Published in final edited form as:

Am J Health Behav. 2014 July ; 38(4): 586–597. doi:10.5993/AJHB.38.4.12.

Negative and Positive Beliefs Related to Mood and Health

Raymond L. Ownby, MD, PhD, Amarilis Acevedo, PhD, Robin J. Jacobs, PhD, Joshua Caballero, PharmD, and Drenna Waldrop-Valverde, PhD

Raymond L. Ownby, Professor and Chair, Department of Psychiatry and Behavioral Medicine, Nova Southeastern University, Fort Lauderdale FL. Amarilis Acevedo, Associate Professor, Center for Psychological Studies, Nova Southeastern University, Fort Lauderdale FL. Robin J. Jacobs, PhD, Associate Professor, Department of Psychiatry and Behavioral Medicine, Nova Southeastern University, Fort Lauderdale FL; Joshua Caballero, Associate Professor, Department of Pharmacy Practice, Nova Southeastern University, Fort Lauderdale FL; Drenna Waldrop-Valverde, Associate Professor, 4Nell Hodgson Woodruff School of Nursing, Emory University, Atlanta, GA

Abstract

Objectives—To observe whether elderly patients' positive and negative beliefs about efforts improving or maintaining health are related to health and mood.

Methods—We developed a brief scale to assess these beliefs. Factor analysis was used to evaluate its dimensions, and the extent to which the scale's dimensions mediate the relation between mood and self-reported health was explored.

Results—Analyses show that the scale reflects a general factor as well as 2 subscales that evaluate distinct but related positive and negative dimensions. The scale was not related to race, gender, or education, but showed modest relations to age. Scales were significantly related to mood, health status and health-related quality of life.

Conclusions—Both negative and positive beliefs mediated the relation between depression and self-reported health.

Keywords

depression; health beliefs; mediation; health-related quality of life

Patients' beliefs about their health and medical treatment are a potent factor in the success of medical treatment. Major theories of health behavior emphasize the importance of beliefs in understanding health-related behavior, as in the Health Belief Model,¹ and the Theory of Planned Behavior.^{2, 3} The Health Belief Model, for example, specifies that a person's beliefs about their health status, the risk of having a condition, and the likelihood of a positive outcome from health behaviors predict whether they will engage in health-related behaviors. The Theory of Planned Behavior emphasizes the key role of health beliefs in shaping

Correspondence to Dr. Ownby; ro71@nova.edu.

Conflict of Interest Statement

The authors declare no conflicts of interest related to this study.

attitudes, norms, and perceived control over health behaviors. Each of these contribute to the intention to engage in a health behavior, and the intention in turn predicts a person's actual behavior.

An important aspect of health beliefs concerns the broadly positive or negative quality reflected in the belief. Positive beliefs, for example, might include agreement with statements that one's health is good, the usefulness of health promotion or treatment, and the likelihood of a positive outcome from promotion or treatment efforts. Beliefs with negative valence might reflect pessimism about one's health status or doubts that efforts to improve one's health will have a positive effect. The importance of positive and negative beliefs is reflected in a number of approaches to understanding health behavior, including locus of control, self-efficacy, and optimism/pessimism. Locus of control, for example, has been related to health status⁴ and emphasizes the extent to which a person believes that he or she has the ability to act as an agent in causing a health behavior to occur. A person might have the positive belief that he or she has the responsibility for and can carry out a behavior such as adhering to a recommended medication regimen, or less positive beliefs that powerful others or chance control one's health.⁵ Health-related self-efficacy^{6, 7} reflects a person's belief that he or she will (positive) or will not (negative) be able to carry out a health-related behavior in spite of barriers.

Understanding patient beliefs about their health and efforts to maintain or improve it is thus likely to be useful in understanding their behavior. Other patient characteristics can have an effect on behavior as well. The role of mood in health behavior may be especially relevant because of the substantial effect of mood on beliefs and energy. Patients with more depressive symptoms, for example, may have negative views of their health or even believe that attempts to improve their health are futile.⁸ Persons with higher levels of depressive symptoms consistently report more severe functional disability and poorer health-related quality of life.^{9, 10} Various mechanisms for these observed relations have been proposed, perhaps related to individual traits associated with risk for greater depressive symptoms but also to patients' current mood state.¹¹ Beck and his associates have written persuasively on the mechanisms relating cognitions to depression.^{12, 13} Studies of tryptophan depletion in persons with depression clearly show that changes in brain neurochemistry can have an immediate and dramatic impact on their beliefs.^{14–16}

The Healthcare Beliefs Scale (HBS) discussed in this paper was initially developed in response to clinical observations of elderly patients during a study on medication adherence.¹⁷ This study used a questionnaire based on the Health Belief Model¹ to assess factors related to self- and caregiver-reported medication adherence. While results supported the model (eg, patient ratings of the seriousness of the health condition for which medication was taken were positively related to adherence), important characteristics of the patients were not assessed by the questionnaire. Some patients displayed positive, optimistic, and energetic beliefs toward maintaining their health that encompassed not only medication adherence but also other behaviors such as diet and exercise. On the other hand, others stated less positive beliefs and expressed limited confidence in the ability of medical treatment to improve their condition. While not clinically depressed, these patients often displayed some cognitive characteristics of depressed patients such as generally negative beliefs about the

utility of strategies to maintain and improve their health. These patients were less adherent to medications and abandoned efforts to improve their health if a treatment did not result in immediate effect. Patients sometimes ascribed their behavior to the subjective feelings of vitality, explaining their behavior with statements such as “I just didn’t have the energy.” The report of lack of energy was especially important in older patients. Patients with more positive beliefs, however, appeared energetic, were more active in interviews, and showed higher levels of adherence to treatment. Other researchers have remarked on the relation of subjective reports of energy and fatigue to health,¹⁸ self-report of decline in health status,¹⁹ and health-related quality of life.^{20, 21} It was concluded that a self-report scale that assessed positive and negative health beliefs about behaviors and energy might be useful if these beliefs could be measured and were, in fact, related to health.

The items of the HBS were created in an attempt to capture these phenomena. A group of items were written by the first author (RO) based on observations of patients during the earlier study. Items were intended not only to assess patient beliefs about their overall health or the likelihood that their efforts to affect their health would have a positive outcome but also their report of the extent to which their subjective experience of energy was positively directed toward health improvement. It was hypothesized that the negative end of this dimension might be reflected in beliefs that efforts to improve one’s health were likely to be unsuccessful. Item content therefore contrasted these beliefs either in negative (“Lately I don’t have the energy to do anything about my health”) or positive terms (“I almost always feel energetic and ready to take care of my health.”) The items of the scale thus assessed some constructs related to the Health Belief Model¹ such as the extent to which efforts to improve one’s health are likely to be successful, but also incorporated the potential effects of positive beliefs about outcomes^{22, 23} and energetic resources available to direct toward health care.

Previous Development of the HBS

As noted, the items of the HBS were developed to assess a hypothesized dimension of health beliefs believed to be related to health behaviors, especially medication adherence. They were then administered in the original study of health beliefs and medication adherence in elderly patients treated for memory disorders.²⁴ An aggregate score with items recoded so that less strongly held negative beliefs increased the total score was calculated, so that the sum of ratings reflected more positive beliefs about health status and efforts to maintain or improve health. In this small study (N = 24), it was found that the total score on the HBS was correlated with several variables potentially related to participants’ mood and cognition. The Spearman correlation of the measure with participants’ ratings of the seriousness and likely outcome of their condition were $-.31$ and $-.25$, respectively. The measure correlated with participant ratings on the Hamilton Depression Rating Scale ($-.24$) and with verbal memory (a 10-item word recall task) at $-.40$ and an executive function measure (maze completion) at $-.25$. Although none of these correlations was statistically significant, perhaps due to the small sample, on this basis the measure was judged suitable for further investigation.

In a second study of medication adherence in persons treated for HIV infection with a larger sample ($N = 124$) that is described in more detail elsewhere^{25–27} the HBS was again administered, along with the AIDS Clinical Trials Group baseline adherence questionnaire²⁸ and the Center for Epidemiological Studies Depression scale (CES-D²⁹). The ACTG questionnaire includes a patient report of medication adherence and a scale of physical symptoms related to HIV infection (eg, fatigue, changes in personal appearance, stomach upset); the total frequency with which participants reported each symptom was summed to provide an index of total symptom burden. Participants' adherence to medication was assessed using an electronic monitoring device (Medication Event Monitoring System; Aardex, Zug Switzerland). Participants also completed a battery of cognitive measures that included assessments of general cognitive ability (subtests of the Wechsler Adult Intelligence Scale³⁰), executive function (the Trail Making Test, Part B³¹), psychomotor speed (the Purdue Pegboard³²) and health literacy (the Test of Functional Health Literacy in Adults, or TOFHLA³³). In this study, participants' scores on the HBS were not related to either self-reported or electronically measured medication adherence, but were inversely related to depression (r with CES-D = $-.51$, $p < .001$) and symptom burden (r with ACTG symptom scale = $-.32$, $p = .001$). The scale was not related to psychomotor speed (r with Purdue Pegboard = 0.11 , $p = .22$) but was inversely related to executive function (r with Trail Making Test, Part B = $-.24$, $p = .009$; higher scores on this measure indicate poorer performance). Scores on the HBS were positively related to health literacy (r with TOFHLA Reading = $.35$, $p < .001$). Given these results, we continued to judge that the scale was suitable for further investigation and for inclusion in the study reported in this paper.

Depressive Symptoms and Reports of Health

As already noted, depressive symptoms have been linked to objectively-measured health status^{34–37} as well as to self-reports of health.³⁸ Mood can have pervasive effects on beliefs, with negative mood increasing doubts while positive mood increases beliefs in positive outcomes. The mechanism by which mood and self-reported health are linked, however, is not clear. A candidate mechanism is by way of cognition. One influential theory, the cognitive model of depression^{12, 13} suggests that the relation between mood and beliefs can be interactive, with negative moods selectively guiding attention to environmental events that reinforce negative beliefs, resulting in even more severe negative mood.^{12, 13} Conversely, positive cognitions are associated with positive mood.^{39–41} In the analyses presented here, we hypothesized that level of depressive symptoms would be directly related both to participants' endorsement of positive or negative beliefs about efforts improve their health as well as to their self-reported health status.

In the analyses presented here, it was also hypothesized that part of the effect of depressive symptoms on reports of health status might be related to the indirect or mediating effects of positive and negative beliefs, both of which were expected to have an impact on self-report of overall health status. The purpose of this paper is to describe the factor structure of the HBS, discuss its relation to other measures of health, and evaluate the extent to which its scales mediate the relation between depressive symptoms and health. We hypothesized that the beliefs assessed by the HBS would be directly related both to depressive symptoms and

general health, and that they would also mediate the relation between depressive symptoms and health.

METHOD

Subjects

Participants were part of a larger study focused on developing a new measure of health literacy and better understanding of health literacy and health.⁴² Participants were community-dwelling volunteers recruited from local organizations, previous studies, and referral from other participants. Participants were recruited across age groups ranging from 18 years to no upper limit and had to be able to complete study measures in either Spanish or English. Analyses presented here include data only from English-speaking participants because of consistent cultural and linguistic differences between the 2 groups in reports of health,^{43, 44} a consideration of which is beyond the scope of this paper.

Measures

Demographic data were obtained from participants in a semi-structured interview and included age, race, years of education, and income. Participants completed several questionnaires via audio computer-assisted self-interview (ACASI), including the Healthcare Beliefs Scale (HBS), the RAND Medical Outcomes Study Short Form 36 (SF-36),²⁰ and the Clinical Epidemiological Studies—Depression scale (CES-D).²⁹ The reliability and validity of the SF-36 has been established in a number of studies and is one of the most widely used measures of health status and health-related quality of life.^{45–48} The CES-D has also been widely used as a measure of depressive symptoms and has demonstrated reliability and validity.^{29, 49, 50}

Physical health status was evaluated with a procedure modified from the Midlife in the United States (MIDUS) study⁵¹ that requested that participants indicate the frequency with which they experienced 10 physical symptoms such as headache or sleep problems (rated on a 6-point scale from “Not at all” to “Almost every day”) as well as whether they had any of 30 health conditions such as heart disease, diabetes, or arthritis. Total numbers of symptoms (sum of frequencies), conditions, and both summed as an index of general health were used in evaluating the relation of the HBS to health status. This index was first described by Ryff et al, who found a relation between personal relationships, education, and both physical symptoms and number of chronic conditions.⁵² Others have shown that this index was sensitive to the interaction of genetic factors and income on health,⁵³ was a useful as a control variable in a study of the relation of education to inflammatory marker (interleukin-6),⁵⁴ and as a dependent variable in a longitudinal study of stress and risk for chronic conditions.⁵⁵ This index is significantly correlated with a number of biological and biometric indicators, including inflammatory markers (interleukin-6 and C-reactive protein) and waist-hip ratio.⁵⁶

Analyses

Although the original intent of the HBS was to assess a single bipolar dimension of positive and negative beliefs, exploratory factor analyses that assessed its dimensionality (through

inspection of the plot of eigenvalues using the scree test⁵⁷) indicated the presence of more than one factor. As this initial evaluation suggested that the scale assessed more than one dimension, multiple-factor confirmatory models were explored using 3 factors as indicated by exploratory analyses. The strategy of exploratory analysis followed by confirmatory analyses was implemented in order to allow a more nuanced exploration of the number of factors represented by the measure as well as the item composition of each. Confirmatory models allow this sort of exploration by providing the ability to specify factor parameters and assess the fit of hypothesized models to actual data. These models suggested that some items should be included on more than one factor, and that none of the multiple factor models showed evidence of acceptable fit. This finding suggested that a single common factor as well as underlying specific factors might be present in the data, and a bifactor model was evaluated. A bifactor model would assume that the items represent both a broad general dimension and that specific item subsets represent distinct but related dimensions.

Bifactor models were introduced long ago⁵⁸ and have enjoyed a recent increase in use⁵⁹ due to their ability to address problems in understanding the dimensionality of scales or tests.⁶⁰ Bifactor models include a single common factor for all of a measure's items and specific factors related to subgroups of items. This structure can thus account for commonalities among all items on a measure while at the same time take into account the variability common to item subgroups. A bifactor model based on preliminary exploratory analyses was created for the HBS, with a general and 2 specific factors. Factor models were created using the MPlus statistical package (Los Angeles: Muthén and Muthén) and model fit was evaluated using the chi-square goodness of fit test and fit indices provided by the software.

Descriptive analyses were completed with SPSS version 21 (Montauk, NY: IBM). The relation of the overall HBS and the 2 subscales to self-reported general health and the extent to which they mediated the relation between depression and health status were evaluated using mediation analysis. These analyses were completed in SPSS 21 using a computational macro developed by Preacher and Hayes⁶¹ with mediation effects assessed using the bias-corrected bootstrapping procedure⁶² as well as the normal theory based Sobel test.⁶³ Regression models used in calculations of mediating effects included demographic variables as covariates to control for the possibly confounding effects of age, race, gender, and education.

Procedure

As part of their participation in a larger study whose focus was the development and validation of a new measure of health literacy,^{42, 64} participants completed 2 sessions, with one session comprising administration of individually-administered measures of cognitive and academic status and the second surveys administered by automated computer assisted self-interview (ACASI). Participants were able to complete all study measures in a single day but were encouraged to take several breaks during each session and were asked to take a break for lunch. Some participants completed study procedures in sessions over 2 days. For all participants, the order of assessment sessions was randomized in order to account for possible order effects, and all participants completed both sessions, that is, no one was lost between sessions.

RESULTS

Descriptive statistics for the sample ($N = 161$) are presented in Table 1. As sampling was purposive with the intent of including persons with a wide range of age of ages, levels of education, and income, there is substantial variability among participants on these variables. While the mean age of participants was 52.5 years, ages ranged from 18 to 85 (median age 53 years); in a similar way, although mean years of education was 13.6, years of education ranged from 6 to 20.

Confirmatory factor analyses showed that the bifactor model with a general factor and 2 correlated specific factors reflecting low energy and negative beliefs or positive beliefs and a sense of control fit the data well based on widely used interpretive guidelines.⁶⁵ The final model was associated with a nonsignificant chi-square value (χ^2 [$df = 24$] = 30.14, $p = .18$), a confirmatory fit index value of 0.995, and a root mean square error of approximation of 0.05 (90% CI 0.00 – 0.09). The 2 specific factors were correlated (-0.71), in part confirming the original hypothesis of a bipolar dimension. Three scale scores for the HBS were computed as the sum of related items (one score for the measure overall and one for each of the 2 specific factors). The Cronbach's alpha estimate of the overall scale was 0.68, marginally acceptable but not unanticipated given the scale's bifactor structure.

Item means, standard deviations, and loadings for the general and specific factors are presented in Table 2. Items 2 and 4 had minimal loadings on the general factors but contributed to the negative beliefs factor; other items had substantial loadings both on the general factor and one of the specific factors.

Correlations of the HBS with demographic and health status variables are presented in Table 3. It can be seen that the HBS scales were not related to race, gender, or education, although the HBS Total and Positive scales were inversely related to age. The HBS scales were significantly related to depressive symptoms (CES-D) and participant report of physical symptoms as well as the combined index of symptoms and conditions. Correlations of the HBS with SF-36 scales are presented in Table 4. Each HBS scale is significantly correlated with each SF-36 scale, suggesting that the attitudes and beliefs measured by the HBS are broadly related to health-related quality of life. As hypothesized, both negative and positive beliefs were related to overall report of health as well as in predicted directions for physical and emotional functioning.

The mediation model evaluating the relation of mood and self-reported health is illustrated in the Figure, while regression models related to mediation analyses are presented in Table 5. It can be seen that, after including relevant covariates, depressive symptoms (CES-D) were a significant predictor of general health (SF-36; Section III in Table 5) and that the model with covariates and depressive symptoms accounted for 12% of variability in general health (adjusted $R^2 = .12$). The hypothesized mediators (HBS positive and negative; sections I and II of Table 5) were also related to depression, with depressive symptoms and relevant covariates accounting for 29% of the variability in negative beliefs and 6% of the variability in positive beliefs (adjusted R^2 values).

In a model that included the hypothesized mediators as well as covariates and depression (IV of Table 5), negative beliefs and depressive symptoms were significantly related to general health, and the model now accounted for 36% of variability in general health. Finally, in normal theory based tests of the mediating effect of the HBS scales (Sobel test), the negative scale was a significant mediator while by conventional significance testing the positive scale was not. It should be noted, however, that evaluation by the bootstrapping procedure which has greater power to detect effects (confidence intervals in section V of the table), all mediators were significant (ie, neither confidence interval included zero). This suggests that the failure to find significance for the mediating effect of positive beliefs with the Sobel test may have been the result of its limited statistical power.⁶²

DISCUSSION

The purposes of these analyses were to evaluate the structure and validity of the HBS and to assess the extent to which it mediates the relation of depressive symptoms to self-reported health. Results suggest that a general factor and 2 specific factors assessing positive and negative health beliefs underlie the HBS. Scale scores representing the total scale and the 2 subscales reflecting positive and negative beliefs were related to health symptoms and conditions and health-related quality of life. Analyses also showed that both negative and positive beliefs were related to self-reported health in regression models that include potential confounders; scales mediated the relation of depressive symptoms to self-reported health. These results are consistent with previous studies on the relation of both depressive symptoms and positive beliefs to health, and extend them by showing that positive and negative beliefs may mediate the connection between depressive symptoms and health.

Findings on the structure of the HBS suggest the importance of a general factor reflecting beliefs about the utility of personal efforts to improve one's health as well as the specific facets measured by items reflecting positively and negatively valenced beliefs. These results are similar to those reported by other researchers who evaluated a measure of dispositional optimism and pessimism, the Life Orientation Test – Revised (LOT-R).⁶⁶ These studies show that this measure, conceptually similar to the HBS in assessing positive and negative beliefs (but not specifically related to health), also reflects distinct but correlated dimensions of pessimism and optimism.^{67–69} Another study in older adults⁷⁰ showed that optimism and pessimism, while related, also could be differentiated.

An important aspect of the positive and negative beliefs that underlie the items of the HBS is its assessment of the subjective experience of energy or vitality. The experience of diminished energy may be a particularly important aspect of health behaviors as it not only impact patients' actual behavior but may also affect their perception of their ability to carry out health related activities. Lack of energy is a common complaint among older adults^{71–73} and it is often difficult for clinicians to distinguish between the effects of aging and illnesses that affect energy level. Fatigue is important in a number of conditions, including rheumatologic and infectious diseases where it has been linked to underlying inflammatory disease processes.^{72, 74} Another study that investigated the relation of optimism-pessimism to SF-36 scores in breast cancer survivors showed that pessimism was related to the mental

but not physical SF-36 composite, while the comparison of these patients on the energy subscale only approached conventional levels of statistical significance.⁷⁵

Limitations of this study should be acknowledged. In the development of the HBS, only a small number of items were evaluated; these analyses show that several of the items have low relations to the dimensions underlying the measure. Findings thus indicate that further development of the measure is needed, perhaps by dropping some items and incorporating new ones. It may be useful to have an expert panel review new items so that additions can better reflect the dimensions of the scale. To date, no studies of test-retest reliability of the measure have been done so that the stability of self-reports on the measure is not known. Further, the conceptual basis of the scale merits additional development and clarification. Although originally hypothesized to assess a single bipolar dimension of positive and negative beliefs about health that are associated with the experience of vitality or energy, the analyses presented here show that the dimensions underlying the measure are more complex. While the measure thus has been shown to have relations with a number of variables relevant to understanding patients' health and health behaviors, further psychometric and conceptual development of the scale is needed.

An additional limitation inherent in these analyses is the nature of our sample. It included a number of younger individuals, many of whom had few or no health problems. Younger individuals' attitudes and beliefs about improving or maintaining their health might be different from those of older individuals, especially those with multiple symptoms or conditions. While the HBS scores were not related to gender or race, both the total score and the positive scale score were inversely correlated with age. This might reflect less positive attitudes about health as one grows older or perhaps a more realistic attitude based on increased personal experience with health problems. In this connection, it is interesting to note that Lang et al found that persons 65 years of age and older were more pessimistic than younger individuals in predictions of their future life satisfaction but that this increased pessimism was associated with better health 5 years later.⁷⁶ The authors suggest that a more pessimistic view of the future might lead persons to be more active in maintaining their health, resulting in better longer-term outcomes.

The approach taken in this paper to developing scales using the bifactor model is likely to be less familiar to many readers, but has the advantage of being able to provide a clearer understanding of what the HBS measures. As noted above, recent interest in this approach has arisen from the model's ability to resolve questions about other measures' factor structures.^{59, 60} Our focus on construing the scale's items as beliefs neglects important aspects of how beliefs may interact with feelings and intentions to constitute attitudes.⁷⁷ Further development of the scale might also focus on assessing these other aspects of healthcare attitudes.

The finding that participants' responses to the HBS mediate the relation between measures of depressive symptoms and self-reports of health has implications for the development of interventions to improve patients' willingness to engage in self-care activities. Although this study did not collect data on participants' actual treatment adherence, it is reasonable to speculate that positive and negative beliefs about the effect of one's efforts might affect

patients' willingness to follow providers' treatment advice. An intervention that focused on reducing or counteracting negative beliefs, perhaps through providing patients with realistic information about their health condition and its treatment, might be helpful in increasing their willingness to work to maintain or improve their health.

The HBS thus assesses patient beliefs about their healthcare that include the perception of control, the probability of health-related activities having a positive outcome, and their experience of energy related to self-care. In this paper it is suggested that these items reflect both a general set of attitudes toward healthcare as well as a bipolar dimension of positive and negative beliefs. Future work will focus on a clearer understanding of the implications of item content and additional investigation of the ability of the HBS to inform an intervention to improve patient treatment adherence.

Human Subjects Statement

This study was approved under a protocol approved by the Institutional Review Board of Nova Southeastern University (Protocol number 02261021Exp). All participants provided written informed consent for their participation.

Acknowledgments

This study was supported by grant R01HL096578 from the US National Heart, Lung, and Blood Institute.

References

1. Janz NK, Becker MH. The Health Belief Model: A decade later. *Health Educ Behav.* 1984; 11(1):1–47.
2. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process.* 1991; 50(2):179–211.
3. Ajzen, I. The theory of planned behavior. In: Lange, PAM.Kruglanski, AW., Higgins, ET., editors. *Handbook of theories of social psychology.* London: Sage; 2012. p. 438–459.
4. Henninger DE, Whitson HE, Cohen HJ, Ariely D. Higher medical morbidity burden is associated with external locus of control. *J Am Geriatr Soc.* 60(4):751–755.
5. Wallston KA, Wallston BS, DeVellis R. Development of the Multidimensional Health Locus of Control (MHLC) Scales. *Health Education Monographs.* 1978; 6(2):160–170. [PubMed: 689890]
6. Bandura A. Self-efficacy: Toward a unifying theory of behavioral change. *Psychol Rev.* 1977; 84(2): 191–215. [PubMed: 847061]
7. Bandura A. Health promotion from the perspective of social cognitive theory. *Psychology & Health.* 1998; 13(4):623–649.
8. Rackley S, Bostwick JM. Depression in medically ill patients. *Psychiatr Clin North Am.* 2012; 35(1):231–247. [PubMed: 22370500]
9. Taylor D, Meader N, Bird V, et al. Pharmacological interventions for people with depression and chronic physical health problems: systematic review and meta-analyses of safety and efficacy. *Br J Psychiatry.* 2011; 198(3):179–188. [PubMed: 21357876]
10. Daly EJ, Trivedi MH, Wisniewski SR, et al. Health-related quality of life in depression: a STAR*D report. *Ann Clin Psychiatry.* 2010; 22(1):43–55. [PubMed: 20196982]
11. Ormel J, Oldehinkel AJ, Nolen WA, Vollebergh W. Psychosocial disability before, during, and after a major depressive episode: A 3-wave population-based study of state, scar, and trait effects. *Arch Gen Psychiatry.* 2004; 61(4):387–392. [PubMed: 15066897]
12. Beck AT. The evolution of the cognitive model of depression and its neurobiological correlates. *Am J Psychiatry.* 2008; 165(8):969–977. [PubMed: 18628348]

13. Disner SG, Beevers CG, Haigh EA, Beck AT. Neural mechanisms of the cognitive model of depression. *Nat Rev Neurosci.* 2011; 12(8):467–477. [PubMed: 21731066]
14. Bell C, Abrams J, Nutt D. Tryptophan depletion and its implications for psychiatry. *Br J Psychiatry.* 2001; 178(5):399–405. [PubMed: 11331552]
15. Argyropoulos SV, Hood SD, Adrover M, et al. Tryptophan depletion reverses the therapeutic effect of selective serotonin reuptake inhibitors in social anxiety disorder. *Biol Psychiatry.* 2004; 56(7): 503–509. [PubMed: 15450786]
16. Booij L, van der Does AJW, Haffmans J, et al. Acute tryptophan depletion as a model of depressive relapse: Behavioural specificity and ethical considerations. *Br J Psychiatry.* 2005; 187(2):148–154. [PubMed: 16055826]
17. Ownby RL, Hertzog C, Crocco E, Duara R. Factors related to medication adherence in memory disorder clinic patients. *Aging Ment Health.* 2006; 10(4):378–385. [PubMed: 16798630]
18. Ryan RM, Frederick C. On energy, personality, and health: subjective vitality as a dynamic reflection of well-being. *J Pers.* 1997; 65(3):529–565. [PubMed: 9327588]
19. Gunzelmann T, Hinz A, Brahler E. Subjective health in older people. *GMS Psychosoc Med.* 2006; 3 [Accessed November 21, 2013] Doc02 (20060327) (online). Available at <http://www.egms.de/static/en/journals/psm/2006-3/psm000022.shtml>.
20. Ware JE, Sherbourne CD. The MOS36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care.* 1992; 30(6):478–483.
21. Chen FF, West SG, Sousa KH. A comparison of bifactor and second-order models of quality of life. *Multivariate Behav Res.* 2010; 41(2):189–225.
22. Seligman ME, Csikszentmihalyi M. An introduction. *Am Psychol.* 2000; 55(1):5–14. [PubMed: 11392865]
23. Scheier MF, Carver CS. Dispositional optimism and physical well-being: the influence of generalized outcome expectancies on health. *J Pers.* 1987; 55(2):169–210. [PubMed: 3497256]
24. Ownby RL, Hertzog C, Czaja SJ. Tailored information and automated reminding to improve medication adherence in Spanish- and English-speaking elders treated for memory impairment. *Clin Gerontol.* 2012; 35(3):221–238.
25. Ownby RL, Waldrop-Valverde D, Caballero J, Jacobs RJ. Baseline medication adherence and response to an electronically delivered health literacy intervention targeting adherence. *Neurobehav HIV Med.* 2012; 4:113–121. [PubMed: 23293544]
26. Ownby RL, Waldrop-Valverde D, Hardigan P, et al. Development and validation of a brief computer-administered HIV-related health literacy scale (HIV-HL). *AIDS Behav.* 2013; 17(2): 710–718. [PubMed: 22961499]
27. Ownby RL, Waldrop-Valverde D, Jacobs RJ, et al. Cost effectiveness of a computer-delivered intervention to improve HIV medication adherence. *BMC Medl Inform Decis Mak.* 2013; 13:29.
28. Chesney MA, Ickovics JR, Chambers DB, et al. Self-reported adherence to antiretroviral medications among participants in HIV clinical trials: the AACTG adherence instruments. Patient Care Committee & Adherence Working Group of the Outcomes Committee of the Adult AIDS Clinical Trials Group (AACTG). *AIDS Care.* 2000; 12(3):255–266. [PubMed: 10928201]
29. Radloff LS. The CES-D Scale: A self-report depression scale for research in the general population. *Appl Psychol Meas.* 1977; 1(3):385–401.
30. Wechsler, D. Manual for the Wechsler Adult Intelligence Scale. Fourt. San Antonio, TX: Psychological Corporation/Pearson Assessment; 2008.
31. Lezak, M. Neuropsychological assessment. Fifth. New York: Oxford; 2004.
32. Lafayette Instrument. Purdue Pegboard Test User instructions. Lafayette, IN: Lafayette Instrument; 2002.
33. Parker RM, Baker DW, Williams MV, Nurss JR. The Test of Functional Health Literacy in Adults: A new instrument for measuring patients' literacy skills. *J Gen Intern Med.* 1995; 10(10):537–541. [PubMed: 8576769]
34. Covinsky KE, Kahana E, Chin MH, et al. Depressive symptoms and 3-year mortality in older hospitalized medical patients. *Ann Intern Med.* 1999; 130(7):563–569. [PubMed: 10189325]

35. Frasure-Smith N, Lesperance F. Depression and cardiac risk: present status and future directions. *Heart*. 2010; 96(3):173–176. [PubMed: 19861300]
36. Davidson KW, Bigger JT, Burg MM, et al. Centralized, stepped, patient preference-based treatment for patients with post-acute coronary syndrome depression: CODIACS vanguard randomized controlled trial. *JAMA Intern Med*. 2013; 173(11):997–1004. [PubMed: 23471421]
37. Moussavi S, Chatterji S, Verdes E, et al. Depression, chronic diseases, and decrements in health: results from the World Health Surveys. *The Lancet*. 2007; 370(9590):851–858.
38. Nayak R, Rajpura J. Assessing depression among older persons with arthritis: A nationwide health status survey. *ISRN Rheumatol*. 2013; 2013:968343. [PubMed: 23956874]
39. Lewis LM, Dember WN, Schefft BK, Radenhausen RA. Can experimentally induced mood affect optimism and pessimism scores? *Curr Psychol*. 1995; 14(1):29–41.
40. Segerstrom SC, Taylor SE, Kemeny ME, Fahey JL. Optimism is associated with mood, coping, and immune change in response to stress. *J Pers Soc Psychol*. 1998; 74(6):1646–1655. [PubMed: 9654763]
41. Rasmussen HN, Wrosch C, Scheier MF, Carver CS. Self-regulation processes and health: the importance of optimism and goal adjustment. *J Pers*. 2006; 74(6):1721–1747. [PubMed: 17083664]
42. Ownby RL, Acevedo A, Waldrop-Valverde D, et al. Development and initial validation of a computer-administered health literacy assessment in Spanish and English: FLIGHT/VIDAS. *Patient Relat Outcome Meas*. 2013; 4:1–15. [PubMed: 23300352]
43. Su D, Wen M, Markides KS. Is self-rated health comparable between non-Hispanic whites and Hispanics? Evidence from the Health and Retirement Study. *J Gerontol B: Psychol Sci Soc Sci*. 2013; 68(4):622–632. [PubMed: 23685926]
44. Johnson KL, Carroll JF, Fulda KG, et al. Acculturation and self-reported health among Hispanics using a socio-behavioral model: the North Texas Healthy Heart Study. *BMC Public Health*. 2010; 10:53. [PubMed: 20122263]
45. Brazier JE, Harper R, Jones NM, et al. Validating the SF-36 health survey questionnaire: new outcome measure for primary care. *BMJ*. 1992; 305(6846):160–164. [PubMed: 1285753]
46. Brazier JE, Harper R, Munro J, et al. Generic and condition-specific outcome measures for people with osteoarthritis of the knee. *Rheumatology (Oxford)*. 1999; 38(9):870–877. [PubMed: 10515649]
47. Ware, JE. [Accessed December 23, 2013] SF-36® health survey update (online). Available at <http://www.sf-36.org/tools/acknowledgement.shtml>
48. McHorney CA, Ware JE Jr, Lu JF, Sherbourne CD. The MOS36-item Short-Form Health Survey (SF-36): III. Tests of data quality, scaling assumptions, and reliability across diverse patient groups. *Med Care*. 1994; 32(1):40–66. [PubMed: 8277801]
49. Fountoulakis KN, Bech P, Panagiotidis P, et al. Comparison of depressive indices: reliability, validity, relationship to anxiety and personality and the role of age and life events. *J Affect Disord*. 2007; 97(1–3):187–195. [PubMed: 16844229]
50. Zich JM, Attkisson CC, Greenfield TK. Screening for depression in primary care clinics: the CES-D and the BDI. *Int J Psychiatry Med*. 1990; 20(3):259–277. [PubMed: 2265888]
51. Ryff, C., Almeida, DM., Ayanian, JS., et al. National Survey of Midlife Development in the United States (MIDUS II), 2004–2006. Ann Arbor, MI: Inter-university Consortium for Political and Social Research (ICPSR); 2012.
52. Ryff, CD., Singer, BH., Palmersheim, KA. Social inequalities and well-being: The role of relational and religious protective factors. In: Brim, OG, Ryff, CD., Kessler, RC., editors. *How healthy are we? A national study of well-being at midlife*. Chicago: University of Chicago Press; 2004. p. 90–123.
53. Johnson W, Krueger RF. Genetic effects on physical health: lower at higher income levels. *Behav Genet*. 2005; 35(5):579–590. [PubMed: 16184486]
54. Morozink JA, Friedman EM, Coe CL, Ryff CD. Socioeconomic and psychosocial predictors of interleukin-6 in the MIDUS national sample. *Health Psychol*. 2010; 29(6):626–635. [PubMed: 20954777]

55. Piazza JR, Charles ST, Sliwinski MJ, et al. Affective reactivity to daily stressors and long-term risk of reporting a chronic physical health condition. *Ann Behav Med.* 2013; 45(1):110–120. [PubMed: 23080393]
56. Friedman EM, Ryff CD. Living well with medical comorbidities: a biopsychosocial perspective. *J Gerontol B Psychol Sci Soc Sci.* 2012; 67(5):535–544. [PubMed: 22377799]
57. Cattell RB. The scree test for number of factors. *Multivariate Behav Res.* 1966; 1(2):245–276. [PubMed: 26828106]
58. Holzinger KJ, Swineford F. The bi-factor method. *Psychometrika.* 1937; 2(1):41–54.
59. Reise SP. The rediscovery of bifactor measurement models. *Multivariate Behav Res.* 2012; 47(5): 667–696. [PubMed: 24049214]
60. Reise SP, Morizot J, Hays RD. The role of the bifactor model in resolving dimensionality issues in health outcomes measures. *Qual Life Res.* 2007; 16(Suppl 1):19–31. [PubMed: 17479357]
61. Preacher KJ, Hayes AF. SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behav Res Methods Instrum Comput.* 2004; 36(4):717–731. [PubMed: 15641418]
62. MacKinnon DP, Lockwood CM, Williams J. Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behav Res.* 2004; 39:99. [PubMed: 20157642]
63. Sobel ME. Asymptotic confidence intervals for indirect effects in structural equation models. *Sociol Methodol.* 1982; 13:290–312.
64. Ownby, RL., Acevedo, A., Waldrop-Valverde, D., et al. A new computer-administered measure of health literacy: Validity and relation to quality of life in Spanish and English speakers; Paper presented at the International Conference on Communication in Healthcare; Montreal. Oct. 2013 Available at: <http://www.flightvidas.org/>
65. Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Struct Equ Modeling.* 1999; 6(1):1–55.
66. Scheier MF, Carver CS, Bridges MW. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): a reevaluation of the Life Orientation Test. *J Pers Soc Psychol.* 1994; 67(6):1063–1078. [PubMed: 7815302]
67. Robinson-Whelen S, Kim C, MacCallum RC, Kiecolt-Glaser JK. Distinguishing optimism from pessimism in older adults: is it more important to be optimistic or not to be pessimistic? *J Pers Soc Psychol.* 1997; 73(6):1345–1353. [PubMed: 9418282]
68. Vautier S, Raufaste E, Cariou M. Dimensionality of the Revised Life Orientation Test and the status of filler items. *Int J Psychol.* 2003; 38(6):390–400.
69. Maydeu-Olivares A, Coffman DL. Random intercept item factor analysis. *Psychol Methods.* 2006; 11(4):344–362. [PubMed: 17154751]
70. Marshall GN, Wortman CB, Kusulas JW, et al. Distinguishing optimism from pessimism: Relations to fundamental dimensions of mood and personality. *J Pers Soc Psychol.* 1992; 62(6):1067–1074.
71. Drey M, Pfeifer K, Sieber CC, Bauer JM. The Fried frailty criteria as inclusion criteria for a randomized controlled trial: personal experience and literature review. *Gerontology.* 2011; 57(1): 11–18. [PubMed: 20407227]
72. Eldadah BA. Fatigue and fatigability in older adults. *PM R.* 2010; 2(5):406–413. [PubMed: 20656622]
73. Avlund K. Fatigue in older adults: an early indicator of the aging process? *Aging Clin Exp Res.* 2010; 22(2):100–115. [PubMed: 20440097]
74. Wolfe F, Michaud K. Fatigue, rheumatoid arthritis, and anti-tumor necrosis factor therapy: an investigation in 24,831 patients. *J Rheumatol.* 2004; 31(11):2115–2120. [PubMed: 15517621]
75. Petersen LR, Clark MM, Novotny P, et al. Relationship of optimism-pessimism and health-related quality of life in breast cancer survivors. *J Psychosoc Oncol.* 2008; 26(4):15–32. [PubMed: 19042270]
76. Lang FR, Weiss D, Gerstorf D, Wagner GG. Forecasting life satisfaction across adulthood: Benefits of seeing a dark future? *Psychol Aging.* 2013; 28(1):249–261. [PubMed: 23421319]

77. Torabi MR, Jeng I. Health attitude scale construction: importance of psychometric evidence. *Am J Health Behav.* 2001; 25(3):290–298. [PubMed: 11322629]

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Figure. Mediation. Depression predicts both health and health beliefs. A portion of the effect of depression on health is mediated by healthcare beliefs. (Blue arrows (*a*, *b*, and *c*) = direct effects; red arrow = indirect or mediating effect.)

Table 1

Description of Sample (N = 161)

Variable	Mean	Standard Deviation	Range
Age	52.5	17.5	18 – 85
Education (years)	13.6	2.2	6 – 20
Income	\$31,187	\$24,227	\$5,000 – \$100,000
Symptoms	14.8	9.6	0 – 41
Conditions	3.2	2.9	0 – 12
Symptoms + Conditions	17.7	11.6	0 – 49
HBS Total	33.1	4.3	16 – 40
HBS Negative	4.0	3.1	0 – 15
HBS Positive	17.2	1.9	11 – 15
CES-D	9.5	6.5	4 – 36
SF-36 General Health ^a	70.0	18.6	20 – 100
SF-36 Physical Function ^a	77.5	26.2	5 – 100
SF-36 Limit Phys Function ^a	22.9	37.1	0 – 100
SF-36 Limit Emot Problems ^a	20.1	34.8	0 – 100
SF-36 Energy/Fatigue ^a	63.1	21.9	5 – 100
SF-36 Emot Well-Being ^a	80.1	17.0	16 – 100
SF-36 Social Function ^a	84.1	21.4	12.5 – 100
SF-36 Pain ^a	2.7	1.3	1 – 6
Gender	70 Men and 91 Women (43%/57%)		
Race	91 Whites and 70 Blacks (57%/43%)		

Note.

^aNote. MOS Short Form-36 scales: General Health; Physical Function = Physical functioning; Limit Phys Function = Role limitations due to physical health; Limit Emot Problems=Role limitations due to emotional problems; Energy/Fatigue = Energy/Fatigue; Emot Well Being = Emotional well-being; Social Function = Social functioning; Pain = Pain.

Table 2

Factors, Item Means and Standard Deviations, and Bifactor Loadings

Factor	Item	Mean	SD	HBS	Negative	Positive
Negative						
	2. I often just don't feel like taking care of myself.	3.08	1.20	.04	.79	
	4. Lately I don't have the energy to do anything about my health.	3.21	1.04	.01	.85	
	5. I feel as though there is no point in trying to improve my health.	3.60	.78	.18	.92	
	8. I am always interested in something new that I can do to improve my health.	3.45	.72	.72	-.64	
	9. I almost always feel energetic and ready to take care of my health.	3.18	.94	.68	-.31	
Positive						
	1. As long as I take care of myself, I can be healthy	3.55	.63	.33		.46
	3. I am in control of my health care.	3.34	.81	.29		.57
	6. A person who takes care of him or herself can feel good almost all the time.	3.45	.68	.46		.53
	7. What I do about my health care makes a difference.	3.71	.48	.45		.74
	1. Nothing I do is going to make a difference in my health.	3.20	1.21	.37		-.89

Table 3

HBS Correlations with Demographic Variables, Depression, and Health Status

	HBS Total ^a	HBS Negative	HBS Positive	Age	Gender	Race	Education	CESD	Symptoms	Conditions	Conditions + Symptoms
HBS Total	1.00	-.93**	.79**	-.15	-.02	.08	-.02	-.43**	-.29**	-.18**	-.28**
HBS Negative		1.00	-.50**	.14	.01	-.08	-.03	.49**	.36**	.24**	.36**
HBS Positive			1.00	-.09	-.01	.04	-.09	-.21*	-.07	-.06	-.06
Age				1.00	.11	-.57**	-.01	-.16	.12	.35**	.19*
Gender (Female)					1.00	-.12	.13	.01	.04	.16	.06
Race (Black)						1.00	-.06	.15	-.13	-.22**	-.16
Education							1.00	-.06	-.02	.05	-.01
CESD								1.00	.43**	.35**	.46**
Physical SX									1.00	.61**	.98**
Conditions										1.00	.76**
Conditions + SX											1.00

Note.

**
p < .01; p < .05

^aHBS Total = Sum of 10 HBS items; CESD = Center for Epidemiological Studies Depression Scale; Symptoms = Total symptoms endorsed times frequency; Conditions = Number of conditions reported; Conditions + Symptoms = Health status index as sum of symptoms and conditions

Table 4

HBS Correlations with SF-36 scales

	HBS TOT	HBS NEG	HBS POS	SF General Health	SF Phys Func	SF Limit Phys Func	SF Limit Emot Probs	SF Energy/ Fatigue	SF Emotional Wellbeing	SF Social Function	SF Pain
HBS Total	1.00	-.93**	.79**	.58**	.42**	-.28**	-.39**	.48**	.43**	.36**	-.29**
HBS Negative		1.00	-.50**	-.60**	-.44**	.32**	.42**	-.52**	-.46**	-.41**	-.34**
HBS Positive			1.00	.36**	.24**	-.10	-.22**	.27**	.23**	.14	-.11
SF General Health				1.00	.46**	-.42**	-.34**	.56**	.42**	.51**	-.41**
SF Physical Func					1.00	-.64**	-.31**	.43**	.20*	.48**	-.70**
SF Limit Phys Func						1.00	.28**	-.41**	-.25**	-.48**	.64**
SF Limit Emot Probs							1.00	-.54**	-.60**	-.58**	.30**
SF Energy/ Fatigue								1.00	.66**	.59**	-.51**
SF Emotional Wellbeing									1.00	.67**	-.35**
SF Social Function										1.00	-.52**
SF Pain											1.00

Note.

**
Note. p < .01*
p < .05

^aHBS Total = Sum of 10 items; HBS NEG = Negative; HBS POS = Positive; SF General Health = SF-36 General health; SF Limit Phys Func = SF-36 Role limitations due to physical health; SF Limit Emot Problems = SF-36 Role limitations due to emotional problems

Table 5

Regression Models and Mediating Effects

I. CES-D → HBS Negative (<i>a</i> in Figure; R² for model = .31; Adjusted R² = .29)				
	Coefficient	SE	<i>t</i>	<i>p</i>
Intercept	-.57	2.12	-.27	.78
Gender (Female)	-.41	.46	-.88	.38
Race (Black)	-.004	.55	-.007	.99
Age	.05	.02	3.16	.002
Education	.01	.10	.12	.91
CES-D	.27	.04	.728	< .001
II. CES-D → HBS Positive (<i>a</i> in Figure; R² for model = .10; Adjusted R² = .06)				
Intercept	19.47	1.46	13.30	< .001
Gender (Female)	.24	.32	.76	.45
Race (Black)	.05	.38	.12	.90
Age	-.02	.01	-1.57	.12
Education	-.07	.07	-1.03	.31
CES-D	-.08	.03	-3.29	.001
III. CES-D and covariates <i>without</i> HBS → SF General Health (<i>c</i> in Figure; R² for model = .15; Adjusted R² = .12)				
Intercept	68.40	13.95	4.90	< .001
Gender (Female)	-.44	3.03	-.15	.88
Race (Black)	2.33	3.64	.64	.52
Age	-.003	.10	-.03	.98
Education	.69	.66	1.04	.30
CES-D	-1.12	.24	-4.61	<.001
IV. CES-D and covariates <i>with</i> HBS Negative & Positive → SF General Health (<i>b</i> and <i>c</i> in Figure; R² for model = .39; Adjusted R² = .41)				
Intercept	39.11	18.71	2.09	.04
Gender (Female)	-2.14	2.51	-.85	.40
Race (Black)	2.14	2.99	.71	.48
Age	.18	.09	2.07	.04
Education	.87	.54	1.60	.11
HBS Negative	-3.35	.53	-6.34	< .001
HBS Positive	1.39	.77	1.82	.07
CES-D	-.10	.24	-.44	.66
V. Indirect Effects: Effects of CES-D → via HBS Negative & Positive → on SF General Health (red arrow in Figure)				
	Coefficient (Bootstrapped 95% CI)	SE	<i>z</i>	<i>p</i>
HBS Total	-.93 (-1.38 to -.58)	.18	-5.04	< .001
HBS Negative	-.90 (-1.43 to -.51)	.19	-4.75	< .001

I. CES-D → HBS Negative (*a* in Figure; R^2 for model = .31; Adjusted R^2 = .29)

	Coefficient	SE	<i>t</i>	<i>p</i>
HBS Positive	-.12 (-.31 to -.01)	.07	-1.54	.12

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript