Scientists have been interested in the influence of religion on mortality for at least 130 years. Since this time, many debates have been held by researchers who believe or do not believe in this association. The objective of this study is to compare the impact of spirituality and religiosity (S/R) with other health interventions on mortality. The authors selected 25 well-known health interventions. Then, a search of online medical databases was performed. Meta-analyses between 1994 and 2009 involving mortality were chosen. The same was done for religiosity and spirituality. The combined hazard ratio was obtained directly by the systematic reviews and the mortality reductions by S/R and other health interventions were compared. Twenty-eight meta-analyses with mortality outcomes were selected (25 health interventions and three dealing with S/R). From these three meta-analyses, considering those with the most conservative results, persons with higher S/R had an 18% reduction in mortality. This result is stronger than 60.0% of the 25 systematic reviews analyzed (similar to consumption of fruits and vegetables for cardiovascular events and stronger than statin therapy). These results suggest that S/R plays a considerable role in mortality rate reductions, comparable to fruit and vegetable consumption and statin therapy. The debate continues to rage; new systematic reviews on this topic have been published. Thus, in order to determine how much impact S/R really has on mortality in comparison to other standard health interventions, we decided to conduct this review.

INTRODUCTION

Scientists have been interested in the influence of religion on mortality for at least 130 years. Since this time, intense debates have been held by investigators who believe or do not believe in this association. In 2001, McCullough et al. performed a meta-analysis of studies on spirituality and religiosity (S/R) and mortality demonstrating a 22% lower mortality rate (odds ratio 0.78, 95% confidence interval, 0.72-0.83; P = .001) for those who attend religious services once a week or more when compared with the general population. These findings met criticism by other researchers that considered these results as clinically insignificant compared with other interventions. As a reply to this criticism, McCullough pointed out that the impact of religious attendance on mortality is similar to the impact of statin therapy, the risk of heavy drinking, and the effects of exercise-based rehabilitation following myocardial infarction.

Years later, Hall analyzed the cost-effectiveness of religious attendance compared with statins and physical exercise and concluded that the approximate cost per life year gained was between $2,000 and $6,000 for regular exercise, $3,000 and $10,000 for regular religious attendance, and between $4,000 and $14,000 for statin-type agents. He finally suggested that religious attendance may be more cost-effective than statins.

Years later, Hall analyzed the cost-effectiveness of religious attendance compared with statins and physical exercise and concluded that the approximate cost per life year gained was between $2,000 and $6,000 for regular exercise, $3,000 and $10,000 for regular religious attendance, and between $4,000 and $14,000 for statin-type agents. He finally suggested that religious attendance may be more cost-effective than statins.

Type of Studies

Studies had to be systematic reviews of cohort, case-control, and/or cross-sectional studies or systematic reviews of randomized controlled trials. The only exception was a study dealing with air bag use due to the lack of a systematic review for this health intervention.

© 2011 Elsevier Inc. All rights reserved
ISSN 1550-8307/$36.00
### Table 1. Health Interventions Divided According to the Classification of Prevention Based on the Merck Manuals

<table>
<thead>
<tr>
<th>Primary prevention</th>
<th>Secondary prevention</th>
<th>Tertiary prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza vaccine in persons aged 65 years old or over</td>
<td>Screening for prostate cancer</td>
<td>Noninvasive positive pressure ventilation in acute exacerbations of chronic obstructive pulmonary disease</td>
</tr>
<tr>
<td>Physical activity</td>
<td>Screening mammo grafy in persons aged 50 to 74 years</td>
<td>PTCA in acute myocardial infarction</td>
</tr>
<tr>
<td>Church/service attendance</td>
<td>Colorectal cancer screening by fecal occult blood test</td>
<td>Beta-blockade treatment in patients with congestive heart failure</td>
</tr>
<tr>
<td>Active religious involvement</td>
<td>Screening for prostate cancer</td>
<td>Statin therapy</td>
</tr>
<tr>
<td>Consumption of fruit and vegetables</td>
<td>Staining in LDL-C</td>
<td>Changes in LDL-C</td>
</tr>
<tr>
<td>Tobacco smoking cessation</td>
<td>Aldosterone blockade and left ventricular dysfunction</td>
<td>Low-dose aspirin in secondary prevention of cardiovascular and cerebrovascular events</td>
</tr>
<tr>
<td>Religious/spirituality</td>
<td>Low-dose aspirin in patients with stable cardiovascular disease</td>
<td>Angiotensin receptor blockers in chronic heart failure</td>
</tr>
<tr>
<td>Air bag use</td>
<td>Drug treatment of hypertension in the elderly</td>
<td>Recombinant human activated protein C therapy in patients with sepsis</td>
</tr>
<tr>
<td>Pneumococcal vaccination in adults</td>
<td>Out-of-hospital defibrillation by basic life support providers</td>
<td>Systemic corticosteroids for acute exacerbations of chronic obstructive pulmonary disease</td>
</tr>
</tbody>
</table>

PTCA, Percutaneous transluminal coronary angioplasty; LDL-C, low-density lipoprotein cholesterol.

Data from the Merck Manuals Online Medical Library.

---

**Spirituality and religiosity.** All systematic reviews involving the terms spirituality, religiosity, religion, religious attendance, and faith with mortality, death, and fatal outcome were included. This method resulted in three articles.2,6,7 We only considered the impact of S/R on mortality of healthy persons, excluding the data of diseased persons due to lack of consistent studies (significant heterogeneity and publication bias).7 We defined spirituality as “personal quest for understanding answers to ultimate questions about life, about meaning, and about relationship with the sacred or transcendent, which may (or may not) lead to or arise from the development of religious rituals and the formation of community”31 and religion as an “organized system of beliefs, practices, rituals and symbols designed to facilitate closeness to the sacred or transcendent.”31

**Health interventions.** Primary prevention strategies (ie, physical exercise) and secondary (ie, vaccination) and tertiary prevention therapies (ie, statin therapy) were selected, according to the classification of prevention strategies based on the Merck Manuals.33 Table 1 shows this division.

**Procedures**

Primary prevention strategies and secondary and tertiary prevention therapies were compared with S/R on the impact of mortality. Combined hazard ratio estimates were identified directly from the systematic reviews.

**RESULTS**

The impact of health interventions on mortality is presented in Table 2.

The reduction of mortality varied between 78% with noninvasive positive pressure ventilation in acute exacerbations of chronic obstructive pulmonary disease23 to 0% with screening for prostate cancer.10 Considering the S/R systematic review with worst results,7 at least 15 of 25 (60.0%) of the meta-analysis had a lower effect on mortality. If we consider the S/R systematic review with best results,6 16 of 25 (64.0%) meta-analysis had lower impact on mortality.

**DISCUSSION**

An important tool for “evidence-based medicine” are the systematic reviews, being considered by the Oxford Centre for Evidence-Based Medicine as level 1a in evidence, the highest level so far.34 Health interventions are often analyzed through these meta-analyses, and mortality is one of the most common outcomes measured.

Many studies have examined the effects of S/R on mortality, although we found only three systematic reviews. The first meta-analysis was carried out by McCullough et al7 in 2001 and demonstrated a lower mortality rate for those who attend religious services once a week or more when compared with less than weekly attendees. According to McCullough, “given the large numbers of people who are religiously active, the favorable association of religious involvement and mortality is a health phenomenon with some relevance for a substantial proportion of the American population. Elucidating the nature of this robust but poorly understood association could be a fruitful topic.”

In 2005, while evaluating the relationship between spirituality and physical health, Powell et al8 found a 25% reduction in mortality and concluded that church/service attendance protects healthy people against death.

Finally, Chida et al9 performed a systematic review in 2009 that found an 18% reduction in mortality for healthy persons. The protective effect of religiosity/spirituality in the initially healthy population studies was independent of behavioral factors (smoking, drinking, exercising, and socioeconomic status),
negative affect, and social support. The authors concluded that S/R has a favorable effect on survival.

Supporting this finding, Lutgendorf et al.,35 in 2004, examined the relationship between religious attendance, interleukin-6 (IL-6) levels, and mortality rates in a community-based sample of 557 older adults. Results indicated that religious attendance was significantly related to lower mortality rates and IL-6 levels, and IL-6 levels mediated the prospective relationship between religious attendance and mortality. According to the author, this was the first study that found mediation by an immune factor of the prospective relationship between a biobehavioral factor and mortality.

While comparing with other health interventions, the impact of S/R is not negligible. For example, colorectal cancer screening by fecal occult blood test is done worldwide and recommended by the U.S. Preventive Services Task Force13 as grade A based on a 16% mortality reduction in one systematic review. This result is lower than the 18% mortality reduction by S/R reported in the 2009 meta-analysis.7

Some consolidated health interventions like aldosterone blockade for left ventricular dysfunction,16 consumption of fruit and vegetables18 and screening mammography in persons aged 50 to 74 years19 had mortality reductions similar to religious services attendance. Moreover, some high-cost interventions

| Table 2. Association of Multiple Health Interventions and Mortality |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| Analyzed Factor | Year of Publication | Type of Prevention | Persons, No. | Decrease in Mortality, % | Hazard Ratio (CI 95%) |
| Noninvasive positive pressure ventilation in acute exacerbations of chronic obstructive pulmonary disease | 2000 | Tertiary | NA | 78 | 0.22 (0.1-0.6) |
| Influenza vaccine in persons aged 65 years old or over | 1995 | Primary | 10,674 | 50 | 0.50 (0.44-0.55) |
| PTCA in acute myocardial infarction | 1995 | Tertiary | 8,496 | 44 | 0.56 (0.33-0.94) |
| Physical activity | 2008 | Primary | 883,372 | 33 | 0.67 (0.63-0.72) |
| Tobacco smoking cessation | 2003 | Primary | 12,603 | 29 | 0.71 (0.65-0.77) |
| Cardiac resynchronization for patients with heart failure due to left ventricular systolic dysfunction | 2006 | Tertiary | 3,380 | 28 | 0.72 (0.59-0.88) |
| Beta-blockade treatment in patients with congestive heart failure | 2003 | Tertiary | 13,129 | 28 | 0.72 (0.65-0.79) |
| Screening mammography in persons aged 50 to 74 years | 1995 | Secondary | NA | 26 | 0.74 (0.66-0.83) |
| Consumption of fruit and vegetables | 2006 | Primary | 221,080 | 26 | 0.74 (0.75-0.84) |
| Church/service attendance | 2003 | Primary | 52,011 | 25 | NA |
| Active Religious involvement | 2001 | Primary | 126,000 | 22 | 0.78 (0.72-0.83) |
| Aldosterone blockade and left ventricular dysfunction | 2009 | Tertiary | 10,807 | 20 | 0.80 (0.74-0.87) |
| Religiosity/spirituality | 2009 | Primary | 4,881 | 18 | 0.82 (0.76-0.87) |
| Low-dose aspirin in the secondary prevention of cardiovascular and cerebrovascular events | 2002 | Tertiary | 6,300 | 18 | 0.82 (0.7-0.99) |
| Air bag use | 2006 | Primary | 858,741 | 17 | NA |
| Angiotensin receptor blockers in chronic heart failure | 2004 | Tertiary | 38,080 | 17 | 0.83 (0.69-1.00) |
| Colorectal cancer screening by fecal occult blood test | 2007 | Secondary | 320,000 | 16 | 0.84 (0.78-0.90) |
| Low-dose aspirin in patients with stable cardiovascular disease | 2008 | Tertiary | 9,853 | 13 | 0.87 (0.76-0.98) |
| Drug treatment of hypertension in the elderly | 1994 | Tertiary | 15,559 | 12 | 0.88 (0.80-0.97) |
| Statin therapy | 2008 | Tertiary | 121,000 | 12 | 0.88 (0.83-0.93) |
| Changes in LDL-C | 2009 | Tertiary | 155,613 | 11 | 0.89 (0.87-0.92) |
| Out-of-hospital defibrillation by basic life support providers | 1995 | Tertiary | 1,827 | 9 | 0.91 (0.87-0.95) |
| Systemic corticosteroids for acute exacerbations of chronic obstructive pulmonary disease | 2009 | Tertiary | 2,132 | NS | 0.87 (0.45-1.66) |
| Pneumococcal vaccination in adults | 2009 | Primary | 101,507 | NS | 0.97 (0.87-1.09) |
| Screening for prostate cancer | 2007 | Secondary | 55,512 | NS | 1.01 (0.80-1.29) |
| Tiotropium for stable chronic obstructive pulmonary disease | 2006 | Tertiary | 8,002 | NS | 0.96 (0.63-1.47) |
| Recombinant human activated protein C therapy in patients with sepsis | 2005 | Tertiary | 4,329 | NS | 0.92 (0.83-1.02) |
| Intensive insulin therapy and mortality among critically ill patients | 2009 | Tertiary | 13,567 | NS | 0.93 (0.83-1.04) |

CI, confidence interval; NA, not available; NS, no significant effect on mortality; PTCA, Percutaneous transluminal coronary angioplasty; LDL-C, low-density lipoprotein cholesterol. The bold items are systematic reviews regarding spirituality/religiosity and mortality.
like defibrillation by basic emergency medical technicians,\textsuperscript{20} re-
combinant human activated protein C therapy in patients with sepsis,\textsuperscript{21} ti-
tropium for stable chronic obstructive pulmonary disease,\textsuperscript{22} statin therapy,\textsuperscript{15} and air bag use\textsuperscript{24} have less impact on mortality than S/R.

Considering that some of McCullough’s critics have observed that religious attendance is most analogous to primary prevention strategies, and this author compared it with some secondary prevention therapies such as postcardiac exercise rehabilitation, we decided to subdivide our health outcome interventions into different levels. While comparing to other primary prevention strategies, religious attendance had less impact on mortality than influenza vaccine in persons aged 65 years old or over\textsuperscript{25} and physical activity.\textsuperscript{26} Similar results were found for fruit and vegetables,\textsuperscript{18} and better results were obtained when compared with pneumococcal vaccination in adults\textsuperscript{27} and air bag use.\textsuperscript{24}

The results of our systematic review shows that the impact of S/R on mortality is similar to many other health interventions, whether primary, secondary, or tertiary prevention strategies. In addition, it seems that the impact is greater than many health interventions recommended today.

Limitations
Our results should be interpreted with caution. Despite the sug-
gestion that S/R may play an important role in delaying mortal-
ty, there is no evidence that changing religious attendance or level of spirituality causes a change in health outcomes. The data provided here that support an association between S/R and mor-
tality are derived entirely from prospective, observation epide-
miologic studies and not interventional studies. In addition, the present study selected only meta-analysis from high-impact jour-
nals. Thus, we don’t know if the results could have changed if studies from all impact journals were selected.

Furthermore, S/R is an intrinsic characteristic of a person and involves more than just religious attendance or religious affilia-
tion. According to Koenig,' spirituality is the personal quest for understanding answers to ultimate questions about life, about meaning, and about relationship to the sacred or transcendent, which may (or may not) lead to or arise from the development of religious rituals and the formation of community.

However, most of the data examined here come from subdi-
visions of epidemiological studies that accessed religious attend-
dance or religious activities regardless of level of spirituality. More studies measuring spirituality levels, with reliable and valid spirituality scales, are necessary in further studies.

Despite these limitations, our results suggest that S/R may play a significant role in delaying mortality, similar to that of other widely accepted health interventions such as consumption of fruit and vegetables and statin therapy. Since taking a spiritual history is a simple procedure, demands little time, and may have an important impact on some health outcomes including mort-
tality,\textsuperscript{56} we believe that it’s reasonable to address this aspect as part of routine patient care.

Acknowledgment
We thank the NUPAME, the research group from the São Paulo Spiritist Medical Association in Brazil, for the support of this publication.

REFERENCES
2. McCullough ME, Hoyt WT, Larson DB, et al. Religious involve-
4. McCullough ME, Hoyt WT, Larson DB. Small, robust, and important: reply to Sloan and Bagiella. Health Psychol. 2001;20:228-
229.
6. Powell LH, Shahabi L, Thoresen CE. Religion and spirituality. Link-
7. Chida Y, Steptoe A, Powell LH. Religion/spirituality and mor-
tality. A systematic quantitative review. Psychother Psychosom. 2009;78:
81-90.
including NICE-SUGAR study data. CMAJ. 2009;180:821-
825.
9. Keenan SP, Gregor J, Sibbald WJ, et al. Noninvasive positive pressure ventilation in the setting of severe, acute exacerbations of chronic obstructive pulmonary disease: more effective and less ex-
285.
roids for acute exacerbations of chronic obstructive pulmonary dis-
362.
2202.
121:24-33.
16. Ezekewitz JA, McAlister FA. Aldosterone blockade and left ventricu-
17. Critchley JA, Capewell S. Mortality risk reduction associated with smoking cessation in patients with coronary heart disease. A system-
18. Dauchet L, Amouyel P, Hercberg S, et al. Fruit and vegetable con-
20. Auble TE, Menegazzi JJ, Paris PM. Effect of out-of-hospital defibril-
lation by basic life support providers on cardiac arrest mortality: a meta-analy-