne knowledge test

Pretest			Immediate Post-Test		
Preference		P	Preference		P
N= 110			N= 110		
CBT	74 (67%)	0.0006	CBT	75 (68%)	0.0002
Handout	36 (33%)		Handout	34 (31%)	

Number and percentage of subjects preferring computer or handout tutorial on acne. Overall, more subjects preferred the CBT pretest than the handout ($p = 0.0006$). Preference for the CBT immediately posttest remained significantly higher than the handout ($p = 0.0002$). The results were analyzed by chi-square.

Table 3B: Preference for CBT or handout before and immediately after acne knowledge test according to randomized groups

Pre-Test			Immediate Post-Test				
Preference	Randomized Groups		P	Preference	Randomized Groups		P
	CBT Group (N= 62)	Handout Group (N= 48)			CBT Group (N= 62)	Handout Group (N= 48)	
CBT	45 (73%)	29 (60%)	0.07	CBT	55 (89%)	20 (41%)	<0.0001
Handout	17 (27%)	19 (40%)		Handout	7 (11%)	27 (56%)	

Number and percentage of subjects preferring CBT or handout on acne. There was no significant difference in the pretest preference between the two groups. For the immediate posttest preference, there was a significant difference in the preference between the two randomized groups ($p < 0.0001$). In the pretest, subjects in the handout group had a higher preference for the CBT. However, for the immediate posttest, the results were the opposite with preference for the handout higher than the CBT in the handout group. The results were analyzed by Fisher's exact test.

Analysis of acne knowledge pretest, immediate posttest and 1-month follow-up shows that knowledge about acne increased significantly compared to pretest whether the tutorial was administered via computer or handout ($P=0.01$). The subjects significantly improved their knowledge about acne immediate posttest and the information acquired was retained after more than 1 month in both groups ($P < 0.0001$). However, there was no significant difference between the scores for the interactive CBT and the handout at all three time points (Tables 4A & 4B; Figure 1).

Table 4A: Acne Knowledge Testing- Total Score

	CBT Group			Handout Group		
	Pretest (N=62)	Immediate Post-test (N=62)	1-Month Follow-up (N=57)	Pretest (N=48)	Immediate Post-test (N=48)	1-Month Follow-up (N=46)
Total Score	13.5 ± 2.8	18.2 ± 1.8	17.1 ± 2.1	12.7 ± 2.7	17.4 ± 2.9	16.6 ± 2.6

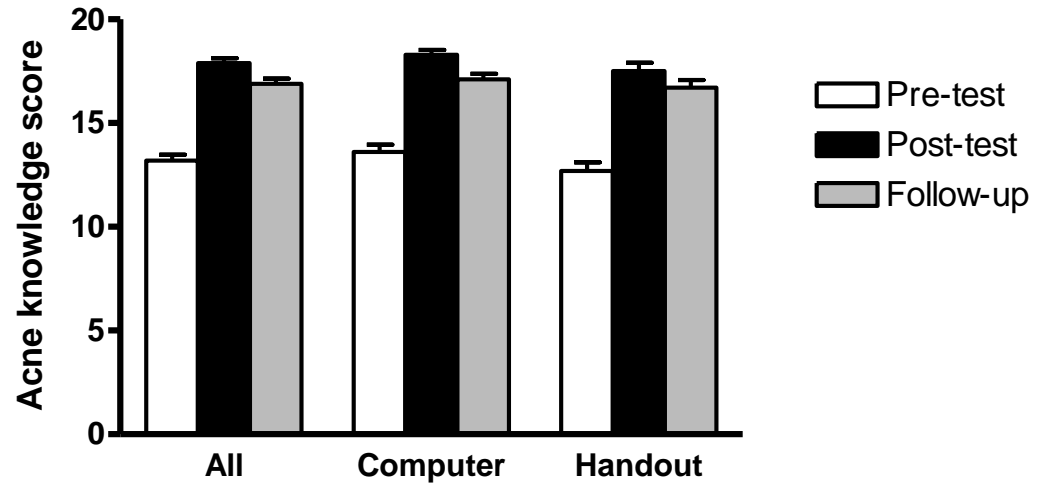
Total Acne Knowledge Score +/- SD for CBT and handout groups.

Table 4B: Acne Knowledge Testing- Total Score Analysis

Source of Variation	P value
Difference in scores between CBT and Handout	0.88
Mode of Test (CBT versus Handout)	<i>0.01</i>
Time	<i>P<0.0001</i>

The total score +/- SD was analyzed by Two-Way ANOVA using Repeated Measures of Analysis. Results are from an unweighted means analysis since mean data was used and sample sizes were not the same in all groups. The results show that (1) Knowledge about acne increased significantly whether the tutorial was administered via computer or handout ($p= 0.01$). (2) Subjects gained significant knowledge about acne immediate posttest and the information was retained after 1 month in both groups ($p<0.0001$). (3) There is no significant difference between the scores for the CBT and handout tutorial at all three time points ($p= 0.88$).

Figure 1: Acne Knowledge Score Pretest, Immediate Posttest, and 1-Month Follow-Up



Acne knowledge significantly improved immediately after the intervention, and information learned was retained after one month.

Fifty percent of the subjects in the CBT group and 46% in the handout group correctly identified bacteria as one cause of acne in the pretest questionnaire. The next most popular answer in both groups about the cause of acne in the pretest was diet. Majority of subjects in either group pretest believed that hormones have an effect on oil production in the pores. Even though most subjects knew that tension, worry or stress could make acne worse in the pretest (77% in CBT and 69% in handout groups) only 51% of the subjects in the CBT group and 38% in the handout group answered in the pretest that food did not worsen acne (Table 5).

With respect to the importance of using prescribed medication regularly, majority of the subjects in the pretest in either group answered that it was very important. Most subjects in both groups also correctly answered in the pretest that acne medications work by preventing the plugging of pores and killing bacteria in the pores (89% in CBT group and 83% in handout group). Majority of subjects in the CBT (81%) and handout (79%) groups in the pretest correctly believed that a pea-sized amount of medication is usually enough for the entire face. In the pretest question about the length of time it takes for acne medications to maximally work, most subjects in both groups expected it to take two months or more (85% of subjects in CBT group and 90% in handout group) (Table 5).

One question was about how whiteheads and blackheads are formed. In the pretest question, 55% of subjects in the CBT tutorial correctly answered they were caused by the pore getting clogged with oil and sticky skin cells, while 44% of subjects in the handout group got the correct answer. The next most popular choice in the pretest answer was

that they are formed as a result of dirt getting clogged in the pores. Similarly subjects in both CBT and handout groups generally did not know in the pretest that the cause of the color of blackheads was the color of skin cells, even though more subjects in the CBT group correctly answered the question than in the handout group (adjusted $p = 0.01$) (Table 5).

For the pretest, only 6% of subjects in the CBT group and 10% in the handout group correctly answered that washing the face could make acne worse. More subjects in the CBT group for both the immediate posttest (64%) and 1-month follow-up (61%) correctly answered the same question than did subjects in the handout group with 33% for the immediate posttest and 37% for the 1-month follow-up (adjusted $p = 0.0002$ immediate posttest; adjusted $p = 0.01$ one-month follow-up) (Table 5).

Only twenty-nine percent of subjects in the CBT group and 19% in the handout group correctly answered the pretest question that acne cannot be cured. For the immediate posttest answer to the same question, there was a statistical difference with more subjects in the CBT group (97%) than the handout group (75%) getting the correct answer (adjusted $p = 0.0001$) (Table 5).

Table 5: Answers to Individual Questions

Question		CBT		Handout		P value
		Percentage Correct	Percentage Incorrect	Percentage Correct	Percentage Incorrect	
1 Pretest	One cause of acne is	50	50	46	54	0.571
1 Immediate Post Test		87	13	85	15	0.683
1 One-month Follow Up		74	26	76	24	0.744
2 Pretest	Where does acne form?	71	29	60	40	0.102
2 Immediate Post Test		84	16	83	17	0.85
2 One-month Follow Up		84	16	83	17	0.85
3 Pretest	Acne is commonly found on what areas of the body?	100	0	100	0	0
3 Immediate Post Test		100	0	100	0	0
3 One-month Follow Up		100	0	98	2	0.155
4 Pretest	When taking medication for acne, how important is it to use the medicine regularly?	98	2	96	4	0.407
4 Immediate Post Test		97	3	98	2	0.651
4 One-month Follow Up		100	0	98	2	0.155
5 Pretest	Whiteheads and blackheads form when:	55	45	44	56	0.12
5 Immediate Post Test		97	3	87	13	0.009
5 One-month Follow Up		81	19	80	20	0.858
6 Pretest	The dark brown or black color of blackheads is from:	20	80	4	96	0.0005*
6 Immediate Post Test		72	28	67	33	0.442
6 One-month Follow Up		37	63	35	65	0.768

Percent correct scores analyzed by chi-square. P value adjusted using Bonferroni correction. * Statistically significant.

Table 5 continued: Answers to Individual Questions

Question		CBT		Handout		P value
		Percentage Correct	Percentage Incorrect	Percentage Correct	Percentage Incorrect	
7 Pretest	A large deep pimple is called a:	53	47	50	50	0.777
7 Immediate Post Test		85	15	90	10	0.285
7 One-month Follow Up		71	29	74	26	0.635
8 Pretest	Hormones have an effect on the production of oil in the pores. True/False?	95	5	94	6	0.757
8 Immediate Post Test		98	2	100	0	0.155
8 One-month Follow Up		96	4	98	2	0.407
9 Pretest	Whiteheads and blackheads become red, swollen and painful because of:	81	19	85	15	0.451
9 Immediate Post Test		90	10	90	10	1.000
9 One-month Follow Up		86	14	83	17	0.558
10 Pretest	What can make acne worse?	77	23	69	31	0.203
10 Immediate Post Test		98	2	98	2	1.000
10 One-month Follow Up		100	0	98	2	0.155
11 Pretest	What does <i>not</i> make acne worse?	51	49	38	62	0.064
11 Immediate Post Test		90	10	89	11	0.818
11 One-month Follow Up		93	7	87	13	0.157
12 Pretest	How common is acne?	61	39	45	55	0.023
12 Immediate Post Test		95	5	94	6	0.757
12 One-month Follow Up		96	4	91	9	0.152

Percent correct scores analyzed by chi-square. P value adjusted using Bonferroni correction. * Statistically significant.

Table 5 continued: Answers to Individual Questions

Question		CBT		Handout		P value
		Percentage Correct	Percentage Incorrect	Percentage Correct	Percentage Incorrect	
13 Pretest	Acne medications work by:	89	11	83	17	0.221
13 Immediate Post Test		97	3	85	15	0.003
13 One-month Follow Up		81	19	93	7	0.012
14 Pretest	Washing your face can worsen your acne. True/False?	6	94	10	90	0.297
14 Immediate Post Test		64	36	33	67	0.00001*
14 One-month Follow Up		61	39	37	63	0.0007*
15 Pretest	Treating acne may prevent scarring. True/False?	87	13	83	17	0.428
15 Immediate Post Test		92	8	87	13	0.249
15 One-month Follow Up		82	18	85	15	0.567
16 Pretest	Sun-tanning is good for acne. True/False?	69	31	79	21	0.107
16 Immediate Post Test		98	2	100	0	0.155
16 One-month Follow Up		98	2	93	7	0.088
17 Pretest	Acne can be cured. True/False?	29	71	19	81	0.099
17 Immediate Post Test		97	3	75	25	0.000007*
17 One-month Follow Up		81	19	72	28	0.133
18 Pretest	Only acne patients have bacteria in their pores. True/False?	100	0	96	4	0.043
18 Immediate Post Test		97	3	96	4	0.700
18 One-month Follow Up		98	2	93	7	0.088

Percent correct scores analyzed by chi-square. P value adjusted using Bonferroni correction. * Statistically significant.

Table 5 continued: Answers to Individual Questions

Question		CBT		Handout		P value
		Percentage Correct	Percentage Incorrect	Percentage Correct	Percentage Incorrect	
19 Pretest	A pea-sized amount of medication is usually enough for the whole face. True/False?	81	19	79	21	0.724
19 Immediate Post Test		100	0	92	8	0.004
19 One-month Follow Up		93	7	91	9	0.620
20 Pretest	How long does it usually take for acne medicine to maximally improve acne?	85	15	90	10	0.285
20 Immediate Post Test		93	7	98	2	0.088
20 One-month Follow Up		91	9	93	7	0.620

Percent correct scores were analyzed by chi-square test. P value was adjusted using Bonferroni correction (P value was multiplied by factor of 20). * Statistically significant p value after Bonferroni correction.

Even though prior to administration of the tutorial both the CBT and handout groups generally did not know the cause of the black or brown color of blackheads, the pretest score for the CBT group was significantly higher than that for the handout group (adjusted p value =0.01). More subjects in the CBT group for both the immediate post test and 1-month follow-up correctly answered the question about whether washing the face could worsen acne than did subjects in the handout group (adjusted p value =0.0002 post test; adjusted p value =0.01 follow up). Similarly, there was a significant difference in the immediate post test answer for whether acne can be cured- the CBT group correctly answered this question more than the handout group (adjusted p value =0.0001).

Subjects' adherence to their acne medication regimen was also assessed by self-report during the 1-month follow-up phone call. Out of the fifty-seven subjects called in the CBT group, 38 (67%) of them reported not missing any doses of their medication in the preceding 2 days before the phone call. Eleven subjects (19%) had missed 1 dose of medication, and 5 subjects (9%) had missed 2 doses of medication in the same time period (Table 6A). Twenty-two subjects (39%) reported not missing any medication doses in the preceding one week prior to the phone call. This was a significant decrease in self-reported medication adherence compared to adherence reported in the two days preceding the phone call ($p=0.007$). Thirteen subjects (23%) reported they had missed 1 dose, 13 subjects (23%) had missed 2 doses, 2 subjects (4%) had missed 3 doses, 2 subjects (4%) had missed 4 doses, 1 subject (2%) had missed 5 doses, and 1 subject (2%) had missed 6 doses of medication within the same one-week period (Table 6B).

Forty-six subjects were called for the 1-month follow up in the handout group. Thirty-two subjects (70%) reported not missing any doses of their medication in the 2 days preceding the phone call. Seven subjects (15%) reported missing 1 dose, 1 subject (2%) reported missing 2 doses, and 1 subject (2%) reported missing 3 doses of medication in the same time period (Table 6A). Twenty-one subjects (46%) reported not missing any doses of their medication in the one week preceding the phone call. This was a significant decrease in self-reported medication adherence compared to adherence reported in the two days preceding the phone call ($p=0.03$). Ten subjects (22%) reported they had missed 1 dose, 6 subjects (15%) reported missing 2 doses, 2 subjects (4%) reported missing 3 doses, 1 subject (2%) reported missing 4 doses, and 1 subject (2%) reported missing 6 doses of medication within the same one-week period (Table 6B).

The most common reason cited in both CBT and handout groups for missing doses was forgetfulness. Some subjects also reported difficulty with using their topical medications especially at night due to fatigue. Other reasons mentioned for missing doses were rushing for school in the mornings, being busy after school and, for subjects on oral medications especially antibiotics, the inconvenience of having to take medications with meals. In the CBT group, one subject reported using the medication only with worsening acne, and another mentioned having to use their topical medication every other day due to skin irritation.

Table 6A: Self-reported medication adherence in the two days preceding 1-month follow up phone call

Number of doses Missed	CBT Group N= 57 n (%)	Handout Group N= 46 n (%)	P
0	38 (67%)	32 (70%)	0.797
1	11 (19%)	7 (15%)	0.471
2	5 (9%)	1 (2%)	0.035
3	0	1 (2%)	0.157
4	0	0	1
5	0	0	1

Percentage analyzed by chi-square. Majority of subjects in either group reported not missing any dose of medication in the 2 days preceding the 1-month follow up phone call. There was a statistical difference between the percent of subjects in the CBT and handout groups who reported missing 2 doses of medication ($p=0.035$). No subject(s) in either group missed more than 3 doses during this 2-day time period.

Table 6B: Self-reported medication adherence in the one week preceding 1-month follow up phone call

Number of doses Missed	CBT Group N= 57 n (%)	Handout Group N= 46 n (%)	P
0	22 (39%)	21 (46%)	0.448
1	13 (23%)	10 (22%)	0.882
2	13 (23%)	6 (15%)	0.194
3	2 (4%)	2 (4%)	1
4	2 (4%)	1 (2%)	0.414
5	1 (2%)	0	0.157
6	1 (2%)	1 (2%)	1
7	0	0	1
8	0	0	1
9	0	0	1
10	0	0	1

Self-reported medication adherence in the week prior to the 1-month follow up phone call was significantly lower in both groups compared to adherence in the 2 days prior to the phone call ($p= 0.007$ for CBT group; $p= 0.03$ for handout group). There were no statistical differences between the two groups in self-reported medication adherence during the one week prior to the follow up phone call. No subject(s) reported missing more than 6 doses of medication within the stated time period.

Discussion

To the best of our knowledge, this is the first study to evaluate the preference of adolescents to learn about acne vulgaris with either an interactive CBT or a handout. Previous studies (12,13) have shown that adolescents' knowledge about acne improved significantly after they were given a tutorial on the subject either on a computer or in a handout form. However in one of the studies (13) pretest subject preference for a computer tutorial was mentioned but not formally assessed.

Our research shows that most adolescents had a significant pretest and immediate posttest preference for the interactive CBT than the handout to learn about acne. This finding is not surprising since computer use is common among youth in the US (17). However, even though immediate posttest preference for the interactive CBT increased in the group randomized to the computer (73% pretest to 89% immediate posttest), there was an increase in the posttest preference for the handout in the handout group (40% pretest to 56% immediate posttest). It is this shift in preference for the handout within the handout group that accounted for the significant difference in the immediate posttest difference in preference between the two groups. This finding was contrary to our expectation since it appears that in spite of the overwhelming preference for the interactive CBT, subjects who got the handout in our study were not concerned as much about the medium of acne education they received as they were about the actual content of the medium.

This finding is generally reflected in the subjects' posttest evaluation of both media. Subjects randomized to either group generally believed that the tutorial helped them to better understand the pathogenesis of acne and its treatment, and they also felt it prepared

them to have a discussion with their doctor about acne. Subjects generally did not feel that either tutorial was too long or boring. Most subjects responded that overall they liked the tutorial they received.

There were two important significant differences in preference between the two groups which could aid in the future design of either an interactive CBT or a handout. Subjects in the handout group felt there were not enough pictures in the handout whereas subjects who got the CBT generally felt the pictures were adequate. In addition, more subjects in the CBT group than the handout group felt the tutorial was easy to understand. The narration of the CBT was nearly verbatim of the text in the handout. As was mentioned previously, the handout contained only 2 sets of pictures both of which were on the pathogenesis of acne. The interactive CBT contained significantly more pictures as well as 2 video cartoons. One video explained the pathogenesis of acne and the other instructed subjects on how to apply topical acne medications to the face. These differences could have made the interactive CBT easier for subjects to understand the information presented. In addition, this could have potentially affected the way in which subjects in the handout group answered particular questions on the acne knowledge test as will be discussed later.

Our study shows that subjects gained significant knowledge in acne immediately after either intervention. More importantly, this information was retained a month after the intervention. Similar results have been reported in previous studies on acne education (12,13). The lack of a significant difference in the actual scores between the two groups at all three measured time points indicates that the medium used for education about acne

in adolescents may not be relevant, provided patients are given the opportunity and actually take the time to read or watch a tutorial. This has been shown in a study evaluating the impact of either a multimedia presentation or a handout on nocturnal enuresis in children (18).

This finding highlights the general importance of effective patient education regardless of the medium used. None-the-less, since handouts are often not read by subjects (10) and lack the ability to be interactive, a quality which may be unappealing to adolescents in particular due to the unidirectional nature (19), a CBT may still be an overall better way of educating adolescent subjects about acne. Studies show that visual media can have a positive impact on patient comprehension and adherence to medical treatment (20). In this study by Wilhelm et al, informed consent from patients undergoing laparoscopic cholecystectomy improved significantly with the addition of a multimedia DVD presentation with all the relevant information for preoperative patient education (20).

The use of a CBT on acne such as the one for this study has several advantages and could be used in many ways. First, it would be designed and developed by medical professionals with the expertise and current knowledge about acne including its treatment as well as the factors that need to be addressed to improve patient adherence. This is particularly important since even though there may be information about acne currently available to adolescents on the internet especially, some of this information is inaccurate since it is not written by medical professionals, and may also be biased towards a particular drug manufacturer's product. Adolescent subjects regard their physician as a credible source of health information (19). Therefore a tutorial on acne developed by

dermatologists would be more trusted especially by this population. The added advantage of this is that physicians would be able to direct adolescent subjects to the appropriate place to obtain the information they need about acne. Studies (19,21) show that adolescents are receptive of health professionals using their experience to guide them to good sources of health information available on the internet due to their inability to often find relevant or adequate health related information pertinent to a particular question they may have.

The second advantage of having a CBT about acne as mentioned previously is that it can be made available to the internet, which would make it readily available to adolescent subjects regardless of location. That way the education is not limited only to patients who happen to be in a doctor's office and some patients who access this information could be prompted to see a physician sooner rather than later for treatment. This is particularly important since research shows that most patients tend to wait for a considerable length of time before seeking medical attention for their acne (7). The interactive nature and simplicity of medical language used in the CBT would make it even more effective since research has shown that well-written but easy-to-read-and-understand patient educational materials increase the likelihood that patients would use them (15,22).

Making the computer tutorial available either on the internet or on a computer in the waiting room of a clinic has the added benefit of parents being able to watch the tutorial along with their children. Since parents are one of the primary sources of adolescents' information about acne, and since misconceptions and myths about acne are very

common among both adolescents and adults, being able to simultaneously educate both generations could be a potentially helpful tool to increase patient adherence and alleviate some of the psychosocial issues caused by acne.

It appears there may be a connection between sight and sound with respect to knowledge acquired particularly in the interactive CBT group. There were two specific questions in the acne knowledge test in which there was a significant difference in the answers given by subjects in either group which could highlight this connection. For the true or false question about whether washing the face could make acne worse, subjects in the CBT group scored significantly higher immediate posttest ($p= 0.0002$) and 1-month follow up ($p= 0.01$) than subjects in the handout group. In the CBT, there was one page explaining some of the things that could worsen acne, including hard scrubbing of the face with a corresponding cartoon of a person scrubbing his face. For the true or false question on whether acne can be cured, subjects in the CBT group again scored significantly higher immediate posttest ($p= 0.0001$) than subjects in the handout group. Similarly, there were two specific pages in the CBT dedicated to this topic. The first was an interactive question asking subjects to answer true or false to the statement that acne can be cured. The second page in the CBT explained in more detail the fact that acne cannot be cured but it can be controlled with medications.

The correlation between the statistical difference in the answer to these two questions by the CBT and handout groups and the presence, or lack thereof, of images and sound could be used to improve on the design of the interactive CBT especially. In addition, as mentioned previously subjects who got the CBT felt there were enough pictures in the

CBT and also reported that the tutorial was easy to understand. Rather than being mostly a narrative interspersed with a few interactive questions, the entire CBT could be made up of interactive questions with further explanation given after patients answer each question using pictures and/or cartoons and/or videos as necessary. This may be a more engaging and effective way of educating adolescents about acne than passively watching and listening to a tutorial on the computer. In addition, if a handout is the only option available, it could be made more interesting and potentially easier to understand by substituting most of the text with pictures or cartoons with short explanatory captions.

The results of our study reveal that myths about acne continue to persist in the adolescent population even though majority of subjects identified their physician as a primary source of information about acne. At baseline, 50% of subjects in the CBT group and 46% in the handout group correctly identified bacteria as one cause of acne. The next most popular answer for the cause of acne was diet. Half of the subjects in the CBT group and a little over a third of the subjects in the handout group answered that food did not make acne worse.

The relationship between diet and acne has been and continues to be debated. In our study we addressed it as one of the myths; however, a recent study (23) suggests that there may be a relationship between diet and acne. The study, which was a review of the literature, suggests parts of Western diets especially dairy products may be associated with acne (23). The hormonal effects of parts of the diet, such as the glycemic index level and fat or fiber intake, may be responsible for the effect of diet on acne (23). There

is inconclusive evidence that chocolate causes acne, and there has been no relationship between either salt or iodine and acne (23).

Majority of subjects in either group answered that stress could make acne worse. In addition, majority of subjects at baseline believed that the color of blackheads was from dirt. These findings correspond with previous research (24), which showed that subjects believed acne was caused by stress, diet and poor skin hygiene.

Perhaps, more reassuring is the fact that at baseline most subjects in our study in either group knew how acne medications work and recognized the importance of using prescribed medications regularly. Majority of subjects were also aware of how much topical medication had to be applied particularly on the face. They were also generally aware that it takes two months or more after initiation of treatment to begin to see improvement in acne. In spite of this awareness, however, most subjects initially believed that acne could be cured. This belief has been previously reported (7,25)

These findings reinforce the need for adolescent education about acne. Even with all the advantages of an interactive CBT or a handout, neither can replace the importance of actual contact between adolescent subjects and their medical provider. The importance of patients' contact with a healthcare provider in addition to having access to education materials has been shown in previous research (26,27). A tutorial would therefore be one of the helpful educational tools a healthcare provider could use to help improve patient comprehension about acne and more importantly to hopefully increase medication or treatment adherence.

Limitations

In our study, adherence was based on self-report by subjects during the follow-up phone call. The reasons cited by subjects for nonadherence- forgetfulness, inconvenience, side effects- have been shown in other studies about adherence in acne (5,16,28,29). This method of assessing patient adherence, even though convenient and inexpensive, can be biased since it is subjective (30). Also, our assessment of adherence was done one month after subjects had been seen in the doctor's office, which is a relatively short period of time to accurately assess patients' adherence in a chronic disease such as acne. Research shows that adherence assessed soon after an intervention may not be reflective of long-term behavioral change in patients since adherence generally decreases with time (31,32). Even though adherence is important, a more important assessment would be if the increased knowledge translates into better clinical outcomes. Since there was no statistical difference in knowledge acquired between the two groups, it would be surprising if there was a difference in adherence either.

In our assessment of patient preference we used subjects who were randomized to either the CBT or the handout. In order to better assess preference only, subjects should have been given both the computer and handout tutorials, which would require more time. This was difficult to do in the clinic setting since our subjects typically had afternoon clinic appointments due to school and often had other activities to attend immediately after their clinic visit. As such most subjects and their parents were willing to participate in the study only if it did not lengthen their clinic visit. A better place to assess preference may be in a school setting as was done in a previous study (12). In addition this would have made the assessment of knowledge acquisition impossible in this study.

The design was adopted in order to assess both facets of the comparison. It would certainly be advantageous to assess these outcomes in separate studies.

Another limitation in our study is the sample size. We recruited one-hundred ten subjects, with complete data on 103 subjects. Such a relatively small number of subjects may have affected our randomization and the subsequent results. In addition, majority of the subjects were recruited from Yale Dermatology Associates, a private practice-modeled academic referral center, and may not be an accurate representation of the general adolescent population.

Majority of subjects in the study had also previously sought medical care for their acne, which could account for the relatively high pretest score on the acne knowledge test. This result could therefore not be an accurate assessment of baseline knowledge about acne in the general adolescent population. Perhaps it would be more accurate to recruit first-time adolescent patients to better assess the baseline knowledge of acne and subsequent effect of either tutorial on the acquisition of knowledge about acne.

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Appendix A: Perception of Acne Questionnaire- Pretest

Please print your first name:

What is your date of birth? (mm/dd/yyyy)

____/____/____

Which category best describes your ethnicity/race?

- White
 African-American or Black
 Asian
 Hispanic or Latino
 American Indian or Alaska Native
 Native Hawaiian or Other Pacific Islander

Have you ever seen a doctor for your acne?

1. Yes
 2. No

Who has provided you with information about acne (check all appropriate answers)?

- | | |
|---|------------------------------------|
| <input type="checkbox"/> Magazines | <input type="checkbox"/> Parents |
| <input type="checkbox"/> TV | <input type="checkbox"/> Friends |
| <input type="checkbox"/> Relatives (other than parents) | <input type="checkbox"/> Newspaper |
| <input type="checkbox"/> Radio | <input type="checkbox"/> Doctor |
| <input type="checkbox"/> Internet | <input type="checkbox"/> Parents |
| <input type="checkbox"/> Facialist or aesthetician | <input type="checkbox"/> School |
| <input type="checkbox"/> Library | |

Other: _____

Do you feel you have enough information about acne from the above sources?

1. Yes
 2. No

How much do you know about acne?

1. Nothing
 2. A little
 3. Some
 4. A lot

Telephone numbers

Home: (____)____-_____

Cell: (____)____-_____

What is your sex? M F

Which is true about you now? (Check the *one* best answer.)

- I have mild acne today.
 I have moderate acne today.
 I have severe acne today.
 I do not have acne today.

How much does your acne bother you? (Check the *one* best answer.)

- It does not bother me.
 It bothers me a little.
 It bothers me most of the time.
 It bothers me a significant amount.

How do you prefer to learn?

- I prefer to read things printed on paper
 I prefer to use computers

Which way do you feel you learn best?

- From reading
 From listening
 From reading and listening

Given a choice would you rather have a printed handout or a computer-based presentation about acne?

- I would prefer a printed handout
 I would prefer a computer-based presentation

Appendix A: Perception of Acne Questionnaire- Pretest

- 1) One cause of acne is: (Check the *one* best answer.)
- A. Poor skin hygiene
 - B. Diet
 - C. **Bacteria**
 - D. Sexual practices
 - E. Do not know
- 2) Where does acne form?
- A. Sweat glands
 - B. Blood vessels
 - C. **Hair follicles called pores**
 - D. Nerves in the skin
- 3) Acne is commonly found on what areas of the body? (Check the *one* best answer.)
- A. Arms and legs
 - B. **Face, chest and back**
 - C. Scalp and back
- 4) When taking medication for acne, how important is it to use the medicine regularly? (Check the *one* best answer.)
- A. Not at all, one application is usually sufficient to clear most acne
 - B. Somewhat, using it half of the time will improve acne by 50%
 - C. **Very, most acne will not improve unless used routinely**
- 5) Whiteheads and blackheads form when: (Check the *one* best answer.)
- A. Dirt gets clogged in the pores
 - B. You eat too much oily food
 - C. **The pore becomes clogged with oil and sticky skin cells**
- 6) The dark brown or black color of blackheads is from: (Check the *one* best answer.)
- A. Dirt
 - B. Bacteria
 - C. **Color of skin cells**
- 7) A large deep pimple is called a: (Check the *one* best answer.)
- A. whitehead
 - B. **cyst**
 - C. follicle
 - D. blackhead
- 8) Hormones have an effect on the production of oil in the pores.
- A. **True**
 - B. False
- 9) Whiteheads and blackheads become red, swollen and painful because of: (Check the *one* best answer.)
- A. Sweets, such as chocolates
 - B. **Bacteria in the pores**
 - C. Contents of blackheads were not squeezed out properly
- 10) What can make acne worse? (Check the *one* best answer.)
- A. Certain foods in my diet
 - B. Computer use
 - C. **Tension, worry or stress**
 - D. Carbonated beverages
- 11) What does *not* make acne worse? (Check the *one* best answer.)
- A. Hair products or cosmetics
 - B. **Certain foods in my diet**
 - C. Tension, worry or stress
 - D. Drugs or medications
- 12) How common is acne? (Check the *one* best answer.)
- A. Rare (less than 10% of people have acne)
 - B. Fairly common (about half of people have acne)
 - C. **Very common (about 85% of people have acne)**
- 13) Acne medications work by:
- A. **Preventing plugging of pores and killing bacteria in the pores**
 - B. Removing dietary fat that has entered into the pore
 - C. Making the skin surface smooth
- 14) Washing your face can worsen your acne.
- A. **True**
 - B. False
- 15) Treating acne may prevent scarring.
- A. **True**
 - B. False
- 16) Sun-tanning is good for acne.
- A. True
 - B. **False**
- 17) Acne can be cured.
- A. True
 - B. **False**
- 18) Only acne patients have bacteria in their pores.
- A. True
 - B. **False**
- 19) A pea-sized amount of medication is usually enough for the whole face.
- A. **True**
 - B. False
- 20) How long does it usually take for acne medicine to maximally improve acne (Check the *one* best answer)?
- A. 1 day
 - B. 3 days
 - C. Less than a week
 - D. **2 months or more**

Appendix B: Perception of Acne Questionnaire- Posttest

- 1) One cause of acne is:
- A. Poor skin hygiene
 - B. Diet
 - C. **Bacteria**
 - D. Sexual practices
 - E. Do not know
- 2) Where does acne form?
- A. Sweat glands
 - B. Blood vessels
 - C. **Hair follicles called pores**
 - D. Nerves in the skin
- 3) Acne is commonly found on what areas of the body?
- A. Arms and legs
 - B. **Face, chest and back**
 - C. Scalp and back
- 4) When taking medication for acne, how important is it to use the medicine regularly?
- A. Not at all, one application is usually sufficient to clear most acne
 - B. Somewhat, using it half of the time will improve acne by 50%
 - C. **Very, most acne will not improve unless used routinely**
- 5) Whiteheads and blackheads form when: (Check the *one* best answer.)
- A. Dirt gets clogged in the pores
 - B. You eat too much oily foods
 - C. **The pore becomes clogged with oil and sticky skin cells**
- 6) The dark brown or black color of blackheads is from: (Check the *one* best answer.)
- A. Dirt
 - B. Bacteria
 - C. **Color of skin cells**
- 7) A large deep pimple is called a: (Check the *one* best answer.)
- A. whitehead
 - B. **cyst**
 - C. follicle
 - D. blackhead
- 8) Hormones have an effect on the production of oil in the pores.
- A. **True**
 - B. False
- 9) Whiteheads and blackheads become red, swollen and painful because of: (check the *one* best answer.)
- A. Sweets, such as chocolates
 - B. **Bacteria in the pores**
 - C. Contents of blackheads were not squeezed out properly
- 10) What can make acne worse? (Check the *one* best answer.)
- A. Certain foods in my diet
 - B. Computer use
 - C. **Tension, worry or stress**
 - D. Carbonated beverages
- 11) What does *not* make acne worse? (Check the *one* best answer.)
- A. **Certain foods in my diet**
 - B. Hair products or cosmetics
 - C. Tension, worry or stress
 - D. Drugs or medications
- 12) How common is acne?
- A. Rare (less than 10% of people have acne)
 - B. Fairly common (about half of people have acne)
 - C. **Very common (75-85% of people have acne)**
- 13) Acne medications work by:
- A. **Preventing plugging of pores and killing bacteria in the pores**
 - B. Removing dietary fat that has entered into the pore
 - C. Making the skin surface smooth
- 14) Washing your face can worsen your acne.
- A. **True**
 - B. False
- 15) Treating acne may prevent scarring.
- A. **True**
 - B. False
- 16) Sun-tanning is good for acne.
- A. True
 - B. **False**
- 17) Acne can be cured.
- A. True
 - B. **False**
- 18) Only acne patients have bacteria in their pores.
- A. True
 - B. **False**
- 19) A pea-sized amount of medication is usually enough for the whole face.
- A. **True**
 - B. False
- 20) How long does it usually take for acne medicine to maximally improve acne? (Check the *one* best answer.)
- A. 1 day
 - B. 3 days
 - C. Less than a week
 - D. **2 months or more**

Appendix C: Perception of Acne Questionnaire- 1-month follow up

Do you feel you have enough information about acne?

- Yes
 No

How much do you now know about acne?

- Nothing
 A little
 Some
 A lot

1) One cause of acne is:

- A. Poor skin hygiene
 B. Diet
 C. **Bacteria**
 D. Sexual practices
 E. Do not know

2) Where does acne form?

- A. Sweat glands
 B. Blood vessels
 C. **Hair follicles called pores**
 D. Hormone ducts

3) Acne is commonly found on what areas of the body?

(Check the *one* best answer.)

- A. Arms and legs
 B. **Face, chest and back**
 C. Scalp and back

4) When taking medication for acne, how important is it to use the medicine regularly? (Check the *one* best answer.)

- A. Not at all, one application is usually sufficient to clear most acne
 B. Somewhat, using it half of the time will improve acne by 50%
 C. **Very, most acne will not improve unless used routinely**

5) Whiteheads and blackheads form when: (Check the *one* best answer.)

- A. Dirt gets clogged in the pores
 B. You eat too much oily foods
 C. **The pore becomes clogged with oil and sticky skin cells**

6) The dark brown or black color of blackheads is from:

(Check the *one* best answer.)

- A. Dirt
 B. Bacteria
 C. **Color of skin cells**

7) A large deep pimple is called a: (Check the *one* best answer.)

- A. whitehead
 B. **cyst**
 C. follicle
 D. blackhead

8) Hormones have an effect on the production of oil in the pores.

- A. **True**
 B. False

9) Whiteheads and blackheads become red, swollen and painful because of: (Check the *one* best answer.)

- A. Sweets, such as chocolates
 B. **Bacteria in the pores**
 C. Contents of blackheads were not squeezed out properly

10) What can make acne worse?

- A. Certain foods in my diet
 B. Computer use
 C. **Tension, worry or stress**
 D. Carbonated beverages

11) What does *not* make acne worse?

- A. **Certain foods in my diet**
 B. Hair products or cosmetics
 C. Tension, worry or stress
 D. Drugs or medications

12) How common is acne?

- A. Rare (less than 10% of people have acne)
 B. Fairly common (about half of people have acne)
 C. **Very common (75-85% of people have acne)**

13) Acne medications work by:

- A. **Preventing plugging of pores and killing bacteria in the pores**
 B. Removing dietary fat that has entered into the pore
 C. Making the skin surface smooth

14) Washing your face can worsen your acne.

- A. **True**
 B. False

15) Treating acne may prevent scarring.

- A. **True**
 B. False

16) Sun-tanning is good for acne.

- A. True
 B. **False**

17) Acne can be cured.

- A. True
 B. **False**

18) Only acne patients have bacteria in their pores.

- A. True
 B. **False**

19) A pea-sized amount of medication is usually enough for the whole face.

- A. **True**
 B. False

20) How long does it usually take for acne medicine to maximally improve acne? (Check the *one* best answer.)

- A. 1 day
 B. 3 days
 C. Less than a week
 D. **2 months or more**

Appendix C: Perception of Acne Questionnaire- 1-month follow up

Please fill out the following table:

What are the names of the medicine(s) your doctor recommended you take for your acne?	How many doses of medicine did you forget to take in the past two days (yesterday and day before yesterday)?	How many doses of medicine did you forget to take in the past week?
	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> Did not take at all	<input type="checkbox"/> 1- <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> 9 <input type="checkbox"/> 10 <input type="checkbox"/> 11 <input type="checkbox"/> 12 <input type="checkbox"/> Did not take at all

Many people find it difficult to take their medication exactly as prescribed by their doctors. If you forgot to take your medicine at least one time, what has made it difficult for you to use your medication daily?

Appendix D: Evaluation of Handout

I prefer to learn about acne with (check the appropriate answer)

- Printed Handout
- Computer-based presentation or tutorial

I like to get feedback while I am learning (check the appropriate answer)

- Yes
- No

Before reading the handout I did not know much about acne.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

The handout helped me to understand acne better.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

The pictures helped me to understand about acne.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

The handout helped me to understand how acne is treated.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Overall, I liked the handout

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

The Handout made me feel I could take charge of my acne.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

The handout prepared me to have a discussion about my treatment choices with my dermatologist.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

The handout was too long.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

The handout was boring.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

The handout was difficult to understand.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

There were not enough pictures in the handout

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Appendix E: Evaluation of Computer-Based Tutorial

I prefer to learn about acne with (check the appropriate answer)

- Printed Handout
- Computer-based presentation or tutorial

I like to get feedback while I am learning (check the appropriate answer)

- Yes
- No

Before the tutorial I did not know much about acne

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

The computer tutorial helped me to understand acne better

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

The pictures helped me to understand about acne

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

The computer tutorial helped me to understand how acne is treated

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Overall, I liked the computer tutorial

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

The Computer tutorial made me feel I could take charge of my acne

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

The computer tutorial prepared me to have a discussion about my treatment choices with my dermatologist

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

The computer tutorial was too long

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

The computer tutorial was boring

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

The computer tutorial was difficult to understand

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

There were not enough pictures in the computer tutorial

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree