A state level investigation of the associations among intellectual capital, religiosity and reproductive health

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Abstract

The current study examines the degree to which state intellectual capital, state religiosity and reproductive health form a meaningful nexus of ecological relations. Though the specific magnitude of effects vary across outcomes, results from hierarchical regression analyses were consistent with the hypothesized path model indicating that a state's intellectual capital (as indicated by average state IQ and graduation rates at various levels) has a positive overall effect on state reproductive health statistics, whereas state religiosity generally has a negative impact. Specifically, both IQ and education were positively associated with breastfeeding rates, immunization rates, and rates of mammography screening, and negatively associated with teen fertility rates and infant mortality rates. Additionally, results confirm that education rates partially mediate the influence of IQ onto religiosity, and both education and religiosity partially or fully mediate the relation between IQ and state health (depending on specific outcome measure). The current results are consistent with a growing interdisciplinary literature establishing that individual, state and national well-being is substantially related to general mental ability and its covariates.

Keywords:
State IQ
Religiosity
State health
Reproductive health
g-nexus

There appears to be a substantial basis for considering intelligence, health, and religion as a cohesive, unified network worthy of scientific investigation. For example, the science of mental abilities has amassed evidence documenting that g has important associations with academic and educational outcomes (Benbow & Stanley, 1996; Kuncel, Hezlett, & Ones, 2004), income and poverty (Hunt, 1995, Murray, 1998), physical health (Gottfredson, 2004) and psychological well-being (Lubinski & Benbow, 2000). Simultaneously, a literature has emerged in sociology and health psychology linking religion and health-related behavior (Miller & Thoresen, 2003). Finally, there is a long, though often not publicized, history of research documenting a negative correlation between intelligence and religiosity (chronologically; e.g., Howells, 1928; Argyle, 1958; Larson & Witham, 1998; Nyborg, 2009; Bertsch & Pesta, 2009).

Research from the emerging field of cognitive epidemiology has also shown that these individual level associations between IQ and other variables translate to analogous associations among socio-political units’ (e.g., nations, US states) and population means. For example, previous research has established that the IQ-religiosity relationship known to exist at the individual level (e.g., Bertsch & Pesta, 2009; Nyborg, 2009) transfers to the state (McDaniel, 2006) and national level (Lynn, Harvey, & Nyborg, 2009). Similarly, IQ has been shown to be related to political involvement and liberal attitudes at the individual level (Deary, Batty, & Gale, 2008; Schoon, Cheng, Gale, Batty, & Deary, 2010), as well as at the national level (Rinderman, 2008). Likewise, several studies have recently documented that IQ (a highly g-loaded measure) predicts health and mortality for individuals within and across population groups (e.g., Batty, Deary, & Gottfredson, 2007; Batty, Der, MacIntyre, & Deary, 2006; Deary, 2008; Reeve, 2009).

Unfortunately, these separate lines of inquiry have remained largely isolated until recently (cf., Reeve, 2009). The purpose of this paper is to further examine the intelligence-
religion–health nexus at the level of US states. In particular, we seek to examine the potential role of state education levels and state religiosity as mediators of the relation between average state IQ state reproductive health statistics.

1. Intelligence–health associations

Intelligence has been shown to predict a wide range of health behaviors and outcomes (e.g., see special issue of *Intelligence*, Deary, 2009). Perhaps most relevant to the current study is recent research showing that the IQ–health relation transfers to both the state (e.g., McDaniel, 2006; Reeve & Basalik, 2010) and national levels (e.g., Reeve, 2009). In particular, using data from the National Assessment of Educational Progress (NAEP) standardized tests for reading and math as an estimate of state IQ, McDaniel (2006) found a strong relationship between IQ and the United Health Foundation’s state health index score ($r = .75$). Using the same estimate of state IQ, Reeve and Basalik found that, independent of wealth and health care expenditures, state IQ was positively associated with percentage of population seeking preventative health care (e.g., colonoscopies, dental check ups and exercise rates), and inversely associated with health problems (e.g., number of deaths due to AIDS, heart disease rates and obesity rates). Similarly, Kanazawa (2006, 2008) found that compared to other factors proposed to explain differences in health and longevity between societies (e.g., the degree of economic inequality), higher levels of intelligence was shown to be a stronger indicator of health.

2. Intelligence–religiosity associations

The existence of a negative relationship between intelligence and religiosity at both the individual and group level is well established (e.g., Howells, 1928; Kanazawa, 2010; Lynn et al., 2009; Nyborg, 2009; Reeve, 2009; Sinclair, 1928). Nyborg (2009) suggests that this cognitive stratification occurs because people gravitate towards belief systems that provide a match with their level of cognitive complexity. Similarly, it has been hypothesized that lower IQ individuals are less likely to have the capacity for critical abstract thought and thus subscribe to religious orthodoxy as a means to find “uncontested and uncontestable answers” (Bertsch & Pesta, 2009). Consistent with this, evidence shows that religious affiliations are stratified by IQ, and this stratification corresponds to the degree of religious orthodoxy and dogmatism (Nyborg, 2009). Likewise, Bertsch and Pesta (2009) found that information processing ability was negatively associated with literal acceptance of religious scriptures and sectarianism, and positively related to religious questioning. Evolutionary psychology makes a similar prediction. Most notably, Kanazawa’s (2010) Savanna–IQ Interaction Hypothesis predicts that intelligence will be associated with the adoption of evolutionarily novel values and beliefs that are arguably more effective in the modern environment. As such, he argues that the adoption of atheism – the lack of belief in a supernatural force behind natural phenomena – is likely indicative of the appreciation of scientific explanations of the natural world.

It has been hypothesized that much of the influence of intelligence on religious beliefs functions via increased educational achievement (e.g., Dawkins, 2006; Nyborg, 2009). That is, at the individual level, IQ may be inversely related to religiosity to the extent it confers the ability to profit from and attain higher levels of education. In turn, education enhances rational thinking and provides people with rational, non-mystical mechanisms for understanding the world. In short, education provides people with the opportunity to seek a rational alternative to religious dogma. Thus, in aggregate, populations with higher average IQ are likely to gravitate away from religious social conventions and towards more rational or liberal socio-political systems conferred by the higher (average) educational achievement of that population. In contrast, populations with deficient education levels are likely to adhere to social systems that provide scripted and easily comprehended belief systems that act as a substitute for a rational, scientific (and often cognitively complex) meaning system. It is in this sense that education likely confers IQ’s (negative) influence on religiosity.

3. Religiosity–health associations

Several reviews of the psychological literature have purported to show evidence for the health benefits of religion (e.g., Benson, 1996; Ellison & Levin, 1998). The predominant hypotheses regarding the positive influence of religion on psychological and physical health include an enhanced sense of meaning in life, increased social support, body sanctification, and proscriptions against certain behaviors that convey health risks (e.g., alcohol use) (see Park, 2007, for a review). However, numerous health researchers have cautioned that the presumed positive impact of religion is either unwarranted (e.g., Sloan, Bagiella, & Powell, 1999) or at least premature (Powell, Shahabi, & Thoresen, 2003). Indeed, Reeve (2009) reviewed several studies which show negative effects of religiosity on health and health care utilization, particularly with respect to women’s health issues (e.g., Azaiha & Cohen, 2006; Bahar et al., 2005; Gyimah, Takyi, & Addai, 2006).

Just as other individual level relations have transferred upward, state and national religiosity levels appear to be related to population health outcomes, especially those related to women’s health issues. Reeve (2009) found that across a sample of 192 nations, national belief rates were inversely related to national health indicators (in particular, reproductive health). Specifically, belief in God was positively associated with high fertility rates, infant mortality, and maternal mortality. Similarly, Medoff and Skov (1992) found that birth rates across the 50 U.S. states were associated with the percentage of the state’s population subscribing to any fundamentalist religion denomination. Strayhorn and Strayhorn (2009) found that teen birth rates increased as state religiosity increased, and that this relation held after controlling for income and abortion rates.

Consistent with g-theory based explanations for the intelligence–religiosity relation and (e.g., Nyborg, 2009) and intelligence–health relations (e.g. Gottfredson, 2004), Park (2007) postulated that religion may provide a “comprehensive meaning system” through which individuals interpret, evaluate and respond to the world. It has therefore been suggested (e.g., Reeve, 2009) that religion can influence health-related behavior via the provision of alternate, less complex but also less rational cognitive framework than a more health literate based framework conferred by acceptance of an atheistic, scientific
based framework. In addition to the effect on individual health behavior, it has been noted that over the last few decades, and in particular during the George W. Bush administration, religious doctrine has increasingly influenced social policies and social health care initiatives (di Mauro & Joffe, 2007). In this sense, religion can influence the health and behavior of even those who do not subscribe to certain beliefs but simply live in a religious community. For example, Kohler, Manhart, and Lafferty (2008) found that comprehensive sex education programs had a significant effect on teen pregnancy rates (reducing the rate), whereas abstinence-only sex education programs did not have any effect and were effectively the same as no education. Thus, national or state level politics (which are often influence by religious beliefs in parts of the U.S.) can have a direct influence on state health issues.

4. Current study

The goals of this study are to (a) examine the degree to which variability in socio-political units’ intellectual resources (in this case, US states) is related to variability in religiosity across those units; in particular, to examine the degree to which education rates mediate the state IQ state religiosity relation, and (b) to investigate the degree to which intellectual resources and religiosity of states correspond to state level reproductive health indicators. Although there are several recent reports of IQ and health relations at the state level, to our knowledge, none have attempted to examine the potential mediation roles of education and religiosity. Our hypotheses are diagramed in Fig. 1. First, we expect that state IQ and state religiosity will be inversely related (Hypothesis 1), and that education level will partially mediate that relation (Hypothesis 2). Second, we expect that education and religiosity will mediate the influence of state IQ on state reproductive health (Hypotheses 3 and 4, respectively).

5. Measurements

5.1. State average IQ

IQ estimates are from McDaniel (2006). State IQ was estimated from the Grade 4 and Grade 8 results of the NAEP standardized tests for reading and math from 1990 to 2005. This distribution of each test in each year was standardized to have a mean of 100 and a standard deviation of 15. This standardization places the scores of each test on the typical metric for IQ tests. State IQ was then defined as the average of these standardized mean reading and math scores \( M = 100.3 \), \( SD = 2.78 \). The alpha estimate of reliability for the IQ estimate was reported by McDaniel (2006) to be .99.

5.2. Educational achievement

Three measures of educational attainment were available for each state; a) percent of population graduating high school (HS grad rates), b) percent of population obtaining a bachelor’s degree (Bach rates), and c) percent of population obtaining a graduate level degree (post-bach rates).

5.3. State religiosity

State religiosity data came from Pesta, McDaniel, and Bertsch (2010) who used the results of the Pew U.S. Religious Landscapes Survey, published by the Pew Forum on Religion and Public Life (2008). The state religiosity composite reflects conservative or fundamentalist views, and was based on the first principal component extracted from the following seven items: (1) “I am certain God exists,” (2) “Religion is very important to me,” (3) “I attend church at least once per week,” (4) “I pray daily,” (5) “My prayers are answered at least monthly,” (6) “My holy book is literally true,” and (7) “Mine is the one true faith.” Item scores for each state were the percentage of survey respondents in each state who agreed with each statement.

5.4. Positive health indicators

Breast feeding rate is the percentage of children ever breastfed among children born in 2005. Data were collected by the CDC and were obtained from Statehealthfacts.org. Based on meta-analytic evidence (e.g., Horta, Bahl, Martines, & Victora, 2007), it is the official position of the CDC, WHO, American Academy of Pediatrics, the US Surgeon General, and US Dept of Health & Human Services that breastfeeding has multiple positive benefits to infants and mothers. According the US Surgeon General, more than 50 national health professional, educational, and other nonprofit organizations, as well as federal government agencies, participate in the United States Breastfeeding Committee, whose mission is “to improve the nation’s health by working collaboratively to protect, promote, and support breastfeeding” (Galson, 2009).

Fig. 1. Diagram of hypothesized relations (letters included to identify each path in corresponding analyses).
Immunization rate reflects the percentage of children aged 19 to 35 months who are immunized. Data were collected in the 2007 National Immunization Survey conducted by the CDC and were obtained from Statehealthfacts.org.

Mammogram rate is the percentage of women aged 40 years or more in a non-institutionalized civilian population who reported having had a mammogram within the past two years. Data for mammogram rates were collected by the CDC via the Behavioral Risk Factor Surveillance System Survey in 2006 and were obtained from Statehealthfacts.org.

5.5. Negative health indicators

Total fertility rate is the number of live births per 1000 of population. Data for total fertility rates were collected by the CDC and were obtained from Statehealthfacts.org. Most recent data available for all states was for the year 2003.

Teen fertility rate reflects the number of births per 1000 teens aged 15 to 19 years. Data for teen fertility rates were collected by the CDC and were obtained from Statehealthfacts.org. Most recent data available was for the year 2003.

Infant mortality rate reflects the number of deaths of infants (i.e., children under one year of age) per 1000 live births. Data for infant mortality rates for the year 2002 were collected by the CDC and were obtained from Statemaster.org.

6. Results

Table 1 displays each state’s value on the outcome measures as well as their relative rank. Descriptive statistics and zero-order correlations are shown in Table 2. Consistent with the hypothesized relations, state IQ is significantly correlated with all of the health indicators in the expected directions; it is positively correlated with all three positive indicators of state reproductive health issues and is negatively correlated with all three state reproductive health problems. Second, all three indicators of state educational levels show the same pattern of relations with the health statistics as did IQ. Third, as expected, state religiosity shows the opposite pattern, having negative correlations with all three positive indicators of state reproductive health and having positive relations all three health problems.

We used hierarchical multiple regression to test the hypothesized model following the procedures described by Cohen, Cohen, West, and Aiken (2003). Accordingly, the direct effect of IQ on education is estimated as $b_{IQEd}$, the direct effect of IQ on religiosity is estimated as $b_{IQRel}$, and the direct effect of education on religiosity is estimated as $b_{EdRel}$. (This portion of the analysis is sufficient to test our initial hypothesis that education partially mediates the effect of IQ on religiosity.) Although our model hypothesizes that IQ’s effect on health will be fully mediated, the complete assessment of this model requires testing for direct effects as well. Thus, the direct effect of IQ on health is estimated as $b_{IQHealth}$, the direct effect of education on health is estimated as $b_{EdHealth}$, and the effect of religiosity on health is estimated as $b_{RelHealth}$. The indirect effects of any variable on health may be determined by the cumulative product of the coefficients leading from the causal variable (e.g., IQ) through other causes (e.g., education and religiosity). The total effects are simply the sum of the causal variable’s direct and indirect effects. In addition, the amount that an endogenous variable is related to an outcome can be assessed as the difference between its zero-order effect (i.e., its bivariate regression coefficient) and its total effect. All of the standardized path coefficients are shown in Table 3 (An alternative table showing unstandardized coefficients is available from the first author but is not shown here for space considerations). To assist with interpretation of Table 3, we have also displayed the individual path coefficients for one of the models (using college graduation rate as the education indicator) with all three of the positive health indicators shown (see Fig. 2). Table 4 provides the summary of direct, indirect, total, and spurious effects for each variable in each version of the model.

Hypothesis 1 indicated that IQ would have a direct negative influence on religiosity. This is confirmed by the estimates of path c as shown in Table 3. The estimate of the direct effect on religiosity (path c) varies somewhat depending on which indicator of education is being used, but all three estimates show a significant direct unique effect for IQ. The total effect of IQ on religiosity can be computed by adding path c to the product of path a and path b, which results in an estimate of $-0.56$, further supporting hypothesis 1.

The results in Table 3 also show that education – measured as college graduation rates and post-bachelor graduation rates – has a significant (negative) direct unique influence on religiosity (path b). For example, for each additional 1% of the state population that has a post-bachelors degree, state religiosity decreases by almost 3 points ($b = -2.82; \beta = -0.45$). The results also show that education partially mediates the relation between IQ and religiosity. Consistent with the model of partial mediation, there is a significant direct effect of IQ on education (path a), education in turn conveys a significant portion of IQ’s influence on religiosity; however, the direct effect of IQ (path c) remains significant as well. Specifically, the indirect effect of IQ on religiosity is $-0.10$ (18.2% of its total effect) when using high school graduate rates as the indicator of educational attainment, $-0.22$ (40% of its total effect) when using college graduation rates, and $-0.12$ (21.8%) when using post-bachelor degree attainment rates. Thus IQ’s direct effect on religiosity accounts for 60% to 71.8% of its total effect, depending on which mediator variable is included. Thus, there is mediation by education, but only partial mediation.

Hypothesis 3 and 4 stated that education would have a positive impact on state health, that religiosity would have a negative impact on state health, and that these would mediate the relation between IQ state health. Table 4 shows the estimated direct, indirect, total and spurious effects for each of the three antecedent variables. Consistent with expectations, education does have a positive impact on state reproductive health indicators. Again, the precise magnitude of its effects varies by education level, but the pattern of results is consistent across all three levels. Education generally has a positive association with the three positive indicators, and a negative association with the three negative indicators, though some of the effects are also essentially nil. The largest and most consistent effects (across the three levels) occur with breastfeeding rates and teen fertility. Higher rates of educational achievement correspond to higher rates of breastfeeding and lower rates of teen fertility across the U.S. states. Post-high school education rates appear to have a stronger effect on...
immunization rates, mammography rates and (lowered) infant mortality rates.

Also consistent with expectations, state religiosity level appears to have a generally negative direct unique effect on state health. Religiosity appears to reduce breastfeeding rates and mammography rates, and increases all three of the health problems. The effects on the negative health indicators are most consistent as religiosity's direct unique influence on these four health statistics (see path e in Table 3) was statistically significant regardless of which indicator of education was partialled out.

The question of whether IQ's effects on health are mediated by education and religiosity can be evaluated by examining the effects associated with IQ listed in Table 4.

Because IQ is the exogenous variable there is no spurious effect and thus its total effect can be divided between its direct effect (path f) and the sum of the indirect effects via education (path a×path d + path a×path b×path e) and religiosity (path c×path e). These results suggest that the specific way in which state IQ is related to state health is more complex than would be suggested by zero-order relations. First, IQ only has a statistically significant direct unique effect on teen fertility. In the traditional model of mediation testing, this would indicate that full mediation is a tenable conclusion with respect to the other outcomes (i.e., IQ's total, or zero-order, effect is significant but its direct effect is non-significant). Of course, in the current context one must pay attention to issues of statistical power due to the small
The purpose of this study was to examine the degree to which state IQ, state religiosity and reproductive health form a meaningful nexus of relations. Though the specific results vary across outcomes, overall the pattern of results were generally consistent with the hypothesized path model. First, the results confirm that a state’s intellectual capital (as indicated by average state IQ and graduation rates at various levels) has a positive overall effect on state reproductive health statistics. Specifically, both IQ and education were positively associated with breastfeeding rates, immunization rates, and rates of mammography screening, and negatively associated with high fertility rates, teen fertility rates, and infant mortality rates. In contrast, the results confirm that state religiosity has a negative impact on state reproductive health. Specifically, state religiosity has a significant direct effect on fertility rates, teen fertility rates, and infant mortality rates (i.e., higher religiosity is associated higher rates of fertility and mortality), and a significant negative effect on breastfeeding rates. Moreover, the results are consistent with the model that posits educational rates acting to partially mediate the (negative) relation between state IQ and state religiosity, and that both education and religiosity act to mediate (varying amounts of) IQ’s influence on reproductive health outcomes. That is, our results are consistent with a model positing that an increased state intellectual capital can act as a significant protective factor against negative health outcomes, and a facilitative factor for positive health outcomes. For example, we found that average state IQ has a major impact on teen fertility (higher IQ leads to lower teen fertility) due in part to a significant direct effect, in part to its significant positive influence on state educational attainment, and in part to its significant negative effect on state level religiosity (which has positive association with teen fertility).

However, we also found more complex effects, in particular for the outcome of overall fertility. We found evidence of inconsistent mediation, meaning that the total effect of education on fertility is less than its direct effect. With the effect of IQ removed, education levels appear to have a positive direct association with overall fertility (in contrast to its zero-order correlation), yet has a negative influence via the reduction in religiosity. Results such as these suggest that more research is needed to better disentangle the specific effects of state intellectual capital on certain aspects of state health outcomes In particular, it is necessary to better understand how (i.e., via what mechanisms) state education levels come to influence state health outcomes.

With respect to infant mortality, our results suggest that religiosity is the focal variable. Across all analyses (using three different indicators of education), only religiosity had significant direct effects (higher religiosity leading to higher infant mortality rates). Neither IQ nor education had practically or statistically significant direct effects. Moreover, Table 4 shows that for this outcome, the majority of both IQ’s and education’s indirect effect functions via (lowered) religiosity. For example, between 39% and 57% of IQ’s total effect on infant mortality is conveyed via its direct impact on religiosity, and essentially all of education’s effect is attributed to its indirect effect via its ameliorative impact on religiosity.

Taken as a whole, the results are consistent with our suggestion that IQ, education, and religiosity form a cohesive and meaningful nexus, if viewed from the perspective of the

### Table 2

Descriptive statistics and zero-order correlations among state level variables.

<table>
<thead>
<tr>
<th>Variables</th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
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</thead>
<tbody>
<tr>
<td>1. State IQ</td>
<td>100.34</td>
<td>2.78</td>
<td>1</td>
<td>1</td>
<td>2.36</td>
<td>.39</td>
<td>.51</td>
<td>.37</td>
<td>.19</td>
<td>.05</td>
<td>.36</td>
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<tr>
<td>2. Grad HS</td>
<td>84.52</td>
<td>3.85</td>
<td>.63</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>.42</td>
<td>.37</td>
<td>.36</td>
<td>.24</td>
<td>.39</td>
<td></td>
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<tr>
<td>4. Post-bach</td>
<td>9.30</td>
<td>2.38</td>
<td>.27</td>
<td>.29</td>
<td>.89</td>
<td>1</td>
<td>1</td>
<td>.39</td>
<td>.37</td>
<td>.36</td>
<td>.24</td>
<td>.39</td>
</tr>
<tr>
<td>5. Religiosity</td>
<td>100.00</td>
<td>15.00</td>
<td>.55</td>
<td>.45</td>
<td>.55</td>
<td>.54</td>
<td>1</td>
<td>1</td>
<td>.39</td>
<td>.37</td>
<td>.36</td>
<td>.24</td>
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<td>6. Breastfeeding</td>
<td>72.54</td>
<td>10.38</td>
<td>.33</td>
<td>.48</td>
<td>.57</td>
<td>.36</td>
<td>.53</td>
<td>1</td>
<td>1</td>
<td>.39</td>
<td>.37</td>
<td>.36</td>
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<td>7. Immunization</td>
<td>80.38</td>
<td>4.51</td>
<td>.20</td>
<td>.23</td>
<td>.42</td>
<td>.40</td>
<td>.15</td>
<td>.08</td>
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<td>1</td>
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<td>8. Mammograms</td>
<td>75.82</td>
<td>4.46</td>
<td>.24</td>
<td>.16</td>
<td>.48</td>
<td>.52</td>
<td>.47</td>
<td>.04</td>
<td>.46</td>
<td>1</td>
<td>1</td>
<td>.39</td>
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<tr>
<td>9. Fertility</td>
<td>13.81</td>
<td>1.73</td>
<td>.34</td>
<td>.10</td>
<td>.09</td>
<td>.18</td>
<td>.42</td>
<td>.29</td>
<td>.19</td>
<td>.51</td>
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<td>1</td>
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<tr>
<td>10. Teen fertility</td>
<td>40.30</td>
<td>11.88</td>
<td>.77</td>
<td>.63</td>
<td>.64</td>
<td>.49</td>
<td>.73</td>
<td>.37</td>
<td>.37</td>
<td>.51</td>
<td>.47</td>
<td>1</td>
</tr>
<tr>
<td>11. Infant mort.</td>
<td>6.99</td>
<td>1.51</td>
<td>.54</td>
<td>.39</td>
<td>.54</td>
<td>.41</td>
<td>.77</td>
<td>.70</td>
<td>.04</td>
<td>.20</td>
<td>.06</td>
<td>.62</td>
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</table>

Note. N = 50. Correlations larger than |.24| are significant at p < .10; |.28| at p < .05; |.36| at p < .01.
Table 3.

<table>
<thead>
<tr>
<th>Health indicator</th>
<th>H.S grad rates as education indicator</th>
<th>Bach rates as education indicator</th>
<th>Post-bach rates as education indicator</th>
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<tr>
<td>Path coefficient</td>
<td>BF</td>
<td>Imm</td>
<td>TF</td>
</tr>
<tr>
<td>a. IQ to Edu</td>
<td>0.63</td>
<td>0.63</td>
<td>0.63</td>
</tr>
<tr>
<td>b. IQ to Educ</td>
<td>0.48</td>
<td>0.33</td>
<td>0.33</td>
</tr>
<tr>
<td>c. IQ to relig</td>
<td>0.48</td>
<td>0.33</td>
<td>0.33</td>
</tr>
<tr>
<td>d. IQ to relig</td>
<td>0.48</td>
<td>0.33</td>
<td>0.33</td>
</tr>
<tr>
<td>e. IQ to health</td>
<td>0.48</td>
<td>0.33</td>
<td>0.33</td>
</tr>
<tr>
<td>f. IQ to health</td>
<td>0.48</td>
<td>0.33</td>
<td>0.33</td>
</tr>
</tbody>
</table>

Note: N = 50. BF = Breastfeeding; Iimm = Immunizations; Mam = Mammograms; FR = Fertility Rate; TF = Teen fertility; IM = Infant Mortality. Path letters shown in Fig. 1.

In such environments, high-g affords success, self-esteem, and effective rational decision making, whereas low-g places people at risk for failure, frustration, confusion, and reliance on mystical thinking. Thus, high-g people are better equipped to construct a complex cognitive framework consistent with a rational world, and make post-conventional moral decisions. In contrast, lower-g people are likely to find the world frustratingly complex, and thus are more likely to gravitate towards social systems that provide scripted and easily comprehended belief systems. It is within this same framework that Gottfredson (2004) makes her arguments regarding the relation between intelligence and health. As she makes salient, self-maintenance of health is a cognitively complex “job.” High-g affords effective decision making and avoidance of health risks (i.e., IQ affords health literacy), where as low-g places individuals at risk of failing to understand the health consequences of behavior. Thus, for lower-g individuals, religion may provide a partially effective substitute. To the extent that religion provides pathways for enhanced health — such as increased sense of meaning, positive affect, body sanctification, social support or direct prescriptions or proscriptions on behavior (e.g., taboos on alcohol, sexual activity outside of marriage) — religiosity may in fact enhance health. However, these religious or dogmatic belief systems may also convey negative effects, especially to the extent they prohibit or discourage rational thinking regarding health care. For example, some denominations place strong social prohibitions on use of condoms which increase the likelihood of sexually transmitted diseases and an increased fertility rate. Some religious belief systems may prevent women from seeking education or medical care with respect to reproductive health (e.g., Azaiza & Cohen, 2006).

In that respect, our results are consistent with the proposition that higher IQ groups (in this case, the population of U.S. states) are more likely to use a rational, scientific cognitive framework and draw upon a store of acculturated knowledge and cognitive skills acquired in educational settings when it comes to making both personal and public health decisions. In contrast, lower IQ groups appear more likely to gravitate towards social systems that provide structured and simple belief systems to simplify their world. In these cases, as our results show, state religiosity appears to convey a negative influence on some aspects of reproductive health. States with low IQ tend to also be relatively undereducated and more religious, and these factors combine to produce worse health outcomes, such as high teen fertility rates.

Though our study could not investigate the specific reasons for these relations, one can make reasonable hypotheses. For example, low average IQ suggests that part of the problem may be attributable to an increased proportion of the state population with limited ability to comprehend information regarding reproductive health, risks of sexual behavior, and contraceptives (i.e., lower health literacy). Similarly, our results are consistent with research at the individual level showing a negative association between g
and religiosity (Bertsch & Pesta, 2009), and a positive association with liberal or progressive social attitudes and leftist political orientations which appears to be partly mediated by education (e.g., Deary et al., 2008; Schoon et al., 2010). Given research showing a negative association with liberal or progressive social attitudes and leftist political orientations which appears to be partly mediated by education (e.g., Deary et al., 2008; Schoon et al., 2010), it is reasonable to hypothesize that lower IQ states are likely to suffer higher rates of teen fertility due to an unwillingness to provide effective sex education, access to contraception methods, and abortion services due in part to their reliance on religious and conservative social attitudes rather than health literacy. Additionally, it is noted that our results based on U.S. states is consistent with previous findings in other countries. For example, Bahar et al. (2005) found that, among Islamic Turkish women, increased levels of education were associated with the rejection of traditional (i.e., fundamentalist) religious beliefs and increased likelihood to use family planning and medical services. Thus, our results serve to confirm and extend these relations among different populations with different predominant religious affiliations.

Critically, it should be noted that these are ‘ecological inferences,’ that is, inferences about individual behavior drawn from data about aggregates. A key concern of course is engaging in the “ecological fallacy” which refers to thinking that relationships observed for groups necessarily hold for individuals (Robinson, 1950). To some degree (though certainly not entirely) this concern is ameliorated because prior research has shown similar relations at the individual (e.g., Gottfredson, 2004; Nyborg, 2009). It is also important to interpret these results from epidemiological perspective. For example, although more religious states might initially be identified as high-risk groups for certain health concerns, the current results suggest that the underlying risk factor might be the non-rational or unscientific decision making conferred by adherence to strong religious orthodoxy among low IQ groups (whereas high IQ groups may be more flexible in their thinking and decision making regarding health issues). Indeed, it is exceedingly unlikely that low IQ or a high degree

Table 4
Standardized direct, indirect and total effects on state reproductive health indicators from model.

<table>
<thead>
<tr>
<th></th>
<th>HS grad rates as education indicator</th>
<th>Bach rates as education indicator</th>
<th>Post-bach rates as education indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BF</td>
<td>Imm</td>
<td>Mam</td>
</tr>
<tr>
<td>Effects</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>State IQ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct</td>
<td>-.17</td>
<td>.08</td>
<td>.02</td>
</tr>
<tr>
<td>Indirect via educ.</td>
<td>.29</td>
<td>.11</td>
<td>.00</td>
</tr>
<tr>
<td>Indirect via relig.</td>
<td>.21</td>
<td>.01</td>
<td>.23</td>
</tr>
<tr>
<td>Total Effect</td>
<td>.33</td>
<td>.20</td>
<td>.25</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct</td>
<td>.38</td>
<td>.17</td>
<td>-.08</td>
</tr>
<tr>
<td>Indirect via educ.</td>
<td>.08</td>
<td>.01</td>
<td>.09</td>
</tr>
<tr>
<td>Indirect via relig.</td>
<td>.46</td>
<td>.18</td>
<td>.01</td>
</tr>
<tr>
<td>Total Effect</td>
<td>.62</td>
<td>.05</td>
<td>.16</td>
</tr>
<tr>
<td>Spurious effect</td>
<td></td>
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<tr>
<td>Religiosity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct</td>
<td>-.46</td>
<td>-.03</td>
<td>-.50</td>
</tr>
<tr>
<td>Spurious effect</td>
<td>-.08</td>
<td>-.12</td>
<td>.03</td>
</tr>
</tbody>
</table>

Note. N = 50. BF = Breastfeeding; Imm = Immunizations; Mam = Mammograms; FR = Fertility Rate; TF = Teen fertility; IM = Infant Mortality. Spurious effect reflects difference between the variable’s zero-order effect and its estimated total effect in the model.
of spirituality directly confers health risks by making people more susceptible. Rather, it is likely that low IQ or strong religious conviction leads social groups to make poor health-related decisions (e.g., reduced health education in schools, limited access to family planning services, limited publicly funded health care), perhaps due to a failure to understand the actual consequences of those decisions, or the unwillingness to provide public access to services seen as antithetical to their religious beliefs. Future research needs to examine the degree to which other known risk factors and correlates of these and other health outcomes are associated with or accounted for by differences in intelligence and belief systems. For example, it has been noted that a host of factors are associated with teen pregnancy rates (e.g., household income, rural vs. urban settings; Kohler et al., 2008).

Additionally, it is important to consider that this study does have certain limitations and weaknesses. First, it should not be forgotten that the current data are at the level of states and our results are based on ecological correlations. Though many state health statistics are a direct consequence of the aggregate individual level behavior, one cannot and should not necessarily extend inferences back to the individual level; assuming they do is a classical example of the ecological fallacy (Robinson, 1950). Relations that exist at the group level do not necessarily exist at the individual level. Second, when analyzing aggregate level data, one must use caution in terms of making inferences that the aggregate mean differences reflect the same construct variance as the individual level measures on which they are based. For example, it is possible for mean state IQ values to shift for a number of reasons that are independent of changes at the individual level. Likewise, while differences in the distributions of ability or achievement scores across populations certainly have important implications, it is not always clear that those mean differences reflect the same source of variation as do individual differences.

Third, the current results are only consistent with the hypothesized path model; the data do not directly support inferences of causality. At a minimum, the data not meet the requirement of temporal sequence necessary for causal conclusions; correlations from cross-sectional data cannot, by themselves, prove causal hypotheses. It is possible that poor state reproductive health confers a negative impact on state intellectual capital rather than the reverse (e.g., teen parents might be less likely to pursue higher education as a result of familial responsibilities or increased economic hardship; poor infant health may lead to cognitive declines in development, etc.). Likewise, one might argue that higher state educational rates confer increases in state IQ (e.g., highly educated parents provide enhanced cognitive development opportunities for children; high education rates increase likelihood of technology based economy which might attract high IQ individuals from other states, etc.). Additional research is needed to make strong causal inferences, and to better elucidate the specific mediating mechanisms responsible for the IQ-health relationship.

Most likely the causal influences among IQ, religiosity and health are multiple and perhaps reciprocal. However, the point here is that failing to understand that some of the influence on state health is associated with a state’s intellectual capital, and inversely related to its religiosity, would result in less effective interventions than otherwise possible. For example, the results of this study would substantiate the importance of interventions targeted at enhancing basic cognitive skills, rational decision making and health literacy. Likewise, the negative association between religiosity and various types of health-related outcomes which have been documented here and elsewhere (e.g. Pesta et al., 2010) disprove the suggestion that societal well-being is linked positively to the adherence to religious beliefs as has been suggested by some (e.g., Family Research Council, 2010). Indeed, the pattern of effects observed here suggests that the degree of religiosity may not just be irrelevant, but may in fact have a detrimental impact on societal well-being. Evidence that states with low religiosity appear better able to achieve higher levels of well-being (see our current results as well as Pesta et al., 2010) may suggest that policymakers need to reconsider how they deal with the root causes of such problems. To be maximally effective, social interventions must be based on credible and accurate information regarding the factors that cause and maintain disparities and gradients in the outcomes deemed important by society and certainly should not promote those factors that are negatively associated with state health. It is for this reason that we believe the finding of substantive relations between state IQ, religiosity, and state reproductive health, though perhaps unsettling for some, should not be ignored. We believe the investigation of such effects is warranted given the potentially important social policy implications.

References


Reeve, C. L. (2009). Expanding the g-nexus: Further evidence regarding the relations among national IQ, religiosity and national health outcomes. *Intelligence*, 37, 495–505.


