

Reducing Antibiotics for Colds and Flu: A Student Taught Program

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Abstract

A student peer-taught program, to decrease antibiotic use for colds and flu, was developed and implemented in one school district (21 schools) in Chisinau, Moldova, in 2003-04. A second district (20 schools) served as the control. Students (12-13 years) and adults most responsible for the family's health care completed surveys in March pre-post intervention. The surveys determined the reported incidence of colds and flu during the past winter, treatment, beliefs about cause, and usefulness of antibiotics. The intervention included: peer-education sessions, parents' meetings, booklet, vignette video, newsletters, poster, and poster contest. The intervention also provided basic information on appropriate use of medicines. Pre-post intervention survey results indicated that the intervention was successful. Adjusted for controls, students who reported they did not treat colds or flu with antibiotics increased 33.7%; the comparable increase for adults was 38.0%. Adjusted for controls, intervention students who did not know if they had used an antibiotic decreased 15.1% and for intervention adults the comparable decrease was 5.0%. All relative responses related to beliefs about the cause of colds and flu and the usefulness of antibiotics to treat them changed in a positive direction. In all groups, beliefs and behaviors relative to antibiotic use were related.

N words = 200

Introduction

Antibiotics have revolutionized the treatment of common bacterial infections and have played a vital role in reducing child mortality. Since the introduction of antibiotics, their consumption has increased dramatically in most parts of the world [1-2]. However, inappropriate use of antibiotics in the absence of a bacterial infection is a long-standing problem in many countries [3]. Antibiotic prescribing for children is often inappropriate and varies among countries despite consistency in rates of indications [4-5]. The problem of antimicrobial drug resistance is particularly prevalent in developing countries where antibiotics are often available without prescription [6-8].

Pediatricians have had the experience of parents demanding antibiotics for their child's common viral upper respiratory infection [9-10]. Many adults are unaware that antibiotics do not cure viral infections. Many physicians and pharmacists are guilty of prescribing and dispensing antibiotics without regard to the cause of infection [11-13].

The Republic of Moldova, the poorest country in Europe, is a sovereign state between Romania and Ukraine with a population of about 4.4 million people. Two factors, economic reform and ready availability of antibiotics without prescription, have exacerbated the problem of inappropriate antibiotic use. The Moldovan health care system changed with the establishment of a market economy after the collapse of the Soviet system. Economic reform led to an increase in private pharmacies and a market flooded with medicines.

Officially, antibiotics are prescription-only drugs in Moldova, but in practice they are widely available without prescription. Unrestricted access to antibiotics has led to widespread self-medication. In addition, health care workers have a long-standing practice of prescribing many drugs at once and patients expect them. In fact, parents commonly treat their children with

five or more drugs concurrently [11]. Common cold treatment is one of the best examples with many parents acting as though they believe the more drugs the better [11-13].

Two baseline projects supported the need for a project to reduce antibiotic use for colds and flu in Moldova. In 2000, 65 mothers were interviewed in children's ambulatory clinics [13]. Results suggested that mothers influence antibiotic prescribing for their children. Mothers had misconceptions about appropriate indications for antibiotics and often gave them to their children without a physician's knowledge. Also, mothers said that physicians do not clarify why an antibiotic is not indicated. In addition, surveys, conducted during the cold and flu season, found that almost half of colds and flu were treated with an antibiotic [12].

Given the nature of the problem, i.e., inappropriate antibiotic use, why involve students in teaching peers and parents about the appropriate treatment of colds and flu? Primarily for the following reasons: 1) schools provide a large accessible population of students and parents, 2) schools are often respected central institutions in their communities, 3) students want to learn about medicines [14-15], and 4) peer education has succeeded in other health education areas [16-34].

As schools often play a central role in a community, they are well suited to be sites of programs that both educate children and teachers and reach out to parents and community leaders. Increasingly, school-based health promotion programs are based on Social Cognitive Theory (SCT), which supports peer-teaching and the involvement of families and the wider community [35].

The use of peers as health educators in school-based programs has primarily focused on preventing or reducing use of addictive substances, i.e., tobacco, alcohol, and drugs [17-27]. More recently, a few school-based programs have involved peer educators in programs focused

on other health behaviors, e.g., nutrition [28-29]; asthma [30], violence [31-33], sex and HIV [34-35]. To our knowledge, no school-based program heretofore has used peers to change medicine use beliefs and behaviors among their classmates or their families.

The primary goal of this study was to evaluate the ability of trained students to teach their peers and parents not to take antibiotics for colds and flu. Secondary goals were to increase appropriate beliefs about the cause of colds and flu and the ability of antibiotics to treat them and to determine the relationships between beliefs and behaviors relative to antibiotic use. The latter is important because, if beliefs are correlated with behaviors, education can be provided to change beliefs with an expectation that behaviors will also change.

Methods

Participants

In keeping with the controlled before and after study design, two well-matched¹ separated school districts in the capital (Chisinau) of Moldova were recruited in early 2003 and assigned to the intervention (I) (21 schools) or the control (C) (20 schools) condition by a coin toss. The school districts' administrations understood that the students and their parents would be asked to participate in the project.

Surveys

In March, 2003, 3586 6th level students (12-13 years) completed 23-item pre-intervention (Pre-I) surveys in their school classrooms (Table I). Surveys were in Romanian or Russian depending on the primary language used in the school. All schools in both districts participated.

¹ The two school districts were well matched on number of schools (20 vs. 21) and balance of Russian versus Romanian speaking schools, and both were in working class areas of Chisinau where students attend the schools closest to their homes which are near their parents' places of work. As the poorest ex-Soviet bloc country in Europe and with a Communist government, there was little variation in family income in Chisinau at the time of the surveys. Moreover, those with improved economic status after the breakup of the Soviet Union tend to send their children to private schools.

----- Table I about here

As required by the Boston University Institutional Review Board (IRB) and a newly constituted Moldovan IRB formed for this study, no subject identifiers were on the instruments and students were promised anonymity. The students were informed of these conditions on the IRB approved consent forms they signed prior to the surveys. No student opted out and the absentee rate was low. Teachers were absent from the classrooms during the surveys.

Development of the surveys was based in part on information acquired in focus group discussions (FGD) conducted in late 2002 and early 2003 among students, parents, teachers, and physicians. The FGD information was used to guide development of the school-based intervention to reduce antibiotic use for colds and flu and to help design the pre-post surveys² needed to evaluate the intervention.

In keeping with the primary goal of the study, the primary survey questions inquired into the incidence of colds and flu during the past winter and whether antibiotics were used to treat them. Secondary questions inquired into other treatments, beliefs about the cause of colds and flu, and the efficacy of antibiotics to treat them. Questions were closed response format except for a very few follow-up questions, e.g., an open-ended question inquiring into what medicines were used for colds and flu. The questions were the same for students and adults except students answered two questions relative to their age and autonomy in using medicines and adults answered three questions relative to their children.

Following completion of their surveys, students were asked to take home surveys and ask the adult in their home most responsible for the family's health care to complete them independently and then to seal them in the attached envelope for the student to return to the classroom. No identifiers were on the instruments and, consistent with the culture and Moldova

IRB requirements, no questions inquired into the family's socioeconomic status. Consent forms, promising anonymity and approved by Boston University's and Moldova's IRBs were included in the take-home packet. Completed surveys were returned by 2716 adults (Table I).

In March, 2004, post-intervention (Post-I) surveys were completed in the same schools by 2999 7th level students and at home by 2156 adults (Table I).

In the Pre-I phase, 82% of adult respondents were mothers but in the Post-I phase 74% were mothers. Father respondents increased from 10% to 12% and "Others" from 9% to 14%; 28% fewer student and adult respondents were in the Post-I than the Pre-I phase (Table I). Out-migration, as parents moved out of Moldova for work, especially mothers, accounted for decreased numbers, particularly in the C district schools when a major employer's business closed.

Student Trainers

During the Pre-I school survey, student volunteers were recruited from the I district schools to be trained as peer leaders to conduct an educational intervention among their classmates and their classmates' parents during the fall and winter of 2003-04. With the approval of their classroom teachers, 50 prospective Student Trainers (STs) were recruited.

As shown in Table II, the student volunteers (STs) were trained in two all day sessions in September, 2003. Prior to start of the training, the STs were administered, and one week later readministered, the survey to test its reliability. No significant differences ($p < .05$) were found in the responses to the primary questions, i.e., incidence of colds and flu in the preceding winter and behaviors related to treating them, e.g., use of antibiotics. Follow-up ST sessions were held bi-weekly during the I phase.

-----Table II about here

Intervention Materials and Methods

Table II also provides information on the intervention materials and methods. The intervention **repeatedly** emphasized four primary messages: *antibiotics do not help colds & flu; colds and flu are caused by viruses; antibiotics do not kill viruses; do not take antibiotics for colds and flu*, but also provided general information on appropriate use of medicines. As shown in Table II, the intervention, with all materials in both Romanian and Russian, included: six sessions of peer-led education in 7th level classes with outreach to parents, two parents' meetings led by the trained students, an interactive video of vignettes, a booklet, two newsletters, a poster, and a poster contest.² A logo featuring a sneezing snowman was used on most of the intervention materials. While the surveys allowed the respondents to use their own judgment to determine whether they had had a cold or flu, e.g., "How many times did you have a common cold or flu this winter?," intervention materials provided information on their symptoms, how the difference between them could be determined, and what actions were appropriate for each.

Of the 50 trained students, 34 delivered the intervention throughout the intervention period, with teachers playing no part. The STs were assigned to their own schools and traveled in pairs to other schools as needed. The average school had four 7th level classes. A total of 489 ST led student sessions and 42 ST led parent sessions were held.

Data Analysis

STs were dropped from the analysis. Survey data were cleaned and computerized in the offices of the principal investigator. SPSS version 11 was used for analysis.

Results

Pre-I

Statistical tests indicated little potential for bias between the I and C groups at baseline. No age (among students) or gender differences were found; boys represented 46.6% respondents in the I group and 47.7% in the C group. Of eight representative behavior and belief related questions, two were significantly different ($p \leq .05$) for both students and adults but no response difference was greater than 4.8%.

The Pre-I surveys strongly supported the need for an intervention as indicated by the following primary result. Of those who reported they had one or more colds and/or flu in the previous winter (72.6% of students, 56.8% of adults) (Table I), 50.5% of students and 72.5% of adults reported they treated them with antibiotics. In addition, 74% of students and 89% of adults indicated they believe that it is “always” or “sometimes useful” to take antibiotics for colds or flu. Support for a school-based intervention was found as 88% of adults indicated they thought students should be taught about antibiotics in school.

Pre-Post I Comparisons

Behavior. Reported antibiotic use results are based on student and adult respondents who reported they had one or more colds or flu in the previous winter. These are shown in Table I as number and percentage of respondents by research group (I, C) and Phase (Pre, Post).

A comparison of the Pre-I and Post-I surveys indicated that the intervention was successful in changing its primary target, reported antibiotic use for colds and flu, in a positive direction. As shown in Figure 1, the percentage of I students who reported they had **not** taken an antibiotic for a cold and/or flu in the previous winter increased from 19.5% to 53.6% from the

² A complete description of the intervention materials and their development is too long to include here. A 23 page Phase II report produced for the funding agencies, describing the training and intervention sessions and materials

pre- to the Post-I phase for a 33.7% net increase in “No” responses relative to the C students. For the I adults, the percentage who reported they had **not** taken an antibiotic for a cold and/or flu was 23.0% Pre-I phase and 61.1% Post-I phase, for a 38.0% net increase in “No” responses relative to the C adults.

-----Figure 1 about here

Note also that the percentage of I students who didn’t know if they had taken an antibiotic (DK) or didn’t answer (NA) decreased from 30.0% to 9.2% from the Pre-I to the Post-I phase for a net decrease of 15.1%, compared with C students. The comparable net decrease for I adults was 5.0%. However, the maximum percentage of adults who didn’t know if they had taken an antibiotic or didn’t answer in either the I or C adult groups in both phases was only 4.5%, much lower than the maximum 32.2% reported by C students on the Pre-I surveys.

Table III shows the results of Logistic Regression analyses with reported antibiotic use as the dependent variable for students and adults. Variables entered into the students’ model were District (I, C), Sex (M, F), Phase (Pre, Post), and an interaction term Phase x District. Schools were not included as cross-tabulations with reported antibiotic use indicated that schools were not related to reported antibiotic use in either phase or research group. For the adults’ model, Sex was replaced with Responder (Other, Mother).

-----Table III about here

For the students’ model with 4 degrees of freedom, chi square was 455.186 ($p < .000$) with 73.5% of antibiotic use responses correctly classified. District was not significant; males were more likely to say they had not taken an antibiotic for their cold or flu as were Post-I phase students. However, after these variables were controlled for, students in both the I District and the Post-I phase were 3.184 (C.I. 2.065 - 4.909) times more likely than other students to indicate

(including the video storyboard) and satisfaction evaluations in detail is available from the first author (NC).

they had not taken an antibiotic. With the non-significant District dropped from the model, the odds ratio increased to 3.694 (C.I. 2.516 – 5.423).

For the adults' model, chi square was 311.810 ($p < .000$) with 74.1% of antibiotic use responses correctly classified. Only the interaction variable was significant indicating that adults who were both in the I District and the Post-I phase were 5.195 (C.I. 3.611 – 7.472) times more likely than other adults to indicate they had not taken an antibiotic. The odds ratio increased to 5.541 (C.I. 4.559 – 6.733) after the non-significant variables were dropped from the model.

In all groups (both Pre-I and Post-I students and adults), of those with cold or flu symptoms, fewer than 5% indicated they had done nothing to treat them, with most indicating they used both a medicine and some kind of traditional therapy. Those who indicated they had taken a medicine were asked to write what they took. The number of different medicines named by the group was: Pre-I students: 7 antibiotics of 21 medicines; Pre-I adults: 10 antibiotics of 26 medicines. The number of different antibiotics named for colds and flu was less in the I groups compared with the C groups after the intervention. Post-I students named 4 different antibiotics compared to C students who named 8; Post-I adults named 3 antibiotics compared to C adults who named 9.

Those who indicated they had taken an antibiotic were asked to state for how many days. There was no significant change as measured by t-tests ($p < .05$) in the number of days named by students or adults from the Pre-I to the Post-I phase for either the I or C groups. For example, for I students, Pre-I days averaged 5.78 and Post-I days 5.63. For C students, Pre-I days averaged 6.00 and Post-I days 5.82. The results were similar for the adults with average days actually decreasing in the Post-I phase compared with the Pre-I phase.

Beliefs. Relative changes in eight beliefs related to antibiotic use are shown in Table IV. An example of question format is “In your opinion do bacteria or viruses cause the common cold?” with three response choices: “bacteria” or “viruses” or “don’t know.” With changes in the I groups adjusted for changes in the C groups, changes in all eight beliefs from the Pre-I to the Post-I phase were in the hypothesized direction for both students and adults. More than half of the relative changes in beliefs were greater than 25%. Although significant ($p \leq .05$), several of the net changes in beliefs are trivial, e.g., less than 5%. Most adults already knew that flu was caused by viruses and not bacteria in the Pre-I phase (#3 & #4). This, in association with the high rate of reported use of antibiotics in the Pre-I phase, indicates that the problem was that many of the adults did not know that antibiotics are not effective against viral diseases.

-----Table IV about here

Beliefs and antibiotic use. As found in the Pre-I phase, reported antibiotic use in the Post-I phase was correlated with beliefs for both students and adults. The I and C groups were combined, as the relationship between behaviors and beliefs is independent of whether the behavior or the beliefs are correct.

-----Table V about here

Table V reports the relationship between the beliefs reported in Table IV and reported antibiotic use in the Post-I phase. All relationships were significant as indicated by chi square ($p < .05$). Both students and adults, who believed that viruses cause colds and flu, were less likely to have reported they took antibiotics to treat them than those who believed bacteria are the cause. In addition, both students and adults, who believed that antibiotics treat bacterial infections, were less likely to have reported they took an antibiotic for a cold or flu than those who believe that antibiotics treat both bacterial and viral infections. Both students and adults

who believed it is always useful to take antibiotics for a cold or flu were more likely to report having taken one than those who believed it is never useful.

Discussion

Limitations

A weakness of this research was the IRB requirement that did not permit identifiers on the questionnaires, thus preventing the ability to match students with adults or to match students from Pre-I to Post-I phase or to compare those participating in one survey with those participating in both. As, however, use of antibiotics was only reported by students and adults who had a cold or flu in the previous winter, a paired analysis would have reduced the sample significantly to only those who reported having had a cold or flu in both the Pre-I and Post-I winters. Thus, this study must be viewed as population based. Whereas students taking the Post-I survey were asked not to complete it if they had not participated in the intervention, there was no way to confirm this. Certainly, there were subjects in the Pre-I survey who were lost to follow-up; they moved away, were attending school in a different district, or were absent on the day of the survey. However, most of these factors were likely to have been the same for both the I and C groups.

Whereas adults were asked not to ask for their child's help on the questionnaire, it is impossible to know if this occurred. The incentive might arguably be greater for this to happen in the intervention than the control group, but students' and adults' responses on key variables, e.g., reported antibiotic use, were not more similar in the I group than in the C group.

As treatment for colds and flu was unobservable, reported use of antibiotics is not actual use. However, reported behavior is common for measuring unobservable health behaviors in school and other population based research, (e.g., alcohol use, nutrition, sex behaviors, smoking),

when anonymity is promised. There is little incentive for respondents to be untruthful in reporting treatment of colds and flu and indeed, there are positive incentives for “doing the right thing.” Doing the right thing, i.e., not taking an antibiotic for a cold or flu, avoids the cost of a physician and/or pharmacy visit and the cost of the antibiotic. Certainly, some studies have used medical records (physician prescribing and pharmacy dispensing) to measure antibiotic use, but, when antibiotics may be acquired OTC or UTC (under-the-counter) without prescription as they are in Moldova, such records are unreliable.

Only urban schools in working class districts participated so results may not be generalizable to other areas in Moldova. Unfortunately, no demographic data were allowed to be collected other than gender, student age, and the relationship of the adult respondent to the student.

Implications

It is generally believed that it is difficult to change people’s behaviors. Thus, the apparent success of this peer-led intervention, to reduce antibiotics for colds and flu in a developing country, was very gratifying. Hopefully, the program’s success will stimulate adaptation, implementation, and evaluation of the program in other areas of Moldova and possibly extend it to other health education topics and other countries.

The probability seems strong that the Moldova school-based program to decrease inappropriate antibiotic use could be successfully adapted to other countries, as research undertaken among students in Armenia, East Africa, Russia, Malaysia, Nepal, the U.S.A., and Europe (e.g., Finland, Greece, Ireland, Netherlands, Spain), has found a high degree of similarity in students' knowledge, autonomy, and desire for information relative to medicines [14-15, 36-41].

There are other areas of research that might be performed relative to this peer-led intervention. This intervention, although emphasizing that antibiotics should not be taken for colds and flu, included much more information on rational medicine use, e.g., expiry dates, side effects, storage, differences between generic and brand name medicines, why one should not take other people's medicines, and how to question health care providers about medicines. The evaluation did not address whether any of this other information was learned or had any affect on medicine related behavior.

The intervention involved considerable student teacher training, materials development, classroom time, and education of students and parents. Multiple intervention components were used consistent with Social Cognitive Theory. However, more research might reveal if less classroom time would be sufficient, if other intervention materials might be used, if other methods of reaching parents would get the same or better results relative to treating colds and flu and other illnesses caused by viruses, and if the results were sustained over time.

There was room for improvement in one area of the intervention. The students and adults in the I groups, who said they took an antibiotic for a cold or flu, failed to learn that antibiotics should be taken for the entire time they are prescribed despite feeling better. Also, the average number of days an antibiotic was taken was less than usually recommended. However, as only those had taken an antibiotic were asked the question about how long they had taken it, these represented two confounded errors in behavior. Also, it is unclear how people would know how long an antibiotic should be taken if it were obtained without a prescription.

Reported antibiotic related beliefs and behaviors were related. Important relationships included results indicating that knowledge of what causes the common cold and what causes the flu related to whether or not an antibiotic was taken for these health problems.

Whereas the specific problem addressed in this study was inappropriate use of antibiotics for the treatment of colds and flu, success may provide a model for changing behaviors in other areas of medicine use and health behaviors. As a long-term benefit, if good health behaviors are established in childhood and adolescence, they may prevail in adulthood and be transferred to the next generation [42-43]. It was found that medicine related beliefs and behaviors were relatively stable in primary school age children over a three year period and correlated with their parents' beliefs and behaviors [44]. This may be true of other health beliefs and behaviors as well.

Successful dissemination of the results of programs such as this one to health officials and professionals – physicians, nurses, pharmacists - may help reduce inappropriate antibiotic use worldwide and increase rational medicine use in general. Health professionals are generally highly respected in their communities and can serve as advocates of school-based peer-led medicine education.

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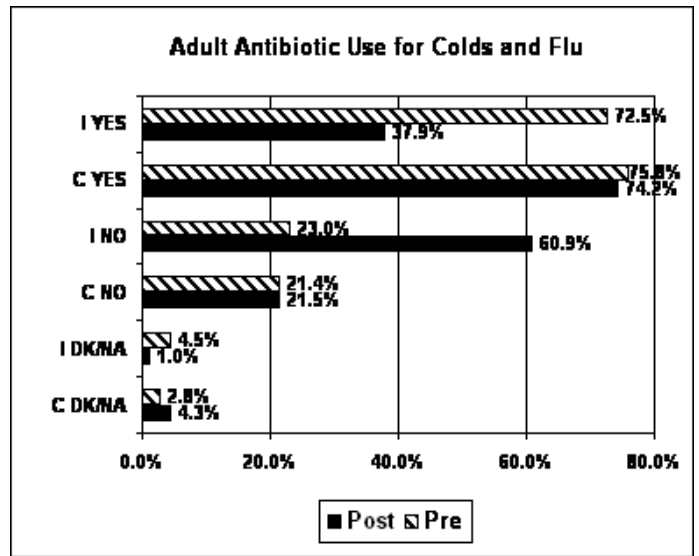
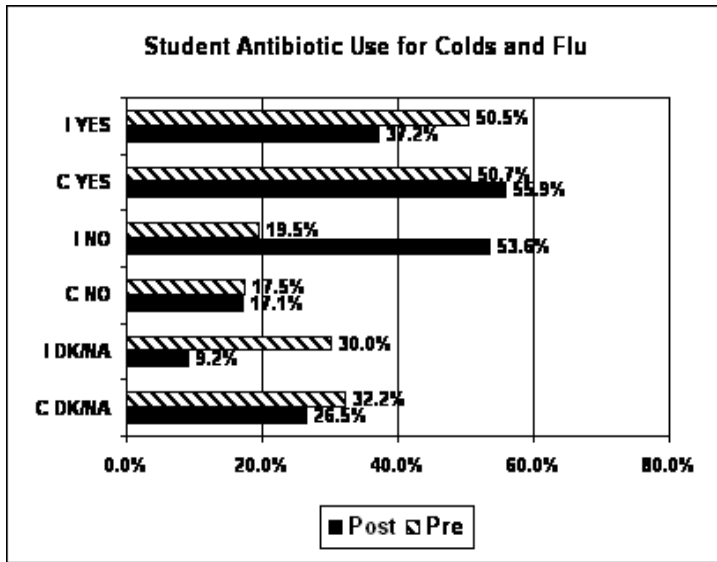
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Figure 1. Students' and adults' reported use of antibiotics for colds and flu by research condition, pre- and post-intervention.

[insert Figure 1 power point slide]

Figure 1. Students' and adults' reported use of antibiotics for colds and flu by research condition, pre- and post-intervention.



Legend: I = Intervention group, C = Control group; Pre = Pre-intervention survey results; Post = Post-intervention survey results; DK/NA = Don't Know/No answer.

Table I. Number of student and adult survey respondents and the percent reporting having a cold or flu in the winter before the survey by research group, intervention (I) and control (C), and intervention phase (Pre, Post).

	I						C					
	Pre-Phase			Post-Phase			Pre-Phase			Post-Phase		
	N	N cold/flu	% cold/flu	N	N cold/flu	% cold/flu	N	N cold/flu	% cold/flu	N	N cold/flu	% cold/flu
Students	1798	1305	72.6	1686	1084	64.3	1788	1280	73.1	1313	776	59.1
Adults	1401	796	56.8	1149	601	52.3	1315	720	54.8	1007	492	48.9

Table II. Training and Intervention Materials^a and Methods

Sessions	When	Where	Materials	Description
Student Trainers' (STs) Training^b				
2 all day	Sept '03	Camp outside Chisinau	16 pg. Training Guide	12 lessons (6 general training skills, 6 implementation of school-based education)
Bi-weekly	Oct '03 - Feb '04	Chisinau offices of Principal Investigator	Feed-back forms	Monitor progress & discuss and solve problems associated with implementation
Student Education				
6 45-min. lessons	Schedule Oct '03 – Jan '04 depending on schools and ST availability	School district in Chisinau consisting of 7 th level classrooms in all 21 schools; 1745 students completed all 6 lessons	Manual Video Leaflet Poster Poster contest	6-lesson manual including teaching plans & guidelines; monitoring and evaluation forms Video: 6 scenes illustrating medicine related situations, e.g., questioning health professionals. Professionally filmed with STs as actors. Video is stopped after each scene & a discussion is held followed by a filmed demonstration of appropriate behavior Leaflet: 4-colors; 4 pgs with project logo (sneezing snowman); emphasizes 4 primary messages (antibiotics do not help colds & flu, colds & flu are not caused by viruses, antibiotics do not kill viruses, DO NOT take antibiotics for colds and flu). Poster: 50x80 cm; photos of STs carrying messages supporting goal of teaching students and parents not to take antibiotics for colds and flu; also distributed to C schools after follow-up surveys completed. Poster contest: letter sent to schools inviting students to submit a poster representing the project; winners published in Bulletin #2.
Adult Education				
2 1-hr. sessions	Oct '03 - Nov '03	21 schools (1167 adults, mainly mothers, attended the 1 st session; 1134 attended the 2 nd session)	Manual Video Leaflet Bulletins (carried home by students)	Manual adapted from student version for completion in 2 hours. Same as student version Same as student version Bulletin #1 Dec '03; #2 Mar '04. Bulletins emphasized primary program messages, general good medicine taking practices, & ST articles, e.g., "My experience as a trainer."

a. All materials in both Russian and Romanian; leaflet, poster, and video storyboards also in English.

b. Of 50 STs attending first training sessions, 34 stayed with the project until it ended

Reducing antibiotics for colds and flu

Table III: Logistic Regression on reported Antibiotic Use^a for Students (N=4445) and Adults (N=2609)

Student Variables ^a	B	S.E.	Wald	df	Sig.	O.R. ^b	95% C.I. for O.R.	
							Lower	Upper
DISTRICT	.149	.102	2.120	1	.145	1.160	.950	1.417
SEX	-.220	.077	8.187	1	.004	.802	.690	.933
PHASE	.420	.200	4.393	1	.036	1.522	1.028	2.254
DIST*PHAS	1.158	.221	27.489	1	.000	3.184	2.065	4.909
Constant	-1.454	.084	297.630	1	.000	.234		
Adult Variables ^a								
DISTRICT	.096	.124	.599	1	.439	1.101	.863	1.404
RESPONDER	-.134	.111	1.439	1	.230	.875	.703	1.086
PHASE	-.001	.143	.000	1	.997	.999	.756	1.322
DIST*PHAS	1.648	.185	78.917	1	.000	5.195	3.611	7.472
Constant	-1.192	.128	86.479	1	.000	.303		

^a Coding: Antibiotic Use (YES/DK/NA = 0, NO = 1); SEX (M=0, F=1); PHASE (C = 0, I = 1); RESPONDER (Other = 0, Mother = 1); DIST*PHAS = DISTRICT x PHASE; ^b O.R. = Odds ratio ((Exp(B))).

Table IV. Relative changes in students' and adults' beliefs related to antibiotic use in the intervention (I) group compared with the control (C) group pre-post intervention.^a

BELIEFS	INTERVENTION (I) (%)			CONTROL (C) (%)			NET (%) ^b
	Post	Pre	Post - Pre	Post	Pre	Post - Pre	I - C
1. Bacteria cause the common cold	10.2	29.0	-18.8	29.3	26.0	3.3	-
Students	4.6	30.1	- 25.5	24.3	27.0	- 2.7	22.1
Adults							- 22.8
2. Viruses cause the common cold	82.5	42.0	40.5	42.4	37.1	5.3	35.2
Students	85.6	55.5	30.1	54.7	55.9	- 1.2	31.3
Adults							
3. Bacteria cause the flu	5.6	19.0	- 13.4	18.2	16.0	2.2	-
Students	3.1	11.9	- 8.8	9.3	13.8	- 4.5	15.6
Adults							- 4.3
4. Viruses cause the flu	86.7	52.4	34.3	52.2	46.3	5.9	28.4
Students	88.8	77.2	11.6	76.6	72.4	4.2	7.4
Adults							
5. Antibiotics treat bacterial infections	40.6	4.8	35.8	5.0	5.1	- 0.1	35.9
Students	75.5	19.3	56.2	16.4	16.3	0.1	56.1
Adults							
6. Antibiotics treat both bacterial and viral infections	31.2	48.6	- 17.4	54.5	46.4	8.1	-
Students	14.7	67.7	- 53.0	70.2	68.9	1.3	25.5
Adults							- 54.3
7. It's never useful to take antibiotics for a cold or flu	35.8	3.6	32.2	4.4	3.5	0.8	31.4
Students	45.8	2.4	43.4	4.6	3.3	1.3	42.1
Adult							
8. You should stop taking antibiotics if you feel better	45.6	47.8	- 2.2	51.2	44.9	6.3	- 4.1
Students	42.9	45.6	- 2.7	47.4	41.6	5.8	- 8.5
Adults							

a Student N: I Post 1686; Pre 1798; C Post 1313; Pre 1788. Adult N: I Post 1149; Pre 1401; C Post 1007; Pre 1315.

b All net differences ((I Post-intervention – I Pre-intervention) – (C Post-intervention – C Pre-intervention)) significant (chi square $p < .05$).

Reducing antibiotics for colds and flu

Table V. Relationships between beliefs and reported antibiotic use for colds and/or flu.^a

BELIEFS^b	REPORTED ANTIBIOTIC USE FOR COLDS AND/OR FLU	
	Students	Adults
The common cold is caused by:	<u>%</u>	<u>%</u>
1. Bacteria	55.3	66.5
2. Viruses	41.9	47.8
Flu is caused by:		
3. Bacteria	50.5	67.6
4. Viruses	35.5	51.2
Antibiotics treat:		
5. Bacterial infections	25.3	38.5
6. Both bacterial& viral infections	58.1	71.1
7. It's useful to take antibiotics for a cold or flu:		
Never	31.0	34.4
Always	51.9	53.2

^a
Combine

^d I and C groups who reported they had taken an antibiotic for cold or flu post-intervention (students N = 837; adults N = 593).

^b Item numbers refer to belief item numbers in Table IV. All relationships significant (chi square p < .05).