Expanding the g-nexus: Further evidence regarding the relations among national IQ, religiosity and national health outcomes

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Abstract

The current study seeks to better understand how religiosity and health are positioned within the g-nexus. Specifically, the degree to which differences in average IQ across nations is associated with differences in national religiosity (i.e., belief rate) and national health statistics independent of differences in national wealth is examined. Consistent with expectations, results show that, independent of national wealth and belief rate, IQ has a positive influence on national health as indicated by fertility rate, infant mortality rate, maternal mortality rate, and deaths due to HIV/AIDS, and life expectancy. Additionally, as hypothesized, IQ and belief rate interacted to influence reproductive health (i.e., fertility rate, infant- and maternal mortality). Specifically, high IQ acts as a buffer against the negative effects of belief rate; when IQ is high belief rate has no effect, but when IQ is low belief rate has a strong negative effect. The pattern of findings from this study, combined with previous research, serve to confirm that general cognitive ability (i.e., the g-factor) is an important and central node within a larger nexus of psychological and social variables. Theoretical and epidemiological implications are discussed.

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Over 100 years ago, Spearman (1904) posited the existence of a general mental ability construct, or ‘g’ based on what he termed the “law of the universal unity of the intellectual function.” As Spearman defined it (p. 273), this law stated that diverse forms of intellectual activity and indicators would be correlated to the degree that each is saturated with a common fundamental factor. Indeed, Spearman postulated that this “fundamental factor” would reappear in virtually all life functions for which intellectual activity was required. Since that time, a century of empirical research has shown that g does in fact predict a broad spectrum of important life outcomes ranging from academic and educational outcomes (Benbow & Stanley, 1996; Kuncel, Hezlett, & Ones, 2004), job performance (Kuncel et al., 2004; Salgado, Anderson, Moscoso, Bertua, & De Fruyt, 2003; Schmidt & Hunter, 1998), income and poverty (Hunt, 1995; Murray, 1998), and delinquency and crime (Caspi & Moffitt, 1993; Gordon, 1997). Efforts to fully understand the scientific significance of this “g-nexus,” as it has been termed by Jensen (1998), has progressed in two directions; one vertical and the other horizontal. The vertical line of inquiry refers to evaluating the biological and neurological basis for g, whereas the horizontal aspect refers to establishing the practical significance of g.

With respect to the horizontal aspect, researchers have begun to include an array of social–psychological and health-related variables. In particular, the g-nexus has been expanded to include religious beliefs (e.g., Nyborg, 2009), and physical (Gottfredson, 2004) and psychological well-being (Lubinski & Benbow, 2000). Simultaneously, an independent literature has emerged in health psychology linking religion and health (see Miller & Thoresen, 2003). Indeed, within healthy US populations, church attendance appears to be related to a reduction in mortality risk (Powell, Shahabi, & Thoresen, 2003). Though there are a number of complexities and important distinctions, it has been posited that religion may provide a “comprehensive meaning system” through which individuals interpret, evaluate and respond to the world (Park, 2007). It is therefore thought that religion can influence health
via the provision of a cognitive framework that directs health-related decisions and behavior. Thus, although it is clear that g-theory, or more aptly the g-nexus, provides a common focal point around which these variables form a cohesive network worthy of study, these separate lines of inquiry have remained isolated. The overall purpose of this paper is to take a first step towards integrating these three “nodes” into a single nexus.

1. Intelligence–health associations

During the last decade, the horizontal aspect of the g-nexus has been expanded to include health-related variables. In particular, the emerging field of cognitive epidemiology has begun to show that IQ predicts health and mortality for individuals within population groups (e.g., Batty, Deary, & Gottfredson, 2007; Batty, Der, Macintyre, & Deary, 2006; Deary, 2008). It has been hypothesized that one reason for this is that intelligent individuals tend to evaluate cognitively complex information more efficiently and accurately, thus making more informed decisions across the life span (Gottfredson, 2004; Hunt, 1995). For example, Williams et al. (1995) showed evidence that noncompliance with treatments and physician instructions were largely due to an inability to understand such instructions. Similarly, Taylor, Frier, Gold, and Deary (2003) found that, among a group of diabetics, intelligence at the time of diagnosis predicted the amount of knowledge about diabetes these patients had acquired one year later. Anstey, Low, Christensen, and Sachdev (in press) showed that intelligence was associated with higher levels of physical activity, greater likelihood of taking vitamins, and reduced likelihood of smoking. Chandola, Deary, Blane, and Batty (2006) found that childhood IQ was significantly related to obesity and weight gain in adulthood, even after controlling for socio-economic factors. Batty, Deary, Schoon, and Gale (2007) found that childhood intelligence was significantly correlated with frequency of consumption of fruits, vegetables, wholemeal bread, poultry and fish, and negatively correlated with intake of French fries, nonwholemeal bread, cakes and biscuits. Similarly, they found that intelligence was associated with exercise and intense physical activity.

Indeed, it would appear that much of the research on the association between intelligence and health and mortality is consistent with an epidemiological hypothesis made by Lubinski and Humphreys (1997, p. 161) over a decade ago: general intelligence functions as a causal determinant for an individual’s exposure, host suitability, and likelihood to develop an array of maladaptive (as well as adaptive) behaviors and, consequently, undesirable (as well as desirable) outcomes. More recently, Gottfredson (2004) has posited that g may be the “elusive fundamental cause of health inequalities that transcends the particulars of time, place, disease, material advantage, and social change” (p. 174). Specifically, Gottfredson highlights the fact that g-theory conforms well to the data on daily self-maintenance, health self-care, and prevention of accidental injury, and as such, can explain social class differences in health better than can conventional theories of social inequality. That is, IQ (or more aptly, g) appears to account for health differences across socio-economic classes above and beyond socio-economic and personal wealth factors. For example, Gottfredson argues that g-theory can explain one of the apparent “paradoxes” faced by health demographers; namely, the fact that greater equalization of health care tends to expand social class differences in health (Steenland, Henley, & Thun, 2002).

Drawing upon Gottfredson’s (2004) suggestion, as well as earlier suggestions for the inclusion of general intelligence into epidemiological studies (e.g., Lubinksi & Humphreys, 1997), researchers have recently begun to examine the correspondence between national differences in average IQ and other national statistics. That national IQ can be expected to correlate with nation-level variables given the associations between IQ and other variables when examined at the level of the individual has already been well established. For example, IQ predicts productivity at the individual level (Schmidt & Hunter, 1998), thus national IQ should predict national productivity as measured by gross domestic product, a prediction that has been empirically confirmed (e.g., Hunt & Wittmann, 2008; Lynn & Vanhanen, 2002, 2006; Whetzel & McDaniel, 2006). Likewise, previous research has also established that the IQ–religiosity relationship known to exist at the individual level (e.g., Nyborg, 2009) transfers to the national level (Lynn, Harvey, & Nyborg, 2009). Similarly, IQ has been shown to be related to political involvement and liberal beliefs at the individual level (Deary, Batty, & Gale, 2008), as well as at the national level; Rinderman (2008a,b) found that national IQ was associated with democratic institutions, rule of law and political freedoms.

Thus, given the evidence for an intelligence–health relationship at the individual level, it is expected that intelligence and health will show significant zero-order relationships at the national level as well. In addition to the aggregate effect these individual differences might have at the level of population statistics, Gottfredson notes that these relations may extend to the national level because national IQ may correlate with the effectiveness of government based on decisions made by elected individuals; a prediction that appears to have been confirmed by the recent results regarding IQ associations with government effectiveness, economic freedoms, democratic institutions, rule of law and political freedoms (e.g., McDaniel, 2006; Rinderman, 2008a,b; Whetzel & McDaniel, 2006). Additionally, previous studies have shown that individual relations can transfer to the national level. For example, IQ is a predictor of productivity at the individual level (Schmidt & Hunter, 1998), thus national IQ should predict national productivity as measured by gross domestic product; a prediction that has been empirically confirmed (e.g., Hunt & Wittmann, 2008; Whetzel & McDaniel, 2006). Likewise, previous research has also established that the IQ–religiosity relationship known to exist at the individual level (e.g., Nyborg, 2009) transfers to the national level (Lynn et al., 2009). Thus it can be hypothesized that national IQ should predict national health statistics. To date, one such effect has already been found; Shatz (2008) recently found that the negative relationship between IQ and fertility generalizes to the national level (see also Lynn & Harvey, 2008).

However, given that it is known that IQ is related to national wealth and prosperity (Hunt & Wittmann, 2008; Whetzel & McDaniel, 2006), it is unclear the degree to which these relations might be due to differences in national wealth. Further, some have argued that the direction of causality between IQ and national wealth is unclear. If wealth influences IQ, then some of these relations might not actually be due
uniquely to IQ but rather reflect spurious correlations due to a common antecedent (i.e., national wealth). A number of studies have recently been published showing zero-order relations between national IQ and important outcomes, such as fertility (e.g., Shatz, 2008). However, few of these studies have controlled for variance in national wealth to assess the degree to which national IQ uniquely influences socially important outcomes. As such, the specific purpose of this paper is to assess the degree to which national IQ differences are uniquely associated with national health indicators independent of differences in national wealth. For the reasons noted above, it is expected that average IQ differences across nations will predict national health statistics independent of national wealth.

2. Intelligence–religiosity associations

Knowledge of a negative relationship between intelligence and religiosity extends back to the early days of differential psychology. For example, Howells (1928) and Sinclair (1928) both reported studies documenting a negative correlation between intelligence and religious beliefs. More recently, researchers have incorporated this relationship into the g-nexus (e.g., Bertsch & Pesta, 2009; Lynn et al., 2009; Nyborg, 2009).

For example, using a representative sample of American adolescents, Nyborg (2009) found that IQ was systematically related to religious denomination. He suggests that this stratification occurs because people gravitate towards denominations that provide a match with their level of cognitive complexity. Similarly, Bertsch and Pesta (2009) found that intelligence, specifically information processing ability, was negatively associated with literal acceptance of religious scriptures and sectarianism, and positively related to religious questioning. At the national level, Lynn et al. (2009) found a correlation of $r = .60$ between national atheism rates and average IQ.

3. Religiosity–health associations

Given the apparent importance of religion in the lives of the majority of Americans (Gallup, 1995), health psychologists have become increasingly interested in understanding the degree to which religious beliefs and/or spirituality influence psychological and physical health. Several reviews of this literature have purported to show evidence for the broad health benefits of religion (e.g., Benson, 1996; Ellison & Levin, 1998). Perhaps the most consistent finding is that among healthy Americans, church attendance is negatively correlated with mortality risk (Powell et al., 2003). 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). More recently, Inzlicht, McGregor, Hirsh, and Nash (2009) found evidence that religious conviction may buffer against anxiety at the neurological level. Specifically, they found that those who reported stronger religious zeal and greater belief in God had reduced reactivity in the anterior cingulate cortex (a cortical system that is involved in the experience of anxiety) in response to errors when completing a speeded task.

However, numerous health researchers have cautioned that the presumed positive impact of religion be either unwarranted (e.g., Sloan, Bagiella, & Powell, 1999) or at least premature (Powell et al., 2003). Chief among the concerns are methodological, psychometric, and sampling deficiencies (for in depth discussions of these issues, see George, Ellison, and Larson (2002), Koenig (2008) and Powell et al. (2003)). For example, George et al. (2002) noted that much of this literature is based on clinical samples, usually consisting of patients with specific diseases who originate in a single health care setting. Similarly, they noted that more than half of the literature examining religion–health relationships is based on elderly (aged 60 years or more) samples. Additionally, much of the literature on the positive effects of religion on health is based exclusively on US samples, often within a few denominations (e.g., catholic, protestant, Presbyterian), with little empirical evidence of its cross-cultural validity.

Some researchers have also noted that not all religious coping is psychologically positive. Pargament (1997) has distinguished between positive religious coping and negative religious coping. For example, Koenig, Pargament, and Nielsen (1998) found that negative religious coping (e.g., reappraisals of God as punishing, expressions of negative attitudes toward God, clergy, or church members, etc.) was related to poorer physical health, worse quality of life, and greater depression among a sample of 577 medically ill, hospitalized, older adults. Similarly, not all religions convey the same message regarding health care to their followers. In fact, some religions explicitly preclude their members from seeking medical care, which would appear to have deleterious effects. For example, Simpson (1989) reported a study showing that Christian Scientists have shorter life expectancies, on average, than the general population, in large part because Christian Scientists do not believe in seeking medical care. Though it has been noted that this study has a number of methodological flaws, George et al. (2002) review other studies documenting the prevalence of childhood deaths resulting from religiously motivated medical neglect. Outside of American samples, studies examining the influence of religiosity have also shown negative effects, particularly with respect to women’s health issues. For example, Azaiza and Cohen (2006) found that, among Arab women, Muslim and Druze women were significantly less likely to seek mammography screening and clinical breast exams than Christian women, largely due to differences in religious beliefs. In particular, they noted that highly religious Arab women tend to believe that illnesses are “God’s will,” which modern medicine cannot change. In addition, they noted that in traditional Arab society, exposure of the body is perceived as a violation of modesty and may arouse feelings of discomfort and embarrassment, thus decreasing the likelihood that women seek, or have access to, health care. Similar results regarding the influence of religion on practices related to pregnancy, abortion and family planning were found among Islamic Turkish women (Bahar et al., 2005). In particular, these authors found that women’s health behavior changed from traditional (i.e., based on religious doctrine) to rational (i.e., based on medical science) as education levels increased.

Thus, while religiosity might be associated positively with health within certain denominations within the US, it is...
possible that differences in national levels of religiosity may be negatively related to national health outcomes, especially those related to women’s health issues. Said differently, while it is likely that religiosity may influence health by having an impact on nutrition, sanctification of the body, and taboos against unhealthy behaviors, religiosity may also interfere with health behaviors and treatments that are based on scientific fact. Thus, consistent with the research on intelligence and religiosity, it seems likely that nations with higher average IQ are, as a population, less likely to subscribe to fundamentalist religious beliefs that interfere with medical care.

4. Current study

As indicated above, the purpose of this paper is to examine the intelligence, religiosity, and health nexus at the national level. Although there have been several cross-national level studies published recently, most of these examine only zero-order relationships. While these studies have provided the groundwork necessary for this line of investigation to flourish, it is appropriate to begin to use more advanced analyses and partition the various sources of variance to identify unique relations. For example, that national IQ is negatively related to national belief rates (specifically, atheism rates) has already been empirically established (e.g., Lynn et al., 2009). Thus, this is not a new test within this study. However, that data can be used to examine the influence of belief rates (i.e., the inverse of atheism rates) on national health. Further, it remains unclear whether belief rate has any unique influence after accounting for the variance due to IQ, or vice-versa. Thus, more specifically, the goal is to better clarify the degree to which IQ and belief rate have unique and independent influences on national health outcomes.

Second, an apparent paradox is noted. Namely, IQ appears to be positively related to health and negatively related to religiosity, yet religiosity appears to be positively related to health. Thus, a second goal is to gain additional evidence to begin to explore this issue. Related to this, no research to date has examined the possibility of interactive effects between religiosity and intelligence. The investigation of such effects are warranted given the potentially complexity of the intelligence–religiosity–health nexus. For example, 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). Further, research shows that religious affiliations are stratified by IQ, and this stratification corresponds to the degree of religious orthodoxy and dogmatism (Nyborg, 2009). Related to this, Cottone, Drucker, and Javier (2007) found that abstract reasoning ability was positively associated with post-conventional moral reasoning (i.e., the highest level of moral reasoning). Kohlberg (1981) suggests that individuals at this level make judgments in light of principles that advance the rights of every human being even if it conflicts with prevailing social norms. Thus, it seems likely that among those who are religious, those high in IQ will be less likely to adhere to strict, fundamentalist beliefs. In contrast, those low in IQ will be more likely to turn to fundamentalist beliefs to guide life decisions. In this sense, lower IQ groups may be more susceptible to the potentially deleterious health effects conferred by adherence to strong religious orthodoxy (e.g., reduced access to reproductive health education and care, particularly among women), whereas high IQ groups may be more flexible in their thinking and decision making regarding social issues. This hypothesis seems consistent with a recent finding that, among Islamic women, women’s health behavior changed from traditional to rational as education levels increased (Bahar et al., 2005). Thus, an interactive (i.e., joint) effect of IQ and religiosity on health outcomes is expected, especially those concerning reproductive issues.

5. Measurements

For all measurements, the most recent data available were used. Thus, not all statistics are from the same year, but are within the range of 2003 to 2008.

5.1. National average IQ

National average IQ estimates were obtained for 192 countries. Estimates are those reported by Lynn and Harvey (2008). These estimates originated from Lynn and Vanhanen’s (2002) extensive work on the development of national IQ estimates and their association with the wealth of nations. These authors demonstrate that these estimates have high reliability (.92) and high validity estimates (e.g., correlation between IQ and education attainment = .83). The reliability and validity of these estimates have been independently confirmed by Rindermann (2007). Scores for 113 nations are based on direct estimates (i.e., measured IQ) typically using tests with non-verbal, culture-reduced content (e.g., Raven’s Progressive Matrices, Cattell Culture Fair test). Scores collected from different years were corrected for changes in time due to the Flynn Effect (Flynn, 1984). The remaining national IQ estimates were obtained by imputing values using the existing data base (details of how estimates were obtained and their validity are discussed at length by Lynn & Vanhanen, 2002). These estimates have been used in a number of previous investigations (e.g., Gelade, 2008a,b; Hunt & Wittmann, 2008; Lynn & Harvey, 2008; Lynn et al., 2009; Rinderman, 2008a,b; Shatz, 2008; Whetzel & McDaniel, 2006).

5.2. National wealth

National wealth was operationalized as GDP purchasing power parity per capita (GDP_PPP), which the value of all final goods and services produced within a nation in a given year, valued at prices prevailing in the United States. According to Nationmaster.com, this is the measure most economists prefer when looking at per-capita welfare and when comparing living conditions or use of resources across countries. Values used in the current study were based on those reported in the CIA World Factbook, and obtained from Nationmaster.com. For all countries, the most recent estimates available were used (for most, these are 2007 estimates, a small number were from 2003 to 2006).

Dickerson (2006) and Hunt and Wittmann (2008) have noted potential flaws with using raw GDP metrics. Namely,
they note that changes in GDP of a given amount are not equally important across the range of GDP. They give the example of a GDP per capita increase of $300. In Luxembourg, where the 2005 GDP per capita was $53,990, this increase is unlikely to make a significance difference. However, in some of the poorest countries, such as Chad or Bhutan where the 2005 GDP per capita was $300, an increase of $300 would likely convey significant (relative) increases in national wealth. Thus, in accord with their suggestions, a logarithmic transformation of GDP_PPP is also used.

5.3. National belief rate

National belief rate was operationalized as the percentage of the population that believes in a god. These rates were taken from Lynn et al. (2009) who obtained data from Zuckerman (2007). Their data reflected the “atheism” rates in 137 countries (i.e., the percentage saying they disbelieved in God). To ease interpretation, given the nature of the literature we reviewed (i.e., religiosity), we inverted these figures to reflect “belief rate” (i.e. 100% – atheism rate = belief rate).

5.4. National health and well-being

To obtain a broad measure of national health, multiple health-related statistics typically used by international agencies (e.g., World Health Organization) as individual indicators of national health were used. While this collection of measures certainly does not cover all aspects of national health, it likely provides a reasonable coverage of key health areas.

5.4.1. Total fertility rate

Total fertility rates reflect those reported by the CIA World Factbook (values are those from 2006). Total fertility rate is defined as the average number of children that would be born per woman if all women lived to the end of their child-bearing years and bore children according to a given fertility rate at each age.

5.4.2. HIV/AIDS deaths

The number of deaths due to HIV/AIDS per capita (i.e., number of adults and children who died due to HIV or AIDS during a given calendar year) as reported by the CIA World Factbook was used. Per capita figures are expressed as deaths per million population. Most recent data available for the largest number of countries for which IQ estimates were available were based on the 2003 estimates.

5.4.3. Infant mortality rate

Infant mortality rate reflects the number of deaths of infants under one year old in a given year per 1000 live births in the same year. Data based on 2008 estimates reported by the CIA World Factbook.

5.4.4. Maternal mortality rate

Estimates of maternal mortality rate were based on 2002 estimates provided by the World Health Organization. Estimates are computed as deaths per 100,000 births averaged over the years 1985–1999. As these estimates are based on data reported by national authorities, UNICEF and the World Health Organization make adjustments to account for the well-documented problems of under-reporting and misclassification of maternal deaths and to develop estimates for countries with no data (for details on the most recent estimates see Hill, AbouZahr, and Wardlaw (2001)).

5.4.5. Life expectancy

Life expectancy at birth for the total population reflects average number of years to be lived by a group of people born in the same year, if mortality at each age remains constant in the future. Life expectancy at birth summarizes the mortality at all ages across gender. These values based on the 2003 estimates (most recent available) reported by the CIA World Factbook and obtained from Nationmaster.com.

6. Results

Descriptive statistics and zero-order correlations are shown in Table 1. All the correlations are in the expected directions. National IQ is correlated with all of the health indicators, indicating that higher IQ is associated with better national health and well-being (e.g., lower fertility, lower mortality, and higher life expectancy). Of course, the IQ–fertility zero-order correlation was previously reported by Lynn and Harvey (2008) and Shatz (2008); this is not a new finding. Likewise, the IQ and belief rate correlation is a replication of that reported by Lynn et al. (2009). In addition, the zero-order correlations show that national belief rate is negatively related to overall health and well-being. Specifically, national belief rate is positively related to fertility rate, infant mortality, maternal mortality, and deaths due to HIV/AIDS, and negatively related to life expectancy.

To examine the unique relations independent of any variance shared with national wealth, partial correlations were computed. The results, shown in Table 2, reveal that

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**Table 1**

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

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</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>
</tr>
</thead>
<tbody>
<tr>
<td>1. National mean IQ</td>
<td>192</td>
<td>84.24</td>
<td>11.74</td>
<td>–50</td>
<td>.60</td>
<td>–.67</td>
<td>–.45</td>
<td>–.38</td>
<td>–.40</td>
</tr>
<tr>
<td>2. Belief rate</td>
<td>137</td>
<td>89.91</td>
<td>15.84</td>
<td>–.73</td>
<td>.50</td>
<td>.21</td>
<td>.26</td>
<td>.34</td>
<td>.26</td>
</tr>
<tr>
<td>3. Total fertility rate</td>
<td>192</td>
<td>3.03</td>
<td>1.62</td>
<td>–.63</td>
<td>.44</td>
<td>.44</td>
<td>.39</td>
<td>.35</td>
<td>.30</td>
</tr>
<tr>
<td>4. HIV/AIDS deaths</td>
<td>104</td>
<td>1752.58</td>
<td>3371.87</td>
<td>−.47</td>
<td>.21</td>
<td>.26</td>
<td>.34</td>
<td>.35</td>
<td>.30</td>
</tr>
<tr>
<td>5. Infant mortality</td>
<td>191</td>
<td>34.60</td>
<td>33.66</td>
<td>−.69</td>
<td>.44</td>
<td>.44</td>
<td>.39</td>
<td>.35</td>
<td>.30</td>
</tr>
<tr>
<td>6. Maternal mortality</td>
<td>131</td>
<td>177.67</td>
<td>213.82</td>
<td>−.65</td>
<td>.40</td>
<td>.79</td>
<td>.31</td>
<td>.36</td>
<td>.30</td>
</tr>
<tr>
<td>7. Life expectancy</td>
<td>190</td>
<td>67.94</td>
<td>11.46</td>
<td>−.75</td>
<td>−.43</td>
<td>−.77</td>
<td>−.62</td>
<td>−.90</td>
<td>−.80</td>
</tr>
</tbody>
</table>

Note. N shows number of countries with valid data for each variable. Correlations based on pair-wise deletion; valid N ranges from 38 to 192.

* Significant at p < .01.

* Significant at p < .05.
Table 2
Partial correlations among national level variables controlling for GDP_PPP.

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<tbody>
<tr>
<td>1. National mean IQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Belief rate</td>
<td>-.45*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Total fertility rate</td>
<td>-.43*</td>
<td>.32*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. HIV/AIDS deaths</td>
<td>-.42*</td>
<td>.12</td>
<td>.11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Infant mortality</td>
<td>-.57*</td>
<td>.23*</td>
<td>.78*</td>
<td>-.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Maternal mortality</td>
<td>-.51*</td>
<td>.17</td>
<td>.71*</td>
<td>-.23</td>
<td>.80*</td>
<td></td>
</tr>
<tr>
<td>7. Life expectancy</td>
<td>.65*</td>
<td>-.20*</td>
<td>-.68*</td>
<td>-.62*</td>
<td>-.86*</td>
<td>-.72*</td>
</tr>
</tbody>
</table>

Note. Correlations based on pair-wise deletion; valid N ranges from 38 to 192.

* Significant at p < .01.

There is no effect of belief rate on fertility when IQ is high (simple slope for belief rate at +1 SD of IQ, b = .00). However, as IQ decreases, national belief rate becomes increasingly associated with fertility and mortality. After controlling for GDP_PPP, at −1 SD of IQ, the simple slope for belief rate is b = .10 (p < .01). Said differently, low IQ appears to place nations at risk with respect to the potentially negative impact of belief rate on women’s fertility. The same effects were found for the outcomes of infant mortality and maternal mortality. For example, because the IQ and belief rate are centered, the first order betas from the final step reflect the “average” effect of those variables across levels of the other variables. For all three outcomes, national belief rate has an average negative effect on health (i.e., higher belief rate is associated with higher mortality and fertility), and IQ has a positive effect on health (i.e., higher IQ is associated with lower mortality and fertility across levels of religiosity).

Fig. 2 shows the plot of the simple slopes with life expectancy as the outcome. The simple slopes show that IQ again acts as a buffer against the negative influence of belief rate on fertility. Specifically, after controlling for GDP_PPP, there is no effect of belief rate on life expectancy when IQ is average (simple slope for belief rate at mean IQ, b = .01, p > .05). Additionally, as IQ decreases, national belief rate appears to begin to have a negative impact on life expectancy, although this simple slope does not reach statistical significance (p > .05) until an IQ of −2.5 SD. After controlling for GDP_PPP, at −1 SD of IQ, the simple slope for belief rate is b = −.19 (p = .15). However, as IQ increases above average, belief rate appears to have a positive impact on life expectancy; after controlling for GDP_PPP, at +1 SD of IQ, the simple slope for belief rate is b = .21 (p < .05). Despite this interaction, the first order betas for the centered variables show that the “average” effect of belief rate on life expectancy is negative. Similar to the other outcomes, IQ has an overall positive average effect on life expectancy.

Given the emotive nature of these topics and concerns regarding the accuracy of the Lynn and Vanhanen IQ estimates, the analyses were replicated with questionable data-points removed. For example, although non-verbal tests were used, Richards (2002) has questioned the cross-cultural validity of IQ testing due to lowered literacy levels in some countries. Volken (2003) has expressed concerns about whether the IQ samples are nationally representative, in particular noting the potential difficulty of accessing remote rural areas of Africa. Thus, to address such concerns, the same procedures reported by Whetzel and McDaniel (2006) were used. Specifically, the dataset was reanalyzed after truncating the distribution of national IQs such that any country’s IQ that was less than 90 was set to a score of 90. Using this

Table 3
Partial correlations with health outcomes.

<table>
<thead>
<tr>
<th>Control variable</th>
<th>Fertility</th>
<th>HIV deaths</th>
<th>Infant mort.</th>
<th>Maternal mort.</th>
<th>Life exp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IQ</td>
<td>.11</td>
<td>-.09</td>
<td>.04</td>
<td>.02</td>
<td>.03</td>
</tr>
<tr>
<td>Belief rate IQ</td>
<td>-.63*</td>
<td>-.43*</td>
<td>-.60*</td>
<td>-.56*</td>
<td>.69*</td>
</tr>
</tbody>
</table>

Note. Correlations based on pair-wise deletion; valid N ranges from 38 to 192.

*Significant at p < .01.

There is no effect of belief rate on fertility when IQ is high (simple slope for belief rate at +1 SD of IQ, b = .00). However, as IQ decreases, national belief rate becomes increasingly associated with fertility and mortality. After controlling for GDP_PPP, at −1 SD of IQ, the simple slope for belief rate is b = .10 (p < .01). Said differently, low IQ appears to place nations at risk with respect to the potentially negative impact of belief rate on women’s fertility. The same effects were found for the outcomes of infant mortality and maternal mortality. For example, because the IQ and belief rate are centered, the first order betas from the final step reflect the “average” effect of those variables across levels of the other variables. For all three outcomes, national belief rate has an average negative effect on health (i.e., higher belief rate is associated with higher mortality and fertility), and IQ has a positive effect on health (i.e., higher IQ is associated with lower mortality and fertility across levels of religiosity).

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"truncated" IQ distribution, the analyses were re-run. The zero-order correlations did not change substantively; all correlations with IQ are still significant at the \( p < .01 \) level. In fact, the correlation with belief rate increased to \( r = -.67 \). The partial correlations with IQ are shown in Table 5. Controlling for GDP_PPP, truncated IQ still shows significant relations with belief rate \( (pr = -.54) \) fertility, infant mortality, maternal mortality, and life expectancy. Controlling for belief rate, truncated IQ still shows significant relations with fertility, infant mortality, maternal mortality, and life expectancy. Finally, all the interaction analyses were redone using the truncated IQ variable. All of the results were essentially the same, with the same four interactions being significant and of the same type. In fact, the interactions were slightly stronger using the truncated IQ than with the regular IQ estimates (the interaction term uniquely accounted for 2% to 6% of the variance across the outcomes). Thus, these analyses largely support the validity of the original analyses. Even using a variable where the variance was reduced and a number of low scoring countries were arbitrarily assigned higher IQ values, the results still convey the same substantive conclusions.

Finally, the analyses were repeated a third time replacing GDP_PPP with the Log(GDP_PPP). This was done in accordance with concerns noted by Dickerson (2006) and Hunt and Wittmann (2008) regarding potential flaws with using raw GDP metrics. Using Log(GDP_PPP) did not substantively alter the results. As noted by other authors, this change resulted in an increase in the correlation between IQ and national wealth \( (r = .65 \text{ vs. } r = .53) \); however, the partial correlations reveal the same pattern of significance and

| Table 4 |
| Test for interactive effect between religiosity and national IQ on health outcomes. |

<table>
<thead>
<tr>
<th>Model</th>
<th>Fertility (N = 137)</th>
<th>HIV deaths (N = 87)</th>
<th>Infant mort. (N = 137)</th>
<th>Maternal mort. (N = 108)</th>
<th>Life exp. (N = 137)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( b )</td>
<td>( \Delta R^2 )</td>
<td>( b )</td>
<td>( \Delta R^2 )</td>
<td>( b )</td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Intercept)</td>
<td>3.96 ( a )</td>
<td>.32 ( a )</td>
<td>.06 ( b )</td>
<td>.36 ( a )</td>
<td>.34 ( a )</td>
</tr>
<tr>
<td>GDP_PPP</td>
<td>-.07 ( a )</td>
<td></td>
<td>-59.33 ( b )</td>
<td>.24 ( a )</td>
<td>-8.92 ( a )</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Intercept)</td>
<td>3.17 ( a )</td>
<td>.32 ( a )</td>
<td>829.18</td>
<td>42.05 ( a )</td>
<td>212.07 ( a )</td>
</tr>
<tr>
<td>GDP_PPP</td>
<td>-.01 ( b )</td>
<td>74.60 ( b )</td>
<td>-46 ( b )</td>
<td>-3.24 ( a )</td>
<td>-1.10 ( b )</td>
</tr>
<tr>
<td>Belief rate</td>
<td>.00 ( b )</td>
<td>-11.77</td>
<td>-12</td>
<td>-1.27</td>
<td>-13.21 ( a )</td>
</tr>
<tr>
<td>IQ</td>
<td>-.11 ( a )</td>
<td>-178.40 ( a )</td>
<td>-2.03 ( a )</td>
<td>-13.21 ( a )</td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td></td>
<td>.04 ( a )</td>
<td>0.38</td>
<td>35.23</td>
<td>171.27 ( a )</td>
</tr>
<tr>
<td>(Intercept)</td>
<td>2.76 ( a )</td>
<td></td>
<td>859.22</td>
<td>35.23</td>
<td>171.27 ( a )</td>
</tr>
<tr>
<td>GDP_PPP</td>
<td>-.01 ( b )</td>
<td>75.66 ( b )</td>
<td>-56 ( b )</td>
<td>-3.92 ( a )</td>
<td>.18 ( a )</td>
</tr>
<tr>
<td>Belief rate</td>
<td>.05 ( a )</td>
<td>-17.24</td>
<td>-1.27</td>
<td>-1.10</td>
<td>.16 ( a )</td>
</tr>
<tr>
<td>IQ</td>
<td>-.07 ( a )</td>
<td>-100.83 ( a )</td>
<td>-1.44 ( a )</td>
<td>-9.01 ( a )</td>
<td>.63 ( a )</td>
</tr>
<tr>
<td>IQ×BR</td>
<td>-.01 ( a )</td>
<td>.38</td>
<td>-.07 ( a )</td>
<td>-.48 ( a )</td>
<td>.01 ( b )</td>
</tr>
</tbody>
</table>

Note. Belief rate and IQ are centered at the mean. GDP_PPP reported in $1000 units. Valid listwise \( N \) for each analysis shown in parentheses. \( b = \) unstandardized beta weight.

\( a \) \( p < .01 \).
\( b \) \( p < .05 \).
Table 5
Partial correlations between truncated IQ and health outcomes.

<table>
<thead>
<tr>
<th>Control variable</th>
<th>Health outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPD_{PPP}</td>
<td>Truncated IQ</td>
</tr>
<tr>
<td>Belief rate</td>
<td>Truncated IQ</td>
</tr>
</tbody>
</table>

Note. Correlations based on pair-wise deletion; valid N ranges from 38 to 192.

\( ^a \) Significant at \( p < .01 \).

\( ^b \) Significant at \( p < .05 \).

relative magnitude. Likewise, none of the interactive effects changed in magnitude when \( \log(\text{GDP}_{\text{PPP}}) \) was used as a control. (Tables of the third set analyses are available from the first author; they are not shown here for page space considerations). Again, these analyses largely confirm our substantive conclusions.

7. Discussion

The purpose of this study was to examine the degree to which IQ, belief rate and health form a meaningful nexus of relations. Overall, the results reveal an interesting pattern of relations largely consistent with predictions based on g-theory. Consistent with within nation studies, national IQ is positively associated with national health and negatively related to national belief rate (i.e., percentage of population believing in a god). Specifically, national IQ is negatively related to fertility rate, deaths due to HIV/AIDS, infant mortality rate, maternal and mortality rate, and positively associated with life expectancy. Importantly, these relations were maintained even after controlling for shared variance with national wealth. Further, consistent with g-theory, but in contrast to some of the health psychology research showing a potentially positive effect of religion on health, national differences in belief rate are negatively related to national health (i.e., positive correlations with fertility rate, deaths due to HIV/AIDS, infant mortality rate, and maternal mortality rate, and negatively correlated with life expectancy). However, the current study shows that the effect of national IQ and national belief rate are interactive. Specifically, the interaction analyses show that belief rate is a risk factor for a high fertility rate, increased infant mortality and maternal mortality when average IQ is low. Said differently, national IQ seems to be a buffer against the potentially negative influence of national religiosity on reproductive health issues (e.g., high IQ protects against increased fertility due to high levels of beliefs).

Given the likely emotive nature of these findings, it is important to understand what they suggest. First, it is appropriate to view these data from an epidemiological perspective. As Lubinski and Humphreys (1997) pointed out, epidemiological research is not only concerned with identifying the proximal causes of pathology, but rather also “with identifying populations in which those causes are most often likely to be found. Incidence and prevalence rates of maladies within various high-risk groups often uncover risk factors conducive to their contraction and spread. It is not always that high-risk groups possess elevated host susceptibilities, but rather it is the behaviors of the high-risk group that places them in harm’s way” (p. 160). They give the example of the HIV/AIDS epidemic. A critical first step towards identifying the behavioral risk factors was to identify high-risk groups (e.g., gay males, IV drug users). It was only by identifying these groups that the underlying risk-behaviors could be isolated (unprotected sex, sharing needles) that were the proximal cause of HIV contraction, independent of demographic groups. The current results can and should be interpreted in a similar fashion. For example, although poor and highly religious nations might initially be identified as high-risk groups, the current results suggest that the proximate risk factor is low IQ. That is, finding that low IQ is associated with increased health problems independent of wealth and religiosity implies that the risk factors leading to lower national health are likely grounded in intellectual issues (e.g., low levels of education, low levels of scientific or rational beliefs), and not simply due to socio-economic factors or religion per se.

As an example, consider the IQ–fertility association. Shatz (2008) appropriately noted that the IQ–fertility relationship may be mediated by economic factors (i.e., national wealth). The finding that IQ is also associated with infant and maternal mortality seems to substantiate Shatz’s suggestion. That is, fertility may be high in countries with lower national average IQ because these tend to be poor countries with few financial resources. However, the current study controlled for national wealth and still found a relationship with average IQ. This suggests that it is not simply an economic issue. Rather, it is possible that independent of national wealth, women in countries with lower average IQ have less access to reproductive health and education (perhaps because of the tendency for these countries to be less democratic and offer fewer personal freedoms; see Rinderman, 2008a,b). Or, it may suggest that lower IQ populations are less likely to utilize or understand reproductive health education and health care instructions, even when it is offered. Or, given the finding that mean IQ is associated government effectiveness (e.g., McDaniel, 2006; Rinderman, 2008a,b; Whetzel & McDaniel, 2006), it may suggest that national wealth is not being effectively administered by the governments of nations with lower average IQ. Such suggestions seem to be buttressed by the finding of an interactive effect between religiosity and IQ. Among high IQ nations, there is no effect of religiosity on reproductive health statistics. However, among low IQ nations, increased religiosity is associated with lower health; in particular, lower reproductive health. This is consistent with the hypothesis that lower IQ populations rely on dogmatic beliefs systems which often place restrictions on women’s access to health education and health care.

Additionally, it is important to consider limitations and weaknesses of this study. First, it should be noted that belief rate is only a single proxy variable representing the larger, multifaceted concept of religiosity. A full understanding of how religiosity and intelligence interact to influence health outcomes awaits further study with more sophisticated measures of religiosity. Related, if the IQ measure is a more construct-valid measure than is belief rate, this could provide an alternate explanation for why IQ predicts health outcomes better than religiosity within this study. Third, it should be kept in mind that correlations from cross-sectional data cannot, by themselves, be used to confirm causal hypotheses. For example, it is equally plausible that high fertility rates decrease national IQ. Large numbers of children born to women indicate large family
sizes which might limit the ability of the families to feed and educate their children, which in turn might lead to stunted cognitive development. Or, the IQ–fertility relation may merely be evidence of Ruston’s (1996) proposed application of r/k selection theory to explain the observed clustering of variables across human populations (e.g., populations living in environments that favor K-based selection strategies will come to have higher intelligence and lower fertility due to natural selection pressures). Fourth, the current results do not give direct insight into the likely mediating mechanisms between IQ, belief rates and health outcomes. Additional research is needed to better elucidate the underlying cause for these correlations.

Nonetheless, the nature of these results has significant implications regardless of the direction of the causal arrow. That national differences in IQ have such strong relations with health statistics independent of national wealth suggest that these differences cannot be ignored. It would seem that this would be a significant and important reason to consider the importance of interventions targeted at reducing the fertility rate around the world, and in particular, in under-developed nations. Indeed, given the finding that IQ is a major predictor of national prosperity and technical achievement, failure to control a factor that potentially has such a major influence on IQ would seem to put those countries at a significant disadvantage. Finding such strong relations with IQ might be unsettling for some; however, it would seem these relations are too strong and too important to simply ignore regardless of one’s position on causality.

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 national health is associated with a nation’s cognitive capital would result in less effective interventions than otherwise possible. Indeed, Gottfredson (2004) makes this point eloquently in her discussion of group-differences within the United States (p. 175):

“Neither the poverty paradigm nor g theory would argue that its fundamental cause is the sole or even major determinant of why particular individuals experience particular diseases or accidents. Although explaining individual differences in specific outcomes is important, the primary aim here is to explain something else, namely, the remarkably general differences between social groups in their rates of disease and injury. The latter are more affected by the accumulation of consistent effects across persons and time within groups. When groups differ substantially on the average in IQ but not other factors causing individuals to become ill or injured (e.g., non-g related genetic risk or motivation), then even small g-related differences in risk at the individual level can cumulate over persons to produce large group differences in rates of morbidity and mortality.”

More generally, these relations appear to form a cohesive and meaningful nexus, if viewed from the perspective of the g-nexus. Briefly, it has long been argued that g attains its importance because it reflects individual differences in the ability to successfully comprehend and function rationally in an increasingly cognitively complex world (Gottfredson, 1997, 2004; Jensen, 1998). 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. As such, they are likely to reject dogmatic meanings systems that contain irrational beliefs; that is, they are likely to gravitate away from dogmatic religious beliefs and towards liberal religious beliefs, or scientific belief systems (Nyborg, 2009). 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. In short, for lower-g individuals, it is likely that religion provides a substitute for a rational, scientific (and often cognitively complex) meaning system with a dogmatic (i.e., simplified and stable) belief system by which to make sense of the world.

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, where as low g places individuals at risk 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 short, high-g individuals likely use a rational, scientific cognitive framework when it comes to health decisions. In contrast, low-g individuals may be more likely to gravitate towards social systems that provide structured belief systems to simplify their world. In these cases, the exact influence of religion on health may depend on the precise nature of the denominational dogma. In some cases, these dogmas may confer positive health effects. However, as our results show, national religiosity appears to convey a negative influence on national health among low IQ nations.

Finally, it is worth acknowledging that some may question whether the study of national differences in average IQ is of any benefit to society. However, like others, it is argued here that understanding the underlying causes of socioeconomic or group disparities in health is of critical importance (e.g., Batty et al., 2006; Gottfredson, 2004, 2005). Indeed, Batty et al. (2006) point out that the reduction in socioeconomic inequalities in health is a critical goal of many national and international organizations (e.g. World Health Organization; Wilkinson & Marmont, 2003). If national health disparities were solely a function of socioeconomic factors, then controlling for these factors should remove the relationship with IQ differences. However, as has been shown here, IQ differences continue to explain national differences in health even after controlling national wealth and religiosity.
Certainly it is not being suggested that socioeconomic interventions are not warranted. Rather, these results, combined with within-nation studies (e.g., Batty et al., 2006), suggest that international programs focused solely on economic factors are likely to fail short of their goals. Instead, it would appear that cognitive factors may be an important risk factor on which to focus (e.g., enhanced education, aptitude appropriate education, etc.). Further, the finding of significant interactions between IQ and religiosity suggests that interventions need to be structured so as to take into account prevailing social norms and dogmatic belief systems. More generally, the point here is that 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. It is from this perspective that this research is thought to be of importance.

8. End notes

Technically mediation is tested through hierarchical regression. Mediation is supported if the partial regression coefficient reflecting the distal antecedent is non-significantly different from zero and the partial regression coefficient reflecting the mediator is significantly greater than zero. If beta for the antecedent is non-significantly different from zero, results are consistent with a full mediation model. If this beta associated with the mediator is significant after controlling for the direct effect of the antecedent, and the beta associated with the antecedent is still significant, the model is consistent with partial mediation. These formal analyses were conducted and only a small indirect effect was found. As these are consistent with the partial correlation analyses, they are not reported here for page space considerations. These analyses are available from the author.

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Gottfredson, L. (2005). Suppressing intelligence research: Hurting those we deem important by society. It is from this perspective that this research is thought to be of importance.


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