

Religion and Health

The meta-analysis of the association of religious involvement and mortality represents a major step forward for research in the relationship between religious activity and health outcomes (McCullough, Hoyt, Larson, Koenig, & Thoresen, 2000). In an area characterized largely by methodologically flawed studies (see Sloan, Bagiella, & Powell, 1999), the authors have conducted a rigorous examination, reviewing 42 odds ratios (ORs) representing 125,826 participants. With no moderator variables in the model (i.e., unadjusted for covariates and confounders), they found an OR of 1.29, with a 95% confidence interval of 1.21–1.39, suggesting an advantage for the religiously involved.

However, we disagree with their interpretation of the finding. As the authors themselves noted, “Odds ratios near 1.0 indicate weak or nonexistent associations between variables, whereas odds ratios greater than 3.0 . . . represent strong associations between variables” (McCullough et al., 2000, p. 212). Despite this assertion and despite the fact that of the confidence intervals reported in the 42 samples they analyzed, 25 included 1.00 and 5 others had a lower limit below 1.10, the authors nevertheless concluded that “the association of religious involvement and mortality was robust and on the order of magnitude that has come to be expected for psychosocial factors” (McCullough et al., 2000, p. 211). The association is anything but robust.

Not only is the OR of 1.29 weak or nonexistent by the authors’ own definition, it is not adjusted for important covariates (e.g., gender, race, income, education, functional status). When these were added to the model, the OR dropped to 1.23 (fourth model), with $p = .306$. Thus, after controlling for relevant covariates, the relationship between religious involvement and mortality no longer is significant, a fact omitted from the abstract.

Consider, by comparison, the ORs typically seen for psychosocial and behavioral factors. Everson, Kaplan, Goldberg, Salonen, and Salonen (1997) recently reported

that hopelessness conferred a greater than threefold increased risk for hypertension (OR = 3.22, after adjustment for standard risk factors). Frasure-Smith and colleagues showed that depressive symptomatology following myocardial infarction conferred a substantially elevated risk of mortality (OR = 6.64, after adjustment for risk factors; Frasure-Smith, Lespérance, & Talajic, 1995). Even the leisure-time activity of gardening 60 min/week was associated with nearly a threefold advantage (OR = 2.94) in regard to cardiac arrest, after adjustment for standard risk factors (Lemaitre et al., 1999). Note that all of these ORs are significant after adjustment for covariates.

The authors assert that the findings of this meta-analysis are definitive. We agree. They demonstrate that the relationship between religious involvement and mortality is weak or nonexistent.

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References

- Everson, S. A., Kaplan, G. A., Goldberg, D. E., Salonen, R., & Salonen, J. T. (1997). Hopelessness and 4-year progression of carotid atherosclerosis. *Arteriosclerosis Thrombosis and Vascular Biology*, *17*, 1490–1495.
- Frasure-Smith, N., Lespérance, G., & Talajic, M. (1995). Depression and 18-month prognosis after myocardial infarction. *Circulation*, *91*, 999–1005.
- Lemaitre, R. N., Siscovick, D. S., Raghunathan, T. E., Weinmann, S., Arbogast, P., & Lin, D. Y. (1999). Leisure-time physical activity and the risk of primary cardiac arrest. *Archives of Internal Medicine*, *159*, 686–690.
- McCullough, M. E., Hoyt, W. T., Larson, D. B., Koenig, H. G., & Thoresen, C. (2000). Religious involvement and mortality: A meta-analytic review. *Health Psychology*, *19*, 211–222.
- Sloan, R., Bagiella, E., & Powell, T. (1999). Religion, spirituality, and medicine. *The Lancet*, *353*, 664–667.

Small, Robust, and Important: Reply to Sloan and Bagiella (2001)

We agree that robust (i.e., reliable) associations are not always of practical importance, but judgments of importance should incorporate considerations of the nature of the variables involved (Prentice & Miller, 1992). First, how important is the criterion? Mortality is arguably the most important and definitive health outcome. Second, how (presumably) trivial is the predictor’s influence on the criterion? Because mortality is multidetermined, religiousness—and, as illustrated below, other behavioral variables—will necessarily have limited predictive power. Third, how minimally is the predictor operationalized? In most studies we reviewed, religiousness was poorly measured, often by only a single item. Poor (unreliable) measurement always attenuates, never inflates, observed associations. In light of these considerations, we think the observed religiousness–mortality association should be judged as substantial and clinically meaningful.

How meaningful? The binomial effect size display (Rosenthal, 1990) expresses this association as the difference in death rates between a sample of 100 “more religious” and 100 “less religious” individuals in which the marginal death rate is .50. In such a sample (see Table 1), an odds ratio (OR) of 1.23 (the estimated association adjusted for confounds and putative mediators) implies 2.6 excess survivors among the more religious and 2.6 excess deaths among the less religious. This survival difference is clearly of practical importance—especially to the 5.2 extra people in the off-diagonal!

Sloan and Bagiella (2001) compared our findings with results from individual studies of hopelessness and physical activity that used criteria other than mortality. Such comparisons are meaningless. Even comparisons with individual studies of depression and mortality are counterproductive because individual parameter estimates are subject to sampling error. To wit, the universe of studies on depression and mortal-

Table 1
Binomial Effect Size Display for the Religiousness–Mortality Association

Vital status at follow-up	“More religious”	“Less religious”	Total
Dead	47.4	52.6	100
Alive	52.6	47.4	100
Total	100	100	200

Note. Data were adjusted for confounds and putative mediators (odds ratio of 1.23).

ity, though hinting at the positive association that Sloan and Bagiella imply, (naturally) also contains studies indicating no association (Wulsin, Vaillant, & Wells, 1999). Compared with such null results, our findings would look quite impressive, but, then, looks can deceive. Better to compare apples with apples. Based on prior meta-analytic findings, McCullough (in press) estimated that hazardous alcohol use and postcardiac exercise rehabilitation programs account for 10 and 8 mortality outcomes per 200 people, respectively. Compared with such psychosocial benchmarks, the 5 outcomes per 200 that religiousness predicts seem noteworthy indeed.

Sloan and Bagiella also questioned the statistical nonsignificance of the fully adjusted association (OR = 1.23). As we explained, as the case-to-predictor ratio increases, standard errors for parameter estimates in multiple regression balloon inordinately, making significance tests increasingly insensitive (e.g., Tabachnick &

Fidell, 1989). Thus, the significance tests in our final regression model (21 cases, 12 predictors) were underpowered and therefore uninformative. What is important is the very small reduction in the magnitude of the association (from 1.29 to 1.23) when completely adjusted for covariates. There was still a religiousness–mortality association, despite our attempts to eliminate it.

Our data suggest that the question of whether religiousness is associated with mortality can be retired and replaced with more interesting questions, such as how this association occurs and what it might reveal about psychology and health.

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References

- McCullough, M. E. (in press). Religious involvement and mortality: Answers and more questions. In T. G. Plante & A. C. Sherman (Eds.), *Faith and health*. New York: Guilford.
- Prentice, D. A., & Miller, D. T. (1992). When small effects are impressive. *Psychological Bulletin*, *112*, 160–164.
- Rosenthal, R. (1990). How are we doing in soft psychology? *American Psychologist*, *45*, 775–777.
- Sloan, R. P., & Bagiella, E. (2001). Religion and health [Letter to the editor]. *Health Psychology*, *20*, 228.
- Tabachnick, B. G., & Fidell, L. S. (1989). *Using multivariate statistics*. New York: Harper & Row.
- Wulsin, L. R., Vaillant, G. E., & Wells, V. E. (1999). A systematic review of the mortality of depression. *Psychosomatic Medicine*, *61*, 6–17.