THE RELATIONSHIP OF COMMITMENT AND SELF-EFFICACY TO ADHERENCE WITH A MEDICAL REGIMEN

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Thesis submitted to the Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

Clinical Psychology

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October, 1990

Blacksburg, Virginia

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(ABSTRACT)

The present study evaluated a commitment-based intervention to improve adherence with a 10-day antibiotic regimen. Subjects were 48 undergraduate students receiving treatment from the Student Health Services at Virginia Polytechnic Institute and State University. Adherence was assessed by pill counts obtained in unannounced home visits 7 to 10 days after the regimen was prescribed and by subjects' self-reports. Pre- and posttest measures of self-efficacy and outcome expectancy were completed by subjects.

Significantly more subjects in the intervention group were adherent (85%) than in the control group (64%) when adherence was defined as at least 80% of medication taken and nonadherence defined as less than 80% or more than 110% of medication taken. Self-efficacy and outcome expectancy scores, when multiplied together for a predictive index, were significantly correlated with self-reported adherence at pre- and posttest, but were not correlated with pill count adherence. Self-efficacy at pre- and posttest and

outcome expectancy at pretest were significantly correlated with self-reported adherence. Self-efficacy at posttest was significantly correlated with pill count adherence.

An intervention designed to increase commitment to medical regimen resulted in greater adherence with a short-term regimen. Self-efficacy and outcome expectancy predicted self-reports of adherence behavior, but were poor predictors of objective measures of adherence. At best, self-efficacy appeared to reflect recent behavior.

Acknowledgements

There are many people I would like to acknowledge for their assistance with this project. First and foremost I wish to express gratitude to my advisor Jack Finney for his guidance, patience, support, and availability. In addition, I would like to thank my committee members: Richard Eisler and Danny Axsom for their personal encouragement and invaluable advice on conceptual issues, and Phillip Barkley for his availability and helpful advice on medical issues.

Next, there are many individuals to acknowledge at the Student Health Service, without whom this project would not have been possible. Committee member Phillip Barkley was instrumental in establishing the Student Health Service as a research site. Bashka Smith was constantly enthusiastic and provided vital assistance in recruiting subjects. Karen Smith was thoughtful and generous in giving of her time to help with the sometimes difficult task of locating and reviewing medical records. The entire staff and especially the nurses were friendly, helpful, and a pleasure to work with.

Finally, I would like to express my appreciation to research assistants Bonnie Cleaveland, Chrissy Cooper, Michelle Hanrahan, Kitty Murphy, and Kevin Schulke for their assistance with data collection and perseverance with efforts to catch subjects at home.

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The Relationship of Commitment and Self-Efficacy to Adherence with a Medical Regimen

Adherence is a term that has been used interchangeably with compliance to describe the degree to which patients follow medical recommendations. Haynes (1979) defined compliance as the "extent to which a person's behavior coincides with medical or health advice"(pp.1-2). Meichenbaum and Turk (1987) have suggested that the term compliance has a negative connotation insinuating passive obedience, while adherence assumes the patient is an active participant in treatment. To assume an active participant suggests new directions for the development of interventions to increase adherence to medical regimen. Later, this paper will discuss the use of strategies that increase patient commitment to treatment and therefore more actively involve patients in their treatment. First, an introduction to the problem of nonadherence to medical regimens will be presented.

Nonadherence to therapeutic regimens seriously hampers the delivery of medical care (Kaplan & Simon, 1990; DiMatteo & DiNicola, 1982; Haynes, Taylor, & Sackett, 1979). Between 15% and 93% of patients fail to adhere to treatment recommendations with most studies reporting around 33% of

patients as nonadherent (Kaplan & Simon, 1990; Rapoff & Christophersen, 1982). For short-term regimens the incidence of nonadherence has been estimated to be 20-30% when the regimen is curative and 30-40% when the regimen is preventive. Nonadherence to long-term regimens requiring life-style changes, such as special diet to prevent or control symptoms of diabetes or hypertension, is estimated to be about 50% (DiMatteo & DiNicola, 1982).

The consequences of nonadherence include: the negation of therapeutic benefits resulting in increased prescription of additional medications, increased cost of medical delivery due to increases in time spent with health care providers, increased need for additional diagnostic procedures such as laboratory tests, and in some cases treatment failures resulting in otherwise avoidable death. For example, it was estimated that 80% of all premature deaths due to cardiovascular disease were the result of nonadherence to recommended lifestyle changes (DiMatteo & DiNicola, 1982). Nonadherence is also an obstacle for research on treatment efficacy. This is particularly true because adherence has been demonstrated to be related to positive health outcome in <u>both</u> treatment and placebo groups (Kaplan & Simon, 1990). Thus, treatment efficacy studies that do not control for adherence may arrive at erroneous

conclusions, even when utilizing adequate placebo controls.

Adherence Interventions

A large number of studies have attempted to increase adherence with varying degrees of success (Haynes, Taylor, Snow & Sackett, 1979). Haynes (1976) broadly categorized interventions utilized to increase adherence as either educational, behavioral, or combined strategies. Educational strategies involve transmitting information to patients about their illness and the demands of their treatment regimen. Behavioral strategies aim to increase adherence by changing stimuli in the environment and altering contingencies to assist patients in meeting the demands of treatment regimens. They intervene to reduce barriers to adherence, stimulate adherence with cues, and reward adherence behaviors. Combined strategies utilize both behavioral and educational techniques. For example, in a study of adherence to antibiotic regimen for otitis media, Finney, Friman, Rapoff, and Christophersen (1985) used both behavioral strategies (self-monitoring and telephone reminders) and an educational strategy (written information) to successfully improve adherence. Self-monitoring involved keeping track of medicine doses taken per day, telephone reminders involved calls to patients during their regimen

reminding them of the importance of taking the medication and completing the regimen, and educational information was provided in the form of a one page handout that explained symptoms and the importance of completing the regimen.

In terms of success at increasing adherence, Haynes (1976) in a methodological analysis and review, rated behavioral strategies (85%) and combined strategies (88%) roughly equal and educational strategies (64%) somewhat lower. The percentages indicate the percent of studies reviewed in each category that produced statistically and/or clinically significant results. While rated the lowest, educational strategies that increase patients' knowledge about their illness and treatment regimen are often sufficient to significantly increase adherence in patients on short-term regimens. Colcher and Bass (1972) found that when patients prescribed a 10-day course of penicillin were simply given clear instructions to take all their medication that adherence and outcome were significantly improved.

In addition to taking medication incorrectly due to misunderstanding, nonadherence may occur when patients fail to complete regimens due to perceptions that they are no longer ill. Nonadherence to short-term regimens typically involves the failure of patients to complete their treatment (Sackett & Snow, 1979). This sort of nonadherence may be

problematic because it results in a greater probability of recurrence of bacterial infections, in addition to an increased likelihood of the development of antibiotic-resistant strains of bacteria (Brown, 1982; Takafuji, 1977).

Commitment Interventions. An under-studied strategy that holds promise for increasing adherence to short-term regimens is the manipulation of patient's commitment to treatment regimen. As defined by Kiesler and Sakamura (1966), commitment is the "pledging or binding of an individual to behavioral acts." By increasing patient commitment to treatment patients may be more actively involved in treatment; resulting in greater adherence through improved behavioral follow-through, as well as increased communication and understanding about their medical regimen. Later, the theoretical relationship of commitment and adherence that may account for some of the reasons why many behavioral and educational adherence improvement strategies have been successful will be further explored. First, studies that have utilized commitment strategies to improve adherence will be reviewed.

"Contingency contracting" is a behavioral method of increasing adherence that may be successful through the manipulation of commitment. Contingency contracting involves active patient participation the negotiation of

brief contracts in which the patient agrees, in writing, to perform adherence behaviors in exchange for suitable rewards (Swain & Steckel, 1981). An example of a reward might be to see the doctor at a more convenient time. The commitment act with contingency contracting is an overt written agreement to perform a specified behavior. The success of this approach lends support for the notion that adherence behaviors may be increased through the manipulation of commitment.

Levy (1977), in a study investigating the effects of verbal and written commitment to the task of making a phone call, found that when both verbal and written commitment were elicited that adherence to the task was significantly greater than when no commitment was elicited. In another study, Levy, Yamashita, and Pow (1979) found that simply asking for a verbal commitment increased adherence to the task of mailing in a symptom report postcard to flu inoculation clinics. However, results from this study are suspect because subjects were not randomly assigned to groups. In a tightly controlled study with a large sample, Wurtele, Galanos, and Roberts (1980) evaluated the effect of verbal and written commitment, verbal commitment alone, and no commitment on the rate of return adherence for tuberculosis detection via skin test. It was found that

verbal plus written commitment significantly increased adherence over verbal commitment alone and that verbal commitment alone significantly increased adherence over no commitment in subjects with a family history of tuberculosis; in subjects without a family history of tuberculosis adding a written commitment did not improve adherence over verbal commitment alone.

While encouraging, the findings from the above studies, suggesting that commitment can enhance adherence, were based solely on one-time acts. This review has found only one study which evaluated the effect of commitment on a regimen requiring multiple adherence behaviors. Kulik and Carlino (1987) tested the effect of verbal commitment on adherence with parents of 89 children receiving a 10-day antibiotic treatment for otitis media. Subjects in the commitment group took significantly more of their medication than did subjects in the no commitment group (97% vs 91%). Considering the already high level adherence in the control group the 6% greater adherence in the commitment group was substantial. The results of the above study requiring multiple behaviors and those of other studies that investigated the effects of commitment to one-time acts of adherence suggest that implementation of commitment manipulations to increase adherence may be beneficial.

Additional research is needed to determine: if adherence to both short and long-term regimens requiring multiple behaviors may be improved through manipulations of commitment, how commitment manipulations are successful in improving adherence, and to refine the current theoretical understanding of commitment.

Measures of Adherence

Bloom (1988) discusses five major methods of assessing medical adherence; clinical outcome, patient self-report, medication measurement, medication monitors, and chemical analysis. In addition to these, physician estimates and appointment keeping have also been used to estimate adherence (Gordis, 1979; Roth, 1984). While none of the above measures provide completely accurate estimates of adherence, some are relatively better than others. A discussion of the relative strengths and weaknesses of the measures will follow.

The use of clinical outcome as a measure of adherence assumes a perfect relationship between adherence and outcome. Unfortunately many drugs do not have known effects for short-term outcomes for many illnesses and therefore we cannot assume that outcome is necessarily indicative of adherence (Bluestone, 1982). However, to determine drug

efficacy it is important to measure outcome since adherence ought to be related to health outcome (Sackett, 1979).

Patient self-report is the easiest obtained and most commonly used measure of adherence (Roth, 1984). Self-report is also the most subjective of the measures and over-reporting of adherence is common. Yet, patients who have taken their medication they usually report that they have and patients who report nonadherence most often are non-adherent (Epstein & Clauss, 1982; Roth, 1984). While patients often do not accurately report adherence, there is evidence that they do accurately predict future adherence if they have had prior experience with the regimen (Bloom, 1988; DiMatteo & DiNicola, 1982; Kaplan & Simon, 1990).

Medication measures include checking if prescriptions are filled, counts of used bottles, and pill counts. Of these measures, unannounced pill counts are the most accurate and reasonably correlated with chemical analyses (Roth, 1984). The weakness of pill counts is that they provide no information about when the pills were taken or even if they were taken (i.e., we infer they were taken if they are missing). As compared to chemical analysis pill counts have the advantage of being relatively easy, quick, and inexpensive (Bloom, 1988).

Similar to medical measures are medical monitors.

These are devices that record when each pill is taken out of its container by the use of a radiation sensitive strip. This method provides the benefit of indicating both if pills are taken and if they were taken at the appropriate time. Like pill counts, the validity of this measure is compromised if the patient is aware that consumption is to be measured.

Chemical analysis involves either the measurement of a drug, it's metabolites, or a tracer substance in the patient's blood or excreta (Roth, 1984). While chemical analysis is the most objective measure of adherence, it is not necessarily the most accurate due to the short half-lives of many drugs, timing of measurement in relation to dose schedule, presence of other medications that may increase or inhibit the metabolism of the drug under study, individual differences in metabolic rate, and the self-modification of patients' behavior when they are aware that they will be tested (Masek & Jankel, 1982). Therefore, patients who are nonadherent may be classified as adherent and vice versa. Of the three methods of chemical analysis, the tracer method is superior because results are least likely to be affected by individual differences in drug metabolizing.

The last two measures, physician estimates and

appointment keeping, have not been demonstrated to be good measures of adherence. Physicians consistently overestimate the extent to which their patients are adherent (Roth, 1984; Kaplan & Simon, 1990) and appointment keeping may be unrelated to medication taking (Finney et al., 1985).

In summary, there are several measures of adherence, but no one is sufficient. When measuring adherence the use of multiple measures has been recommended (Bloom, 1988). As a minimum studies of adherence should include self-report, an objective measure (e.g., pill count, medication monitor, or chemical analysis), and a health outcome measure.

Theories Relevant to Commitment

Dissonance. Kulik and Carlino (1987) suggested that inducing individuals to made a verbal commitment to take their medication may result in increased adherence because nonadherence would arouse dissonance in the patient due to inconsistency between behavior and attitude. This explanation of the effect of verbal commitment on adherence is based on cognitive dissonance theory as proposed by Festinger (1957). According to Festinger, dissonance occurs when one's behavior is not congruent with one's thoughts. To reduce dissonance people may change their thoughts so that they will be consistent with their behavior. The

Festinger dissonance explanation for improved adherence would be as follows: when individuals are induced to say (behavior) that they will take their medication their attitudes, if not already accepting of adherence behaviors, become so. Thus, to avoid dissonance, people will adhere to their medical regimen to remain congruent with expressed and adopted beliefs.

Dissonance, as it is currently understood, may occur when inconsistency is not present. Further, inconsistency alone will not necessarily produce dissonance, rather, dissonance occurs when individuals attribute self-responsibility for aversive consequences (Scher & Cooper, 1989). According to Cooper and Fazio (1984) it is the felt responsibility for aversive consequences that provides the motivation for attitude change. Attitudes are changed in a way that justifies the previous behavior. For example, if a patient makes an agreement with his or her physician to take all of his or her medication as prescribed, yet does not intend to take it, the patient may feel guilting and responsible for having lied (i.e., experiences dissonance). Therefore, to reduce dissonance, the patient may change their attitude and decide it is in their best interest to take all the medication afterall.

An alternative explanation proposed to account for the

effects of dissonance manipulations comes from Bem's self-perception theory (1972). Self-perception theory asserts that individuals come to know their own attitudes, emotions, and other internal states by observations they make of their own behavior. In the adherence example, patients perceive themselves as medication takers after observing themselves committing to take medication. The resolution of the theoretical differences between self-perception explanations and dissonance theory has been to consider dissonance a more appropriate explanation for attitude change after counter-attitudinal behavior and self-perception more appropriate in strengthening attitude congruent behavior (Fazio, Zanna, & Cooper, 1977). Therefore, if the patient "wants" to adhere, saying so publicly may strengthen this attitude even more.

Adherence improvement interventions based the current dissonance model and self-perception theory would be expected to be more effective with short-term regimens. In short-term regimens, as opposed to long-term regimens, fewer challenges to adherence beliefs and behaviors are likely to be presented between the intervention and the completion of the treatment regimen, thus newly established behaviors would probably be maintained. While in long-term regimens it is likely that many factors would limit the effectiveness of a dissonance and self-perception based intervention

(i.e., continuing inconvenience of the regimen, side effects, differing medical opinions, and influence of social environment).

Investment. The investment model proposed by Rusbult and Farrell (1983) is a theoretical model of commitment from the social psychology literature that provides new direction for adherence interventions and may account for the success of many previous interventions. The investment model has been demonstrated to predict commitment to heterosexual relationships as measured by length of time in relationship (Rusbult, 1980) and job commitment as measured by job turnover (Rusbult & Farrell, 1983). The model states that commitment (COM) is a function of satisfaction (SAT) plus investment (INV) minus alternatives (ALT), where SAT equals rewards (REW) minus costs (CST). Therefore, COM = (REW - CST) + INV - ALT.

In relation to adherence behaviors the components of the investment model could be defined in the following ways: COM = the degree to which patients follow treatment recommendations, REW = the benefits of treatment, CST = side effects and any perceived loss due to treatment, INV = explicit public statements of intent (i.e., verbal and written agreements) and expenditures of time, energy, and money, and ALT = home remedies, differing second opinions,

and nonmedical healers. When defined in this way the success of several adherence strategies may be accounted for by components of the investment model. For example, educational strategies and patient counseling may in part improve adherence by increasing INV relative to the time and energy they require, increasing perceived SAT by highlighting the benefits of adhering to treatment and the negative consequences of not following treatment. Virtually all adherence interventions that require patients to expend time and energy, without incurring CST, may be in part successful by increasing INV to treatment. Likewise, any interventions or treatments themselves (e.g., the relief of pain) that present clear benefits may increase adherence by increasing perceived REW. Given the apparent relevance of commitment to adherence behavior, study of the investment model as it applies to adherence is warranted.

A study by Finney, Weist, and Eisler (1989) designed to increase adherence to appointment keeping in a mental health care facility illustrates how an intervention based on commitment theory may successfully improve adherence. The intervention involved therapists reviewing with clients initial therapeutic efforts of clients, detailing clinician and client behaviors that lead to progress in therapy, reinforcing the client's decision to be in therapy and

contrasting it with other unchosen options, obtaining a written contract to establish commitment to therapy, and making the commitment public. In line with theoretical predictions clients increased appointment keeping from an average of 33% to 83% due to this intervention. The success of this intervention may be explained by both the investment model and dissonance theory. Adherence may have increased because: INV was made salient by therapists reviewing with clients the efforts they had made in therapy, REW was provided for therapeutic efforts, while CST of remaining in therapy was not addressed, therefore SAT was increased, and the value of ALT was decreased by reinforcing the choice of therapy as compared to other options. Also, nonadherence would have aroused dissonance in clients, required their giving up accrued investment to treatment, and acting against verbal and written public statements of commitment.

Self-Efficacy

Bandura (1977) proposed that, "... expectations of personal efficacy determine whether coping behavior will be initiated, how much effort will be expended and how long it will be sustained in the face of obstacles and aversive experiences."(p.1) Bandura presents a paradigm in which change and maintenance of behavior are a function of

expectations about one's ability to perform a behavior and expectations about outcomes that will result from performing a behavior. Outcome expectations are sometimes misconstrued as the efficacy of a technique or means, however, outcome expectations are defined as beliefs that one has whether a given behavior, if initiated, will lead to a given outcome (Bandura, 1986). In order for a for a person to perform a behavior they must first believe they can perform the behavior and then second believe that performing the behavior will lead to a desirable outcome.

Commitment is logically related to self-efficacy because one would not likely commit to an act that they did not believe they could perform or think would result in a positive outcome. Therefore, some level of self-efficacy is necessary for there to be commitment to a given behavior; however, a high level of self-efficacy is not sufficient to insure commitment. Those who have high self-efficacy for a behavior may or may not be committed to the behavior, but those committed would necessarily have high self-efficacy.

The concept of self-efficacy is relevant to adherence because, as reported in several studies (Kaplan & Simon, 1990), patients are able to accurately predict their own adherence behavior in situations that they understand and have had experience with. An example of self-efficacy

applied to adherence behavior was presented in a study by Kaplan, Atkins, and Reinsch (1984) in which patients with chronic obstructive pulmonary disease were able to accurately predict persistence with regimen and performance on laboratory exercise tests. Thus, self-efficacy may be useful for the prediction of adherence, as a measure of change resulting from the implementation of adherence improvement interventions, and as an area of focus for intervention.

The Present Study

The purpose of the present study was to evaluate if adherence to a medical regimen requiring multiple behaviors could be improved through a manipulation of commitment. Commitment manipulations used were based on the investment model (Rusbult & Farrell, 1983) and dissonance theory (Cooper & Fazio, 1984). The components of the theories that were manipulated are indicated below in parentheses.

The study consisted of an experimental group and a control group. In the experimental group subjects made verbal and written commitments to take their medication as prescribed (INV & dissonance), reviewed with an experimenter the steps that they had taken towards resolving their illness, and came up with a plan to remember to take their

medication. The review was designed to increase cognitive awareness of investment (INV & dissonance) to, and the benefits (REW) of, treatment, highlight the costs of nonadherence without addressing possible costs of treatment (CST), and decrease consideration of alternatives (ALT) to treatment. The plan served to behaviorally increase investment (INV) through personal involvement and the expenditure of energy towards the goal of adherence behavior. Finally, self-efficacy was measured before prior to the intervention to evaluate it's predictive ability and towards the end of the treatment regimen to evaluate changes in self-efficacy due to manipulations of commitment. Adherence was assessed by self-report and pill counts obtained at unannounced home visits. Treatment outcome was determined by self-report of symptoms and additional prescriptions of antibiotics for unresolved and recurrent infections.

Hypotheses

1) An effect for commitment was expected; the commitment group was predicted to be more adherent than the control group.

2) Efficacy expectancy and outcome expectancy were hypothesized to be positively correlated with, and

predictive of, adherence.

3) An interaction between commitment and self-efficacy was predicted; the commitment manipulation was expected to have a greater effect on adherence in those low on self-efficacy than in those who were high on self-efficacy at the initial interview.

4) The commitment group was predicated to exhibit a greater increase in self-efficacy from pre- to posttest than the control group.

5) Irrespective of experimental group, health outcome was predicted to be better for those who were adherent than for those who weren't.

6) Health outcome was hypothesized to be better for those in the commitment group than for those in the control group.

7) Pill count and self-report data were expected to be positively correlated.

METHOD

Experimental Design

A randomized clinical trial of adherence improvement strategies was conducted using a posttest only control group design for measures of adherence and a pre- and posttest control group design for measures of self-efficacy. The two

groups, treatment and control, were involved in activities that were roughly equivalent in structure, time required, and experimenter attention, but theoretically different in content and impact.

Subjects

Ninety-one students from Virginia Polytechnic Institute and State University who received a prescription for a 10-day oral antibiotic treatment from the Student Health Services were recruited for the study from February 1989 until May 1990. Subjects were identified and referred by health care providers at Student Health Services. Fourty-eight subjects were successfully followed up on home visits, 39 were not found at home after 3 attempts to find them at home, and 4 subjects were dropped from the study due to changes in their medication prior to the completion of the study. Of the 48 subjects successfully followed there were 30 females and 18 males which ranged in age from 18 to 26 with a mean age of 19.66. The average age and age range of subjects were approximately equal in the two groups as were the proportion of males and females in each group. Diagnoses and medications prescribed were spread relatively evenly between the groups. See Table 1 for characteristics of subjects successfully followed. For characteristics of subjects not successfully followed at a home visit see

Table 2.

All subjects were instructed in the pharmacy that they were on 10 days of antibiotics for the treatment of a bacterial infection and that they were to take all ten days of medication even if they were feeling better. In addition, labels were put on all pill containers instructing that all medication was to be finished unless otherwise directed by the prescriber. Handouts providing additional educational information on the medications were available upon request.

Experimenters

A clinical psychology graduate student coordinated the study and was assisted by a team of one graduate student and four undergraduate psychology students. Research assistants were trained to administer questionnaires, conduct a structured interview to obtain a self-report of adherence, and to complete pill counts. Experimenters completed procedural checklists to maintain protocol consistency across experimenters (see appendices F & K). Prior to beginning the study procedural reliability was established with pilot subjects.

Procedure

Health care providers were informed that a study of adherence to antibiotic regimen would be conducted and asked

to identify and refer prospective participants. Providers identified patients who on their current visit received a prescription for a 10-day regimen of antibiotics. Prior to seeing an experimenter subjects were provided with an information sheet that explained the study, and a written informed consent form that they were requested to read and sign if interested (see appendices A & B). Providers were blind to the patient's experimental group assignment and the adherence improvement strategies being utilized. Prior to being seen by the experimenter subjects were randomly assigned to groups.

Once informed written consent was obtained, subjects were referred to an experimenter who invited them to participate, answered any questions, and recorded the type of medication prescribed and number of pills due to be taken that day (see appendix C). The subject was then sent to turn their prescription in to the pharmacy and asked to return to complete some questionnaires. Upon return, all subjects filled out a schedule indicating the best times to find them at home (see appendix D), followed by the self-efficacy questionnaire (see appendix E).

Commitment Manipulation. Following the administration of the self-efficacy questionnaire subjects from the experimental group filled out an investment questionnaire

that requested information on the steps they had already taken towards resolving their illness (see appendix G). Following completion of the questionnaire, the experimenter reviewed with the subjects all efforts taken by the them to resolve their illness. The experimenter emphasized to the subject that alternative treatments taken (if any) did not result in the resolution of the problem and that their choice to seek treatment at Student Health Services was the correct one. It was also stated by the experimenter that if the medication was not properly taken that a recurrence of their illness could result (see appendix H). In addition, subjects were told that the logical next step would be to come up with a plan to insure that they would be successful at fighting their illness (see appendix I). Finally, subjects were asked to verbally commit to take their medication as prescribed for them and to sign a form stating a written commitment to take their medication as prescribed (see appendix J) .

Control Manipulation. At the stage in the experiment that the experimental group was doing the activities described above the control group was involved in activities that were roughly equivalent in structure, time required, and experimenter attention, but theoretically irrelevant to adherence. At the stage the experimental group received the

investment questionnaire the control group received a questionnaire of approximately the same length that requested information on demographic variables (see appendix L). As a control for time spent with experimental group subjects reviewing the investment questionnaire, the experimenter reviewed with control subjects responses to the demographic questionnaire (see appendix M). Following the review of the demographic questionnaire, control subjects filled out a questionnaire in which they indicated the times they would study during the next week and how they prepare for tests (see appendix N). This served as a control for having experimental group subjects come up with a plan to take their medication. Finally, control subjects were asked if they participated in any sports on a regular basis and asked to sign a statement indicating whether or not they regularly participate in sports (see appendix O).

Home Visit. On the 7-10th day of treatment all subjects were visited in their home by an experimenter of the same sex who obtained from subjects a report of current symptoms on a symptom checklist, conducted a structured interview to get a self-report of adherence behavior, acquired remaining pills for counting, and finally, administered the self-efficacy measure (see appendices P, Q, R, & E). After the completion of the self-efficacy measure

subjects were debriefed.

Additional health outcome data were obtained from Student Health Services after the home visit. Status of health outcome was based additional prescriptions of antibiotics and self-report of symptoms at the home visit.

Measures

Adherence. To calculate percent adherence scores from pill count data the following formula adapted from Finney et al. (1985) was used:

$$\frac{(DISP - REM)}{(DAY \times NUM) - (MISS + LATE)},$$

where DISP = number of pills dispensed, REM = number of pills remaining at the dorm visit, DAY = the day of the regimen on which the dorm visit was made, NUM = the number of doses per day, MISS = the number of doses missed on the first day of the regimen, and LATE = the number of doses to be taken later on the day of the dorm visit following the count.

To calculate percent adherence scores from the self-report data the following formula was be used:

$$\frac{(DAY \times NUM) - (MISS + LATE) - REPORT}{(DAY \times NUM) - (MISS + LATE)},$$

where REPORT = the number of pills not taken by self-report and the other components are the same as indicated above.

Previous research has typically statistically analyzed

medication adherence data as a continuous variable, with values ranging from 0 to 100 percent of medication taken, and as a categorical variable, where, if less than some clinically significant amount of medication is taken the patient would be classified as nonadherent (Goldsmith, 1979; Sackett, 1979). As pointed out by Goldsmith (1979), these indicators of adherence do not allow for the assessment of over-medication as nonadherence. In the present study, to maintain relevance to previous studies, and to consider over-medication as nonadherence, both methods of analysis used by previous researchers and methods developed to handle data indicating over-medication were conducted. Treatment of the data for statistical analysis is detailed below.

Adherence data, self-report and pill count, were found to have a significant negative skew. Therefore, an ARCSIN transformation was used to normalize the distribution of the data and to equalize variances; the ARCSIN transformation is recommended by Schefler (1979) for use with percentage data. Prior to transforming the data all values over 100% were set at 100% as has been standard in previous studies.

To obtain a continuous variable sensitive to over-medication, a difference score was calculated where percent of medication taken, as indicated by pill count, was subtracted from 100%. The difference score obtained was

then used as a continuous variable for analyses. Thus, what was analyzed was how far actual adherence was from ideal adherence (e.g., 95% becomes statistically equivalent to 105%).

Categorical analyses, with subjects classified as either adherent or nonadherent, were also conducted in the standard manner and in a way to designate over-medication as nonadherence. In the first set of analyses, subjects were designated as adherent if pill counts indicated at least 80% regimen adherence and nonadherent if less than 80% regimen adherence was indicated. Alternatively, in a second set of analyses nonadherence included measures less than 80% and more than 110%.

Health Outcome. Health outcome was determined by self-report of symptoms at the home visit on a symptom checklist (see appendix Q), the additional prescription of antibiotics for recurrent infection, and the occurrence of yeast infection in women as a possible side effect of antibiotic use. To determine if subjects received any additional antibiotics for recurrent infections or if yeast infections were present subsequent to treatment, medical records were reviewed by the Student Health Services medical staff and an experimenter.

Self-Efficacy. The self-efficacy measure was

administered to all subjects prior to experimental manipulations and during the home visit (see appendix E). Efficacy expectancy scores were derived by simply totaling the individual item scores on the measure (items 1 - 12). To derive outcome expectancy scores, item 13 (a five point scale) was converted to a ten point scale and added to item 14. A score combining efficacy and outcome expectancy was calculated by multiplying the totals derived for each of the measures as suggested by the model proposed by Bandura (1977).

To determine internal reliability Cronbach's coefficient alpha was computed separately for the efficacy expectancy and the outcome expectancy scales. Based on 91 pretest measures of self-efficacy coefficient alpha was .89 for efficacy expectancy and .24 for outcome expectancy.

RESULTS

Commitment

To test the relationship between experimental group and adherence, *t* tests were conducted on difference score data and transformed data derived from pill counts. Prior to transforming the data the average percent adherence, as determined by pill count with 100% set as a ceiling score, was 91% for the commitment group and 84% for the control

group. The original distribution of data can be seen in Figure 1. An analysis of difference score data revealed that subjects in the commitment group were significantly more adherent than subjects in the control group (11.00 vs 18.86), [$t(46) = 2.11$, $p < .02$, one-tailed], while a strong trend in the same direction was evident on the analysis of transformed data (1.24 vs 1.09), [$t(46) = 1.61$, $p < .06$, one-tailed]. A z test on the difference between two proportions was used to compare the proportion of adherent to nonadherent in the commitment group verses the control group. When nonadherence was designated as either less than 80% or more than 110% of medication taken a significantly higher proportion of subjects in the commitment group (85%), as compared to subjects in the control group (64%), were classified as adherent [$z = 1.67$, $p < .05$, one-tailed]. In the analysis where adherence was designated as 80% or greater, and nonadherence only as less than 80%, the proportion of adherent subjects in the commitment group (85%) was nonsignificantly higher than in the control group (73%).

Self-Efficacy

To evaluate the relationship between adherence and efficacy expectancy, outcome expectancy, and their combined index, Kendall's tau b rank-order correlation was used.

Kendall's tau *b* was used in place of Spearman's rho as recommended for analyses of data that have a high number of ties and are not normally distributed (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975). Kendall correlation coefficients obtained are presented in Table 3. As is evident in the table, correlations were computed on the total data and separately by experimental group.

Pretest Self-Efficacy Relationships. Analyses of adherence data and pretest measures of self-efficacy revealed that only self-reported adherence was significantly correlated with the self-efficacy measures. Efficacy expectancy, outcome expectancy, and the combined index were all positively correlated with self-reported adherence.

Separate correlations by experimental group yielded consistently higher correlations in the control group, between expectancy measures and adherence, than in the commitment group. In the control group self-reported adherence was significantly positively correlated with pretest measures of both efficacy expectancy and the combined index. In the experimental group only the combined index was significantly positively correlated with self-reported adherence. At pretest, outcome expectancy was not significantly related to adherence when analysed by experimental group.

Posttest Self-Efficacy Relationships. Pill count, difference score, and self-report measures of adherence were significantly positively correlated with efficacy expectancy. No significant correlations were found for outcome expectancy at posttest. Only self-reported adherence significantly correlated with the combined index at posttest.

Separate correlations by experimental group yielded consistently higher correlations in the control group, between expectancy measures and adherence, than in the commitment group. Posttest measures of efficacy expectancy in the control group were positively correlated with adherence derived from pill count, self-report, and difference scores. Similarly, though consistently not as strongly related as in the control group, posttest measures of efficacy expectancy in the commitment group were positively correlated with adherence. At posttest, outcome expectancy was not significantly related to adherence when analysed by experimental group.

Relationships between Self-Efficacy and Commitment

To test for interactions between self-efficacy and commitment, several fixed effects analyses of variance (ANOVA) were conducted. Expectancy measures were separated into highs and lows by median splits. The results of

analyses done on pre- and posttest measures of efficacy expectancy, outcome expectancy, and the combined efficacy index, with adherence pill count, self-report, and difference scores are presented in Table 4. While the ANOVAs were conducted to test for interactions, all results are presented for completeness. The main effect of experimental group differed for the various analyses conducted; this was due to the differences in cell sizes that were the product of median splits performed on the expectancy measures.

Interactions. Only one significant interaction was found. At posttest, on an analysis conducted on difference scores, a significant interaction was found between experimental group and efficacy expectancy.

Pretest Main Effects. Significant main effects were found for measures of outcome expectancy and the combined efficacy index when self-reported adherence was the dependent measure. No significant main effects were found for the expectancy measures when pill count and difference score adherence served as dependent measures. Significant main effects were found for experimental group on all analyses conducted on difference score adherence. No significant main effects for experimental group were found on analyses conducted on pill count or self-reported

adherence data.

Posttest Main Effects. Significant main effects were found for efficacy expectancy with all three measures of adherence. No significant main effects were not found for outcome expectancy. A significant main effect for the combined index at resulted when pill count was used as the dependent measure. Analyses on pill count data yielded a significant main effect for experimental group with efficacy expectancy. Significant main effects were found for experimental group on all analyses conducted on difference scores. No other main effects for experimental group were found.

Repeated Measures

To examine the effects of experimental group on self-efficacy over time *t* tests where conducted on difference scores obtained by subtracting self-efficacy at pretest from self-efficacy at posttest. The means obtained on pre- to posttest differences for efficacy expectancy, outcome expectancy, and the combined efficacy index are presented in Table 5 by experimental group. Means indicate greater increases in self-efficacy in the commitment group than in the control group, however, none of the *t* tests conducted were significant.

Health Outcome

Kendall correlations were used to test if self-report of symptoms at the home visit were related to adherence pill count, self-report, and difference scores. Chi-square analyses were used to test if the prescription of additional medication for unresolved infections was related to adherence, with adherence defined categorically by the method described earlier. No significant relationships were found between health outcome and adherence. Similarly, no significant relationships between health outcome and experimental group were shown. Descriptive data on the additional prescription of antibiotics and self-reported symptoms at home visit are presented in Table 6.

As shown in Table 7, 6 of the 30 women in the study were prescribed medications to treat yeast infections following antibiotic treatment. Five of these women had been prescribed antibiotics at least twice in the previous 4 months. All but one of the subjects took at least 80% of their medication.

Correlation of Adherence Measures

Pill count and self-report adherence data were significantly positively correlated (tau b = .23, p <.02, one-tailed). Interestingly, the correlation between pill count and self-report is stronger for the control group (tau

b = .37, *p* <.02) than for the commitment group (tau *b* = .17, *p* <.28). Correlations conducted on adherence and the number of antibiotics subjects had been prescribed in the previous 6 months revealed that the number of antibiotics prescribed was significantly positively correlated with self-report of adherence (tau *b* = .41, *p* <.001), but not with pill count adherence (tau *b* = .13, *p* <.29).

Gender Differences

Chi-square analyses with Yates' continuity correction were conducted to evaluate the relationship between gender and adherence. Males were found to be significantly more adherent than females when adherence was designated categorically to be 80% to 110% of medication taken (X^2 = 4.27, *p* < .04). A trend indicating males were more adherent than females was found when adherence was designated as 80% or greater (X^2 = 2.73, *p* < .10).

Descriptive Statistics

In Table 8 are presented reasons subjects gave during the home visit for missing doses of their medication. The majority of subjects either did not report missing any doses or said that they missed doses because they forgot.

Manipulation Check

A chi-square analysis with Yates' continuity correction was conducted to test for group differences on subjects

reporting the use of a system to help them to remember to take their medication. Subjects in the experimental group (19 of 26) were more likely to report they used a system than were subjects in the control group (8 of 22); (X^2 = 5.12, p <.02). On ratings based on a 1 to 10 scale of how committed they were to taking their medication as prescribed, on average subjects in the experimental group (8.16) did not differ from subjects in the control group (8.14).

DISCUSSION

Effect of Commitment. Adherence with short-term antibiotic regimens is improved through the use of strategies designed to increase commitment to adherence behaviors. While results on measures of difference scores, and categorical analyses adjusted for over-medication, were statistically significant, they did not reach the criteria suggested by Sackett et al. (1975) for clinical significance; a difference of 25% between groups. One probable reason for the lack of a clinically significant difference between groups was the apparent ceiling effect due to an unusually high level of adherence of subjects in general. The high level of adherence found in control subjects might be explained by the substantial utilization

of adherence interventions by the Student Health Service pharmacy, sensitization of subjects to the importance of adherence by the pretest self-efficacy questionnaire, and self-selection factors probably responsible for a preexisting high level of commitment. As indicated by self-report, subjects in the control group rated themselves on average as equally committed to taking medication as the intervention group. Overall, commitment by self-report was quite high, with an average of 8.15 on a 10 point scale.

The impact of the intervention in the present study, 7% greater adherence in the commitment group as compared to the control group, was similar to that found by Kulik and Carlino (1987), where 6% greater adherence was found in the commitment group as compared to the control group. One possible interpretation of this data is that manipulations to increase investment and commitment, over what is produced by verbal commitment, do not result in corresponding increases in adherence. However, other evidence suggest a more complex explanation. A study by Wurtele et al. (1980) demonstrated that when combined with verbal commitment, written commitment did improve adherence over verbal commitment alone. In addition, in the present study significantly more subjects in the intervention group than in the control group reported that they used a system to

help them remember to take their medication. Thus, it is suggested that verbal and written commitment alone were not responsible for the higher level of adherence evident in the intervention group. Further research that separately evaluates the manipulations used in the current study would be useful to better understand the relative influences of various types of commitment interventions.

Before any firm conclusions may be made about the ability of commitment manipulations to increase adherence, more powerful studies utilizing larger sample sizes need to be conducted. The present study found a difference of 7% between groups, a difference that might suggest the use of a larger sample than 48 to insure adequate power to avoid a type II error. According to Howell (1987) when power is equal to .80 and there is a medium effect size then *N* should be at least 126, and even when there is a large effect size *N* should be at least 49.

The investment model (Rusbult & Farrell, 1983) provides a framework from which stronger commitment interventions may be designed. The model suggests increasing rewards and investment and decreasing costs and alternatives to increase commitment and therefore improve adherence to medical regimen. In the present study, while investment was behaviorally manipulated, only the perception of rewards,

costs, and alternatives was manipulated. To create stronger commitment interventions all or some of the components of the investment model could be behaviorally manipulated.

To follow are some suggestions of ways to create potentially stronger commitment manipulations. Investment might be further increased by requiring patients to demonstrate competence with, and actually begin, treatment regimens prior to leaving the health care provider. Gimmicks might be used to associate rewards with proximal adherence behaviors rather than just with distal health outcomes that are only potentially good. For example, special pill containers could be designed to play a little tune when opened at the appropriate time. Costs and alternatives to treatment could be discussed further with patients. Patients might be asked to come up with a list of costs and alternatives. This list could be supplemented with known potential costs such as side effects and alternatives such as vitamins. Theses costs and alternatives could then be addressed directly and countered when appropriate with education. Patients could be asked to make a commitment to an interactive mode of treatment, rather than just to a specific regimen. They could be encouraged to discuss with their doctor any difficulties (costs) they might have after starting a regimen and any

alternatives they might have tried. If and when alternatives are beneficial or known not to be detrimental (e.g., exercise and vitamins), they could be incorporated in treatment and it could be made salient to patients that alternatives may be considered as supplements to treatment. The above manipulations should result in not only increased patient adherence via increased commitment, but also in improvements in the quality of health care delivered. The implication is that communication with health care providers may be improved and thus increased diagnostic accuracy and more personally tailored treatments may be facilitated.

Self-Efficacy and Adherence. Contrary to hypotheses, self-efficacy measures did not predict adherence as indicated by objective measures. However, all self-efficacy measures did predict self-report of adherence. Therefore, subject self-reports of how much medication they thought they would take matched the amount of medication they said they took, but did not match the amount indicated by pill count. While pretest measures of efficacy expectancy were not related to objective measures of adherence, posttest measures were. However, posttest measures of outcome expectancy and the combined efficacy index were not related to pill count adherence. Thus, efficacy expectancy seems more to reflect recent behavior than to predict future

behavior. As stated in relation to commitment manipulations, before any firm conclusions may be made about the ability of self-efficacy to predict adherence, more powerful studies utilizing larger sample sizes need to be conducted.

Self-Efficacy and Commitment. Of interest in evaluating the effect of the intervention is the finding that efficacy expectancy in the control group was consistently more strongly correlated with adherence than efficacy expectancy in the commitment group. Therefore, it appears that the effect of commitment interacted with efficacy expectancy in a way that decreased the strength of the relationship between efficacy expectancy and adherence. An explanation for this effect is that, as predicted, adherence in those low on self-efficacy was increased more by commitment than was adherence in those high on self-efficacy. Thus, in the commitment group the effect of self-efficacy on adherence appeared decreased when actually low self-efficacy may have been augmented by the intervention.

Only one significant interaction was found to support the hypothesis that the intervention would more strongly influence those low on self-efficacy than those high. At posttest efficacy expectancy interacted with experimental group when adherence difference scores were used as the

dependent variable. Therefore, the manipulation had a greater influence at bringing those low on efficacy expectancy closer to ideal adherence than those high on efficacy expectancy. Although this finding is consistent with predictions and differences in the correlations by experimental group, no other interactions were found to be significant. Thus, no conclusions about the relationship between commitment and self-efficacy are warranted.

The results presented in Table 5, though not significant, suggest that the manipulation of commitment does affect self-efficacy. While conclusions at this time are not warranted, these results suggest further study of the relationship of commitment and self-efficacy. It may require a more powerful design with a larger sample to detect significant differences if they exist.

Health Outcome. Adherence to antibiotic regimen in this study appeared to be unrelated to the resolution or recurrence of bacterial infection. However, it would be unwise to draw any conclusions about the efficacy of the medications prescribed due to the high level of adherence seen in both groups. The only health outcome, a detrimental one, that was apparently related to adherence was the development of yeast infections in women. As many as one-fifth of the women in the study may have developed yeast

infections as a result of taking antibiotics.

Adherence Measures. A small, though significant, correlation was found between self-report of adherence and pill count. Interestingly, when correlations were conducted separately by experimental group the control group exhibited a stronger correlation between self-report of adherence and pill count than did the commitment group. Thus, it is indicated that the subjects in the control group were more accurate in their self-reports of adherence than were the subjects in the commitment group. A likely explanation for this finding is that subjects in the commitment group felt more demand to report high adherence than did subjects in the control group.

Gender Differences. Interestingly, males were significantly more adherent than females. The reason for this finding is unclear. However, one explanation for this finding is that, as suggested by Kaplan (1990), nonadherence may at times be rational and provide feedback about individuals' experience with therapeutic regimens. Among women it is common knowledge that the use of antibiotics may lead to yeast infections and that many antibiotics compromise the effectiveness of birth control pills. Therefore, nonadherence with antibiotics in women may represent an attempt at maximizing health outcomes.

Reasons Given for Nonadherence. About half of the subjects reported taking their medication as prescribed. Of those subjects reporting that they missed doses most simply reported that they forgot; while two subjects said they did not have their medication with them. For subjects like these interventions based on behavioral principles to cue medication taking at appropriate times may be most effective. Of greatest concern were the eight subjects that reported they did not take their medication for reasons potentially related to problematic health consequences. One reported not feeling like taking the medication, two felt the medication was doing more harm than good, two felt they were better and did not need it anymore, one thought the medication made him or her tired, and one did not take the medication because he or she was drinking alcohol. These subjects' reports suggest that for certain individuals interventions involving counseling about the medical regimen and increased contact with health care providers may be warranted.

Implications. While previously demonstrated to predict and influence health behavior (Kaplan et al., 1984) in this study self-efficacy only reflected recent behavior. The lack of prediction of self-efficacy in this study may have been due to a ceiling effect similar, and related to, the

ceiling effect evident in adherence. It may be that too few subjects low in self-efficacy were included in the study for prediction based on self-efficacy to be significant. Therefore, it is suggested that future studies obtain for study populations and regimens with more variable rates of adherence.

The results of this and previous studies (Wurtele et al., 1980; Kulik & Carlino, 1987) suggest that when paired with clear instructions, obtaining verbal and written agreements to take medication as prescribed will result in improved adherence to short-term antibiotic regimens. While additional intervention may at times be warranted, simply obtaining verbal and written commitments from patients is inexpensive and effective.

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Table 1

Subject Characteristics

	control	experimental
number	22	26
average age, yrs.	19.96	19.41
age range	18-26	18-24
gender F	13	17
M	9	9
diagnoses		
upper respiratory infections and otitis media	14	19
urinary tract infections and sexually transmitted diseases	7	6
other	1	1
antibiotic prescribed		
trimethoprim/ sulfamethoxazole	2	3
amoxicillin	13	13
doxycycline	1	4
cephalexin	1	3
nitrofurantoin	2	1
erythromycin	2	2
penicillin	1	0

Table 2

Subjects Not Found at Home for Follow-up

	control	experimental
number	21	18
average age, yrs.	19.67	20.24
age range	18-25	18-23
gender F	13	9
M	8	9
diagnoses		
upper respiratory infections and otitis media	14	12
urinary tract infections and sexually transmitted diseases	4	5
other	3	1
antibiotic prescribed		
trimethoprim/ sulfamethoxazole	4	0
amoxicillin	9	9
doxycycline	2	5
cephalexin	0	0
nitrofurantoin	1	2
erythromycin	4	2
penicillin	1	0

Table 3

Kendall Correlation Coefficients: Intercorrelations Between Expectancy Measures and Adherence Measures

	Adherence Measure								
	Pill Count			Self-Report			Difference Score		
Measure	tot	ctrl	com	tot	ctrl	com	tot	ctrl	com
Pretest									
efficacy expectancy	.09	.16	.06	.27 **	.35 *	.20	.10	.12	.10
outcome expectancy	-.03	.01	-.11	.20 *	.22	.22	-.10	-.14	-.07
combined	-.02	.09	-.09	.28 **	.34 *	.29 *	-.08	-.04	-.06
Posttest									
efficacy expectancy	.24 **	.36 **	.21	.41 ***	.59 ***	.35 **	.22 *	.37 **	.21
outcome expectancy	.04	.11	-.06	.14	.20	.14	-.01	.04	.02
combined	.13	.23	.09	.29 **	.35 *	.28 *	.10	.20	.12

Note. Effects of analyses conducted on all subjects, control group subjects, and commitment group subjects are indicated under tot, ctrl, and com respectively.

*p <.05. **p <.01. ***p <.001. one-tailed

Table 4

F Statistics and Significance Levels for ANOVAs conducted on Self-Efficacy Data

	Adherence Measure								
	Pill Count			Self-Report			Difference Score		
Measure	ex	grp	int	ex	grp	int	ex	grp	int
Pretest									
efficacy expectancy	1.36	2.93	.87	2.98	.28	1.38	1.10	4.89 *	1.35
outcome expectancy	.23	2.14	.05	6.41 *	.71	.41	.06	3.95 *	.00
combined	.07	2.66	1.85	4.62 *	.54	.00	.92	5.22 *	2.89
Posttest									
efficacy expectancy	5.28 *	4.22 *	.70	12.97 ***	1.09	3.32	6.90 **	7.69 **	5.98 *
outcome expectancy	.52	2.74	1.47	1.04	.19	.78	.92	4.88 *	2.62
combined	4.10 *	3.10	.60	2.62	.21	.18	3.48	5.24 *	2.08

Note. The effects of expectancy, experimental group, and their interaction are indicated under ex, grp, and int respectively. Degrees of freedom equals (1,44) for all analyses above.

*p <.05. **p <.01. ***p <.001.

Table 5

Mean Differences in Self-Efficacy from Pretest to Posttest

Group	n	Self-Efficacy Measure		
		efficacy expectancy	outcome expectancy	combined
control	22			
M		-.23	.45	27.77
SD		6.34	2.54	178.53
commitment	26			
M		1.92	1.08	79.54
SD		5.80	2.56	156.27

Table 6

Prescription of Additional Antibiotics and Number of Symptoms at Follow-up by Group

Group	n	No. Subjects who who received add. Antibiotics	No. Symptoms Reported at Home Visit	
			M	range
control	22	5	1.18	0-4
commitment	26	4	1.23	0-7

Table 7

Subjects with Yeast Infections

Subject	Medication	No. Antibiotics in past 4 mn.	% Adherence
1	tri/sulfa	0	100
2	doxycycline	1	83
3	amoxicillin	2	57
4	penicillin	2	96
5	amoxicillin	7	100
6	doxycycline	3	81

Table 8

Reasons Given for Missing Doses of Medication

Reason Given	Group	
	control	experimental
Claimed to take all their medication.	11	10
Forgot.	6	10
Didn't feel like it.	0	1
I felt I was better and didn't need it anymore.	1	1
I thought the medicine was doing more harm than good.	2	0
The medication made me tired.	0	1
I didn't take it because I was drinking.	0	1
Difficult to take with busy schedule.	1	1
Not carrying medication; unable to get to it.	1	1

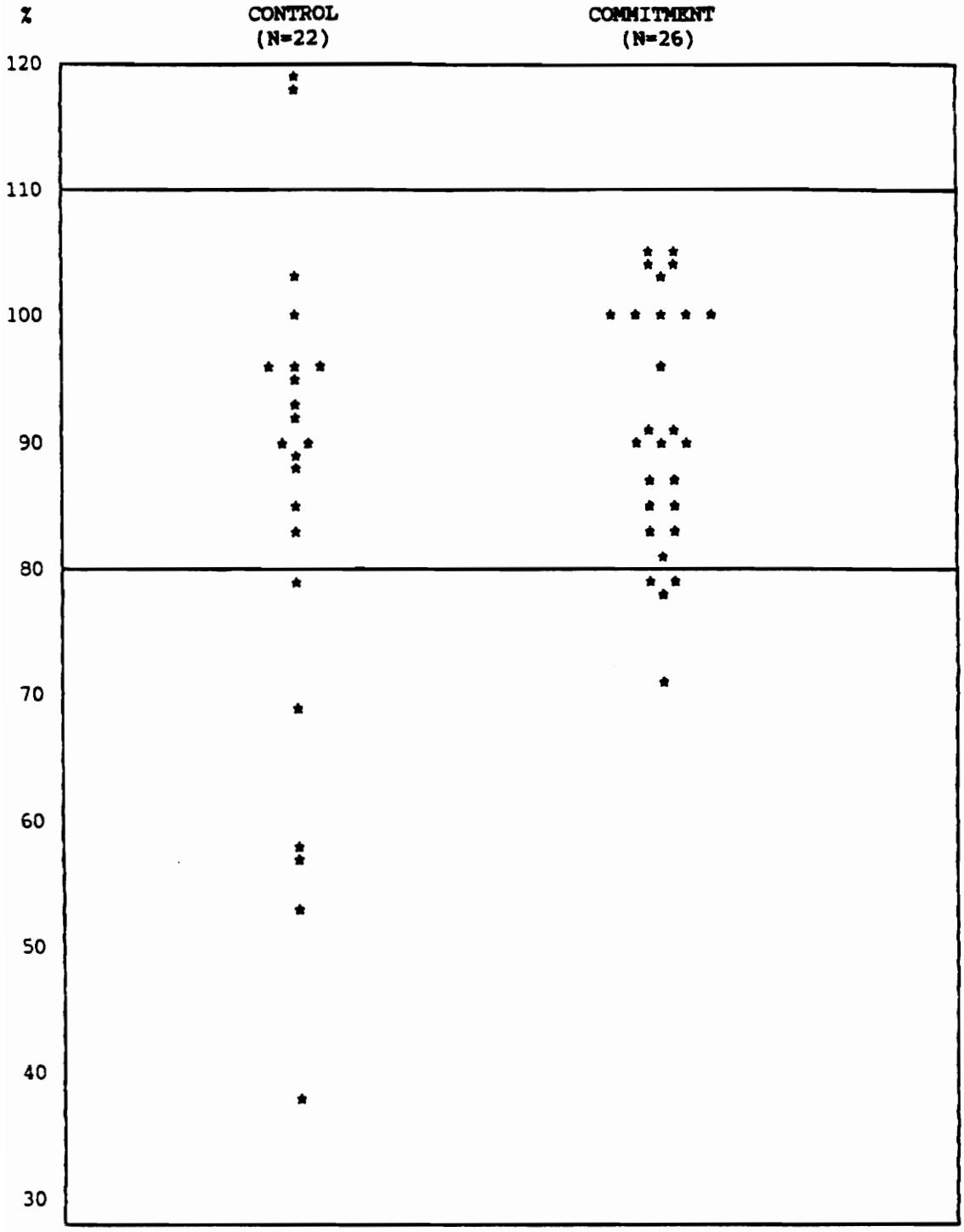

Figure 1

Appendix A

Study Information Sheet

You are being invited to participate in a study designed to investigate health behaviors of students who are ill. Participation in this study involves completing questionnaires today and a home visit sometime within the next 10 days to assess your success with the medical regimen and your illness symptoms. Your involvement will require no more than 20 minutes today and no more than 15 minutes for the follow-up visit. If you chose to participate, much of the time you will spend is time that you would be waiting for test results and/or for your prescription to be filled anyway. We intend to take up as little of your time as possible.

If you are interested please read and sign the attached consent form. Your participation in this study and all information obtained will be kept confidential. If you are not interested please return these forms to the person who gave them to you.

Appendix B

subj #___ Consent Form

The purpose of this study is to investigate health behaviors of students who are ill. Participation in the study will involve filling out some questionnaires today and a visit to your home by an experimenter of the same sex as you. The visit will involve filling out one questionnaire and a brief interview to assess your success with the medical regimen and your illness symptoms. Involvement in the study will require no more than 20 minutes today and 15 minutes during the home visit.

There are no apparent risks associated with this study. All information obtained will be confidential; only the experimenters will have access to the information you provide. Your name will only appear on this and one additional form and to insure confidentiality all other records will be identified by an assigned subject number. By agreeing to participate in this study, you are also agreeing to allow a physician who is part of the study to review your medical record to look at the number of, and reasons for, visits to the Student Health Service. The study is not being conducted by the Student Health Service's physicians; they are only referring students prescribed antibiotics who might be interested in participating.

This research project has been approved by the Human Subjects Research Committee and the Institutional Review Board. Questions about the project should be directed to the principal investigators:

Dana E. Putnam 231-6914
Dr. Jack W. Finney 231-6670

Or the chair of the Human Subjects Research Committee:

Dr. Helen J. Crawford 231-6520

Or the chair of the Institutional Review Board:

Dr. Ernest Stout 231-5281

I understand that I can withdraw from participation in this study at any time.

I hereby agree to voluntarily participate in the research project described above and under the conditions described above.

Signature: _____

I.D. #: _____

Phone #: _____

Address: _____

Appendix C

Date: __

Medication Information Sheet

Medication Type (antibiotic):_____

Amount to be taken today:_____

Amount to be taken each day:_____

Have you ever been on a 10-day regimen of antibiotics in the past? (check) yes __ no __

How many times? __

How old are you? __

Other medication prescribed:_____
_____
_____

subj # __

subj #___

Appendix D

PLEASE INDICATE WITH AN X THE BEST TIMES TO FIND YOU AT HOME.

	MON	TUES	WED	THUR	FRI	SAT	SUN
8:00 AM							
9:00							
10:00							
11:00							
12:00 PM							
1:00							
2:00							
3:00							
4:00							
5:00							
6:00							
7:00							
8:00							

PLEASE INDICATE THE MOST IDEAL TIMES BY CIRCLING THE APPROPRIATE X'S.

Appendix E

On this scale please estimate how well you think that you will be able to remember to take your medication. It might be helpful to think back to times when you have been on medication in the past.

1) How likely are you to be able to take your medication as prescribed for at least 2 days?

1	2	3	4	5
unlikely		somewhat likely		very likely

2) How likely are you to be able to take your medication as prescribed for at least 4 days?

1	2	3	4	5
unlikely		somewhat likely		very likely

3) How likely are you to be able to take your medication as prescribed for at least 6 days?

1	2	3	4	5
unlikely		somewhat likely		very likely

4) How likely are you to be able to take your medication as prescribed for at least 8 days?

1	2	3	4	5
unlikely		somewhat likely		very likely

5) How likely are you to be able to take your medication as prescribed for at least 10 days?

1	2	3	4	5
unlikely		somewhat likely		very likely

****

Please answer questions 6 - 11 in a way that best describes how you think you would behave after taking your medication for 3 days.

****

6) If something comes up just when you are about to take your medication (for example, you get a phone call) how likely are you to remember to take it afterwards?

1	2	3	4	5
unlikely		somewhat likely		very likely

7) If while on your way to a 9:00 am class you remembered that you missed your morning dose of medicine how likely are you to turn around and go home and take it before going to class?

1	2	3	4	5
unlikely		somewhat likely		very likely

8) If while on your way to a 9:00 am class you remembered that you missed your morning dose of medicine and were unable to go back home and take it before class how likely are you to remember to take it after class?

1	2	3	4	5
unlikely		somewhat likely		very likely

9) If you left for a 3-day trip and after 5 minutes on the road you remembered that you forgot to bring your medication how likely are you to go back and get it.

1	2	3	4	5
unlikely		somewhat likely		very likely

10) If you left for a 3-day trip and after 15 minutes on the road you remembered that you forgot to bring your medication how likely are you to go back and get it.

1	2	3	4	5
unlikely		somewhat likely		very likely

11) If you left for a 3-day trip and after 30 minutes on the road you remembered that you forgot to bring your medication how likely are you to go back and get it.

1	2	3	4	5
unlikely		somewhat likely		very likely

****

12) If you feel better, but have not finished all of your medication, how likely are you to continue taking it?

1	2	3	4	5
unlikely		somewhat likely		very likely

13) If you take all of your medication, what do you think is the likelihood that you will get well?

1	2	3	4	5
unlikely		somewhat likely		very likely

14) How many days do you think you will need to take your medication in order to get well?

1	2	3	4	5	6	7	8	9	10

subj # __

Appendix F

Procedural Checklist

1. Consent form read and signed. __

   Checked for signature. __

2. Symptom checklist completed. __

3. Type of medication and number of pills due to be taken today recorded. __

   Subject sent to turn in prescription. __

4. Best times to find at home schedule filled out. __

   Checked for at least two available times. __

5. Self-efficacy questionnaire filled out. __

   Checked for completeness. __

6. Investment questionnaire filled out. __

7. Investment questionnaire reviewed with subject. __

8. Subject comes up with a plan to remember to take their medication. __

   Checked for completeness. __

9. Verbal and written commitment obtained. __

10. Experimenter fills out the impressions of subject form and writes the subject number on all forms. __

11. Add subject to the data collection sheet. __

Appendix G

We realize that you have taken many steps towards resolving your illness. You may have already tried home remedies. At the very least you had to determine that you needed to see a doctor, make time your schedule to come in, and wait to be seen. We appreciate that you have made the additional effort to be involved in this study. We're interested in ways students try to help themselves when they are physically ill. Below is a list of behaviors that you may have done in effort to get better, please check off all that are applicable.

Home remedies

drank more water __ drank juice __ drank herbal tea __
used humidifier __ gargled with salt water __
other __ specify:

Over the counter medications used

vitamins __ nuprin ___aspirin __cough syrup __ decongestant __
tylenol __ antacid __ other __ specify:

Consulting with others

doctor __ nurse __ friend __ parents __

Scheduling & receiving medical care

made appointment __ rescheduled appointment __ seen by doctor __
seen by nurse __ other __ specify:

Missed

school __ work __ dates __ other __

subj # __

Appendix H

Review with subject what has been checked

1st) Home Remedies and Over the Counter Medications

"I see that you (state any home remedies or over the counter medications that were checked)." If any home remedies or over the counter medications were checked say, "while some of these things may have reduced your symptoms, it is clear that they were not sufficient to make you well."

or

If no any home remedies or over the counter medications were checked say, "while some of the home remedies and over the counter medications may reduce symptoms, they are not sufficient to make you well."

2nd) Consulting Others, Scheduling and Receiving Care, and Missed

"Also I see that you ..." To all subjects say, "It is good that you made the effort and took the time to come in today. The next step, of course, is for you to take your medication. Taking all of your medication is important because, as you may know, not taking the complete course prescribed may lead to recurrent infections. To insure that you will be able to take all of your medication we would like for you to come up with a plan." Give subject the form on which the plan will be written.

Appendix I

The times that I will take my medication each day are as follows:

MONDAY_____

TUESDAY_____

WEDNESDAY_____

THURSDAY_____

FRIDAY_____

SATURDAY_____

SUNDAY_____

Two ways that I will remember to take my medication are as follows:

1._____

_____

_____

_____

_____

2._____

_____

_____

_____

_____

subj #___

Appendix J

As part of this study we would like you to agree to take your medication as prescribed for you. That is, take the number of doses prescribed each day, every day, until all of your pills have been taken. Of course this is your choice. Will you do this?

please check: yes __ no __

signature: _____

subj #___

Appendix K

Procedural Checklist

1. Consent form read and signed. __

   Checked for signature. __

2. Symptom checklist completed. __

3. Type of medication and number of pills due to be taken today recorded. __

   Subject sent to turn in prescription. __

4. Best times to find at home schedule filled out. __

   Checked for at least two available times. __

5. Self-efficacy questionnaire filled out. __

   Checked for completeness. __

6. Demographic questionnaire filled out. __

7. Demographic questionnaire reviewed with subject. __

8. Subject writes on how she studies for tests and writes papers. __

   Checked for completeness. __

9. Verbal and written control statement obtained. __

10. Experimenter fills out the impressions of subject form and writes the subject number on all forms. __

11. Add subject to the data collection sheet. __

Appendix L

Students of various backgrounds and interest areas come to Virginia Tech. As part of this study we are interested in which students at Tech utilize the health care services available. To help us with this please fill out the information below.

age: __

gender: male female (please circle)

ethnicity: _____

year in school: _____

home town prior to coming to Tech: _____

major: _____ (if undeclared please indicate)

extracurricular activities: _____

_____

subj #___

Appendix M

Review with subject what has been written

For example: "I see that you are 19 years old and are a freshman, lived in D.C. prior to coming to Tech, and yet undecided about your major. (sex and ethnicity need not be mentioned; probably will be obvious) Also, I see that you go to aerobics and play racquetball.

"Next, we would like you to indicate (give subject form) the times that you plan to study this week and two ways that you prepare for tests." If there are questions as to why, explain to subject that we are interested in the relationship of student academic behaviors and illness. If the subject continues to ask questions explain that all of their questions will be answered following the dorm visit.

Appendix N

The times that I will study this week are as follows:

MONDAY_____

TUESDAY_____

WEDNESDAY_____

THURSDAY_____

FRIDAY_____

SATURDAY_____

SUNDAY_____

Two ways that I prepare for tests are as follows:

1._____

_____

_____

_____

_____

2._____

_____

_____

_____

_____

subj #___

Appendix O

As part of this study we would like to know if you participate in any sports on a regular basis. That is, at least once a week for most weeks of the school year.

please check: yes __ no __

signature: _____

subj #___

Appendix P

Procedural Checklist for Home Visit

1. Symptom checklist completed. __
2. Structured interview conducted. __
3. Pill count conducted. __
4. Self-efficacy questionnaire filled out. __
5. Write subject number on all forms. __
6. Wash pill tray and knife. __

subj #___

Appendix Q

Symptom Checklist - check all that apply TODAY
(the experimenter will not discuss your symptoms with you, we are only interested in your symptoms as an indicator of illness severity)

__ runny nose __ cough __ sore throat __ stomach ache
__ fatigue __ general sick feeling __ nausea __ vomiting
__ fever__ painful urination __ burning during urination
__ upper abdominal pain__ frequent urination
__ pain on side, between ribs and hip
__ lower abdominal pain __ missed periods
__ abnormal vaginal bleeding __ vaginal discharge
__ vaginal itchiness __ skin rash
__ other specify:_____

Medication

Please list any medications that you are currently taking, including birth control pills. _____
_____

subj # ___

Appendix R

subj # ___

Home Visit: Self-Report & Pill Count

Introduction

(knock on door)"Hello, I'm _____ . I am here to see ____ _____. Hi, I am here to follow-up on the Student Health study."

Self-Report

"First, I would like to ask you a few questions about how well you were able to take your medication as it was prescribed for you. Most people find it difficult to stick to prescription instructions exactly and many will occasionally miss a dose, so please don't hesitate to say if for some reason you had difficulty taking all of your medication. Please be as accurate as you can."

"To start with: do you remember missing any doses?" yes/no (circle) If yes: "How many?" ___ "Now I am going to read you some reasons why people don't take their medication, please tell me which reason best fits why you didn't take your medication." 1) Forgot. 2) Didn't feel like it. 3) I felt that I was better and didn't need it anymore. 4) I thought the medicine was doing more harm than good. 5) other. (circle one) _____

"Do you have more doses of medication that you plan on taking later today? For example, an evening dose?" If yes: "how many doses?" record ____

"Did your prescription require any dietary restrictions?" yes/no (circle) If yes: "Please rate on a scale of 1 to 5, with 1 being always, 3 sometimes, and 5 never, how often you were able to stick to the dietary restrictions associated with taking your medication?" 1) Always 2)Most Always 3)Sometimes 4)Occasionally 5)Never. (circle one)

"With the same scale of 1 to 5 please rate how often you were able to take your medication at the same time each day?" 1) Always 2)Most Always 3)Sometimes 4)Occasionally 5)Never

"Did you use any special system to help you remember to take your medicine?" (record answer) _____

Pill Count Protocol

"One of the things that we are interested in finding out with this study is how well people estimate their ability to take their medication as prescribed for them. To help us evaluate this we would like to count the pills that still remain in your vial. To insure cleanliness we will not touch your pills, we will merely pour them into our counter and then back into your container. Would you please get your pill container now." Experimenter will pour pills into counter, count and record the number of pills, then pour them back into the original container.

"Next, I would like you to fill out this questionnaire. On this scale please estimate how well you think that you would be able to take 10 days of medication in the future based on your experience taking medication this time." Give subject self-efficacy scale.

"On a scale of 1 to 10, with 10 being the highest, please rate how committed you were to taking your medication as prescribed?" record answer __.

Debriefing: "We're finished, I want to thank you for participating in this study. The purpose of this study was to evaluate how commitment is related to people taking their medication. If you know anyone else who is participating in this please don't discuss it's purpose with them until after they have had their home visit. Do you have any questions?"

VITA

Dana E. Putnam

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Education:

M.S., Clinical Psychology
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M.S. expected December, 1990

B.A., Psychology (Magna Cum Laude)
University of California, Santa Barbara
B.A., awarded March, 1986

Clinical Experience:

Psychology Extern, Veteran's Administration Medical Center, Mental Hygeine Clinic, Salem, VA, 5/90 - 8/90.
Supervisor: Jerome D. Gilmore, Ph.D.

Responsibilities included individual and group therapy, intake interviewing, and psychological assessment. Developed and conducted a stress management workshop. Experience includes working with schizophrenia, major depression, and post tramatic stress disorder.

Graduate Assistant, Psychological Services Center and Child Studies Center, Blacksburg, VA, 8/89 - present. Supervisors: Richard M. Eisler, Ph.D. and Jack W. Finney, Ph.D.

Responsibilities include assessment of children for attention-deficit hyperactivity disorder, review of case files, and general administrative duties.

Graduate Clinician, Psychological Services Center, Blacksburg, VA, 8/88 - 5/89, 8/89 - 5/89. Supervisors: Richard M. Eisler, Ph.D., Carolynn Pickett, Ph.D., and Russell T. Jones, Ph.D.

Responsibilities included individual, couples, and family psychotherapy, and personality and behavioral assessment with children and adults. Experience includes working with bulimia nervosa, obsessive compulsive disorder, sexual dysfunction, enuresis, encopresis, and oppositional defiant disorder.

Counselor, Southwood Psychiatric Residential Treatment Center, Chula Vista, CA, 7/86 - 7/88.

Responsibilities included counseling and behavioral management of emotionally disturbed children and adolescents, and adolescents with substance abuse problems, as well as occasional supervision of other counselors in a residential setting.

Counselor, Devereux Foundation, Santa Barbara, CA, 5/86 - 5/87.

Responsibilities included counseling and behavioral management of adolescents in a residential setting.

Group Counselor, Juvenile Hall, Santa Barbara, CA, 6/85 - 9/85.

Responsibilities included intake, transport, and behavioral management of incarcerated adolescents.

Research Experience:

Masters Thesis Research, Virginia Polytechnic Institute & State University Student Health Center, Blacksburg, VA, 8/89 - 10/90. Supervisor: Jack W. Finney, Ph.D.

Initiated, designed, planned, and organized a study on the effect of increasing commitment on adherence to medical regimen. Publication intended.

Research Assistant, National Institutes of Health funded-studies on Chronic Obstructive Pulmonary Disease and Arthritis, University of California, San Diego, CA, 9/86 - 7/88. Supervisor: Robert M. Kaplan, Ph.D.

Conducted structured interviews, administered and coded questionnaires, and tested patients on treadmill while monitoring blood pressure, heart rate, and respiration.

Research Assistant, Chronic Low Back Pain Study, Veterans Administration Medical Center, San Diego, CA, 6/86 - 5/88. Supervisors: Mark A. Slater, Ph.D. and Hamp Atkinson, M.D.

Assisted in data management, library research, and patient interviewing. Submitted paper on health care utilization for presentation at the 1988 Society for Behavioral Medicine conference.

Research Assistant, Child Abuse Study, University of California, Santa Barbara, CA, 9/86 - 12/86 Supervisor: Daphane Bugental, Ph.D.

Assisted in data management and coded interactions observed between parents and their children.

Teaching Experience:

Graduate Teaching Assistant, Virginia Polytechnic Institute & State University, Blacksburg, VA, 8/88 - 8/89.

Taught four introductory psychology discussion sections.

Instructor, University of California, Santa Barbara, CA, 7/86 -8/86.

Taught an introductory psychology course for incoming freshman students in the Summer Transitional Enrichment Program.

Tutor, University of California, Santa Barbara, CA, 6/86 - 7/86.

Tutored high school students taking college level psychology courses in the Summer Juniors Program.

Professional Memberships:

American Psychological Association

Association for the Advancement of Behavior Therapy