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## Intelligence

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## Average county-level IQ predicts county-level disadvantage and several county-level mortality risk rates <sup>☆</sup>

J.C. Barnes <sup>a,\*</sup>, Kevin M. Beaver <sup>b</sup>, Brian B. Boutwell <sup>c</sup>

<sup>a</sup> School of Economic, Political and Policy Sciences, The University of Texas at Dallas, 800 W. Campbell Rd., Richardson, TX 75080, United States

<sup>b</sup> Florida State University, United States

<sup>c</sup> Sam Houston State University, United States

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## ABSTRACT

Research utilizing individual-level data has reported a link between intelligence (IQ) scores and health problems, including early mortality risk. A growing body of evidence has found similar associations at higher levels of aggregation such as the state- and national-level. At the same time, individual-level research has suggested the IQ–mortality risk association may be mediated by socioeconomic status, but no aggregate research has considered this possibility. This paper extended the current knowledge base in two important ways: 1) by analyzing the association between county-level IQ and county-level mortality risk; and 2) by testing a theoretical model where county IQ influences county disadvantage which, in turn, influences county mortality risk. The findings indicated a consistent relationship between county IQ and several measures of county mortality risk. The IQ–mortality risk association was mediated by county disadvantage for some county mortality risk measures but not others, suggesting the relationship between county IQ and county mortality risk is more nuanced than was hypothesized.

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### 1. Introduction

Research has revealed that intelligence (IQ) scores are associated with nearly every human phenotype ([Gottfredson, 1997](#); [Herrnstein & Murray, 1994](#)). IQ scores, for instance, have been shown to correlate with academic achievement ([Deary, Strand, Smith, & Fernandes, 2007](#)), economic well-being ([Strenze, 2007](#)), humor ability ([Greengross & Miller, 2011](#)), criminal involvement and violent behavior ([Diamond, Morris,](#)

[& Barnes, 2012](#); [Moffitt, 1990](#)), as well as other factors related to everyday life ([Gottfredson, 1997](#); [Herrnstein & Murray, 1994](#)). Perhaps the most important correlate to IQ—at least from a health/medical standpoint—is the consistent association between IQ scores and personal health outcomes such as mortality risk. A long line of research has revealed a relatively strong association between IQ scores and various measures of health, suggesting that individuals who score the highest on IQ tests are the same individuals who tend to have the best health and the lowest risk of experiencing early mortality ([Batterham, Christensen, & Mackinnon, 2009](#); [Batty, Deary, & Gottfredson, 2007](#); [Sabia et al., 2010](#); but see [Corley, Crang, & Deary, 2009](#) for dissenting evidence of war death risk in World War II; and see [Modig & Bergman, 2012](#)). Indeed, persons scoring high on IQ tests are less likely to smoke cigarettes ([Ciarrochi, Heaven, & Skinner, 2012](#); [Hemmingsson, Kriebel, Melin, Allebeck, & Lundberg, 2008](#); but see [Kanazawa & Hellberg, 2010](#)), less likely to engage in risky behavior that wagers their health ([Wilson & Herrnstein, 1985](#)), and more likely to exercise and take vitamins ([Anstey, Low, Christensen, & Sachdev, 2009](#))

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\* Corresponding author.

E-mail address: [jcbarnes@utdallas.edu](mailto:jcbarnes@utdallas.edu) (J.C. Barnes).

than those who score relatively lower on IQ tests. In short, the literature is consistent in revealing that IQ scores are linked with health outcomes and the most common interpretation of this association is that IQ scores are antecedent to health-related outcomes and, therefore, may exert a causal influence ([Batty et al., 2007](#)).

Though research has identified a link between IQ and mortality risk, the mechanisms underlying this association are less well understood. One explanation ties IQ scores to socioeconomic status (SES) and, in turn, SES to mortality risk. Analyzing a sample of older adults (aged 65+), [Fried et al. \(1998\)](#) reported on a host of factors related to 5-year mortality risk including several indicators of SES such as income and educational attainment. In short, Fried et al. found SES to be negatively correlated with mortality risk such that participants making less than \$50,000 had a higher mortality risk, as did participants with lower levels of educational attainment. Similar findings were reported by [Lleras-Muney \(2005\)](#) who performed an instrumental variables analysis to examine the link between education and mortality risk in U.S. adults. Drawing on U.S. Census data, the author reported higher levels of education were associated with lower mortality risk. [Pappas, Queen, Hadden, and Fisher \(1993\)](#) also reported a robust link between SES and mortality risk such that lower SES groups experienced higher death rates.

A recent study by [Jokela, Elovainio, Singh-Manoux, and Kivimaki \(2009\)](#) offers insight as to whether SES mediates the IQ–mortality risk correlation. Jokela and colleagues first analyzed the relationship between IQ score and mortality risk among participants of the U.S. National Longitudinal Survey of Youth (NLSY) and reported a negative correlation; respondents who scored higher on the Armed Services Vocational Aptitude Battery had a lower probability of facing an early death. Once indicators of SES were controlled, however, the IQ–mortality risk association disappeared. This finding suggests IQ score is predictive of SES which influences mortality risk.

Researchers utilizing individual-level data have shown linkages among IQ scores, SES, and mortality risk ([Jokela et al., 2009](#)), but whether these relationships hold at higher levels of aggregation remains an open empirical question. Evidence suggests aggregate measures of intelligence are predictive of a broad range of outcomes at the county, state, and even national level (e.g., [Lynn, Harvey, & Nyborg, 2009](#); [Lynn & Mikk, 2007, 2009](#); [Lynn & Vanhanen, 2006](#); [McDaniel, 2006](#)). Recent findings have revealed U.S. counties with higher average IQs experience lower crime rates and less collective disadvantage ([Beaver & Wright, 2011](#)), U.S. states with higher average IQs are more wealthy on average ([Kanazawa, 2006](#); [Strenze, 2007](#)), and nations with higher average IQs evince higher levels of educational achievement ([Lynn & Mikk, 2007, 2009](#)). Of particular interest, though, are the studies that have identified a link between aggregate intelligence levels and aggregate mortality rates ([Lynn, 1979](#); [Lynn & Vanhanen, 2012](#); [Templer & Rushton, 2011](#)).

[Templer and Rushton \(2011\)](#) estimated the correlation between average IQ and several health outcomes at the state-level. Correlations between average IQ and different outcomes were observed and these bivariate associations revealed average state-level IQ was predictive of the state's infant mortality rate, life expectancy, and AIDS rate. Specifically, states with a higher average IQ experienced lower

infant mortality rates, higher life expectancies, and lower AIDS rates. In a recent analysis, [Lynn and Vanhanen \(2012\)](#) summarized the literature estimating associations between national IQ levels and a range of social outcomes, including health outcomes. Their review revealed a number of studies that have identified a link between national IQ and national health outcomes such as the proportion of children born of low birth weight, rates of HIV/AIDS infection, infant mortality rates, life expectancy, and rates of malnourishment. For all of these associations, the observed correlation was in the direction of higher national IQ predicting better national health outcomes.

In sum, the available evidence suggests aggregate measures of intelligence are correlated with aggregate measures of health outcomes (especially mortality rates) and that aggregate IQ is associated with aggregate disadvantage (an indicator of aggregate SES). The current study builds upon this research and extends it in two primary ways. First, our study is among the first to analyze the correlation between average IQ and mortality rates at the county-level. A growing body of evidence has analyzed these associations at higher levels of aggregation such as the state-level and the national-level, but none—of which we are aware—has analyzed the association at the county-level. There is reason to believe that the correlation may differ at lower levels of aggregation due to reduced levels of heterogeneity among counties as compared to states or nations. Second, we propose a theoretical model to explain the link between county-level IQ and county mortality rates by building on previous individual-level research. Specifically, we hypothesized that the link between county-level IQ and county mortality rates would operate indirectly via levels of county disadvantage (an indicator of county-level SES). Because research has shown county-level IQ correlates with county disadvantage ([Beaver & Wright, 2011](#)), we hypothesized that county-level IQ would work through county disadvantage to predict several county mortality rates (see [Fig. 1](#)).

## 2. Methods

### 2.1. Sample

Data for the current analysis were drawn from the National Longitudinal Study of Adolescent Health (Add Health; [Harris, 2009](#)). The Add Health sample has been described previously ([Harris et al., 2009](#); [Kelley & Peterson, 1997](#)). To be brief, the Add Health study was launched in 1994 and sought to obtain information from a nationally representative sample of American adolescents. Sampling began at the school-level where more than 130 schools were identified and all students attending these schools were administered a short questionnaire during a designated class session ( $N > 90,000$ ). From this initial sample, a subsample ( $N = 20,745$ ) was drawn and administered a much more in-depth questionnaire (i.e., the wave 1 survey) between September 1994 and December 1995. The wave 1 survey addressed a range of topics such as the adolescent's health, social skills, and involvement in extracurricular activities.

One feature of the wave 1 survey that will be capitalized upon in the current analysis was that a host of data taken from the U.S. Census Bureau, the Centers for Disease Control (CDC), and other federal agencies were included with the

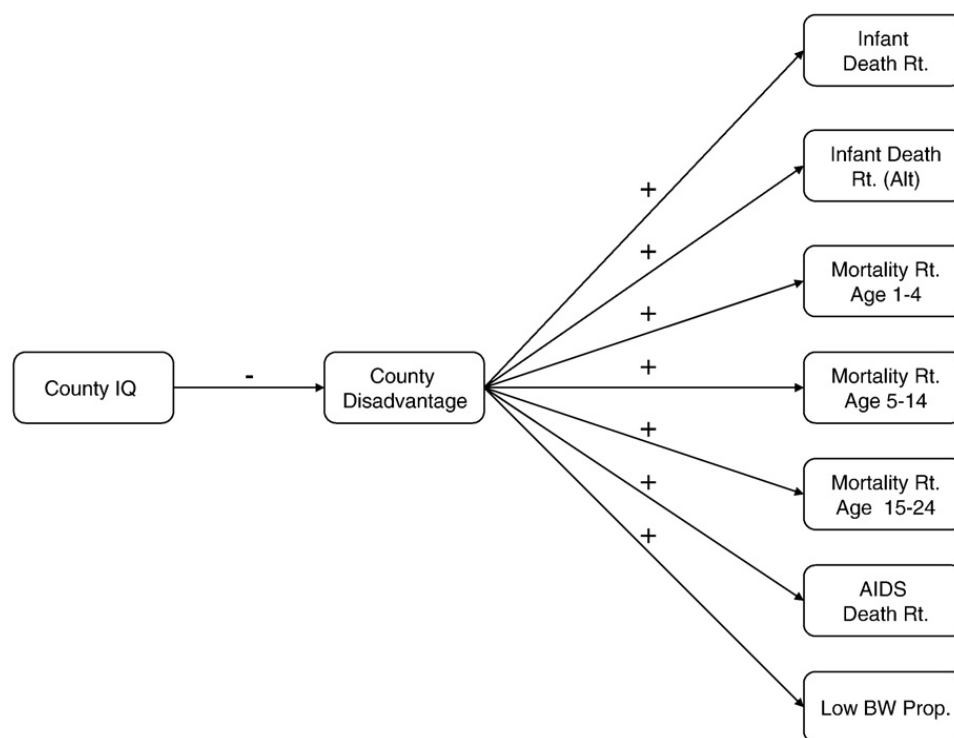


Fig. 1. Theoretical model with predicted directions of association.

individual-level data at wave 1. Because respondents were clustered within schools many of them also shared their county of residence. As such, Add Health researchers included a range of county-level measures taken from these government databases that can be linked with the individual respondents. During wave 1 interviews, respondents resided in 267 different counties spanning 37 states.

## 2.2. Measures

### 2.2.1. County mortality rates

Data drawn from the Area Resource File (ARF) System were utilized to develop several county-level mortality indicators by the Add Health research team (Billy, Wenzlow, & Grady, 1998). The ARF is a large-scale data source maintained by the Office of Data Analysis and Management of the Bureau of Health Professions, Health Resources and Services Administration (Billy et al., 1998). The ARF County file consists of a wide range of county-level health data taken from more than 75 original source files. Data for the current study were drawn from the February 1995 version of the file and all variables correspond to the year 1990. The following variables were included in the current analysis: the infant (<1 year old) death rate for all races per 1000 individuals (<1 year old) in the county (referred to as infant death rate in tables/figures); the infant (<1 year old) mortality rate for all races per 1000 live births in the county (referred to as infant death rate [alt.]); the age-specific mortality rate for persons 1–4 years in the county (referred to as mortality age 1–4); the age-specific mortality rate for persons 5–14 years in the county (referred to as mortality age 5–14); the age-specific mortality rate for persons 15–24 years in the county (referred to as mortality age 15–24); the AIDS death rate per 100,000 individuals in the county (referred to as AIDS death rate); and the proportion of births

(out of all births) that were low birth weight (<2500 g) in the county (referred to as low bw prop). Descriptive statistics are provided in Table 1 along with bivariate correlations.

### 2.2.2. County IQ

During wave 1 interviews, all respondents were administered a shortened version of the Peabody Picture Vocabulary Test – Revised (PPVT), known as the Picture Vocabulary Test (PVT). The PVT was designed to measure verbal skills and receptive vocabulary and has been analyzed previously as a measure of verbal IQ (Rowe, Jacobson, & Van den Oord, 1999). In order to generate county-level estimates of verbal IQ, each respondent's score on the PVT was aggregated up to the county-level by calculating the average PVT score for respondents residing in the same county. Because not all counties had a sizable portion of respondents from which to generate average verbal IQ estimates, we imposed a restraint on the data prior to aggregating the PVT scores to the county level. Specifically, IQ scores were only aggregated to the county-level when a minimum of 10 respondents residing in that county had non-missing PVT scores.<sup>1</sup> This restraint led to a reduction in the usable number of counties—the analytic sample size was 96—but increased the reliability and validity of the county IQ measure.

### 2.2.3. County disadvantage

An index of the collective disadvantage in each county was created by combining information from the following five variables which were taken from the 1990 U.S. Census:

<sup>1</sup> Substantive results were unchanged when sensitivity tests were calculated by setting the minimum threshold of respondents in each county to 5 (analytic sample  $n = 116$ ) and when the minimum threshold was set to 20 (analytic sample  $n = 84$ ).

**Table 1**  
Descriptive statistics ( $N=96$ ).

	Mean	Standard deviation	Min–Max	X1	X2	X3	X4	X5	X6	X7	X8
(X1) County IQ	100.97	6.20	85.80–116.45	–							
(X2) County disadvantage	.00	.97	–1.71–3.27	–.49*	–						
(X3) Infant death rate	118.28	36.75	29.70–222.37	–.38*	.74*	–					
(X4) Infant death rate (Alt.)	91.62	23.72	28.85–150.75	–.23*	.68*	.92*	–				
(X5) Mortality rate age 1–4	16.43	38.25	0–287	–.19*	.10	.22*	.13	–			
(X6) Mortality rate age 5–14	18.40	39.29	0–289	–.18*	.09	.21	.12	1.00*	–		
(X7) Mortality rate age 15–24	86.81	214.98	0–1737	–.21*	.10	.20*	.10	.99*	.99*	–	
(X8) AIDS death rate	7.09	8.29	0–50.29	–.44*	.27*	.34*	.21*	.51*	.51*	.50*	–
(X9) Low birth weight prop.	.07	.02	.04–.13	–.32*	.71*	.77*	.67*	.12	.12	.10	.35*

\*  $p < .05$ , (one-tailed tests).

the unemployment rate, the proportion of residents living below the poverty line, the percentage of residents on public assistance, the proportion of residents who are black, and the proportion of female-headed households (see [Sampson, Raudenbush, & Earls, 1997](#)). These five measures were factor analyzed (an exploratory factor analysis using the principal factors method) and the results suggested they be combined into a single construct. In other words, the first factor generated by the factor analysis explained a large portion of the total variance (83%) and the eigenvalue was 3.15. As a result, a new variable was extracted by using the factor analysis solution to predict values for each county using regression scoring ( $\alpha = .88$ ). Higher values reflected a greater degree of county disadvantage.

### 3. Analysis plan

The analysis proceeded in two steps. The first step was to analyze the bivariate relationships between county IQ and the various county mortality rates. In order to analyze these relationships, a path model was estimated using the “sem” package in *Stata* 12.1. Analyzing these relationships within a simultaneous equation modeling (i.e., SEM) framework allowed for the error correlations between the various mortality rates to be directly estimated and controlled. The second step was to re-estimate the associations between county IQ and each of the mortality rates, but this time the county disadvantage measure was included as an endogenous variable to county IQ and an exogenous predictor of the mortality rates. In other words, the second step of the analysis allowed for the estimation of the direct and indirect (via county disadvantage) effects of county IQ on the mortality rates. As with the first step to the analysis, all relationships were estimated using the “sem” package in *Stata* 12.1 and all error terms were correlated for the mortality rate variables.

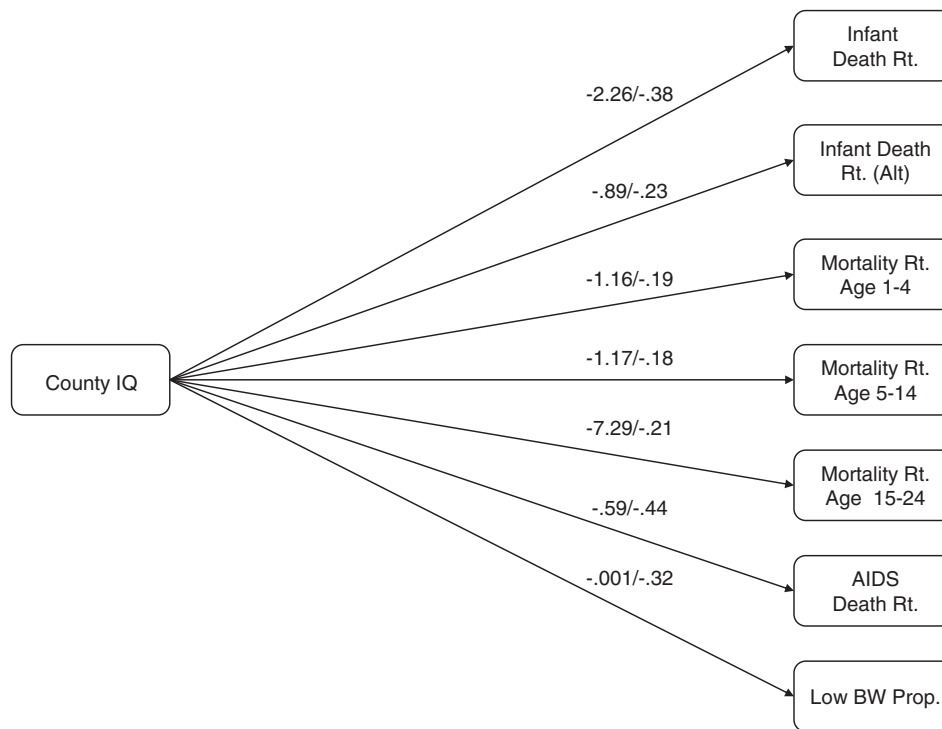
### 4. Findings

The analysis began by observing the relationships between county IQ and the various mortality rate variables. As shown in [Fig. 2](#), county IQ was a statistically significant ( $p < .05$  one-tailed tests) predictor of all seven mortality variables. Both unstandardized and standardized regression estimates are presented to aid in the interpretation of the substantive influence of each relationship. In each case, the relationship was negative and quite substantial. The negative associations indicate that counties with higher average IQs

were less likely to experience the outcome of focus as compared to counties with lower average IQs. For instance, the path leading from county IQ to the infant death rate was estimated to have an unstandardized coefficient of  $-2.26$ . This coefficient indicates that a 1 point increase in the average county IQ was associated with a 2.26 point decrease in the infant mortality rate (per 1000 individuals) in the county. The standardized path coefficient leading from county IQ to the AIDS death rate was  $-.44$ , indicating that a one standard deviation increase in county IQ (around 6 points) was associated with a .44 standard deviation decrease in the AIDS death rate (roughly 3.6 fewer deaths per 100,000).

The next step to the analysis was to examine whether the influence of county IQ on the various mortality outcomes operated through county levels of disadvantage. The results from this analysis are presented in [Fig. 3](#). It is important to note that only paths significant at the .05 or .10 (one-tailed) alpha level are shown. The figure reveals a strong significant (negative) association between county IQ and county disadvantage, wherein counties with higher average IQs experienced lower levels of disadvantage. Indeed, the standardized regression coefficient was  $-.49$ , indicating that a one standard deviation increase in county IQ (roughly 6 points) was associated with nearly a half a standard deviation decrease in county levels of disadvantage. Thus, smarter counties experienced less disadvantage on average.

The influence of county disadvantage on the infant death rate ( $b = 27.81$ ,  $Beta = .73$ ), the infant death rate (alt.) ( $b = 18.14$ ,  $Beta = .74$ ), and the low birth weight proportion ( $b = .01$ ,  $Beta = .73$ ) reached statistical significance ( $p < .05$  one-tailed) and each of these three associations was positive meaning that counties with more disadvantage experienced higher infant death rates and higher proportions of births that were low birth weight. For instance, the unstandardized regression coefficient for the impact of county disadvantage on the infant death rate was 27.81 ( $Beta = .73$ ), meaning that counties with a one unit increase in disadvantage (approximately one standard deviation) experienced nearly 28 more infant deaths per 1000 births compared to counties with an average level of disadvantage (i.e., counties scoring at the mean, 0.00). More important for the current focus is that the influence of county IQ on several measures was weakened (or flipped sign) once the relationship between county IQ and county disadvantage was accounted for. Specifically, once county disadvantage was included in the model, county IQ no longer significantly predicted the infant death rate ( $b = -.15$ ,  $Beta = -.03$ ) or the proportion of low birth weight births ( $b = .0001$ ,  $Beta = .0002$ ). Furthermore, the



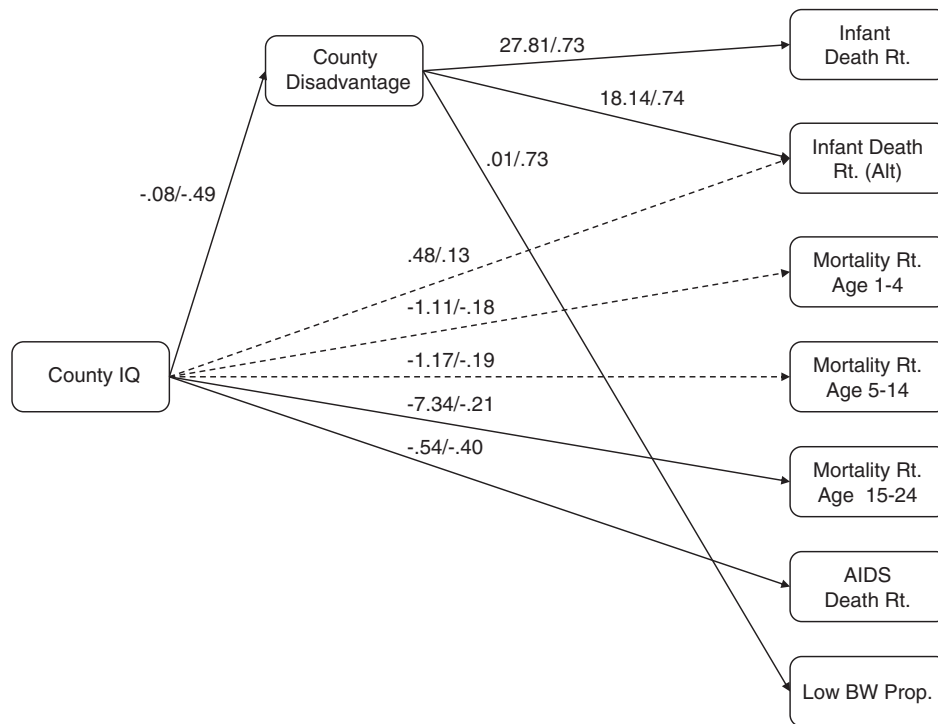
**Fig. 2.** The total effect of county IQ on county mortality rates ( $N=96$ ). Note: Unstandardized regression coefficients along with standardized regression coefficients are shown ( $b/\text{Beta}$ ); All paths are significant at the .05 alpha level (one-tailed tests); All possible error covariances for the mortality rates are estimated but not shown.

influence of county IQ on the infant death rate alt. ( $b = .48$ ,  $\text{Beta} = .13$ ), the mortality rate age 1–4 ( $b = -1.11$ ,  $\text{Beta} = -.18$ ), and the AIDS death rate was diminished ( $b = -.54$ ,  $\text{Beta} = -.40$ )—or in the case of the infant death rate alt., the effect changed sign—over the corresponding estimates from Fig. 2. This pattern of results suggests, preliminarily, that county IQ works through county disadvantage (at least partially) to impact certain mortality outcomes.<sup>2</sup>

<sup>2</sup> The findings referenced in the text were obtained from a path analysis where the county disadvantage measure was included as an observed variable (i.e., factor scores from an exploratory factor analysis [EFA] were saved as a new variable and entered directly into the model). A reviewer correctly noted that this analysis could also be estimated using a full structural equation model with a measurement model for county disadvantage. We explored this analysis and found a pattern of results that was very similar to that presented here. The county disadvantage measure created from the EFA correlated very strongly with the measurement model approach ( $r = .92$ ), suggesting substantial overlap in the two methods. In terms of the mediation model results, most substantive findings were unchanged. Indeed, only four substantive differences arose using the measurement model approach: 1) county disadvantage significantly correlated with the AIDS death rate ( $b = 21.52$ ,  $\text{Beta} = .34$ ); 2) the direct effect of county IQ on the mortality rate age 1–4 was no longer statistically significant; 3) the direct effect of county IQ on the mortality rate age 5–14 was no longer statistically significant; 4) despite the differences above (especially 2 and 3), only one mediation pathway appeared to be effected—the indirect effect of county IQ on the AIDS death rate was statistically significant ( $b = -.22$ ,  $\text{Beta} = -.17$ ) in the measurement model. Overall, the findings from the measurement model approach appear to be slightly more consistent with the theoretical model outlined in Fig. 1.

In order to assess the degree to which the effect of county IQ on the mortality outcomes was mediated by the inclusion of the county disadvantage variable, total effects, direct effects, and indirect effects were calculated and are presented in Table 2. The estimates presented in the first column of Table 2 represent the total effect of county IQ on each of the mortality outcomes. These estimates are identical to the estimates presented in Fig. 2. The direct effect of county IQ on each of the mortality outcomes is presented in the next column. This column of data presents the influence of county IQ on each of the mortality rate variables that does not operate through county disadvantage. As can be seen, county IQ maintained a direct (and negative) effect on four of the seven mortality rate outcomes: the mortality rate age 1–4 ( $b = -1.11$ ,  $\text{Beta} = -.18$ ), the mortality rate age 5–14 ( $b = -1.17$ ,  $\text{Beta} = -.19$ ), the mortality rate age 15–24 ( $b = -7.34$ ,  $\text{Beta} = -.21$ ), and the AIDS death rate ( $b = -.54$ ,  $\text{Beta} = -.40$ ).

Finally, the third column of data presents the indirect effect of county IQ on each of the mortality outcomes. The indirect effect is calculated through the county disadvantage measure. In other words, the last column of data in Table 2 reveals the amount of the total effect of county IQ on the mortality outcomes that is mediated by the county disadvantage measure. As can be seen, three of the indirect effects reached statistical significance: the effect of county IQ on the infant death rate ( $b = -2.10$ ,  $\text{Beta} = -.35$ ), the infant death rate alt. ( $b = -1.37$ ,  $\text{Beta} = -.36$ ), and the low birth weight proportion ( $b = -.001$ ,  $\text{Beta} = -.35$ ).



**Fig. 3.** Mediation model results of the effects of county IQ and county disadvantage on county mortality rates ( $N = 96$ ). Note: Unstandardized regression coefficients along with standardized regression coefficients are shown ( $b/\text{Beta}$ ); Bolded paths are significant at the .05 alpha level (one-tailed tests); Dashed paths are significant at the .10 alpha level (one-tailed tests); Paths with  $p > .10$  (one-tailed tests) are not shown; All possible error covariances for the mortality rates are estimated but not shown.

were significantly mediated by the county disadvantage measure.<sup>3 4</sup>

### 5. Discussion

Extant evidence suggests that IQ score and mortality risk are correlated at the individual-level (e.g., Sabia et al., 2010), and a growing literature has revealed a substantively identical pattern of results at the state- and national-level (e.g., Lynn &

Vanhanen, 2012). The current study expanded on the latter body of evidence in two important ways. First, this is the only study—of which we are aware—to reveal a correlation between county-level measures of average IQ and county-level measures of mortality risk. Indeed, the present findings revealed a consistent relationship between county IQ and mortality risk such that counties with higher average IQs experienced significantly lower mortality risks. In short, smarter counties had lower mortality risks.

The second contribution made by the current study was that a theoretical model was proposed and tested against the data. Building on prior individual-level research it was hypothesized that counties with higher average IQs would experience lower mortality risks, but that this effect would be mediated by (i.e., work through) the level of collective disadvantage present in that county. In other words, smarter counties were expected to have lower levels of disadvantage and, in turn, experience lower mortality risks (see Fig. 1). The analysis provided partial support for this theoretical model. The influence of county IQ on mortality risk was mediated by county disadvantage when the infant death rate was the outcome variable (both measures of the infant death rate) and when the proportion of low birth weight births was the outcome variable. No evidence of mediation was gleaned when the mortality rate for ages 1–4 was analyzed, when the mortality rate for ages 5–14 was analyzed, when the mortality rate for ages 15–24 was analyzed, or when the AIDS death rate was analyzed (though see footnote 2). When viewed as a collective whole, these findings suggest that county IQ may indirectly influence county mortality risk via its influence on county levels of disadvantage, but this is by

<sup>3</sup> Three sensitivity tests were performed. First, each of the relationships was analyzed separately in a regression model with no correlated errors and the substantive findings were identical to those presented in the tables. Second, the mortality rate age 1–4, the mortality rate age 5–14, and the mortality rate age 15–24 were modeled as count variables that were over-dispersed (i.e., variance greater than the mean) with a negative binomial regression model. The pattern of results from these models was identical to those presented in the tables – county IQ exhibited a statistically significant (negative) total effect on each outcome and this influence was not mediated by county disadvantage. Third, there was one county that exhibited high mortality rates across each of the outcome variables. Overall, the pattern of results was substantively similar to those presented here after removing this county from the sample and re-estimating the models. The only differences emerged when the influence of county IQ on the mortality rate age 1–4, the mortality rate age 5–14, and the mortality rate age 15–24 was analyzed. In each case, county IQ exhibited a moderately significant ( $p < .10$ , one-tailed) total effect but neither the direct effect (after controlling for county disadvantage) nor the indirect effect (via county disadvantage) was statistically significant.

<sup>4</sup> Weighted least squares (WLS) models were estimated where the weights were equal to the square root of the number of observations for each county. These WLS models were estimated independently (i.e., no correlated error terms) and all were estimated as ordinary least squares regression models. Substantive conclusions were identical to those presented here.



**Table 2**Total, direct, and indirect effects (via county disadvantage) of county IQ on county mortality rates ( $N=96$ ).

	Total effect			Direct effect			Indirect effect		
	<i>b</i>	<i>Beta</i>	<i>SE</i>	<i>b</i>	<i>Beta</i>	<i>SE</i>	<i>b</i>	<i>Beta</i>	<i>SE</i>
<i>County mortality rates</i>									
Infant death rate	−2.26*	−.38	.56	−.15	−.03	.46	−2.10*	−.35	.45
Infant death rate (Alt.)	−.89*	−.23	.38	.48 <sup>a</sup>	.13	.32	−1.37*	−.36	.30
Mortality rate age 1–4	−1.16*	−.19	.62	−1.11 <sup>a</sup>	−.18	.71	−.04	−.01	.34
Mortality rate age 5–14	−1.17*	−.18	.64	−1.17 <sup>a</sup>	−.19	.73	.001	.0002	.35
Mortality rate age 15–24	−7.29*	−.21	3.46	−7.34*	−.21	3.96	.05	.002	1.92
AIDS death rate	−.59*	−.44	.12	−.54*	−.40	.14	−.05	−.04	.07
Low birth weight prop.	−.001*	−.32	.0002	.0001	.03	.0002	−.001*	−.35	.0002

<sup>a</sup>  $p < .10$  (one-tailed test).\*  $p < .05$  (one-tailed test).

no means the only mechanism at work. In other words, the findings lend partial support for the hypothesized relationships between county IQ, county disadvantage, and county mortality risk.

The pattern of findings presented herein raises many important questions/issues in terms of theory, policy, and future research. Most important from a theoretical and future research perspective is the question: what other factors may account for the county IQ–county mortality risk correlation? We proposed that this relationship would work through county-levels of disadvantage, but the data suggest other factors may also be at work. What might these other factors be? One alternative mediation pathway may be political power. It has been well documented that neighborhood disadvantage is negatively correlated with political influence (Bursik & Grasmick, 2001), suggesting that areas with greater disadvantage (and perhaps lower average IQ) will have less access to state and local health/medical resources. In short, counties with lower average IQ may receive less political attention/resources in terms of medical care, leading to a relative increase in mortality risk as compared to counties with higher average IQ.

The current findings suggest average county IQ could be used as an indicator of the relative health risks for residents in those areas. Given the heated debate surrounding governmental health care, research into the individual- and aggregate-level predictors of health risk are likely to become all the more salient. Because counties consist of smaller (and arguably less heterogeneous) populations as compared to states or nations, perhaps county IQ can serve as an indicator of health risk and, as a result, a marker for delineating areas where residents are most in need of increased health care resources.

There is another possibility, moreover, that also needs to be considered when contemplating the theoretical nature of our findings. Rushton's (1985a,b, 2004) use of life history theory (adopted from the field of biology) to explain both the evolution of human cognition as well as the relationship between IQ and various developmental and social outcomes offers important insight for the findings obtained herein. As part of his argument, Rushton (2004) suggested that certain traits would covary in humans given various selection

pressures encountered by our ancestors over the deep time of evolution. More specifically, IQ is considered to be a correlate of slower physical maturation, longer life spans, and lower levels of fecundity. As a result, it is not surprising that “smarter” counties should have lower aggregate mortality rates. From an evolutionary and life history standpoint, this is exactly what we would expect given the predictions offered by Rushton (2004).

Limitations of the analysis must be considered when interpreting the results. First, our measure of IQ was drawn from the Add Health's PVT test which is likely best characterized as a crystallized measure of intelligence. PVT scores have been utilized as indicators of IQ by prior research (e.g., Beaver & Wright, 2011), but future studies should seek to replicate the current set of findings with alternative measures of IQ score, especially those that tap fluid intelligence. A second limitation is that we were unable to analyze cause-specific mortality risk (aside from the AIDS death rate). The Add Health data, in order to limit the possibility of deductive disclosure, randomized county ID numbers meaning that we were unable to capitalize on mortality rate data gleaned from sources other than those provided by the Add Health research team. It would be interesting to analyze whether county IQ is related to other mortality outcomes such as the proportion of deaths resulting from violent crime. Given the link between aggregate IQ and aggregate crime rates (Lynn & Vanhanen, 2012), it may be reasonable to anticipate a negative relationship between these variables. At a minimum, we hope that the current study will serve as a springboard for future researchers considering the correlates and consequences of county IQ.

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