JOURNAL OF SOCIAL, BEHAVIORAL, & HEALTH SCIENCES

Journal of Social, Behavioral, and Health Sciences
2025, Volume 19, Pages 1–20
https://doi.org/10.5590/JSBHS.2025.19.1675

Original Research WALDEN UNIVERSITY

Examining the Effects of a Social Cognitive Intervention Aimed at Promoting Appropriate Antibiotic Use Self-Efficacy

Erin M. Hill, PhD
West Chester University of Pennsylvania, West Chester, Pennsylvania, United States
https://orcid.org/0000-0003-0145-5261

Andriana Frost, PsyD
The US Oncology Network (Medical Oncology Hematology Consultants), Newark, Delaware, United States
https://orcid.org/0009-0005-2239-0657

Contact: *ehill@wcupa.edu*

Our goal in this study was to examine the effect of a social cognitive intervention aimed at improving appropriate antibiotic use self-efficacy (AAUSE). The intervention incorporated several aspects of self-efficacy theory, including mastery, vicarious learning, and verbal persuasion. To test the effectiveness of the intervention, we used two comparison conditions—reading a pamphlet focused on antibiotic resistance (ABR) or one focused on general health (diet, physical activity, sleep). A total of 226 undergraduate students completed the study, which involved completing a series of questions/questionnaires at time 1 (preintervention), engaging in the intervention (or reading a pamphlet), and then completing the time 2 (postintervention) questions/questionnaires. Changes in AAUSE and other dependent variables (antibiotic-resistance knowledge, concern about antibiotic resistance, interest in minimizing antibiotic use) were observed from preintervention to postintervention in the intervention group and the ABR pamphlet group. At time 2 (postintervention), compared with both comparison groups, participants who took part in the social cognitive intervention had higher overall AAUSE, AAUSE specific to avoiding antibiotics for viruses, and self-perceived knowledge. Our results indicate that social cognitive strategies might be particularly beneficial in promoting AAUSE and related antibiotic-resistance preventive attitudes and behaviors.

Keywords: *social cognitive intervention, appropriate antibiotic use, self-efficacy, antibiotic-resistance preventions*

Date Submitted: March 5, 2024 | **Date Published:** January 30, 2025

Recommended Citation

Hill, E. M., & Frost, A. (2025). Examining the effects of a social cognitive intervention aimed at promoting appropriate antibiotic use self-efficacy. *Journal of Social, Behavioral, and Health Sciences, 19*, 1–20. https://doi.org/10.5590/JSBHS.2025.19.1675

Introduction

Antibiotic resistance has increasingly become a global public health crisis. While antibiotic-resistant germs can develop as a natural part of evolution (Smith et al., 2015), the misuse and overuse of antibiotics can exacerbate the process (World Health Organization [WHO], 2020). Each year in the United States, more than 2.8 million individuals develop antibiotic-resistant infections, and such infections can contribute to extended hospital stays and increased risk of death. In the United States, more than 35,000 individuals die as a result of antibiotic-resistant infections each year (Centers for Disease Control and Prevention [CDC], 2020). In light of the proliferation of antibiotic-resistant infections, there have been warnings that society could revert to a pre-antibiotic era in which everyday infections become untreatable with traditional medications (Cars et al., 2008).

The WHO (2020) outlined several actions to help prevent/address the spread of antibiotic-resistant bacteria. These actions include behavior changes aimed at the agricultural sector (e.g., minimizing use of antibiotics in healthy animals), the healthcare industry (e.g., investment in the development of new antibiotics), health professionals (e.g., infection-prevention strategies, promoting physician-patient communication about antibiotic resistance), policymakers (e.g., surveillance programs for antibiotic-resistant infections), and the individual level (e.g., avoid demanding antibiotics from healthcare professionals, only taking antibiotics as prescribed). Many of the efforts aimed at reducing the spread of antibiotic-resistant bacteria have involved antibiotic stewardship programs that focus on educating and prompting healthcare professionals to focus on the judicious use of antibiotics in clinical settings (Feldstein & Felter, 2018; Hulscher & Prins, 2017; Stenehjem et al., 2018).

While healthcare professionals are ultimately the "gatekeepers" in relation to gaining access to antibiotic prescriptions, as noted by the WHO (2020), education and commitment to action are also necessary among members of the general public in reducing unnecessary antibiotic use. Widespread misunderstanding exists about when and how antibiotics should be used among members of the general public (WHO, 2015). For example, many individuals believe that antibiotics are effective for both bacterial and viral infections (Seipel et al., 2019; WHO, 2015). Furthermore, physicians report that one of the main reasons for prescribing antibiotics for upper respiratory tract infections (which tend to be viral) is patient expectations (Fletcher-Lartey et al., 2016). Other research has similarly found that physicians often feel pressured by patients to prescribe antibiotics (Cole, 2014). Further, some physicians report that concern about patient satisfaction is a factor that influences their antibiotic-prescribing decisions (Patel et al., 2020).

While addressing prescribing and communication strategies on the healthcare professional side remains an important endeavor, it is also critical that members of the general public are educated about antibiotic resistance and modify their own behaviors accordingly. Notably, multicountry systematic reviews indicate that the role of education and income is complex in terms of their relationship with antibiotic perceptions and misuse. That is, misuse appears to occur across education and income levels (Mallah et al., 2022a, 2022b); therefore, understanding the various aspects of this health behavior remains important to examine across a wide range of populations.

In terms of understanding health behaviors, self-efficacy—an individual's belief in their ability to perform certain behaviors to produce a specific outcome—is of critical importance (Bandura, 2001). Self-efficacy is a major determinant of a range of health behaviors, including physical activity engagement, healthy eating, and adherence to medical treatments (Liou & Kulik, 2020; Luszczynska & Schwarzer, 2005; Nafradi et al., 2017; Sheeran et al., 2016).

Self-efficacy is an important component of social-cognitive theory (Bandura, 2001) and is a particularly important factor in health behaviors and well-being (Bandura, 1998). Ways to enhance self-efficacy include mastery, vicarious experiences (e.g., exposure to others' modeling behaviors), verbal persuasion by others, and emotional arousal (e.g., decreasing one's anxiety can help to prompt engagement in the behavior [Luszczynska & Schwarzer, 2005]). There is evidence that targeting self-efficacy through interventions (e.g., social-cognitive interventions) can be effective in modifying health behaviors (e.g., Griffin-Blake & DeJoy, 2006; Kreausukon et al., 2012; Sheeran et al., 2016; Williams & French, 2011). In their meta-analysis, Sheeran et al. (2016) specifically noted that changes in self-efficacy are particularly important in influencing intentions and health behaviors, and that there is a medium effect size in looking at the impact of self-efficacy on behavior.

Self-efficacy has also been well-studied as an important variable associated with appropriate medication use and medication adherence. Medication adherence self-efficacy has been linked to a better understanding of medication instructions (Cameron et al., 2010) as well as to a range of adherence behaviors, including diabetes-medication adherence (Huang et al., 2018a), glaucoma-treatment adherence (Sleath et al., 2015), and to endocrine-therapy adherence among breast cancer survivors (Kimmick et al., 2015). While research focused on medication adherence and appropriate use has noted the importance of health literacy (Zhang et al., 2014), psychosocial factors, such as self-efficacy, can play a unique role in explaining adherence to medical advice/instructions (Huang et al., 2018b; Shiyanbola et al., 2018).

In expanding this area of study, Hill and Watkins (2018) developed the Appropriate Antibiotic Use Self-Efficacy Scale (AAUSES) to measure self-efficacy specific to antibiotic use. Notably, the AAUSES measures overall appropriate antibiotic use self-efficacy (AAUSE), but it also has three subscales: (1) minimization of antibiotics and trust in physician recommendations (e.g., waiting for laboratory test results to come back before initiating a course of antibiotics), (2) avoidance of antibiotics for viral infections, and (3) avoidance of taking old/others' antibiotics. In validating the questionnaire, Hill and Watkins (2018) found that the scale was correlated with antibiotic-resistance concern and decreased dissatisfaction with not receiving antibiotics for bronchitis (a condition that tends to be viral). Further, individuals in the study who had taken antibiotics for a cold or flu had significantly lower levels of appropriate antibiotic use efficacy compared with those who had not.

Purpose of Our Study

Given the importance of self-efficacy in health behaviors (e.g., Luszczynska & Schwarzer, 2005; Sheeran et al., 2016), targeting AAUSE through an intervention might be an important mechanism in helping to engage the public, including college undergraduates, with the fight against antibiotic-resistant bacteria. Our overall goal in this study was to test the effectiveness of a social cognitive intervention aimed at improving AAUSE and related antibiotic-resistance perceptions and prospective behaviors. There is evidence to suggest that social cognitive interventions might be particularly effective in improving health behaviors, such as fruit and vegetable consumption, other dietary behaviors, and physical activity (e.g., Anderson et al., 2001; Kreausukon et al., 2012; Shamizadeh et al., 2019). Therefore, examining the extent to which a social cognitive intervention might improve AAUSE and related behaviors is beneficial to understanding ways to address the public health crisis of antibiotic resistance.

To examine the effectiveness of the intervention, we used two comparison conditions in our study: one condition involved reading information about antibiotic resistance (in pamphlet format) while the other comparison condition involved reading about general health information (in pamphlet form—topics included healthy eating, physical activity, and sleep). Specifically, we were interested in whether it was the social cognitive aspects of the active intervention—rather than merely the passive exposure to antibiotic-resistance information—that could have an impact on perceptions, attitudes, and prospective behaviors. That is, we wanted to know not only the extent to which differences existed between the intervention and comparison conditions but also across all three groups in terms of perceptions and behaviors relevant to antibiotic resistance.

Methods

Participants

The participants in our study were 226 undergraduate college students enrolled at a state university on the east coast. Participants were recruited through the university's psychology department participant pool and via flyers posted around the university. Students recruited through the psychology participant pool (from introductory psychology courses) could participate in research studies as an option in fulfilling their course research requirement. Recruitment through the participant pool was our primary method used in gaining participants for our study. Due to wide use of the participant pool among faculty and researchers at the university, it can often be necessary to use multiple methods to recruit participants, and thus flyers were also posted around the university to increase participant recruitment and to diversify the participant pool for our study. We compensated the participants who were recruited via flyers with two Wawa $5 gift cards (Wawa is a popular convenience store in parts of the East Coast of the United States).

Data Collection

For our study, there was one experimental condition (the social cognitive intervention) and two comparison groups (receiving health-related pamphlets instead of participating in the intervention program). Due to differences in time requirements between the conditions (intervention—taking approximately 2 hours; comparison conditions—reading pamphlets as part of the study; taking less than 1 hour), participants recruited through the participant pool had the option of signing up for a study titled "Health Presentation and Health Attitudes" (involving the intervention; worth 2 research requirement credits) or a study titled "Health Information and Health Attitudes" (involving being part of a comparison condition; requiring less than an hour of participation, for which participants received 1 research credit). Therefore, due to differences in participant research credit compensation between conditions (and that participants self-selected to sign up for either study), complete randomization across all three conditions was not possible. Participants who signed up for the "Health Information and Health Attitudes" study were randomized across the two comparison conditions (receiving a pamphlet about antibiotic resistance or a pamphlet with general health information). For all three groups, participants completed the first set of questionnaires (time 1—preintervention), then participated in the intervention or received a health pamphlet (in the comparison conditions), and then completed the second set of questionnaires (time 2—postintervention).

The intervention was implemented as an interactive presentation. Each presentation was 2 hours long (including time to complete questionnaires). Upon arrival, participants completed a consent form and then the time 1 questionnaires. The presentation was given and, at the conclusion of the presentation, participants completed the time 2 questionnaires. Between 15 and 20 students attended each administration of the intervention, which was given on the university's campus in a classroom setting. Only students who signed up via the psychology department's participant pool participated in the intervention.

Appropriate Antibiotic Use Self-Efficacy Intervention

Components of the intervention focused on mastery experiences, vicarious learning, and verbal persuasion (Bandura, 2001), and focused largely on what students could do to maintain their health (Bandura, 1998). For the presentation, students were provided with information on the differences between viral and bacterial infections, were introduced to the term *antibiotic resistance*, and received information on when antibiotics are appropriate to use and when they are not effective (i.e., when the illness is caused by a virus, such as colds, flu, and/or most upper respiratory infections). Participants were also presented with recommendations on nonmedication-based ways to maintain their health, such as regular handwashing, proper food preparation, and the importance of staying up to date with vaccinations.

In terms of the specific components of the intervention, verbal persuasion was used to help students internalize the impact that antibiotic resistance could have on them (e.g., current antibiotics may become ineffective; previously treatable infections may become more difficult to treat). Vicarious learning took place through modeling appropriate handwashing techniques both via video and by a live demonstration by the presenter. Additionally, students worked in small groups and engaged in large group discussions to promote learning and modeling among peers.

To help facilitate self-efficacy through mastery, participants were encouraged to reflect on past times they were ill and did not require antibiotics and discussed ways that they coped or treated the illness without antibiotics. Students received feedback on their ability to manage their symptoms and work with their primary care provider to address their illness without antibiotics. Additionally, students discussed how they have used antibiotics in the past and were provided with feedback on their appropriate use.

Additionally, students' mastery of the material was tested by presenting case vignettes that described illness symptoms, and students worked in small groups to discuss the advice they would give the fictious patient. Specifically, participants were instructed to read over the vignette and decide if they thought the patient required antibiotics, and what advice would they give the patient if they likely did or did not need antibiotics. Further, students were asked to identify behaviors they could undertake if they were feeling ill to alleviate symptoms and promote health if antibiotics were not indicated by a medical professional. Participants briefly identified barriers to using antibiotics appropriately in the future and reflected on ways to overcome the barriers (Ashford et al., 2010).

In wrapping up the intervention, participants were prompted to write three things they learned from the session on an index card and handed the card back to the research assistant. All intervention sessions (total of four) were conducted by the graduate research assistant and second author on this project (AF) to help maintain consistency in presentation of information during the four separate presentation sessions. Data for the intervention condition were collected during the Spring 2019 semester (between March and April 2019). Data collection for the comparison conditions occurred between March 2019 and February 2020.

Comparison Conditions

We used two health pamphlets as comparison conditions in our study. The first comparison group received a pamphlet about antibiotic resistance following completion of the time 1 questionnaires. The pamphlet provided information on antibiotic resistance, why antibiotic resistance has become a problem, when antibiotics should be prescribed, and when they are not effective (i.e., in the case of viruses). The pamphlet also described ways to reduce the risk of infections (e.g., handwashing, vaccination, food hygiene practices). The second comparison group received a pamphlet about general health and well-being. This pamphlet detailed ways to promote health, including healthy eating, physical activity, and the importance of good sleep. After the participants had finished reading the pamphlets, they were then instructed to complete the time 2 questionnaires.

Measures

Appropriate Antibiotic Use Self-Efficacy

We used the AAUSE Scale (AAUSES; Hill & Watkins, 2018) in our study. The scale includes 13 items that present various situations that might arise when an individual is sick or feels unwell. Participants then respond to each item on an 11-point scale from 0 "cannot do at all" to 100 "highly certain can do." A total score is computed by taking the mean of all items. There are also three subscales measuring (1) minimization of antibiotics and trust in physician recommendations (six items), (2) avoidance of antibiotics for viral infections (five items), and (3) avoidance of taking old/others' antibiotics (two items). Participants completed the AAUSES at time 1 and time 2. The overall scale had adequate reliability in the present study (time 1: $\alpha = .854$, time 2 $\alpha = .884$), as did the minimization/trust subscale (time 1 $\alpha = .739$, time 2 $\alpha = .812$) and the avoidance of antibiotics for viral infections subscale (time 1 α = .833, time 2 α = .869). The avoidance of old/others' antibiotics subscale had adequate reliability at time 2 (α = .728) but not at time 1 (α = .546).

Antibiotic Resistance Knowledge

Participants completed a brief quiz on their antibiotic-resistance knowledge at time 1 and time 2. The quiz was embedded as part of the set of surveys they received. The test was composed of eight true/false questions. In scoring the quiz, participants received 1 point for each correct answer and 0 points for incorrect answers. Participants also rated their self-perceived knowledge at time 1 and time 2. The question was embedded with four distractor questions (measuring self-perceived knowledge about nutrition, physical activity, preventive medicine, sleep in addition to antibiotic resistance). The stem of the question read "in the context of health and well-being, how knowledgeable are you about … ?" and participants responded to each item on a 5-point Likert scale ranging from 1 "not at all knowledgeable" to 5 "very knowledgeable."

Antibiotic Resistance Concern

Participants were provided with a list of public health/general health issues and were asked to rate their concern for each. A list of eight public health concerns were presented: (1) obesity epidemic, (2) healthcare costs, (3) global poverty, (4) climate change, (5) the rise of antibiotic-resistant bacteria, (6) influenza pandemics, (7) cholera, and (8) income inequality. The stem of the set of questions read "I am concerned about. …," and participants responded to each item on a 6-point Likert scale ranging from 1 "very strongly disagree" to 6 "very strongly agree." Concern about antibiotic resistance served as a dependent variable in our study, with the other items serving as distractor items. Participants completed these questions in part 1 and part 2 of the study (preintervention and postintervention).

Interest in Minimizing Antibiotic Use in General

We provided participants with a list of health changes they may or may not want to undertake related to their own health. A list of eight potential health changes were presented: (1) getting more physical activity, (2) focusing on better managing stress, (3) getting better quality sleep, (4) cutting down on time on social media, (5) spending more time with friends, (6)) minimizing antibiotic use in general, (7) eating more vegetables and fruits, and (8) cutting down on eating processed food. The stem of the set of questions read "I am interested in…," and participants responded to each item on a 6-point Likert scale ranging from 1 "very strongly disagree" to 6 "very strongly agree." Interest in minimizing antibiotic use in general served as a dependent variable in our study, with the other items serving as distractor items. Participants completed these questions at time 1 and time 2.

Responses to Illness Scenarios

Due to the inability to directly observe behaviors associated with antibiotic use in our study, we instead presented participants with four illness scenarios and asked about the likelihood of engaging in various self-care and healthcare-seeking behaviors. For two of the scenarios, antibiotic use would be appropriate (urinary tract infection, leg wound) and for the other two scenarios, antibiotic use would likely have not been appropriate (head cold, respiratory infection). The hypothetical illness scenarios have been used previously and are published elsewhere (Hill, 2017). For each scenario, participants were asked to report their likelihood of engaging in the following behaviors: (1) going to the doctor, (2) staying home from work for a day or two to get better, (3) going to the doctor to get a prescription for antibiotics, and (4) looking around the house for unused antibiotics to help them feel better. Participants responded to each behavior on a 4-point Likert scale ranging from 1 "very unlikely" to 4 "very likely." Participants completed these questions only at time 2.

Data Analysis

Prior to analyses, the data were assessed for missing values. Missing values were identified for three cases. Missing values were imputed using expectation maximization for two of the cases (scale: AAUSES time 1 measurement; Schlomer et al., 2010). However, for one case, data were found to not be missing at random (scale: AAUSES minimization/trust subscale); therefore, no value was imputed for the case. Upon assessment of the data, it was apparent that the scores of the variables were significantly skewed and indicated non-normal distributions (e.g., most participants reported higher levels of AAUSE). Further, assessment of the assumptions for some of the main analyses, including MANCOVA, were violated (e.g., multivariate normality, homogeneity of variance-covariances matrices).

The original analytic plan was to conduct both within-subjects *t*-tests and a MANCOVA to examine the effect of the intervention and comparison conditions on the dependent variables. The within-subjects *t*-tests would allow for examination of change in dependent variables (AAUSE knowledge, antibiotic-resistance concern, interest in minimizing antibiotics) from preintervention to postintervention across the intervention and comparison groups. The MANCOVA allows for the identification of differences in the dependent variables postintervention (time 2) after controlling for the preintervention (time 1) measures. The dependent variables of interest include AAUSES overall score and subscales, knowledge test score, self-perceived knowledge, antibiotic-resistance concern, interest in minimizing antibiotic use in general, and the questions pertaining to going to the doctor to get a prescription for antibiotics in the case of a (1) head cold, and (2) upper respiratory infection.

Given the violation of normality for all dependent variables and the violation of multiple assumptions of MANCOVA, nonparametric tests were employed instead. Specifically, the Wilcoxon signed-rank test was used to examine changes in dependent variables from time 1 to time 2. Given the lack of nonparametric alternatives to MANCOVA, the Kruskal-Wallis test was used to compare differences in the dependent variables (time 2 measurements) across the three groups (intervention, antibiotic-resistance pamphlet, general health pamphlet). To examine pairwise differences between the groups (following significant Kruskal-Wallis tests), the Mann-Whitney U test was employed as a post hoc test.

Results

Descriptives and Bivariate Correlations

We compared three groups as part of our study: the intervention group (n = 61) and two comparison groups—the group that received an antibiotic-resistance pamphlet (n = 84) and the group that received a pamphlet about general health information (n = 80). Participants ranged in age from 18 to 43 years, M = 19.64, SD = 2.57 (intervention: 18–26 years, M = 19.71, SD = 1.44; ABR pamphlet group: 18–43 years, M = 19.82, SD = 3.50; general health pamphlet group: 18–31 years, M = 19.40, SD = 2.05). Sociodemographic information for each of the groups is presented in Table 1.

Table 1. *Sociodemographic and Health Information Across the Study Groups*

		Intervention (*n* = 62)		**ABR Pamphlet (*n* = 84)**		**GH Pamphlet (*n* = 80)**	
Variable	**Category**	***n***	**(%)**	***n***	**(%)**	***n***	**(%)**
Gender	Male	22	35.5	21	25.0	22	27.5
	Female	40	64.5	63	75.0	57	71.3
	Demi-feminine/demi-female	0	0	0	0	1	1.3
Student Status	Full-time	60	96.8	83	98.8	78	97.5
	Part-time	2	3.2	1	1.2	2	2.5
Student Living Status	Commute from home	9	14.5	10	11.9	10	12.5
	Residence on campus	42	67.7	67	79.8	62	77.5
	Off-campus housing	11	17.7	7	8.3	8	10.0
Year	First-year	38	61.3	52	61.9	53	66.3
	Sophomore	11	17.7	18	21.4	19	23.8
	Junior	6	9.7	10	11.9	3	3.8
	Senior	7	11.3	4	4.8	4	5.0
	Missing	0	0	0	0	1	1.3
Ethnicity	White American	48	77.4	63	75.0	56	70.0
	Hispanic/Latino American	1	1.6	3	3.6	7	8.8
	African American	10	16.1	13	15.5	13	16.3
	Native Hawaiian or Pacific Islander	1	1.6	0	0	0	0
	Asian	0	0	3	3.6	2	2.5
	Other	2	3.2	1	1.2	1	1.3
	Missing	0	0	1	1.2	1	1.3
Physical Health	Poor	1	1.6	2	2.4	2	2.5
	Fair	8	12.9	4	4.8	11	13.8
	Good	19	30.6	29	34.5	26	32.5
	Very good	23	37.1	37	44.0	26	32.5
	Excellent	10	16.1	12	14.3	15	18.8
Mental Health	Poor	3	4.8	3	3.6	3	3.8
	Fair	9	14.5	12	14.3	20	25.0
	Good	24	38.7	38	45.2	22	27.5
	Very good	16	25.8	25	29.8	21	26.3
	Excellent	9	14.5	6	7.1	14	17.5
	Missing	1	1.6	0	0	0	0

Note: ABR = antibiotic resistance; GH = general health

Preintervention to Postintervention Changes Across the Groups

To examine changes in the dependent variables across the groups, Wilcoxon signed-rank tests were conducted for each group: the intervention group (n = 62), the antibiotic-resistance pamphlet group (n = 84), and the general health pamphlet group (n = 80). The dependent variables that were examined were AAUSE (total score), AAUSE—minimization of antibiotics and trust in physician recommendations subscale, AAUSE—avoidance of antibiotics for viral infections subscale, antibiotic-resistance knowledge (test score), self-perceived antibiotic-resistance knowledge, antibiotic-resistance concern, and interest in minimizing antibiotic use in general. Due to the number of pairwise comparisons (7 within each group), a Bonferroni correction was applied and an α of .007 (.05/7) was used for the related-samples Wilcoxon signed-rank test.

Results for the Wilcoxon signed-rank test are presented in Table 2. Participants in both the intervention and antibiotic-resistance pamphlet groups showed an increase in all variables from preintervention to postintervention. For participants in the general health pamphlet group, there was no significant change in the variables from preintervention to postintervention, with the exception of three variables: overall AAUSE, the AAUSES avoidance of antibiotics for viral infections subscale, and self-perceived knowledge.

Table 2. *Preintervention and Postintervention—Descriptives and Comparisons Across Dependent Variables*

	Intervention Group (n = 62)		***Wilcoxon Signed-rank***	**Antibiotic Resistance Pamphlet Group (n = 84)**		***Wilcoxon Signed-rank***	**General Health Pamphlet Group (n = 80)**		***Wilcoxon Signed-rank***
	Pre (time 1) *M (SD)*	**Post (time 2) *M (SD)***	***Test***	**Pre (time 1) *M (SD)***	**Post (time 2) *M (SD)***	***Test***	**Pre (time 1) *M (SD)***	**Post (time 2) *M (SD)***	***Test***
AAUSES total	69.79 (17.99) *Mdn* = 71.54	87.61 (13.10)* *Mdn* = 91.92	W = 1845 p < **.001**	68.25 (17.24) *Mdn* = 67.69	80.41 (15.67)* *Mdn* = 83.84	W = 3431 p < **.001**	69.70 (15.33) *Mdn* = 70.38	73.40 (16.27)* *Mdn* = 76.92	W = 1845 p < **.001**
AAUSES min/trust subscale	81.21 (15.96) *Mdn* = 86.67	90.16 (12.29)* *Mdn* = 93.33	W = 1351 p < **.001**	78.21 (16.00) *Mdn* = 80.83	85.79 (14.34)* *Mdn* = 91.67	W = 2600 p < **.001**	81.60 (14.04) *Mdn* = 80.83	83.08 (14.84) *Mdn* = 85.0	W = 1316 p = .064
AAUSES avoidance for viruses subscale	52.16 (24.81) *Mdn* = 49.0	84.35 (15.45)* *Mdn* = 88.0	W = 1942 p < **.001**	50.53 (25.54) *Mdn* = 50.0	70.51 (23.64)* *Mdn* = 77.0	W = 2971.5 p < **.001**	52.28 (23.79) *Mdn* = 52.0	58.58 (24.53)* *Mdn* = 62.0	W = 2248 p < **.001**
ABR knowledge	5.89 (1.17) *Mdn* = 6.0	6.85 (.87)* *Mdn* = 7.0	W = 1009.5 p < **.001**	5.96 (1.34) *Mdn* = 6.0	6.82 (1.03)* *Mdn* = 7.0	W = 1212.5 p < **.001**	5.88 (1.17) *Mdn* = 6.0	6.13 (1.17) *Mdn* = 6.0	W = 387 p = .017
Self-perceived ABR knowledge	2.66 (1.26) *Mdn* = 2.0	3.98 (.97)* *Mdn* = 4.0	W = 1181 p < **.001**	2.47 (1.10) *Mdn* = 2.0	3.42 (.94)* *Mdn* = 3.0	W = 1758 p < **.001**	2.41 (1.06) *Mdn* = 2.0	2.68 (.93)* *Mdn* = 3.0	W = 610 p = **.004**
ABR concern	4.29 (1.21) *Mdn* = 4.0	4.81 (1.10)* *Mdn* = 5.0	W = 588 p = **.001**	4.17 (1.12) *Mdn* = 4.0	4.58 (1.07)* *Mdn* = 5.0	W = 736.5 p = **.003**	4.15 (1.08) *Mdn* = 4.0	4.10 (1.22) *Mdn* = 4.0	W = 189 p = .498
Interest in minimum antibiotic use	4.08 (1.35) *Mdn* = 4.0	4.77 (1.17)* *Mdn* = 5.0	W = 764 p < **.001**	3.96 (1.39) *Mdn* = 4.0	4.61 (1.15)* *Mdn* = 4.0	W = 1047.5 p < **.001**	3.83 (1.53) *Mdn* = 4.0	3.90 (1.28) *Mdn* = 4.0	W = 365.5 p = .390

*indicates significant difference between preintervention and postintervention at $p \leq .007$, as indicated by Wilcoxon signed-rank tests. Due to the number of comparisons across dependent variables within each group (7), a Bonferroni correction was applied (.05/7) and the new α was determined to be .007. *Note:* AAUSES = Appropriate Antibiotic Use Self-Efficacy Scale; min/trust subscale = minimization of antibiotics and trust in physician recommendations subscale; avoidance for viruses subscale = avoidance of antibiotics for viral infections; ABR = antibiotic resistance.

Postintervention Differences Between the Groups

To first investigate whether any differences existed between the groups for the time 1 measurements, we performed a Kruskal-Wallis test; the dependent variables tests were AAUSES total, AAUSES minimization/trust subscale, AAUSES avoidance of antibiotics for viral infections subscale, antibiotic-resistance knowledge test score, self-perceived antibiotic-resistance knowledge, antibiotic-resistance concern, and interest in minimizing antibiotic use. No differences across the groups—intervention, antibiotic-resistance pamphlet, general health pamphlet—were found ($p > .05$).

We also used the Kruskal-Wallis test to examine differences across the groups across the outcome variables, assessed postintervention/at time 2 (AAUSES total and subscales, knowledge, self-perceived knowledge, ABR concern, interest in minimizing antibiotic use in general, and the response to two hypothetical scenarios and whether they would go to the doctor to get a prescription for antibiotics for a head cold and upper respiratory illness). The results are presented in Table 3. Due to the number of comparisons, a Bonferroni correction was applied, and a new α was determined to be .006 (.05/9 = .0055). Group differences were identified for all dependent variables ($p \leq .001$), with the exception of going to the doctor to get a prescription for antibiotics for an upper respiratory illness ($p = .387$).

Mann-Whitney U tests were used for post hoc analyses. Results for the post hoc analyses are also presented in Table 3. In comparing the intervention group to the ABR pamphlet group, in applying an α of .006, the groups were significantly different in terms of the AAUSES total score ($p = .001$), the AAUSES avoidance of antibiotics for viral infections subscale ($p < .001$), and self-perceived knowledge ($p < .001$). In comparing the intervention group to the general health pamphlet group, differences were found for all tested dependent variables ($p \leq .002$). That is, all dependent variables were examined with the exception of *going to the doctor to get a prescription for antibiotics for an upper respiratory infection,* which was not significant in the initial Kruskal-Wallis test. In comparing the two pamphlet (comparison) groups, differences were found for the AAUSES total score ($p = .004$), the AAUSES avoidance of antibiotics for viral infections subscale ($p = .001$), ABR knowledge ($p < .001$), self-perceived knowledge ($p < .001$), interest in minimizing antibiotic use in general ($p < .001$), and whether the participant would go to the doctor to get a prescription for antibiotics for a head cold ($p = .002$). Among the tested dependent variables, no difference was found for the AAUSES minimization/trust subscale ($p = .175$) or antibiotic-resistance concern ($p = .008$).

Table 3. *Differences in Dependent Variables Among the Intervention and Comparison Groups*

	Int. Group	**ABR Group**	**GH Group**	**Kruskal-Wallis Test (omnibus)**	**Mann-Whitney U (post hoc)**		
	Post (time 2) *M (SD)*	Post (time 2) *M (SD)*	Post (time 2) *M (SD)*		Int. vs. ABR	Int. vs. GH	ABR vs. GH
AAUSES total	87.61 (13.10) *Mdn* = 91.92	80.41 (15.67) *Mdn* = 83.84	73.40 (16.27) *Mdn* = 76.92	31.32 $p <$ **.001**	1777.5 $p =$ **.001**	1149 $p <$ **.001**	2447 $p =$ **.004**
AAUSES min/trust subscale	90.16 (12.29) *Mdn* = 93.33	85.79 (14.34) *Mdn* = 91.67	83.08 (14.84) *Mdn* = 85.0	10.53 $p =$ **.005**	2073.5 $p = .034$	1690.5 $p =$ **.002**	2910.5 $p = .175$
AA avoid	84.35 (15.45) *Mdn* = 88.0	70.51 (23.64) *Mdn* = 77.0	58.58 (24.53) *Mdn* = 62.0	43.57 $p <$ **.001**	1634 $p <$ **.001**	913 $p <$ **.001**	2364 $p =$ **.001**
ABR knowledge	6.85 (.87) *Mdn* = 7.0	6.82 (1.03) *Mdn* = 7.0	6.13 (1.17) *Mdn* = 6.0	22.62 $p <$ **.001**	2615 $p = .962$	1549.5 $p <$ **.001**	2174.5 $p <$ **.001**
Self-perceived ABR knowledge	3.98 (.97) *Mdn* = 4.0	3.42 (.94) *Mdn* = 3.0	2.68 (.93) *Mdn* = 3.0	55.44 $p <$ **.001**	1693.5 $p <$ **.001**	831.5 $p <$ **.001**	2008 $p <$ **.001**
ABR concern	4.81 (1.10) *Mdn* = 5.0	4.58 (1.07) *Mdn* = 5.0	4.10 (1.22) *Mdn* = 4.0	13.91 $p =$ **.001**	2264.5 $p = .198$	1635 $p <$ **.001**	2519 $p = .008$
Interest in minimizing antibiotic use	4.77 (1.17) *Mdn* = 5.0	4.61 (1.15) *Mdn* = 4.0	3.90 (1.28) *Mdn* = 4.0	22.34 $p <$ **.001**	2334 $p = .263$	1465 $p <$ **.001**	2285 $p <$ **.001**
[a]Seeking antibiotics for a head cold	1.66 (.81) *Mdn* = 1.50	1.81 (.87) *Mdn* = 2.0	2.25 (.96) *Mdn* = 2.00	16.62 $p <$ **.001**	2846.5 $p = .297$	3355 $p <$ **.001**	4233 $p =$ **.002**
[a]Seeking antibiotics for an upper respiratory infection	2.37 (.93) *Mdn* = 2.0	2.54 (.94) *Mdn* = 3.0	2.59 (1.02) *Mdn* = 3.0	1.90 $p = .387$	--- ---	--- ---	--- ---

Note. --- indicates that no post hoc was conducted due to nonsignificant omnibus test. Int. = intervention group, ABR = antibiotic resistance pamphlet group, GH = general health pamphlet group. AAUSES = Appropriate Antibiotic Use Self-Efficacy Scale; min/trust subscale = minimization of antibiotics and trust in physician recommendations subscale; avoidance for viruses subscale = avoidance of antibiotics for viral infections; ABR = antibiotic resistance. Due to the number of tests conducted for the omnibus test (9), a Bonferroni correction was applied (.05/9) and the new alpha was determined to be .0055 (rounded to .006).

[a]For these items, participants were provided with illness scenarios (head cold, upper respiratory infection)—and were asked about the likelihood that they would "go to the doctor to get a prescription for antibiotics," with response options being 1 ("very unlikely") to 4 ("very likely").

Discussion

The aim of our study was to examine the effect of a social cognitive intervention aimed at improving AAUSE. Several outcome measures were of interest in the present study; not only were we interested in understanding how the intervention might impact AAUSE, but we also wanted to examine whether the intervention would change perceptions and concerns about antibiotic resistance, and corresponding attitudes toward antibiotic-resistance preventive behaviors. Two comparison conditions were used as part of our study: one comparison group received and read a pamphlet discussing antibiotic resistance (antibiotic-resistance pamphlet group) and the other comparison group received and read a pamphlet discussing general health information (general health pamphlet group). The results indicated that for both the intervention group and the antibiotic-resistance pamphlet group, there was an improvement in AAUSE and the other dependent variables under examination. The results also indicated significant differences in the outcome variables between the intervention and comparison groups, as well as the two comparison groups.

In examining the changes in AAUSE and other perceptions from preintervention to postintervention, it is noteworthy that participants' scores improved across all dependent variables in both the intervention and ABR pamphlet groups. This finding suggests that the exposure to the information on antibiotic resistance, whether in presentation or pamphlet format, was impactful in terms of the impact on self-efficacy and related perceptions. This finding is consistent with the research that shows that exposure to information about appropriate antibiotic use and antibiotic resistance can be influential in terms of promoting antibiotic-resistance preventive behaviors (Roope et al., 2018; Sabuncu et al., 2009; Trepka et al., 2001). Importantly, this change occurred for psychosocial variables, including AAUSE and ABR concern, but it was also observed for more objective measures, including the knowledge test. While participants in the general health pamphlet condition did show an improvement in knowledge scores as well—possibly an artifact of being able to take the test twice (time 1, then time 2)—the improvement in scores did not reach statistical significance.

While statistically significant changes in the dependent variables were observed for both the intervention and ABR pamphlet groups from preintervention to postintervention (time 1 to time 2), it is noteworthy that there were statistically significant changes in AAUSE in the general health pamphlet condition. Those in the control group showed an improvement in AAUSE (total score and the avoidance for viruses subscale score) as well as self-perceived knowledge about antibiotic resistance. It is possible that given the nature of the questions asked (e.g., in the AAUSES, in the ABR knowledge test), participants internalized some of the information—for example, that antibiotics should not be used for viral infections. However, as noted, despite an improvement in self-perceived knowledge, in contrast to the other two groups, no objective improvement in ABR knowledge was observed from time 1 to time 2.

In addition to changes observed from preintervention to postintervention, we were also interested in differences across the groups at time 2 (postintervention) of the study. Notably, participants in the intervention group showed higher overall AAUSE, greater AAUSE regarding the avoidance of antibiotics for viruses, and self-perceived knowledge than both comparison conditions. Further, with the one exception (seeking antibiotics for an upper respiratory infection), the intervention group had higher scores at time 2 across all dependent variables compared to the general health pamphlet condition. Therefore, similar to other studies that have shown that interventions with social cognitive components are particularly impactful on self-efficacy (Anderson et al., 2001; Ashford et al., 2010; Luszczynska et al., 2007), our study helps to illustrate that social cognitive strategies might also be particularly beneficial in improving AAUSE.

It is noteworthy that there was no difference between the intervention group and the ABR pamphlet group on AAUSE regarding minimization of antibiotics/trust in physician recommendations, ABR knowledge, ABR concern, interest in minimizing antibiotic use and seeking of antibiotics for a head cold (hypothetical scenario). Further, the ABR pamphlet group had higher scores than the general health pamphlet group with only three exceptions (AAUSE minimizing use/trust in physician recommendations, ABR concern, and the respiratory infection item). This illustrates that a less intrusive and time-intensive intervention (reading a pamphlet compared to an interactive presentation) might still be impactful in changing some aspects of AAUSE and related perceptions and behaviors. Similarly, a recent study found that simply providing information about the potential harm associated with antibiotic misuse to self or others was effective in decreasing antibiotic requests (Miller et al., 2020). Future research examining the differences between a social cognitive intervention compared with educational information in terms of their impact on antibiotic-use perceptions and behaviors would be beneficial in better understanding the effects observed in our study.

Because we were unable to observe actual antibiotic-use behaviors that might have followed from taking part in the study, we instead used hypothetical scenarios and asked participants what they would do under certain circumstances. While less than ideal in comparison to collecting actual behavior information, this method has been employed to understand a range of health behaviors, including antibiotic-prescribing behaviors (Sirota et al., 2017) and antibiotic use and prescription expectations (Hill, 2017; Thorpe et al., 2020; Thorpe et al., 2021). In terms of outcomes measured in our study, we were interested in whether participants in each condition would go to the doctor to get a prescription for antibiotics for a head cold and a respiratory infection. There was a significant difference between the two ABR-focused conditions (intervention, ABR pamphlet) and the general health pamphlet condition in that those who were exposed to ABR information reported being less likely to seek antibiotics for a head cold.

It is particularly noteworthy, however, that there were no differences across the three groups in terms of whether they would seek antibiotics for an upper respiratory infection. This finding indicates that while the ABR information presented may have been able to effectively dissuade participants from seeking antibiotics for a head cold, the ABR information (whether as part of the social cognitive intervention or pamphlet condition) did not seem to have the same impact in terms of upper respiratory infections. Previous research has found that more than half of college students with symptoms of an upper respiratory infection expected antibiotics from their university health center—and this was related to their attribution about the cause of the infection being bacterial (Haltiwanger et al., 2001). In terms of pressure to prescribe antibiotics, respiratory infections are cited as one of the illnesses associated with an increased expectation of an antibiotic prescription (Al-Shawi et al., 2018; Kaplan et al., 2020).

The null findings for this variable, therefore, point to clinical implications and future directions for this area of study. Addressing misconceptions about upper respiratory infections may be a particularly important avenue in clinical settings, including university health centers (Kaplan et al., 2020). Further, it is unclear whether the null findings were due to a lack of emphasis on upper respiratory infections in the ABR-related conditions (intervention, ABR pamphlet) or whether participants' beliefs (e.g., that "infection" = bacterial) or previous experience with physicians (e.g., previous prescriptions for upper respiratory infections) contributed to the lack of difference across the groups. Indeed, previous experience with overprescription of antibiotics can influence patient expectations for subsequent illnesses (Wang, 2020). Interestingly, Al-Shawi et al. (2018) reported that, even among individuals with good antibiotic-resistance knowledge, more than half (58.6%) reported still expecting a prescription of antibiotics for their child for an upper respiratory infection. It is also possible that the seeking of antibiotics in this case is related to symptom severity and/or longevity as well. Further research on misconceptions about appropriate antibiotic use and misunderstandings about what types of infections tend to be bacterial or viral would be beneficial in understanding perceptions and behaviors relevant to the antibiotic resistance public health crisis.

Limitations

There are several limitations that should be considered in relation to our study. The sample was recruited from the undergraduate university student population; as such, it is unclear the extent to which the results—and the effectiveness of such an intervention—would be generalizable to the public. The intervention was structured similarly to a university class; that is, students participated in the intervention in a classroom setting and participated in self-reflective and group activities. Therefore, it was very similar to the structure of a lecture/seminar discussion. Undergraduate student participants might be especially responsive to this format in part because it is what they are used to as university students. Given the effectiveness of the intervention demonstrated in our study, it would be particularly important to examine the extent to which an intervention might be effective in other formats (e.g., YouTube videos, online format) and in different populations—particularly among other members of the general public (i.e., nonstudents). This would, of course, involve employing different sampling strategies—and possibly entail the use of crowdsourcing data collection websites, such as Prolific, which allow researchers to collect data using nationally representative samples.

In addition to expanding the intervention to other populations, it might also be beneficial to consider additional framing of the antibiotic resistance public health crisis. This research was carried out before the COVID-19 pandemic. However, amidst the pandemic, engaging in protective health behaviors (e.g., vaccinations, mask wearing) was often framed in terms of protecting the most vulnerable in our society—older adults and those who are immunocompromised. Along similar lines, older adults and individuals who are immunocompromised are at greater risk for antibiotic-resistant bacterial infections (The Lancet, 2023). In turn, exploring the possible effect of framing antibiotic-resistance mitigation as something to protect the vulnerable might be an interesting component to examine in future studies.

The intervention was designed with a focus on AAUSE and the corresponding antibiotic-resistance preventive behaviors that would hopefully follow from improvements in self-efficacy. One notable limitation is that we did not directly observe antibiotic-use behaviors—for example, we did not follow participants over the course of winter and collect data from them in terms of their antibiotic-use behaviors (e.g., in relation to symptoms for a cold, flu, or respiratory illness). To help make up for the lack of directly observed behaviors, we instead used hypothetical scenarios to help understand what participants might do in certain illness situations. Although hypothetical scenarios have been used in understanding antibiotic use in members of the general public and among physicians in relation to their prescribing behaviors (Hill, 2017; Sirota et al., 2017; Thorpe et al., 2020; Thorpe et al., 2021), it is possible that there would be a discrepancy between participants' responses to hypothetical scenarios and their actual behaviors.

The potential role of the Hawthorne effect and/or social desirability should also be considered in interpreting the results. Despite the use of several distractor items and scales (e.g., nutrition self-efficacy, physical activity self-efficacy, and items about other health issues), it is possible participants became aware of the outcomes of interest in our study. Specifically, given the focus on antibiotic resistance in the intervention and ABR pamphlet conditions, it is possible that participants' responses at time 2 (postintervention) were reflective of their wanting to demonstrate "improvements" in their overall antibiotic-resistance perceptions and beliefs. To help address this, it would be beneficial for future research to include longitudinal follow-up measurements; for example, participants could be followed for several months after the intervention/study and report their actual antibiotic use over that time period. Not only would this help address concerns about the Hawthorne effect/social desirability, but it would also allow researchers to see the impact of the intervention on actual antibiotic-use behaviors.

Finally, it must be emphasized that due to the constraints associated with participant recruitment at our institution, complete randomization across all three conditions was not possible. Specifically, participants were recruited through two mechanisms: the undergraduate psychology participant pool and through flyers posted around the university. For participants recruited through the participant pool, due to the differences in time requirements for the intervention and comparison (pamphlet) conditions, participants signed up for a 2-credit study (intervention) or signed up for a 1-credit study (comparison groups). Therefore, participants self-selected into the intervention or comparison groups (likely based primarily on time requirements/research credits). Further, to help with achieving our sample size, we also recruited participants from across the university using flyers—and participants recruited through this mechanism were part of the comparison conditions only (due to the timing of recruitment/scheduling). Therefore, due to a lack of randomization across groups, this intervention study is not a true experiment. Even so, participants did not appear to be significantly different in terms of sociodemographics, and there were no differences in the time 1 (preintervention) measurements across the three groups. Nonetheless, this limitation should be kept in mind, and future research in this area should endeavor to employ all aspects of experimental designs (including randomization across groups) when possible.

Conclusion

The aim of our study was to examine the effect of a social cognitive intervention aimed at promoting AAUSE. Our results indicated that participants' AAUSE and related perceptions improved from preintervention to postintervention in both the intervention group and the ABR pamphlet comparison group. The results also indicated that, with the exception of seeking antibiotics for an upper respiratory infection, participants in the intervention condition had greater AAUSE, knowledge, ABR concern, interest in minimizing antibiotic use in general, and were less likely to seek antibiotics for a head cold compared with the general health pamphlet condition. Fewer differences were found between the intervention and ABR pamphlet conditions, but individuals in the intervention condition reported greater AAUSE (overall, avoidance of antibiotics for viral infections) and greater self-perceived knowledge. Overall, our results indicated the potential positive effects of a social cognitive intervention aimed at promoting AAUSE. Conveying critical information about antibiotic resistance and employing social cognitive strategies in interventions/health promotion programs may be particularly beneficial in helping to address perceptions and behaviors relevant to the antibiotic-resistance public health crisis.

References

Al-Shawi, M. M., Darwish, M. A., Abdel Wahab, M. M., & Al-Shamlan, N. A. (2018). Misconceptions of parents about antibiotic use in upper respiratory tract infections: A survey in primary schools of the Eastern Province, KSA. *Journal of Family Community Medicine*, *25*(1), 5–12. https://doi.org/10.4103/jfcm.JFCM_46_17

Anderson, E. S., Winett, R. A., Wojcik, J. R., Winnet, S. G., & Bowden, T. (2001). A computerized social cognitive intervention for nutrition behavior: Direct and mediated effects on fat, fiber, fruits, and vegetables, self-efficacy, and outcome expectations among food shoppers. *Annals of Behavioral Medicine*, *23*(2), 88–100. https://doi.org/10.1207/S15324796ABM2302_3

Ashford, S., Edmunds, J., & French, D. P. (2010). What is the best way to change self-efficacy to promote lifestyle and recreational physical activity? A systematic review with meta-analysis. *British Journal of Health Psychology*, *15*(Pt 2), 265–288. https://doi.org/10.1348/135910709X461752

Bandura, A. (1998). Health promotion from the perspective of social cognitive theory. *Psychology and Health*, *13*, 613–649.

Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology*, *52*, 1–26. https://doi.org/10.1146/annurev.psych.52.1.1

Cameron, K. A., Ross, E. L., Clayman, M. L., Bergeron, A. R., Federman, A. D., Bailey, S. C., Davis, T. C., & Wolf, M. S. (2010). Measuring patients' self-efficacy in understanding and using prescription medication. *Patient Education and Counseling*, *80*(3), 372–376. https://doi.org/10.1016/j.pec.2010.06.029

Cars, O., Hogberg, L. D., Murray, M., Nordberg, O., Sivaraman, S., Lundbor, C. S., So, A. D., & Tomson, G. (2008). Meeting the challenge of antibiotic resistance. *British Medical Journal*, *337*. https://doi.org/10.1136/bmj.a1438

Centers for Disease Control and Prevention. (2020). *Antibiotic/antimicrobial resistance*. https://www.cdc.gov/drugresistance/index.html - :~:text=Each year in the U.S.,working to combat this threat

Cole, A. (2014). GPs feel pressurised to prescribe unnecessary antibiotics, survey finds. *British Medical Journal*, *349*, g5238. https://doi.org/10.1136/bmj.g5238

Feldstein, D., & Felter, C. (2018). Antibiotic stewardship programs in nursing homes: A systematic review. *Journal of the American Medical Directors Association*, *19*(2), 110–116. https://doi.org/10.1016/j.jamda.2017.06.019

Fletcher-Lartey, S., Yee, M., Gaarslev, C., & Khan, R. (2016). Why do general practitioners prescribe antibiotics for upper respiratory tract infections to meet patient expectations: A mixed methods study. *BMJ Open*, *6*(10), e012244. https://doi.org/10.1136/bmjopen-2016-012244

Griffin-Blake, C. S., & DeJoy, D. M. (2006). Evaluation of social-cognitive versus stage-matched, self-help physical activity interventions at the workplace. *American Journal of Health Promotion*, *20*(3), 200–209. https://doi.org/10.4278/0890-1171-20.3.200

Haltiwanger, K. A., Hayden, G. F., Weber, T., Evans, B. A., & Possner, A. B. (2001). Antibiotic-seeking behavior in college students: What do they really expect? *Journal of American College Health*, *50*(1), 9–13. https://doi.org/10.1080/07448480109595705

Hill, E. M. (2017). Decision making about antibiotic use: Examining the role of antibiotic resistance knowledge, concern, and previous inappropriate antibiotic use. *Journal of Communication in Healthcare*, 1–8. https://doi.org/10.1080/17538068.2017.1373902

Hill, E. M., & Watkins, K. (2018). Development and initial validation of the appropriate antibiotic use self-efficacy scale. *Patient Education and Counseling*, *101*(10), 1838–1845. https://doi.org/10.1016/j.pec.2018.05.020

Huang, Y. M., Shiyanbola, O. O., & Chan, H. Y. (2018a). A path model linking health literacy, medication self-efficacy, medication adherence, and glycemic control. *Patient Education and Counseling*, *101*(11), 1906–1913. https://doi.org/10.1016/j.pec.2018.06.010

Huang, Y. M., Shiyanbola, O. O., & Smith, P. D. (2018b). Association of health literacy and medication self-efficacy with medication adherence and diabetes control. *Patient Preference and Adherence*, *12*, 793–802. https://doi.org/10.2147/PPA.S153312

Hulscher, M., & Prins, J. M. (2017). Antibiotic stewardship: Does it work in hospital practice? A review of the evidence base. *Clinical Microbiology and Infection*, *23*(11), 799–805. https://doi.org/10.1016/j.cmi.2017.07.017

Kaplan, N. M., Khader, Y. S., Alfaqih, M. A., Saadeh, R., & Al Sawalha, L. (2020). Implementation of the WHO approved "Tailoring Antimicrobial Resistance Programs (TAP)" reduces patients' request for antibiotics. *Antibiotics*, *9*(8). https://doi.org/10.3390/antibiotics9080507

Kimmick, G., Edmond, S. N., Bosworth, H. B., Peppercorn, J., Marcom, P. K., Blackwell, K., Keefe, F. J., & Shelby, R. A. (2015). Medication taking behaviors among breast cancer patients on adjuvant endocrine therapy. *Breast*, *25*(5), 630–636. https://doi.org/10.1016/j.breast.2015.06.010

Kreausukon, P., Gellert, P., Lippke, S., & Schwarzer, R. (2012). Planning and self-efficacy can increase fruit and vegetable consumption: A randomized controlled trial. *Journal of Behavioral Medicine*, *35*(4), 443–451. https://doi.org/10.1016/j.breast.2015.06.010https://doi.org/11007/s10865-011-9373-1

Liou, D., & Kulik, L. (2020). Self-efficacy and psychosocial considerations of obesity risk reduction behaviors in young adult white Americans. *PLoS One*, *15*(6), e0235219. https://doi.org/10.1371/journal.pone.0235219

Luszczynska, A., & Schwarzer, R. (2005). Social-cognitive theory. In M. Conner & P. Norman (Eds.), *Predicting health behavior* (pp. 127–169). Open University Press.

Luszczynska, A., Tryburcy, M., & Schwarzer, R. (2007). Improving fruit and vegetable consumption: A self-efficacy intervention compared with a combined self-efficacy and planning intervention. *Health Education Research*, *22*(5), 630–638. https://doi.org/10.1093/her/cyl133

Mallah, N., Orsini, N., Figueiras, A., & Takkouche, B. (2022a). Education level and misuse of antibiotics in the general population: A systematic review and dose-response meta-analysis. *Antimicrobial Resistance & Infection Control*, *11*(1), 24. https://doi.org/10.1186/s13756-022-01063-5

Mallah, N., Orsini, N., Figueiras, A., & Takkouche, B. (2022b). Income level and antibiotic misuse: A systematic review and dose-response meta-analysis. *The European Journal of Health Economics*, *23*(6), 1015–1035. https://doi.org/10.1007/s10198-021-01416-8

Miller, B. J., Carson, K. A., & Keller, S. (2020). Educating patients on unnecessary antibiotics: Personalizing potential harm aids patient understanding. *Journal of the American Board of Family Medicine*, *33*(6), 969–977. https://doi.org/10.3122/jabfm.2020.06.200210

Nafradi, L., Nakamoto, K., & Schulz, P. J. (2017). Is patient empowerment the key to promote adherence? A systematic review of the relationship between self-efficacy, health locus of control and medication adherence. *PLoS One*, *12*(10), e0186458. https://doi.org/10.1371/journal.pone.0186458

Patel, A., Pfoh, E. R., Misra Hebert, A. D., Chaitoff, A., Shapiro, A., Gupta, N., & Rothberg, M. B. (2020). Attitudes of high versus low antibiotic prescribers in the management of upper respiratory tract infections: A mixed methods study. *Journal of General Internal Medicine*, *35*(4), 1182–1188. https://doi.org/10.1007/s11606-019-05433-5

Roope, L. S. J., Tonkin-Crine, S., Butler, C. C., Crook, D., Peto, T., Peters, M., Walker, A. S., & Wordsworth, S. (2018). Reducing demand for antibiotic prescriptions: Evidence from an online survey of the general public on the interaction between preferences, beliefs and information, United Kingdom, 2015. *Eurosurveillance*, *23*(25). https://doi.org/10.2807/1560-7917.ES.2018.23.25.1700424

Sabuncu, E., David, J., Bernede-Bauduin, C., Pepin, S., Leroy, M., Boelle, P. Y., Watier, L., & Guillemot, D. (2009). Significant reduction of antibiotic use in the community after a nationwide campaign in France, 2002–2007. *PLoS Med*, *6*(6), e1000084. https://doi.org/10.1371/journal.pmed.1000084

Schlomer, G. L., Bauman, S., & Card, N. A. (2010). Best practices for missing data management in counseling psychology. *Journal of Counseling Psychology*, *57*(1), 1–10. https://doi.org/10.1037/a0018082.supp

Seipel, M. B. A., Prohaska, E. S., Ruisinger, J. F., & Melton, B. L. (2019). Patient knowledge and experiences with antibiotic use and delayed antibiotic prescribing in the outpatient setting. *Journal of Pharmacy Practice*, 897190019889427. https://doi.org/10.1177/0897190019889427

Shamizadeh, T., Jahangiry, L., Sarbakhsh, P., & Ponnet, K. (2019). Social cognitive theory-based intervention to promote physical activity among prediabetic rural people: A cluster randomized controlled trial. *Trials*, *20*(1), 98. https://doi.org/10.1186/s13063-019-3220-z

Sheeran, P., Maki, A., Montanaro, E., Avishai-Yitshak, A., Bryan, A., Klein, W. M., Miles, E., & Rothman, A. J. (2016). The impact of changing attitudes, norms, and self-efficacy on health-related intentions and behavior: A meta-analysis. *Health Psychology*, *35*(11), 1178–1188. https://doi.org/10.1037/hea0000387

Shiyanbola, O. O., Unni, E., Huang, Y. M., & Lanier, C. (2018). Using the extended self-regulatory model to characterise diabetes medication adherence: A cross-sectional study. *BMJ Open*, *8*(11), e022803. https://doi.org/10.1136/bmjopen-2018-022803

Sirota, M., Round, T., Samaranayaka, S., & Kostopoulou, O. (2017). Expectations for antibiotics increase their prescribing: Causal evidence about localized impact. *Health Psychology*, *36*(4), 402–409. https://doi.org/10.1037/hea0000456

Sleath, B., Blalock, S. J., Carpenter, D. M., Sayner, R., Muir, K. W., Slota, C., Lawrence, S. D., Giangiacomo, A. L., Hartnett, M. E., Tudor, G., Goldsmith, J. A., & Robin, A. L. (2015). Ophthalmologist-patient communication, self-efficacy, and glaucoma medication adherence. *Opthalmology*, *122*(4), 748–754.

Smith, R. A., M'Ikanatha N. M., & Read, A. F. (2015). Antibiotic resistance: A primer and call to action. *Health Communication*, *30*(3), 309–314. https://doi.org/10.1080/10410236.2014.943634

Stenehjem, E., Hersh, A. L., Buckel, W. R., Jones, P., Sheng, X., Evans, R. S., Burke, J. P., Lopansri, B. K., Srivastava, R., Greene, T., & Pavia, A. T. (2018). Impact of implementing antibiotic stewardship programs in 15 small hospitals: A cluster-randomized intervention. *Clinical Infectious Disease*, *67*(4), 525–532. https://doi.org/10.1093/cid/ciy155

The Lancet. (2023). Tackling antimicrobial resistance to protect healthy ageing. *The Lancet Healthy Longevity*, *4*(11). https://doi.org/10.1016/S2666-7568(23)00218-0

Thorpe, A., Sirota, M., Juanchich, M., & Orbell, S. (2020). "Always take your doctor's advice": Does trust moderate the effect of information on inappropriate antibiotic prescribing expectations? *British Journal of Health Psychology*, *25*(2), 358–376. https://doi.org/10.1111/bjhp.12411

Thorpe, A., Sirota, M., Orbell, S., & Juanchich, M. (2021). Effect of information on reducing inappropriate expectations and requests for antibiotics. *British Journal of Psychology*. https://doi.org/10.1111/bjop.12494

Trepka, M. J., Belongia, E. A., Chyou, P. H., Davis, J. P., & Schwartz, B. (2001). The effect of a community intervention trial on parental knowledge and awareness of antibiotic resistance and appropriate antibiotic use in children. *Pediatrics*, *107*(1). https://doi.org/10.1542/peds.107.1.e6

Wang, N. C. (2020). Understanding antibiotic overprescribing in China: A conversation analysis approach. *Social Science & Medicine*, *262*, 113251. https://doi.org/10.1016/j.socscimed.2020.113251

Williams, S. L., & French, D. P. (2011). What are the most effective intervention techniques for changing physical activity self-efficacy and physical activity behaviour—and are they the same? *Health Education Research*, *26*(2), 308–322. https://doi.org/10.1093/her/cyr005

World Health Organization. (2015). *Antibiotic resistance: Multi-country public awareness survey*.

World Health Organization. (2020). *Antibiotic resistance*. https://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance

Zhang, N. J., Terry, A., & McHorney, C. A. (2014). Impact of health literacy on medication adherence: A systematic review and meta-analysis. *Annals of Pharmacotherapy*, *48*(6), 741–751. https://doi.org/10.1177/1060028014526562

JSBHS

The *Journal of Social, Behavioral, and Health Sciences* (*JSBHS),* cosponsored by the College of Social and Behavioral Health, College of Allied Health, and College of Health Sciences and Public Policy, is a peer-reviewed, online, interdisciplinary journal focusing on theoretically based research that addresses contemporary national and international issues. *JSBHS* articles include peer-reviewed research reports, brief reports, comprehensive literature reviews, book reviews, and student research.