

Modeling the Effects of Spirituality/Religion on Patients' Perceptions of Living with HIV/AIDS

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BACKGROUND: Spirituality/religion is an important factor in health and illness, but more work is needed to determine its link to quality of life in patients with HIV/AIDS.

OBJECTIVE: To estimate the direct and indirect effects of spirituality/religion on patients' perceptions of living with HIV/AIDS.

DESIGN: In 2002 and 2003, as part of a multicenter longitudinal study of patients with HIV/AIDS, we collected extensive demographic, clinical, and behavioral data from chart review and patient interviews. We used logistic regression and path analysis combining logistic and ordinary least squares regression.

SUBJECTS: Four hundred and fifty outpatients with HIV/AIDS from 4 sites in 3 cities.

MEASURES: The dependent variable was whether patients felt that life had improved since being diagnosed with HIV/AIDS. Spirituality/religion was assessed by using the Duke Religion Index, Functional Assessment of Chronic Illness Therapy—Spiritual Well-Being—Expanded, and Brief RCOPE measures. Mediating factors included social support, self-esteem, healthy beliefs, and health status/health concerns.

RESULTS: Approximately one-third of the patients felt that their life was better now than it was before being diagnosed with HIV/AIDS. A 1-SD increase in spirituality/religion was associated with a 68.50% increase in odds of feeling that life has improved—29.97% due to a direct effect, and 38.54% due to indirect effects through healthy beliefs (29.15%) and health status/health concerns (9.39%). Healthy beliefs had the largest effect on

feeling that life had improved; a 1-SD increase in healthy beliefs resulted in a 109.75% improvement in feeling that life changed.

CONCLUSIONS: In patients with HIV/AIDS, the level of spirituality/religion is associated, both directly and indirectly, with feeling that life is better now than previously. Future research should validate our new conceptual model using other samples and longitudinal studies. Clinical education interventions should focus on raising awareness among clinicians about the importance of spirituality/religion in HIV/AIDS.

KEY WORDS: spirituality; quality of life; HIV; acquired immunodeficiency syndrome; path analysis.

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Patients with life-threatening diseases often undergo deep personal transformation, including changes in life outlook. As a coping mechanism, many focus on the positive aspects of life, seek and use social support, or search for the spiritual meaning of the illness.¹⁻³ To wit, a large body of literature supports the connection between spirituality/religion and health.³⁻¹⁰ Religion is usually defined in the context of ideological commitments and institutional membership. Religiosity, a related concept, involves the cognitive, emotional, behavioral, interpersonal, and physiological processes linking religion and spirituality. The term "religion" is often used as an umbrella term for both religion and religiosity.^{11,12} Meanwhile, the term spirituality is increasingly used to represent the personal, subjective dimension of religious experience. The literature suggests that spirituality and religion are intertwined and can be considered as aspects of a larger construct,^{11,12} sometimes referred to as spirituality/religion.

In areas of the world with ready access to highly active antiretroviral therapy (HAART), patients with HIV/AIDS are living longer than ever before,¹³ and, hence, understanding and improving their quality of life (QoL) is paramount. Spirituality/religion is a key construct for men and women affected by HIV.¹⁴⁻¹⁶ It is associated mostly with positive feelings (e.g., hope, peace), but also with some negative ones (e.g., feeling punishment from God or feeling ostracized by a religious group). Spirituality/religion has also been shown to be

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positively associated with health outcomes (e.g., long survival, health behaviors, less distress, and lower cortisol levels)¹⁷ as well as with the will to live^{17,18} in people with HIV/AIDS. Although spiritual and religious coping seem to play a role for patients with HIV/AIDS, a deeper understanding of specific pathways through which spirituality/religion affects patients with HIV/AIDS is still lacking.¹⁴

In previous studies of patients with HIV/AIDS, patients were asked to compare their life now with their life before HIV/AIDS diagnosis.^{18,19} Surprisingly, a large proportion of patients—one-third to one-half—said their life was better at present, and, in one study,¹⁸ spirituality was associated with feeling that life had become better. These 2 studies are corroborated by other research showing an alteration in the spiritual perspectives of patients with HIV/AIDS since the onset of the disease, such as a shift to focusing on the present and reordering of priorities.^{20,21}

To posit the mechanisms by which spirituality/religion may be related to QoL in patients with HIV/AIDS, we developed a conceptual model (Fig. 1). The purpose of the present study is to test the conceptual model by using data from a new multicenter study of patients with HIV/AIDS.

CONCEPTUAL MODEL

Our model draws upon Pargament's religious coping model,⁶⁻⁸ Ellison and Levin's mechanisms by which spirituality and religious involvement may influence health outcomes,⁴ and Tsevat et al.'s¹⁸ work relating health-related QoL and spirituality with the feeling that life has improved. In our model, spirituality/religion was conceptualized along 2 dimensions: distal and proximal. Distal measures of religion and spirituality mainly tap individual behaviors (e.g., frequency of attendance at services, prayer, or meditation, etc.), whereas proximal measures gauge the functions of religion and spirituality for the individual (e.g., support, coping, meaning, etc.); proximal measures tend to be linked more directly with health and well-being.⁶⁻⁸

We hypothesized in our study that spirituality/religion would influence the feeling that life has improved either directly or via 4 mediating mechanisms: healthy lifestyle, which we captured through medication adherence; social support; self-perception, or self-esteem; and, healthy beliefs, which we captured through optimism.⁴ Strict medication adherence is crucial to combating HIV/AIDS and related opportunistic infections. Psychosocial factors, such as social support, avoidance of risky behaviors, and positive feelings about oneself, have been linked with improved adherence in patients with HIV/AIDS.²² Those are the same factors that are believed to mediate the relationship between spirituality/religion and health, in general. People with HIV/AIDS may benefit, in particular, from instrumental aid (e.g., transportation to a medical appointment) and socioemotional assistance (e.g., companionship), as well as from formal assistance programs and pastoral advice and counseling.²³

We also hypothesized that health status/health concerns would be directly related to feeling that life has improved. In other words, the better one's health status or the fewer one's health concerns (e.g., the better one's physical functioning or the fewer one's financial worries), the more likely the patient is to feel that life has improved. Furthermore, health status/health concerns were hypothesized to mediate the relationship between spirituality/religion and the feeling that life has improved, as spirituality/religion has been found to be correlated with less emotional distress²⁴ and a better QoL.²⁵

We specified what we thought was the most plausible causal ordering of the variables to account for the association between spirituality/religion and feeling that life became better after the HIV diagnosis. In our model, every path (arrow representing a direct effect) is an explicitly hypothesized relationship. Of course, many others, i.e., the myriad indirect effects, can be logically deduced from these and are implicitly hypothesized. Therefore, we state only a few hypotheses here to give a sense of why we posit this causal order: we

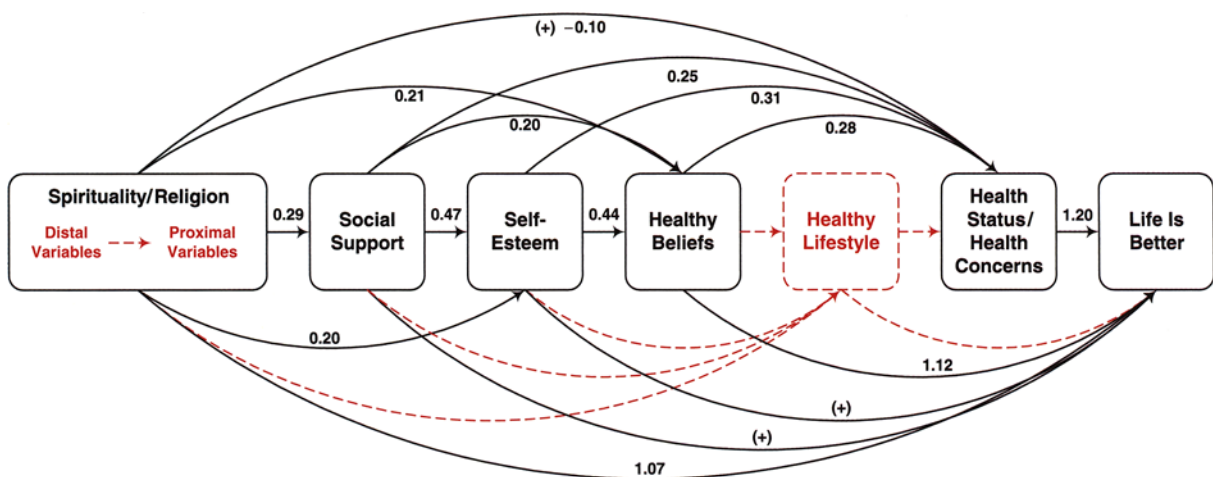


FIGURE 1. Initial conceptual and final path models of the relationship between spirituality/religion and perception that life is better now than it was before being diagnosed with HIV. The trimmed, final path model excludes the relationships shown in red. Odds ratios are shown on paths to "life is better"; all others are standardized path coefficients (ordinary least squares β coefficients). All coefficients are statistically significant at $P < .05$. (+) signs represent hypothesized positive effects that were not corroborated; (+) signs without accompanying coefficients are not statistically significant. (+) signs accompanied by a negative coefficient indicate that the relationship was in the opposite direction from that hypothesized.

hypothesized that as a patient's level of spirituality/religion increases, s/he interacts more with others and seeks and receives more social support. As social support increases, the patient is less isolated and her/his self-esteem grows. A greater self-esteem leads to more healthy beliefs. As healthy beliefs increase, the patient's medication adherence improves. With improved adherence to medication (healthy lifestyles), the patient's health status improves and health concerns decrease. And, finally, as health status improves/health concerns decrease, the patient is more likely to believe that life is better now than in the past.

METHODS

Subjects

Between February 2002 and February 2003, 450 outpatients with various stages of HIV/AIDS were recruited from 4 sites in 3 cities: the University of Cincinnati Medical Center and the Cincinnati Veterans Affairs (VA) Medical Center, both in Cincinnati, OH; George Washington University Medical Center in Washington, DC; and the VA Pittsburgh Healthcare System in Pittsburgh, PA. To obtain a sample that was demographically representative of patients seeking care at each site, we enrolled minority and female patients in approximately the same proportion as their proportions at each study site's HIV clinic. Informed consent was obtained from each subject. Subjects were paid \$30 per interview. The institutional review boards at each site approved the study.

Measures

We collected data from chart review and patient interviews. Clinical data included CD4 counts, viral loads (dichotomized as detectable vs undetectable), and time since HIV diagnosis. Information regarding current antiretroviral therapy was ascertained both by chart review and patient interview, with names and pictures of all approved antiretroviral medications presented to the patient for ease of identification. Health status/health concerns, spirituality/religion, and other behavioral data were collected through patient interviews using standardized instruments.

Our outcome measure, whether life is better,¹⁸ was a binary variable and contrasted patients for whom life was "better now" with those who responded "worse now," "about the same," or "don't know." We used this variable for consistency and comparability with an earlier study,¹⁸ as our goal was to replicate and extend the previous study using a larger, more representative, and contemporaneous sample of patients. We measured spirituality/religion by using 3 instruments: the Duke Religion Index (DUREL),²⁶ the Functional Assessment of Chronic Illness Therapy—Spiritual Well-Being—Expanded (FACIT-Sp-Ex) scale,²⁷ and a religious coping scale, the Brief RCOPE.²⁸ The DUREL assesses the distal variables of organized religious activity (DUREL-ORA; frequency of attending services), nonorganized religious activity (DUREL-NORA; frequency of praying, meditating, studying Bible, etc.), and intrinsic religiosity (DUREL-IR). The FACIT-Sp-Ex is a 23-item measure of proximal spiritual well-being addressing faith, meaning, and peace. The Brief RCOPE addresses both positive religious coping (RCOPE-Positive; spiritual connection, spiritual support seeking, religious forgiveness, collab-

orative religious coping, benevolent religious reappraisals, religious purification, and religious focus) and negative religious coping (RCOPE-Negative; spiritual discontent, punishing God reappraisals, interpersonal religious discontent, demonic reappraisals, and reappraisals of God's powers). The DUREL and RCOPE have previously been tested in national, community, or clinical populations, whereas the FACIT-Sp-Ex has also been used specifically in patients with HIV/AIDS. The measures showed good internal consistency reliability in our sample (Cronbach's α of 0.88, 0.92, 0.82, and 0.95 for the DUREL, RCOPE-Positive, RCOPE-Negative, and FACIT-Sp-Ex, respectively). We confirmed a higher ordered construct of spirituality/religion based on these 3 measures by using confirmatory factor analysis²⁹ (Appendix A). As our interest was in the broad concept of spirituality/religion, we included a composite (e.g., latent variable) that represented this complex construct (Cronbach's α =0.83; Appendix A).

We assessed health status/health concerns by using 3 measures: the HIV/AIDS-Targeted (HAT)-QoL,³⁰ the HIV Symptom Index (HSI),³¹ and the 10-item version of the Center for Epidemiologic Studies-Depression (CESD-10) scale.³² The HAT-QoL is a 34-item scale addressing 9 domains identified previously by patients with HIV/AIDS as being important: overall functioning; sexual functioning; disclosure worries; medication worries; health worries; financial worries; HIV mastery, or level of comfort with how the patient contracted HIV; life satisfaction; and provider trust. The HSI assesses the presence and degree of both of 20 symptoms, including fatigue, fever, pain or numbness, difficulty with memory, rash, headache, stomach pain or gas/bloating, changes in body appearance such as fat deposits, and changes in weight over the past 4 weeks. For each symptom that the patient checked off as having, s/he rated its degree of bother on a 4-point scale ("it doesn't bother me"; "it bothers me a little"; "it bothers me"; or "it bothers me a lot"). For the HSI, we counted the number of symptoms that the patient reported as bothering them or bothering them a lot. The CESD-10 is a 10-item measure assessing depressive symptomatology.³³ Because several questions on the HSI pertaining to depression have similar counterparts on the CESD-10, we scored only the 15 questions on the HSI with no CESD-10 counterparts, as advocated by Kilbourne et al.³³ Our 3 measures of health status/health concerns showed good reliability in our sample (Cronbach's α of 0.91, 0.87, and 0.86 for the HSI, CESD-10, and HAT-QoL, respectively). We identified a composite of health status/health concerns through a confirmatory factor analysis represented by the 3 constructs (Cronbach's α =0.81) and used the composite in our path analysis (Appendix A).

We measured healthy lifestyle through medication adherence by using a modified version of a questionnaire developed by the AIDS Clinical Trials Group³⁴ assessing the number of antiretroviral medication doses missed in the last 4 days. We assessed social support by using the Brief Interpersonal Support Evaluation List, which captures appraisal, belonging, and tangible support (score range: 12 to 48)³⁵ and self-esteem by using the 6-item Rosenberg Global Self-Esteem Measure (score range: 6 to 24).³⁶ Finally, we assessed healthy beliefs, or optimism, by using the 12-item Life Orientation Test (score range: 0 to 48).³⁷ The respective Cronbach's α 's for the social support, self-esteem, and healthy beliefs scales were 0.90, 0.81, and 0.83.

Procedure of Analysis

First, we assessed the multivariable relationship between the outcome “life is better” and our independent variables by constructing a logistic regression model. Independent variables were divided into the following blocks: demographics, health status and clinical variables, spirituality/religion variables, and variables representing healthy lifestyle, social support, self-perception, and healthy beliefs. Candidate independent variables were those that exhibited simple bivariate relationships with the outcome at $P < .10$. Variables in the first block (demographics) were entered in unison, and backward selection was used until all variables remaining were associated with the outcome at $P < .05$ in the presence of the other predictors. Candidate variables from the next block were added, and all variables in the model were again subjected to backward elimination. We repeated the process sequentially until variables had been added from all blocks. As a final step, to determine whether spirituality/religion has a greater impact on the feeling that life has improved among patients with poor health status than it does among patients with excellent health status, we added the possible interaction between HAT-QoL overall functioning and spirituality (FACIT-SpEx), and again performed backward elimination of nonsignificant predictors. At all stages of the variable selection process, previously removed variables were tested for re-insertion into the model whenever it appeared that collinearity among the predictors might have led to the removal of a potentially valuable predictor. These analyses were performed using SAS, version 8.02 (SAS Institute, Cary, NC).

Next, we used path analysis, a simple structural equation modeling technique,^{38,39} to test our conceptual model. As emphasized by Pedhazur, path analysis is “a method for studying direct and indirect effects of variables hypothesized as causes of variables treated as effects” and “is intended *not* to discover causes but to shed light on the tenability of the causal models a researcher formulates based on knowledge and theoretical considerations” (pp. 769–70).³⁹ The “causal” effects described in this paper are based on correlational matrices, and, thus, represent associations. Although structural equation modeling (SEM) is often advocated for testing path models, path analysis is sufficient for models without a measurement component, which, as we explain below, was our case.

The path analysis used in this study is unique as it combines ordinary least squares and logistic regression. While we used ordinary least squares regression to estimate the effects of some of the model’s variables, our ultimate dependent variable, “life is better,” was binary and would typically be estimated by using logistic regression. We combined the information from both estimation procedures by developing semi-standardized path coefficients to parse the direct and various indirect influences on “life is better” (Appendices 2 and 3). We are unaware of any other studies using this approach; it was developed specifically for this study.

In the findings, the direct, indirect, and total (causal) effects are presented in 2 forms (Table 2). For “life is better,” we report the effects using a new measure—the *percent change in the odds* (% Δ odds) of feeling that life is better *per standard deviation increase* (SDI) in a predictor (% Δ odds/SDI). For a particular path, % Δ odds/SDI is calculated using unstandardized path coefficients and the most distal variable’s SD. The path coefficients for the steps between the variables of interest

are multiplied, thus yielding the change in log-odds resulting from a 1-unit increase in the distal variable. This value is then multiplied by the distal variable SD to produce the change in log-odds resulting from a 1-SD increase in the distal variable. The exponent of the value yields the odds ratio (OR); multiplying the OR by 100 and subtracting 100 yields the % Δ odds/SDI in the distal variable. These path coefficients, % Δ odds/SDI, are semi-standardized—the predictors can be viewed as standardized, while the dependent variable is not. As the dependent variable is the same for each predictor, the path coefficients are comparable. For the other endogenous variables, the effects of their predictors are shown as β coefficients.

In presenting our results, we refer to effects with adjectives such as “small,” “moderate,” and “strong.” These reflect our judgments of the strength of effects because there is no gold standard; however, we do present the coefficients for readers to make their own judgments. The path analysis was conducted using SPSS, version 12.0.2 (SPSS, Inc., Chicago, IL).

RESULTS

A total of 449 patients answered the question that asked them to compare life before having HIV/AIDS with life now. The mean (SD) age was 43.3 (8.4) years. A total of 386 (86.0%) patients were male; 225 (50.1%) were African American, 203 (45.2%) were Caucasian, and 10 (2.2%) were Hispanic (Table 1). The majority of the patients (342 [76.5%]) were treated with mul;HAART.

Preliminary Model Testing

Comparing life now with their life before they knew they had HIV/AIDS, 145 (32.3%; 95% CI: 28.1 to 36.8%) patients said life was better now, 130 (29.0%) said it was worse, 116 (25.8%) said it was about the same, and 58 (12.9%) did not know. In bivariate analyses, believing that life was better now was associated with certain demographic, health status, spirituality/religion, and other personal characteristics (online Appendix 2, Table S1). Among the demographic variables, patients who had attended college, patients who were currently employed, and patients who identified themselves as having a religion were significantly ($P < .05$) more likely to say that their life is better now than before they knew they contracted HIV. All of the HAT-QoL domains were significantly associated with feeling that life is better, such that higher HAT-QoL scores were associated with a greater probability of feeling that life is better. Patients believing life had improved had significantly fewer bothersome HIV-related symptoms, fewer depressive symptoms, and greater levels of optimism, self-esteem, and social support. Feeling that life is better now was also associated with level of participation in nonorganized religious activity, with intrinsic religiosity, with both positive and negative religious coping, and with greater spiritual well-being. Believing that life is better now was not significantly associated with length of time since diagnosis, receipt or adherence to HAART, detectable versus undetectable viral loads, history of injection drug use, or alcohol use.

In our final multivariable logistic regression model, patients saying that life had improved had significantly ($P < .05$) better overall functioning; fewer worries about finances and HIV disclosure; poorer HIV mastery; and greater levels of spirituality (FACIT-SpEx scores) and optimism (online

Table 1. Patient Characteristics

Mean (SD) age, y	43.3 (8.4)
Mean (SD; median [25th, 75th percentiles]) time since diagnosis, y	8.4 (5.3; 8 [4, 12])
Male, N (%)	386 (86.0)
Race	
Caucasian, N (%)	203 (45.2)
African American, N (%)	225 (50.1)
Hispanic, N (%)	10 (2.2)
Other, N (%)	11 (2.5)
Sexual orientation	
Heterosexual, N (%)	148 (33.0)
Gay or lesbian, N (%)	226 (50.3)
Bisexual, N (%)	54 (12.0)
Asexual, N (%)	2 (0.5)
Refused to answer, N (%)	19 (4.2)
Injection drug use history	
Never used, N (%)	370 (82.4)
Past use, N (%)	61 (13.6)
Current use, N (%)	12 (2.7)
Refused to answer, N (%)	6 (1.3)
Number of alcoholic drinks per month, Mean (SD; median [25th, 75th percentiles])	12.5 (30.2; 1.5 [0.0, 9.0])
Education level	
Did not graduate from high school, N (%)	60 (13.4)
Graduated from high school but did not attend college, N (%)	122 (27.2)
Attended college, N (%)	267 (59.5)
Employment status	
Working full-time, N (%)	180 (40.1)
Working part-time, N (%)	51 (11.4)
Not working, N (%)	218 (48.5)
Married or living with significant other, N (%)	121 (27.0)
Has one or more children, N (%)	139 (31.0)
Has a religion, N (%)	357 (79.5)
Taking highly active antiretroviral therapy, N (%)	342 (76.5)
Mean (SD; median [25th, 75th percentiles]) CD4 count, cells/ μ L	420.0 (301.0; 351 [192, 610])
Viral load \leq 400 copies/mL, N (%)	232 (52.7)

Appendix 2, Table S2). As hypothesized, the interaction of overall functioning and spirituality was negative and statistically significant, indicating that spirituality was more strongly related to feeling that life is better among persons with lower levels of overall functioning than among persons with higher levels of functioning. The area under the receiver operating characteristic (ROC) curve for the final logistic regression model was 0.79.

Path Analysis

Owing to a small number of missing values on the independent variables (Online Appendix 1), our path analysis is based on $N=447$. The preliminary model testing showed that age, sex, race, length of time since diagnosis, and medication adherence were not associated with feeling that life is better. Therefore, these variables were not included in the path analysis.

In our path model, all bivariate correlations (Pearson's r) were positive and significant ($r=.19$ to $.62$; $P<.001$). We observed that a 1-factor model based on the DUREL, FACIT-Sp-Ex, and RCOPE-Positive yielded a plausible composite (Appendix A). We also found that medication adherence did not affect "life is better" directly or indirectly through health sta-

tus/health concerns. Therefore, we dropped medication adherence from the analysis. Also, we observed that social support and self-esteem do not directly affect "life is better," but both affect it indirectly. In the analysis below, we present findings from refined equations, i.e., equations including only those variables that have statistically significant effects (see Appendix C).

Healthy Beliefs. Healthy beliefs has the largest effect on "life is better" (Δ odds/SDI=110%), that is, a 1-SD increase in healthy beliefs increases the odds of feeling that life is better by 110% (Table 2, column 6). Only health status/health concerns intervenes between healthy beliefs and "life is better," but this indirect effect accounts for only a small share of the influence of healthy beliefs on "life is better" (Δ odds/SDI=14.25%; Table 2, column 4). Healthy beliefs has a moderate effect on health status ($\beta=0.28$; Table 2, column 1) and as discussed below, health status/health concerns has a moderate effect on the odds of feeling that life is better. Most of the effect of healthy beliefs on "life is better" is direct (Δ odds/SDI=95.51%). Thus, most of the effect of healthy beliefs on "life is better" operates through mechanisms (intervening variables) that are not captured in our model.

Spirituality/Religion. The most proximal variable in our model, spirituality/religion, has the second largest effect on "life is better" (68% Δ odds/SDI; Table 2; Fig. 1). More than half of the effect of spirituality/religion on "life is better" is indirect (38% Δ odds/SDI; Table 2, column 4) and thus, is due to the intervening variables in our model. The balance (Δ odds/SDI=29.97%) is due to the direct effect of spirituality/religion on "life is better." The table shows the contribution of each potential indirect path from spirituality/religion to "life is better." These paths are grouped to present each other variable in the model in turn as the principal intervening variable through which spirituality/religion affects "life is better." i.e., the variable defining the group has a direct effect on "life is better." If one or more variables are antecedent to the principal intervening variable in a path, it or they are the mechanisms through which spirituality/religion operates to affect the principal intervening variable.

Spirituality/religion indirectly influences "life is better" principally through its effect on healthy beliefs (Δ odds/SDI=29.15%). That is, a 1-SD increase in spirituality/religion produces a 29.15% increase in the odds of feeling that life is better through its effects on healthy beliefs. Half of this effect (Δ odds/SDI=15.13%) is due to the direct effect of spirituality/religion on healthy beliefs. The balance is divided among the possible paths through which spirituality/religion indirectly influences healthy beliefs. For example, a Δ odds/SDI of 5.99% is attributable to an increase in spirituality/religion resulting in an increase in self-esteem, which, in turn, leads to an increase in healthy beliefs and then an increase in the likelihood of believing that "life is better."

Health status/health concerns is the only other principal intervening variable through which spirituality/religion affects "life is better." While its overall effect is very small (Δ odds/SDI=9.39%), spirituality/religion produces both upward and downward pressures on "life is better" through health status/health concerns. As discussed below, health status/health concerns has a positive direct effect on "life is better." Conversely, the direct effect of spirituality/religion on health

Table 2. Direct, Indirect, and Total Effects of Paths Affecting View that Life is Better

Path to Life Is Better	Standard Deviation Change in Penultimate Variable in Causal Chain per Standard Deviation Increase in Most Distal Variable in Path		Percent Change in Odds of Believing that Life is Better per Standard Deviation Increase in Most Distal Variable in Path			
	Direct or Indirect Effects	Total Effect	Direct Effect	Indirect Effects	Subtotal Indirect Effects	Total Effect
Spirituality/Religion			29.97	38.54		68.50
Social Support	0.29	0.29		0.00	0.00	
Self-Esteem	0.20	0.33		0.00	0.00	
Social Support → Self-Esteem	0.14			0.00		
Healthy Beliefs	0.21	0.41		15.13	29.15	
Social Support → Healthy Beliefs	0.06			3.89		
Social Support → Self-Esteem → Healthy Beliefs	0.06			4.14		
Self-Esteem → Healthy Beliefs	0.09			5.99		
Health Status/Health Concerns	-0.10	0.19		-4.52	9.39	
Social Support → Health Status/Health Concerns	0.07			3.45		
Social Support → Self-Esteem → Health Status/Health Concerns	0.04			2.00		
Social Support → Healthy Beliefs → Health Status/Health Concerns	0.02			0.76		
Social Support → Self-Esteem → Healthy Beliefs → Health Status/Health Concerns	0.02			0.81		
Self-Esteem → Health Status/Health Concerns	0.06			2.88		
Self-Esteem → Healthy Beliefs → Health Status/Health Concerns	0.02			1.16		
Healthy Beliefs → Health Status/Health Concerns	0.06			2.84		
Social Support			0.00	54.12		54.12
Self-Esteem	0.47	0.47		0.00	0.00	
Healthy Beliefs	0.20	0.41		14.10	29.13	
Self-Esteem → Healthy Beliefs	0.21			15.04		
Health Status/Health Concerns	0.25	0.51		12.42	24.99	
Self-Esteem → Health Status/Concerns	0.14			7.09		
Self-Esteem → Healthy Beliefs → Health Status/Health Concerns	0.06			2.82		
Healthy Beliefs → Health Status/Health Concerns	0.06			2.66		
Self-Esteem			0.00	45.16		45.16
Healthy Beliefs	0.44	0.44		23.41	23.41	
Health Status/Health Concerns	0.31	0.31		15.66	21.75	
Healthy Beliefs → Health Status/Health Concerns	0.12			6.09		
Healthy Beliefs			95.51	14.25		109.75
Health Status/Health Concerns	0.28	0.28		14.25	14.25	
Health Status/Health Concerns			60.64	0.00		60.64

status/health concerns is small, but negative ($\beta = -0.10$; Table 2, column 1). There are 7 indirect effects of spirituality/religion on health status/health concerns; all are positive and small, but sum to a small effect ($\beta = 0.29$). Thus, an increase in spirituality/religion results in a negative effect on health status/health concerns and, in turn, on "life is better" ($\Delta\text{odds}/\text{SDI} = -4.52\%$), but also in a positive effect via social support, self-esteem, and healthy beliefs, on health status/health concerns, and, in turn, on "life is better" ($\Delta\text{odds}/\text{SDI} = 14.25\%$). Social support and self-esteem are not principal intervening variables through which spirituality/religion affects "life is better."

Social Support. Social support has a moderate effect on "life is better" ($\Delta\text{odds}/\text{SDI} = 54.12\%$). Social support does not directly affect "life is better." Therefore, all of the influence of social support on "life is better" is indirect and due to the intervening variables in our model.

Healthy beliefs and health status/health concerns are the principal intervening variables through which social support affects "life is better." The effect of social support via healthy beliefs is slightly larger than its effect via health status/health

concerns, but both effects are small ($\Delta\text{odds}/\text{SDI} = 29.13\%$ vs 24.99% , respectively).

About half of the effect of social support via healthy beliefs ($\Delta\text{odds}/\text{SDI} = 14.10\%$) occurs through the direct effect of social support on healthy beliefs ($\beta = 0.20$). The balance is due to social support's indirect influence on healthy beliefs via self-esteem ($\Delta\text{odds}/\text{SDI} = 15.04\%$).

Similarly, about half of the effect of social support via health status/health concerns ($\Delta\text{odds}/\text{SDI} = 12.42\%$) occurs because of the direct effect of social support on health status/health concerns ($\beta = 0.25$). The balance ($\Delta\text{odds}/\text{SDI} = 12.57\%$) is due to social support's indirect influences on health status/health concerns via self-esteem and healthy beliefs.

Self-Esteem. Self-esteem also has a moderate effect on "life is better" ($\Delta\text{odds}/\text{SDI} = 45.16\%$). Self-esteem does not directly affect "life is better"—all of its influence on "life is better" is indirect and due to the intervening variables in our model.

Healthy beliefs and health status/health concerns are the principal intervening variables through which self-esteem affects "life is better." The effect of self-esteem via healthy beliefs is about the same as its effect via health status/health

concerns, but both effects are small (Δ odds/SDI = 23.41% vs 21.75%, respectively). The effect of self-esteem via health status/health concerns (Δ odds/SDI = 15.66%) occurs because of the direct effect of self-esteem on health status/health concerns ($\beta = 0.31$). The balance is due to self-esteem's indirect influence on health status/health concerns via healthy beliefs (Δ odds/SDI = 6.09%).

Health Status/Health Concerns. Health status/health concerns is the third strongest predictor of "life is better" (Δ odds/SDI = 60.64%). It is the ultimate determinant of "life is better" in the model; thus, its effect is direct.

DISCUSSION

Our results confirm our hypotheses that spirituality/religion is positively associated with the feeling that life has improved in patients with HIV/AIDS.¹⁸ Our findings are thus similar to findings from studies of patients with cancer, which have found that greater levels of overall well-being are associated with hope^{40,41} and better psychological adjustment.⁴⁰⁻⁴³ Our study adds to the current literature by exploring a new outcome in patients with HIV/AIDS, feeling that life has improved since diagnosis. Also, a new finding from this study is that spirituality/religion has the second strongest association with feeling that life has improved, next to healthy beliefs, or a positive life outlook. Furthermore, we were able to demonstrate that half of spirituality/religion's association with believing that life is better is a direct effect whereas the other half is indirect, mostly through healthy beliefs. Both direct and mediating effects of spirituality/religion on health and well-being are supported by other research as well.¹⁴

A proportion of the direct influence of spirituality/religion remained unexplained by our model, and the contribution of social support and self-esteem as mediating factors was small. Other research has shown that social ties, along with health behaviors and indicators of well-being, attenuate but do not eliminate the association between religion and better functioning.⁴⁴ Also, spirituality/religion may foster not only self-esteem but also other aspects of the concept of self/self-perception, e.g., personal mastery.⁴⁵ Spirituality/religion may make serious health problems less threatening to one's core sense of self, partly by raising awareness of other, nonphysical aspects of self-definition (e.g., talents, traits, character, morality) that may become more central for persons confronting health crises.^{3,46} Our measure of self-esteem and the conceptual model may have captured only a part of the mediating effect of the larger self-concept.

We were surprised that social support and self-esteem were not directly associated with feeling that life has improved; instead, they operate through healthy beliefs. Future research should look at the role of social isolation experienced by patients with HIV/AIDS,¹⁴ e.g., social isolation may affect people variably depending on personal attitudes (e.g., "I don't need anybody," "I'll be fine without them"). The effect of social support may operate exclusively through psychological factors, such as a positive life outlook. In addition, an overlap between positive life outlook and the view that life has improved may result in the strong relationship that we observed. The changes in a sense of meaning and purpose in life experienced by people affected by HIV/AIDS, and the resulting fresh personal insights,⁴⁷ are difficult to disentangle. Although healthy

beliefs appear to play an instrumental role in the view that life has improved, a closer examination of the overlap between the 2 concepts is needed.

We also tested a 2-factor distal-proximal model of spirituality/religion. We found that the distal factors (e.g., frequency of attending services) and the proximal factors (e.g., religious coping) did not represent 2 different dimensions of spirituality/religion in our sample of patients with HIV/AIDS. Thus, the various spirituality/religion measures appear to be closely related to each other and contribute as a group to the overall construct. However, our results do confirm the important contribution of previously identified elements of the construct, e.g., formal religious participation, religious coping, etc., as well as the construct's complex and multifaceted character¹¹ with many overlapping components that are difficult to disentangle (e.g., frequency vs content of prayer), which may be why we could not clearly see a distinction between the distal and the proximal factors. One contradiction with previous research²⁸ was the finding that negative religious coping did not fit into the spirituality/religion measurement model. Further examination of this measure as well as studies addressing the possible negative (undesirable) implications of certain aspects of spirituality/religion (e.g., pathological coping approaches such as feelings of anger at God, guilt, or shame) are recommended.

In this study, we used logistic regression and path analysis combining logistic and ordinary least squares regression. Ordinary least squares regression is about partitioning variance while path analysis adds the perspective of partitioning covariance. For any pair of variables in a path model, their correlation can be partitioned into causal and noncausal effects. Also, the causal effects, if any, can be partitioned into direct effect and indirect effects. The importance of this "additional" perspective is that we can test our various explanations for the association of variables. The indirect effects are the postulated "causal mechanism" producing an association between variables. The direct effects represent the causal effect of the independent variable due to all unmeasured mechanisms; as such, it is a type of residual.

Logistic regression is not ordinary regression; it begins with a dichotomous outcome. Ideas about predictors are usually theoretical ideas about the determinants of the underlying probabilities of some variable. Logistic regression coefficients are often converted to ORs to make the relationships more intuitive. There are some pseudo-standardized coefficients for logistic regression, but their use with ordinary least squares standardized coefficients is untenable. We developed a semi-standardized coefficient as part of this project. These coefficients yield information as if the predictors are standardized (z-scores) and contributing to the resulting ORs. The coefficients allow us compare the relative strength of predictors. The idea was extended to develop coefficients for direct and indirect effects. These coefficients allowed assessment and comparison of the ways in which a predictor acts on the dichotomous dependent variable.

As with any research, this study has several shortcomings. In particular, the data used in this analysis are cross-sectional, and our outcome measure is based on self-report at one point in time. Quality of life was assessed retrospectively and responses reflect only patients' current perceptions of their present versus past-QoL. Such "transition questions" may reflect a response shift resulting from a change in under-

lying health,⁴⁸ may or may not mirror serially assessed measures, and may mean different things to different people⁴⁸⁻⁵¹—and yet such retrospective assessment may be preferable to serial assessment.^{19,52} Future studies using longitudinal data and multiple and more objective indicators of changes in perceptions of living with HIV/AIDS would be helpful. About half the effect of spirituality/religion on feeling that life is better now, the direct effect, is due to mechanisms (intervening variables) that are not included in the model and thus remain for future research.

Another limitation is the study's use of a single indicator of life is better now. Usually, multiple indicator measures are one of 2 types. One depends on the composite being more reliable than the average individual item. The average item often less directly measures the construct of interest, and the validity of a new composite is tenuous. Our single measure is a straightforward question about our concern and, as such, is being shaped by a respondent's sense of whether his/her life is better now. It certainly has more face validity than the typical new composite. Also, typically, a composite likely would achieve the reliability of our question only through having a substantial number of items. The other common type of multiple indicator measure uses items to measure different parts of the whole. The validity of this second type is generally more difficult to establish because it must define the essential parts of the whole. This is very difficult, and this is a less commonly chosen route of measurement. It does offer the intriguing opportunity to explore the determinants of different parts of the whole. We decided to explore possible explanations for a relationship between spirituality/religion and "life is better" before exploring the issue of what possible subdimensions of "life is better now" might contribute to this relationship.

Despite its limitations, this study provides new insights into the mechanisms through which spirituality/religion affects patients' perceptions of living with HIV/AIDS. Future research should validate our new conceptual model using other samples and longitudinal studies. Alternative models should also be developed and tested, focusing on the associations between specific dimensions of spirituality/religion (as opposed to the broad construct of spirituality/religion that we used) and outcomes in patients with HIV/AIDS.

The results of this study have 2 main implications. First, the finding that many patients not only can cope and adapt to such a serious illness—but actually reach a point where they believe that life is better than before being diagnosed with HIV/AIDS—offers hope for numerous people infected with a virus that once portended only suffering and death. Clinicians may use these findings in counseling patients newly diagnosed with HIV/AIDS, with the caveat that one does not know how long it takes to feel that life has become better. Second, the findings point to the need to raise awareness among clinicians about the importance of spirituality/religion in the lives of patients with HIV/AIDS. Tools and techniques to help educators and clinicians incorporate spiritual assessments are readily available.⁵³⁻⁵⁷

APPENDIX A: MEASUREMENT OF SPIRITUALITY/RELIGION AND HEALTH STATUS/HEALTH CONCERNS

To measure 2 latent variables, spirituality/religion and health status/health concerns, we first tested the constructs using confirmatory factor analysis. Second, we developed an

alternative scaling scheme after a failed attempt to include the 2 latent variables in a path model.

Confirmatory Factor Analysis

We conducted confirmatory factor analyses of spirituality/religion (2 factors: distal and proximal) and health status/health concerns (3 factors: HAT-QoL, HSI, and CESD-10) by using LISREL, version 8.3 (Scientific Software International, Inc., Chicago, IL). The results for each of the 2 latent variables were as follows:

Spirituality/Religion. A 2-factor model of distal and proximal spirituality/religion did not fit the data. Instead, a 1-factor model based on the DUREL, FACIT-Sp-Ex, and RCOPE-Positive yielded a plausible solution ($\chi^2=3.97$, $df=5$, $P=.554$; root mean square error of approximation=0.000; goodness-of-fit index=0.992). The factor loadings were 0.633 (DUREL-ORA), 0.656 (DUREL-NORA), 0.826 (DUREL-IR), 0.606 (FACIT-Sp-Ex), and 0.814 (RCOPE-Positive). The RCOPE-Negative scale did not fit the model.

Health Status/Health Concerns. The health status/health concerns model based on the HAT-QoL, HSI, and CESD-10 was a perfect fit with our data because the model was just identified.³⁸ Often in factor analysis, the number of unknowns, i.e., factor loadings, is fewer than the number of equations describing the model being fitted. Factor analysis produces a best-fit solution for the loadings, but the loadings may reproduce the correlations among the observed variables poorly, i.e., the fit may be a poor one. In a just-identified equation system, the number of unknowns equals the number of equations, and the model has a solution. These factor loadings reproduce perfectly the actual correlations among the items (hence the term "a perfect fit"). In a just-identified model, the criterion of a good fit is not statistical, but hinges on theoretical expectations—whether the loadings are the size one would expect, given the logic of the model. Here, the loadings were moderately high (0.69, 0.84, and 0.85), indicating a good fit.

Alternative Measurement for Spirituality/Religion and Health Status/Concerns

We were unable to fit a structural model including the latent variable models, so we formed composite measures of spirituality/religion and health status/concerns. To form the composite measure of spirituality/religion, we converted the loadings from each of the 5 spirituality/religion variables (the 3 DUREL subscales, the FACIT-Sp-Ex, and the RCOPE-Positive) into z-scores and summed them. Using z-scores equally weights the 5 variables forming the composite. Similarly, we converted each of the 3 health status/health concerns variables into z-scores and summed them to form a composite measure. The Cronbach's α statistic based on standardized items was 0.83 for the spirituality/religion composite and 0.81 for the health status/health concerns composite.

APPENDIX B: PATH ANALYSIS COMBINING ORDINARY LEAST SQUARES AND LOGISTIC REGRESSION

As explained by Pedhazur, "In a causal model, a distinction is made between exogenous and endogenous variables. An exogenous variable is one whose variation is assumed to be

determined by causes outside the hypothesized model An endogenous variable, conversely, is one whose variation is explained by exogenous or other endogenous variables in the model" (p. 770).³⁹ Spirituality/religion is the lone exogenous variable; the others are endogenous. Path coefficients are derived from a set of regression equations that describe the model. Each endogenous variable is regressed on all of the variables that precede it in the causal chain. For example, "life is better" is regressed on all the other variables; health status/health concerns is regressed on the 5 variables to its left in Figure 1; and so on, with social support regressed only on spirituality/religion. Typically, each equation is estimated with ordinary least squares regression and the coefficients yield the direct effect of each predictor on each endogenous variable—the coefficients that would appear on the paths shown in Figure 1. Again, typically, studies such as ours report *standardized path coefficients*. Those appearing on single-headed arrows, *direct effects*, indicate the dependent variable change in SD units for a 1-SD change in the independent variable. Such coefficients can be joined to derive *indirect effects* by multiplying the path coefficients appearing on a sequence of steps connecting a pair of variables that have at least one intervening variable. For example, one indirect effect of spirituality/religion on healthy beliefs is spirituality/religion's direct effect on social support, multiplied by social support's direct effect on self-esteem, multiplied by self-esteem's direct effect on healthy beliefs. The model depicts spirituality/religion having other indirect effects on healthy beliefs, e.g., spirituality/religion's direct effect on social support times social support's direct effect on healthy beliefs. The first variable in a chain defining an indirect effect can be viewed as the independent variable and the last as the dependent variable. Like the direct effect, an indirect effect indicates the dependent variable change in SD units for a 1-SD change in the independent variable. While *unstandardized coefficients* can be used in path models, *standardized path coefficients* allow direct comparisons of any effects in the model because every variable has the same metric—SD units. Unstandardized coefficients are meaningfully compared only for the same

independent and dependent variable, i.e., where the metrics of the variables are comparable. However, the typical approach is not applicable for our study's path model. While ordinary least squares regression may be used to estimate the effects of some of the model's endogenous variables, "life is better" is binary and typically estimated with logistic regression. Coefficients from logistic and ordinary least squares regressions are different species and are not usually mated. We circumvented this problem by deriving *semi-standardized path coefficients* to parse the direct and various indirect influences on "life is better."

APPENDIX C: DIRECT EFFECTS OF PREDICTOR VARIABLES ON "LIFE IS BETTER"

Each arrow in the conceptual model represents the association between the adjoining constructs (Fig. 1), which is captured through a regression model (Table A3). For linear relationships, we used ordinary least squares regressions and calculated both unstandardized (B) and standardized (β) coefficients (Table A3, right; these represent the direct effects of a predictor on the dependent variable). For dichotomous outcomes, we used logistic regression models. We present 3 versions of each coefficient. The B coefficient shows the change in the log-odds of feeling that life is better per unit increase in the predictor (Table A3, left). If a coefficient's sign is positive, it indicates that the probability of feeling that life is better now increases as the predictor increases, because the log odds and the probability of feeling that life is better are positively associated; however, a coefficient relating to log odds is not very intuitive. Often, coefficients are converted to the somewhat more intuitive OR, $\text{Exp}(B)$; the OR equals the exponent of the regression coefficient, e.g., the exponent of the B for health status/health concerns, 0.19, is 1.20. The OR indicates the change in the odds of feeling that life is better per unit increase in the predictor. Often, the OR is converted to the percent change in the odds per unit increase in a predictor, calculated by multiplying an OR by 100 and subtracting 100; e.g., a 1-point increase in health status/health concerns results in a 20.4% increase in

Table A3. Regression Equations Providing Statistically Significant Direct Effects for Path Model

Predictor	Dependent Variables										
	Binary Logistic Regression			Ordinary Least Squares Regressions							
	Life is Better			Health Status/Health Concerns		Healthy Beliefs		Self-Esteem		Social Support	
B*	Exp(B)*	Percent Change in Odds/Standard Deviation Increase*	B*	β^*	B*	β^*	B*	β^*	B*	β^*	
Health status/health concerns	0.19	1.20	60.64								
Healthy beliefs	0.11	1.12	95.51	0.12	0.28						
Self-esteem				0.22	0.31	0.76	0.44				
Social support				0.08	0.25	0.14	0.20	0.20	0.47		
Spirituality/religion	0.07	1.07	29.97	-0.06	-0.10	0.33	0.21	0.18	0.20	0.63	0.29
Intercept	-3.11	0.04		-9.51		-0.68		12.11		37.65	
Adjusted R ² or Nagelkerke R ²			0.25*		0.44		0.45		0.31		0.08

*Coefficients shown are significant at $P < .05$.

[†]Nagelkerke $R^2 = (1 - \exp(-LR/n)) / (1 - \exp(-LL/n))$, where LR is the model Likelihood Ratio χ^2 , LL is the $-2 \log$ likelihood for an intercept-only model (i.e., maximum value that the numerator may have), and n is the sample size.

the odds that life is better (not presented). We modified the expression of the OR to show the percent change in the odds *per SD* increase in a predictor (% Δ odds/SDI), e.g., a 1-SD increase in health status/health concerns results in a 60.6% increase in the odds that life is better. (In Table A3, % Δ odds/SDI is calculated by (1) multiplying the B coefficient by the predictor's SD; (2) taking the exponent of the product to obtain an OR; and (3) multiplying that OR by 100 and subtracting 100. In the manuscript's Table 2, the logic is extended, but the calculation is more involved.) The percent change in the odds *per SD* increase in a predictor allows one to compare the relative strength of predictors in the equation. We use the coefficients presented in Table A3 to develop the more completely specified results shown in Table 2. Below, we briefly review these direct effects presented in Table A3.

We hypothesized that an increase in spirituality/religion would (directly) result in an increase in social support. The hypothesis was corroborated; spirituality/religion has a moderate effect on social support ($\beta=0.29$).

We hypothesized that an increase in spirituality/religion would result in an increase in self-esteem. The hypothesis was corroborated; spirituality/religion has a small effect on self-esteem ($\beta=0.20$). We also hypothesized that an increase in social support would result in an increase in self-esteem. The hypothesis was corroborated; social support has a strong effect on self-esteem ($\beta=0.47$). Together, spirituality/religion and social support account for 31% of the variation in self-esteem ($R^2=.31$).

We hypothesized that spirituality/religion, social support, and self-esteem would each have a direct, positive influence on healthy beliefs. These hypotheses were corroborated. An increase in spirituality/religion results in a small increase in healthy beliefs ($\beta=0.21$). An increase in social support also results in a small increase in healthy beliefs ($\beta=0.20$). An increase in self-esteem results in an increase in healthy beliefs; its effect ($\beta=0.44$) is approximately twice the effects of spirituality/religion and social support. Together, spirituality/religion, social support, and self-esteem account for 45% of the variation in healthy beliefs.

We hypothesized that spirituality/religion, social support, self-esteem, and healthy beliefs would each have a direct, positive influence on health status/health concerns. Hypotheses regarding social support, self-esteem, and healthy beliefs were corroborated. An increase in social support results in a moderate increase in health status/health concerns ($\beta=0.25$). An increase in self-esteem results in an increase in healthy beliefs; its effect is moderate ($\beta=0.31$). An increase in healthy beliefs also results in a moderate increase in health status/health concerns ($\beta=0.28$). While spirituality/religion has a direct effect on health status, it is small and negative. An increase in spirituality/religion results in a small decrease in health status/health concerns ($\beta=-0.10$), when controlling for the effects of social support and self-esteem. Together, spirituality/religion, social support, self-esteem, and healthy beliefs account for 44% of the variation in health status/health concerns.

We hypothesized that spirituality/religion, social support, self-esteem, healthy beliefs, and health status/health concerns would each have direct, positive influences on the probability of feeling that life is better. As noted above, social support and self-esteem did *not* directly affect "life is better," and those 2 hypotheses were refuted.

Hypotheses regarding spirituality/religion, healthy beliefs, and health status/health concerns were corroborated. An in-

crease in spirituality/religion resulted in a small increase in the feeling that life is better—a 1-SD increase in spirituality/religion results in a 29.97% increase in odds of feeling that life is better (Δ odds/SDI=29.97%). An increase in healthy beliefs results in an increase in the feeling that life is better; its effect is substantial and 3 times the direct effect of spirituality/religion (Δ odds/SDI=95.51% vs 29.97%, respectively). An improvement in health status/health concerns causes a moderate increase in the view that life is better (Δ odds/SDI=60.64%). Together, spirituality/religion, healthy beliefs, and health status are moderately predictive of feeling that life is better (Nagelkerke $R^2=.25$).

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Supplementary Material

The following supplementary material is available for this article online at www.blackwell-synergy.com

Appendix 1: Treatment of missing data.

Appendix 2, Table S1: Relationships between feeling that life has improved and other variables.

Appendix 2, Table S2: Multivariable correlates with feeling that life is better now.