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Physical Health Following a Cognitive–Behavioral Intervention

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ABSTRACT

One hundred and twenty entering freshmen, at risk for depression on the basis of their pessimistic explanatory style scores, were randomly assigned to 1 of 2 conditions: an 8-week, cognitive–behavioral intervention designed to prevent future depression (seminar group) or to a no-intervention control group.We assessed the physical health of these participants 6-30 months after entry into the project. Participants in the seminar group had better physical health than did control participants: fewer self-reported symptoms of physical illness, fewer doctors' visits overall, and fewer illness-related visits to Student Health. They were more likely to visit a doctor for a checkup and had healthier habits of diet and exercise. We postulate that the learning of antidepression skills produces better physical health.

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Peterson, Seligman, and Vallaint (1988) outlined the requirements that need to be met in order to demonstrate a causal relationship between psychological traits and physical health.

well-being. Second, the time span must be sufficient. Although some stressors may cause immediate effects, it is likely that others operate in a more insidious manner, taking months or years to affect one's health. Finally, because poor health can take many forms, multiple health measures need to be taken.

There are three main areas where these criteria have been met. These are the Type A Behavior Pattern (TABP) and its relationship with coronary heart disease (CHD), stress and its effect on the development of ulcers, and the Type C Personality and its relationship with cancer (Bakal, 1992; Genest & Genest, 1987; Haynes, Feinleib, & Kannel, 1980; Rosenman et al., 1975). Additionally, patients who participate in intervention programs that modify TABP, stress, and Type C Personality, experience benefits in terms of fewer physical symptoms, less recurrence, and increased longevity (Brooks & Richardson, 1980; Friedman et al., 1984; Grossarth-Maticek & Eysenck, 1991).

The large literature on psychological effects on physical health, however, even when it fulfills the rest of the criteria, is almost entirely correlational., So, in a typical example, Peterson et al., (1988) demonstrated that pessimistic men were more than twice as likely to have succumbed to chronic disease at the time of follow-up than were their optimistic Harvard classmates. In another example, hostility measured by the Minnesota Multiphasic Personality Inventory (MMPI) predicted coronary heart disease and total mortality over a 25-year period (Barefoot, Dahlstrom, & Williams, 1983). Even though sophisticated causal modeling techniques eliminate the possibility of specified third variables in such studies, only an experiment in which participants are randomly assigned to have the relevant psychological trait can rule out all third variables conclusively enough to demonstrate causality.

There have been three prior studies that have demonstrated a relationship between explanatory style and physical health: The Peterson et al., (1998) study; the Virginia Polytechnic Study (Peterson, 1988), in which pessimistic students reported more days of illness and made more doctor's visits than their optimistic peers; and the Recurrent Coronary Prevention Pessimism Study (Buchanan, 1995), in which pessimism predicted death from coronary events over a period of 8 1/2 years. Without intervention, explanatory style is a stable variable (Burns & Seligman, 1989). It is well documented, however, that explanatory style can be modified (Buchanan & Seligman, 1995; Evans et al., 1992). Current research has indicated that group seminars based on the principles of cognitive–behavioral therapy reliably change the explanatory style of pessimistic individuals (DeRubeis et al., 1990; Gillham, Reivich, Jaycox, & Seligman, 1995; Jaycox, Reivich, Gillham, & Seligman, 1994; Seligman et al., 1988). More importantly, participants who were assigned to the seminar condition showed improvements, relative to no-treatment controls, in terms of reduced incidence of depression and anxiety (Gillham et al., 1995; Jaycox et al., 1994).

We now report a study that fulfills the criteria of causality and that demonstrates that a cognitive intervention can cause physical health benefits through reduction in depression mediated by changes in level of hopelessness.

Method

The participants in this study (the Health Extension) were selected from a larger study (the APEX Project). We will thus provide an outline of the APEX Project before describing the methodology of the Health Extension.

The APEX Project

The primary goal of the APEX Project was to explore prevention of depression through a group-based cognitive–behavioral intervention. A secondary goal was to examine possible mediators of depressive symptom reduction including explanatory style, hopelessness, and dysfunctional attitudes.

Participants

The APEX participants were 231 undergraduates at the University of Pennsylvania who were part of the entering classes of 1991, 1992, and 1993. All participants were identified as at-risk for depression on the basis of their scores on the Attributional Style Questionnaire (ASQ; Peterson et al., 1982). ASQs were mailed to all incoming students in the summer before their first semester. The most pessimistic students; that is, those scoring in the bottom quartile of the ASQ full-scale score (CPCN; see Reivich, 1995, for scoring details) were invited to participate in a pretraining evaluation to determine their eligibility. Participants were eligible to participate if they met all of the following criteria: (a) not currently in psychotherapy or taking psychoactive medications; (b) still scoring in the bottom quartile of the ASQ at the pretraining evaluation; (c) scoring 19 or less on the Beck Depression Inventory (BDI: Beck,Ward, Mendelson, Mock, & Erbaugh, 1961) to exclude those participants who were currently experiencing a depressive episode; (d) not currently meeting criteria for an Axis I disorder and never having met criteria for major depression with psychotic features, bipolar disorder, any psychotic disorder, and alcohol or drug dependence.

The Learned Optimism Training Program

Immediately following the pretraining evaluation, those participants who satisfied all the criteria were assigned to one of two conditions using stratified random sampling according to depression history, gender, ASQ median, and BDI median. These conditions were a no treatment control (control group) and a prevention training program, called the *Learned Optimism* program (seminar group). The prevention training program consisted of eight 2-hr meetings, held over an 8-week period, with homework to be completed between meetings. Training was delivered to the participants in groups of 10 by a trainer and co-trainer. Participants also had individual meetings with the trainers on six different occasions: the beginning of training, the middle of training, 1 month posttraining, 3 months posttraining; the fall of their sophomore year, and the spring of their sophomore year. During these individual meetings, the skills taught in the prevention training program were reviewed and

any questions the participants had about applying the skills to their lives were answered. The trainers were all cognitive therapists with between 2 and 30 years experience. The co-trainers were either these same therapists or doctoral students in the clinical psychology program at the University of Pennsylvania.

Skills taught in the training program were largely based on the cognitive–behavioral techniques developed by Beck and his colleagues (Beck, 1964, 1967, 1976; Beck, Rush, Shaw, & Emery, 1979; Hollon & Beck, 1979). Reivich, Jaycox, and Gillham (1991) developed a detailed training manual for the program. The format included lecturing, audiovisual presentations, role- playing, games and activities, open discussions, and homework reviews. Participants were also provided with a detailed workbook for use throughout the program and beyond.

The Health Extension

The Health Extension to the APEX Project began in the spring of 1994—3½ years after the APEX Project began. Participants thus formed five cohorts depending on when they joined the APEX Project: Fall 1991, Spring 1992, Fall 1992, Spring 1993, and Fall 1993.

The Health Extension participants were selected from the original APEX participant pool of 231. Attempts were made to reach all participants who were still actively part of the APEX Project and were still attending the University of Pennsylvania. Of these, 123 participated in the first phase of the Health Extension. Three of these participants were dropped from the study because of chronic ill health (systemic lupus and juvenile diabetes) at the time of entry into the APEX Project, thus leaving a pool of 120. Of these, 104 completed the second phase of the Health Extension, which took place 2 weeks after the first phase.[1]

Health Measures

Participants met with a research assistant who had been given extensive training in interviewing participants. After reading and signing a consent form, the following were completed:

1. Health Visits—Objective: Participants were asked to read and sign a release of medical information form provided by the University's Student Health Service. One hundred and eighteen of the 120 participants signed this consent form, which gave access to their student health records. Records pertaining to psychiatric treatment or drug and alcohol related problems were not obtained (as per Pennsylvania state law). Participants' medical records were then reviewed for the following information: health at entry to the university (all students must undergo a complete physical following acceptance to the university—three participants were dropped on the basis of physician's report), number of visits to the Student Health Service, reason(s) for visit, diagnosis, and treatment. Because participants were from different entering classes, number of visits was quantified as number per semester. As previous research (e.g. Peterson, 1988) had indicated that pessimists were more likely to

experience ill health than were optimists, we hypothesized that there would be a difference not only in the number of visits, but also the reason for the visit. Therefore, all visits were coded as being either (a) illness visits, (b) maintenance or check-up visits, (c) accident visits, or (d) other/unknown. Illness visits were largely for discomforting symptoms such as sore throats, vomiting, fever, and so on. Checkup visits included pap smears, influenza shots, and health counseling for such things as weight loss and smoking cessation. Accident visits were mainly due to sport injuries but also included falls and fights. Other visits were those that did not fit the other three categories and included such things as having a wart removed and receiving medication for acne.

2. Health Visits—Subjective: Participants were asked to recall all visits they had made to medical professionals following their enrollment in the APEX Project. Participants were asked when each visit occurred, where the visit took place, and the reason for the visit.

   This provided a subjective measure of use of health care resources. These visits were coded in the same way as the Health Visits—Objective measure. Participants were, by and large, accurate in their recollection of visits to Student Health Services, though both groups underestimated the number of visits. The correlation between actual visits to Student Health Services and self-reported visits was .71.
3. Health Behaviors Questionnaire (adapted from a health habits and history of health behavior questionnaire designed by the National Center for Health Statistics [1974]): This measure was used to determine whether the seminar group participants were taking better care of themselves by engaging in more health maintenance behaviors and fewer health risk behaviors. This 30-item questionnaire asks participants to indicate to what degree they engage in a variety of behaviors to protect their health. Responses are given on a 7-point scale. Behaviors include not smoking, visiting the doctor, wearing seat belts, and avoiding parts of the city with lots of crime and pollution. Scores were summed across the 30 items to yield a composite measure of health protective behaviors. Additionally, to determine whether there were any subsets of behaviors over which the two groups differed, a factor analysis was performed using varimax rotation in which only factors with eigenvalues greater than 1.0 were maintained. This analysis yielded a stable factor solution with three factors. Items with a factor loading of at least +/- 0.4 were considered salient. The three factors were labeled (a) *Relaxation*, (b) *Diet and Exercise*, and (c)*Prevention*.
4. Physical Symptoms—Retrospective (Suls & Mullen, 1981): Participants were asked to list any symptoms of illness they had experienced in the preceding 2 weeks. They were provided with a list of 16 common symptoms including sore throat, rash, fever, headache, and so on. Space was also provided for participants to write in any unlisted symptoms they may have experienced.
5. Physical Symptoms—Prospective: At the end of the phase one interview for the Health Extension, participants were given 14 copies of the Daily Symptoms Questionnaire, one to be filled out each evening for the next two weeks and returned at Phase 2 of the Health Extension. One hundred and four of the original 120 participants returned these 14 questionnaires at the time indicated, and the total number of symptoms experienced was calculated for each participant. Additionally, participants were asked to indicate what response (if any) they made to these

symptoms. These responses where coded as *active* (took medication, saw a doctor, etc.) or *passive* (did nothing, ignored it, etc.). Dividing the number of active or passive responses by the total number of symptoms reported thus created two additional variables.

6. Global Health Rating—Objective: All APEX participants were interviewed once a semester for the duration of their undergraduate careers using the Longitudinal Interval Follow-up Evaluation (LIFE; Keller et al., 1987). For part of this interview, they answered questions about their interpersonal relationships, their academic performance, and their health. Specifically, participants were asked if they had suffered any physical illnesses, visited their physician, or missed classes because of illness. From their answers, a global health measure was generated for each month the evaluation covered. Health was rated on a 0–3 scale, where 0 = *no health problems*, 1 = *minor problems* (e.g. cold, migraine), 2 = *moderate problems* (e.g. illness that caused them to fall behind in schoolwork), and 3 = *serious problems* (e.g. had to drop classes because of illness). For use in the Health Extension, these ratings were averaged across all months since the participants enrolled in the APEX Project. The raters were blind to whether a participant was in the control group or the seminar group.

Measures—Mediators

To the extent that differences did emerge between the two groups, we hypothesized that they would be mediated through changes in depression, explanatory style, dysfunctional attitudes and/or hopelessness as a result of the Learned Optimism Training Program. Instruments used were the ASQ, the BDI, the Dysfunctional Attitudes Scale (DAS; Weissman & Beck, 1978), and the Hopelessness Scale (HS; Beck, Weissman, Lester, & Trexler, 1974). These mediator measurements were collected at entry into the APEX Project and after completion of the training procedure 6 weeks later.

Statistical Procedures

The two main hypotheses in this study were that group differences would emerge in terms of physical symptoms and in number of visits to physicians. These two predictions were analyzed using separate Multivariate analyses of variance (MANOVAs) for symptoms and visits in which group and time served as independent variables. For the symptoms analysis, data from the Physical Symptoms Questionnaires (Prospective and Retrospective) were combined with the Global Health Rating Measure. For the visits analysis, the Health Visits-Subjective and Objective data were combined. Because participants differed in the amount of time that had passed between the conclusion of the APEX Seminar and the beginning of the Health Extension (6–30 months), both group and time were entered into the MANOVAs as independent variables. The time interval used was number of semesters since entry into the APEX Project and was included in the analyses to control for the effects time may have had on reporting rates. Further, additional hypotheses related to the symptoms and visits data and the Health Behaviors Questionnaire were analyzed with independent t-tests or chi-squared tests as appropriate. These were that seminar participants would take a more active

stance to the symptoms they experienced, and that they would make proportionally more check-up visits than illness visits. The analyses of potential mediators followed the procedure outlined by Baron and Kenny (1986).

Results

Seminar Versus Control Groups

As mentioned, a sizable number of participants who participated in the APEX Project did not participate in the Health Extension. There were no significant differences between the participants and nonparticipants on all key variables: gender, group assignment, and pre- and post-APEX measures of depression and pessimism.

Physical Symptoms. Participants in the control group experienced more symptoms of physical illness than did participants in the seminar group (all group means and standard deviations may be found in Table 1). This analysis revealed a main effect for group, $F(3, 96) = 2.37$, p(one-tailed) = .038. There was no effect for time on the symptoms data, and no Group × Time interaction. Univariate F tests indicated that the seminar participants reported significantly fewer symptoms on the Physical Symptoms–Prospective Questionnaires than did controls, $F(1,98) = 4.33$, p(one-tailed) = .020. The group seminar participants were also rated as healthier by the APEX evaluators, $F(1,98) = 2.83$, p(one-tailed) = .048. There were no differences between the groups on the Physical Symptoms–Retrospective Questionnaire.

Table 1

Means and Standard Deviations of Health and Apex Measures for Seminar and Control Participants

Measure	Seminar participants		Control participants	
	M	*SD*	*M*	*SD*
BDI				
Pre-APEX	7.25	4.93	7.11	5.08
Post-APEX	4.88	3.76	5.62	3.90
CPCN				
Pre-APEX	0.11	1.74	0.01	1.98
Post-APEX	0.00	1.88	0.60	2.01
DAS				
Pre-APEX	326.0	56.9	320.8	60.4
Post-APEX	307.4	39.7	321.4	38.7
HPS				

Pre-APEX	4.04	3.22	3.35	2.61
Post-APEX	3.70	3.45	4.00	2.51
Symptoms—Prospective	13.81	4.78	18.81	14.21
% active	33.33	23.69	23.21	29.66
% passive	66.67	23.09	76.19	24.69
Symptoms—Retrospective	6.32	4.08	5.95	4.90
% active	25.24	22.90	28.00	24.22
% passive	74.76	31.02	72.00	23.78
Global Health Rating*	0.12	0.18	0.22	0.37
Visits—Objective**	0.67	0.66	0.82	0.75
% illness	0.42	0.25	0.50	0.31
% check-up	0.33	0.26	0.25	0.19
% accident	0.18	0.26	0.19	0.32
% other	0.07	0.12	0.05	0.20
Visits—Subjective**				
Student Health	0.57	0.84	0.70	0.60
Other	0.23	0.24	0.27	0.60
% illness	0.31	0.35	0.48	0.37
% check-up	0.45	0.34	0.32	0.32
% accident	0.16	0.25	0.13	0.22
% other	0.11	0.26	0.08	0.14

Note. BDI = Beck Depression Inventory; CPCN = Attributional Style Quistionnaire full-scale score ; DAS = Dysfuntional Attitudes Scale; HPS = Hopelessness Scale;

* Average health rating. ** Number of visits per semester

Participants had been asked to report on the Physical Symptoms—Prospective Questionnaires what action they took in response to the symptoms they experienced. These actions were blindly coded as either active or passive; thus, the proportion of active to passive reactions could be calculated. This revealed that seminar participants made proportionally more active, and less passive, responses to their symptoms, $\chi^2(1, N=119) = 5.24$; p(one-tailed) = .038.

Health visits. There was a main effect for group, $F(2,109) = 2.45$, p(one-tailed) = .047. The main effect for time approached significance, $F(2,109) = 2.59$, p(2-tailed) = .08. The interaction of Time × Group was not significant, $F(2,109) = 1.017$, *ns*. Univariate tests revealed that the control participants reported having made more doctors visits on the Health Visits—participantive measure $F(1,110) = 3.60$, p(one-tailed) = .03.

The Health Visits—Objective measure indicated that there was no difference in the number of visits actually made to Student Health Services, $F(1, 100) = 1.13$, *ns*. Although the MANOVA found no main effect for time, a univariate analysis revealed that participants

across both groups reported fewer visits per semester the longer they were at the university, $F(1, 110) = 4.78$, p(two-tailed) = .029. Participants were also asked to indicate the location of the visits they had reported on the Health Visits—Subjective measure. This allowed for a test of the participants' memory of visits because comparisons could be made with the Health Visits—Objective measure of Student Health visits. When broken down into location of visit, there was no significant difference in the number of Student Health visits reported by the two groups, $t(115) = 1.40$, p(one-tailed) = .082. This parallels the finding that there was no significant difference in the number of visits actually made to Student Health. There was, however, a significant difference in the reported number of visits made to other locations, $t(115) = 2.99$, p(one-tailed) = .002. Unfortunately, attempts to establish an objective measure of these visits made outside of Student Health were not successful.

Health visits were also coded for type of visit. Control group participants reported making more than twice as many illness visits than seminar group participants, $t(115) = 2.95$, p(one-tailed) = .002. There were no differences in the overall number of checkup, accident, or "other" visits made. When type of visit was coded as a proportion of the total number of visits, control participants were found to make proportionally more illness related visits (48%) than were seminar participants (31%), $t(100) = 2.40$, p(one-tailed) = .009. They also made proportionally fewer checkup visits (32% vs. 45%), $t(100) = 2.06$, p(one-tailed) = .022. There were no differences between the two groups on the proportion of accident and "other" visits made.

A similar pattern of findings for type of visit from the Health Visits—Objective measure confirmed these self-report results. Control participants made more illness visits to Student Health than did the seminar participants, $t(114) = 2.20$, p(one-tailed) = .015. There was also a trend for seminar grou participants to make more check-up visits to Student Health, $t(114) = 1.43$, p(one-tailed) = .078. When type of visits was coded as a proportion of total visits made, there was a trend for control participants to make proportionally more illness-related visits than seminar participants (50% vs. 42%), $t(93) = 1.43$, p(one-tailed) = .078. A significant difference between groups in the proportion of check-up visits was found. Seminar participants made proportionally more check-up visits than the control participants (33% vs. 25%), $t(93) = 2.13$, p(one-tailed) = .018. There were no differences in terms of the proportion of accident or "other" visits. Again the close parallels between the findings from the Health Visits—Subjective and Objective measures may be taken as an indication that the participants' memory of health visits was valid.

Health Behaviors

There was no difference between the groups on the degree to which they endorsed the 30 health related behaviors, $t(118) = .13$, *ns*. Comparisons between the two groups on the three subscales revealed through factor analysis indicated that seminar participants were significantly more likely to endorse items related to diet and exercise, $t(118) = 2.01$, p(one-tailed) = .047. There were no differences on the other two factors.

Potential Mediators of the Health Effects

In order to maximize the sensitivity of the outcome measures in the search for mediators, the three major significant findings were combined. *Z* scores were calculated for Physical Symptoms—Prospective, Global Health Rating, and Health Visits—Subjective and summed to create a new variable labeled *overall health effect*. Analyses of mediation for depression (BDI), explanatory style (ASQ), hopelessness (HPS), and dysfunctional attitudes (DAS) were then performed with this variable.

Only depression (BDI) was found to be a significant mediator of group to health (see Table 2). There was an effect of group on BDI, which remained significant after the effect of health was partialled out. There was also an effect of BDI on health, and the effect of group on health was reduced when the effect of BDI was partialled out. A chi-square analysis (Olkin & Finn, 1990) revealed that depression was a significant mediator of the relationship between group and health, $\chi^2(1, N = 99) = 3.20, .025 < p < .05$.

Table 2

Analysis of Depression as a Potential Mediator of the Relationship Between Group and Overall Health

	F	*p*
Effect of group on BDI	7.397	.004
Effect of group on BDI, partialing health	4.331	.020
Effect of BDI on health	6.916	.005
Effect of group on health	8.903	.002
Effect of group on health, partialing BDI	5.780	.009
Test of significance: $\chi^2(1, N = 99) = 3.20, .025 < p < .05$		

Note. *p* values reflect a one-tailed test of significance. BDI = Beck Depression Inventory.

In turn, hopelessness was found to mediate the relationship between group and BDI (see Table 3). There was an effect of group on HPS, which remained significant after the variance attributable to BDI was partialled out. There was an effect of HPS on BDI, and the effect of group on BDI decreased after the effect of HPS was partialled out. A chi-square analysis revealed that hopelessness was a significant mediator of the relationship between group and depression, $\chi^2(1, N = 119) = 4.67, .0125 < p < .025$.

Table 3

Analysis of Hopelessness as a Potential Mediator of the Relationship Between Group and Depression

	F	*p*
Effect of group on HPS	9.910	.001

Effect of group on HPS, partialing BDI	6.217	.007
Effect of HPS on BDI	11.890	.001
Effect of group on BDI	6.566	.006
Effect of group on BDI, partialing HPS	2.996	.043
Test of significance: $\chi^2(1, N = 119) = 4.67, .0125 < p < .025$		

Note. *p* values reflect a one-tailed test of significance. HPS = Hopelessness Scale; BDI = Beck Depression Inventory.

Discussion

The central hypothesis that participants who received cognitive behavioral depression prevention training would experience fewer physical symptoms and report fewer doctors' visits was confirmed. This study also fulfilled the criteria for establishing a causal relation between a psychological trait and physical health outcomes. These three criteria were the longitudinal nature of the study, the adequate time span used, and the multiple measures of physical health.

There were three measures of physical symptoms in this study: the Physical Symptoms–Retrospective questionnaire, the Physical Symptoms–Prospective questionnare, and the health rating made by the APEX evaluators using the structured LIFE interview. Seminar participants were found to be experiencing fewer physical symptoms on both the Daily Questionnaire and the Health Rating Measure. This extends on the work of Peterson (1988) who found that optimists reported fewer physical symptoms than did pessimists in the Virginia Polytechnic Study. No differences were found on the Physical Symptoms–Retrospective Questionnaire; however, the Prospective—Daily Questionnaire is a sounder measure as it did not rely on 2 weeks of memory.

The physical symptoms results also extended the findings of Lin and Peterson (1990) and Peterson, Colvin, and Lin (1992), who reported that pessimists were more passive in the face of ill health. Although the control participants did make more illness-related visits (i.e., an active stance), they also suffered more physical symptoms (thus necessitating more visits) and generally responded in a passive manner more frequently than did the seminar participants. Additionally, the Health Behaviors Questionnaire indicated that seminar participants were taking more active steps to protect their health, at least in terms of diet and exercise.

This study used two measures of doctor's visits: a self-report of visits made to all physicians and an objective record of visits made to Student Health. There was an effect of the training program on the number of doctor's visits with seminar participants reporting fewer visits. Again, this extended on the work of Peterson (1988) who found that optimists made fewer doctors visits than pessimists. On the objective measure of Student Health visits, no difference between the groups was found. Similarly, when the subjective data was code for location of visit, no difference between the groups was obtained for reported visits to the Student Health. It can thus be concluded that the difference in terms of overall number of visits made is the result of the control participants making more visits outside of Student

Health. This is problematic because although the participantive data indicate that the control participants did make more outside doctor's visits, attempts to objectively verify these reports were not successful. Attempts to confirm visits made outside of Student Health through mailings and follow-up phone calls met with an approximately 15% response rate. Therefore, the possibility exists that control participants did not make more outside visits, but merely overreported the number of visits made (or seminar participants underreported). This is an interesting question in itself that can be answered in part by comparing the reported number of Student Health visits with the actual number made. Both groups underreported the number of Student Health visits made (seminar: subjective, 0.57; objective, 0.67; control: subjective, 0.70; objective, 0.82). The overall accuracy of the two groups was virtually identical; both seminar and control participants recalled approximately 85% of their visits to Student Health. There appears no reason to believe that this level of accuracy should be different when it comes to visits outside of Student Health, and thus, although it cannot be verified, we believe that the control participants did indeed make more doctors visits than seminar participants.

When visits were coded for type of visit, it was found that the control participants both reported making more illness visits and did make more illness visits to Student Health. This is noteworthy as it suggests that the control participants were experiencing more physical illness. An equally noteworthy finding was that the seminar participants showed a trend toward making more check-up visits. This suggests that the seminar participants were taking better care of themselves.

One final finding from the data on visits was that the subjective number of visits was affected by the time the participants entered the study. Specifically, the greater the duration between the conclusion of the APEX seminar and the beginning of the Health Extension, the fewer the visits reported. This finding was consistent across both groups—there was no Group × Time interaction. It is believed that the effect for time is simply the result of memory. For example, participants who entered the APEX Project in the fall of 1991 were asked to recall visits over a 30-month period, and they recalled fewer visits per semester than did participants asked to recall visits over a shorter time span.

How did depression prevention result in better physical health? The analyses of mediation showed empirically that depression clearly plays a role. High levels of depression across groups predicted poorer physical health. As the cognitive–behavioral intervention significantly reduced and prevented depression, those participants in the seminar condition would be expected to reap the health benefits of this reduced depression.

We can also speculate on why reduced depression might lead to better physical health:

1. Depression leads to immunosuppression (Schleifer, Keller, Siris, Davis, & Stein, 1985), so it is possible that the health differences between the two groups were the result of a depression-induced decrease in immune functioning in the control participants. This may be the case, as the majority of symptoms the participants reported, and the majority of illness visits they made, were related to infectious illness (e.g., strep throat, mononucleosis, influenza, etc.). We did not measure

immune response.

2. Depressed individuals also suffer more uncontrollable events, and the more uncontrollable events one experiences, the more likely one will become ill (Rabkin & Struening, 1976). It is possible that the APEX seminar taught the participants to be better problem solvers, and thus they experienced fewer events that they could not handle.

   Unfortunately, we have no measurement of the number of negative events experienced by the participants and thus this must remain speculative.

3. Depression also produces passivity, and passivity about physical health will produce further health problems. In this current study, a difference in the level of depression between the groups was mediated by HPS, a measure of passivity. Perhaps the seminar participants were less hopeless and simply took better care of themselves. That is, as a result of participating in the APEX seminar, they took a proactive, rather than a reactive, stance to their problems, including their physical health. Three of the findings indicated that seminar participants were taking better care of themselves (checkup visits, active response to symptoms, and diet and exercise habits). This attitude, in turn, should lead to fewer health problems in that health habits reduce the incidence of physical illness.

The nature of the suspected link between the degree to which participants took care of themselves and the amount of illness they experienced needs to be assessed more closely. Peterson et al., (1992) provided evidence that a participant's response (active or passive) to a cold has no effect on the duration of the cold. But perhaps prior action may have prevented the cold in the first place. We need to examine what it is that participants do (or what they can do) to prevent illness and whether these behaviors are effective and more common among seminar participants. We also need to track these participants for longer periods. Although the time interval between the end of the APEX seminar and the beginning of the Health Extension study was long enough to detect some group differences, greater differences may emerge over time. There is also a world of difference between having a sore throat or a cold and developing cancer or heart disease. It remains to be seen whether the benefits of the APEX Project will persist across a longer time and reduce the incidence of these more chronic and serious illnesses in the seminar participants.

A general shortcoming of this study is the overall paucity of physical illness and symptoms in the population studied. It may, therefore, be beneficial to administer the cognitive–behavioral seminar to an older, and potentially less healthy, population. Further, we are in the process of following this population over the next five years beyond college, when the baseline incidence of physical illness rises.

Before concluding, it is necessary to address the issue of nonparticipation. As mentioned, over half of the participants who took part in the APEX Project declined participation in the Health Extension. While participants and nonparticipants did not differ in terms of group assignment and pessimism, depression and hopelessness pre- and post-APEX, it is possible that they differed in terms of physical health. At this point we may only speculate that this was not the case. When initially asked to participate in the Health Extension, participants were not informed that it concerned their physical health thus ruling-out the possibility that

"sicker" participants opted out of the study because they did not want to reveal their health status. In fact, the primary reasons given for non-participation were lack of time and lack of incentive (the monetary compensation for the Health Extension was quite modest compared with the payment for APEX participation).

In conclusion, by randomly assigning pessimistic students to a control group or a prevention group that reduced depression, we found that prevention training caused better physical health. We speculate that learning the skills that prevent depression improved physical health by causing the students to take a more pro-active stance toward physical illness.

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Footnote

[1] By the spring of 1994, 7 participants had dropped out of the APEX Project, while 5 were still part of the project, but were enrolled at different schools. Additionally, 8 participants were studying abroad at the time the Health Extension began leaving a potential pool of 211. Of these, 14 were never reached (despite persistent efforts), while 9 agreed to participate, but never showed up although they were rescheduled three times. The largest decrease in the participant pool was the result of students who declined participation. Sixty-five of the original APEX participants opted not to participate in the Health Extension. Participants did not differ from nonparticipants in terms of BDI pre- and post-APEX, CPCN pre- and post-APEX, and group assignment (seminar vs. control).