Mind the gap(s)…in theory, method and data: Re-examining Kanazawa (2006)

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Abstract: Kanazawa (2006) has put forward an evolutionarily grounded theory which claims that '*individuals in wealthier and more egalitarian societies live longer and stay healthier not because they are wealthier or more egalitarian but because they are more intelligent*' (2006: 637). The claim rests on an argument which asserts that general intelligence is a solution to evolutionarily novel problems and that most dangers to health in contemporary society are evolutionarily novel. Kanazawa also claims that this relationship does not hold in sub-Saharan Africa. These claims are based on a cross-national analysis which finds a positive correlation between 'national' IQ scores and mortality data. The implication is that intelligence is the principal factor determining longevity in the rest of the world, regardless of issues such as adequacy of diet and availability of health care. Kanazawa's theoretical claims about the evolution of general intelligence as a domain-specific adaptation are inconsistent with adaptationist analysis: natural selection does not solve general problems. The assumptions that sub-Saharan Africa is more representative of the evolutionary past than is the rest of the world, and that most hazards to health in contemporary society are evolutionarily novel, are implausible. The methods used are inadequate because Kanazawa argues for causation from correlation and fails to consider alternative explanations. The IQ data are flawed for reasons to do with sample size and sampling, extrapolation, and inconsistency across measures. Nor are they temporally compatible with the economic and demographic data.

1. Introduction.

Over the last decade evolutionary theory has become more generally applied to the behavioural sciences and its implications for health have increasingly been recognized (Eaton et al., 2002). As evolutionists we applaud this development. Evolutionary theory improves our understanding of human behaviour and ecology. However, Kanazawa's recent paper in this journal falls short of the scientific standards required to further this synthesis and make a useful contribution to health psychology. In this paper we address failings in his theory, his methods, and the data he deploys.

Kanazawa attempts to challenge the well-documented argument (Marmot & Wilkinson, 1999; Wilkinson, 1992, 2000) that differences in health and life expectancy are explained by social and economic inequalities. He proposes, instead, that intelligence is the principal determinant of health and longevity. This proposal is linked to Kanazawa's theory about the evolution of general intelligence (Kanazawa, 2004). He sees general intelligence as a domain specific adaptation for solving evolutionarily novel problems and argues that most dangers to health in contemporary environments are evolutionarily novel. As a result, he claims, more intelligent individuals are better able to cope with these dangers and thus live longer.

As a secondary argument Kanazawa claims that the environment of sub-Saharan Africa is evolutionarily more familiar than that of the rest of the world. Consequently, sub-Saharan Africa provides less evolutionary novelty for its population in all domains including health. Kanazawa concludes that intelligence and health outcomes should not be related in sub-Saharan Africa (SSA).

Kanazawa attempts to support these arguments with statistical analyses combining IQ data from Lynn and Vanhanen (2002) with economic and demographic data from United

Nations and World Bank databases. He finds a positive relationship between so-called 'national' IQ data and mortality rates. When measures of IQ, economic development and inequality are all correlated with mortality rates, only IQ emerges as a significant predictor. When sub-Saharan countries are analysed separately this relationship is no longer found.

We show that Kanazawa's claims run counter to evolutionary theory, that his methods are inadequate and that the IQ data are seriously flawed.

2. Problems with theory.

2.1 Inequality and stress.

Kanazawa opens his paper with a brief outline of Wilkinson's work on socioeconomic inequalities and health. Wilkinson (2000) lays out the thesis that less egalitarian societies with large differences in relative wealth are less healthy than more egalitarian countries or those with smaller relative wealth differences. Finding oneself at the bottom of a social hierarchy with few affiliates and other supports is a highly stressful situation. Cummins (2005) describes the neuroendocrine system, pointing out that adrenaline is designed to mobilise energy immediately and increase heart rate, whereas cortisol produces a slower response that replenishes energy by releasing glucose from stored fatty acids

Both Wilkinson and Cummins see neuroendocrine functioning as a conditional proximate mechanism that has been selected for in order to produce appropriate energy releasing responses in problematic situations, and as directly related to social dominance and subordination. Kanazawa claims that the stress mechanisms discussed by Wilkinson reduce the fitness of individuals if they are activated because of 'chronic low status' and argues that

natural selection would have provided an escape. His argument rests on a number of questionable assumptions.

First, Kanazawa assumes that there are individuals with permanently low status in primate groups. He also seems to assume that there is no movement within the lower ranks. He cites no evidence to support these views and disregards evidence that points to low ranking individuals in all primate species, including humans, forming coalitions to ameliorate their situation and improve their fitness (see Cummins, 2005, for a comprehensive review).

A second questionable assumption is that if the position of chronically low status individuals never changes they will avoid conflict. In fact the inherent risks of mate acquisition, for example, may be far greater for chronically low status individuals than for those further up the hierarchy and as a consequence they may face many more short-term emergencies. In short, Kanazawa provides no reason to reject the hypothesis that neuroendocrine functioning is an adaptation that is useful to low and high ranking individuals alike. The utility of this adaptation is that it releases energy to deal with emergencies that would otherwise undermine fitness, perhaps permanently.

2.2 The Savanna principle and evolutionary novelty.

After discussing inequality and stress, Kanazawa sets out the Savanna principle which claims that 'the human brain has difficulty comprehending and dealing with entities and situations that did not exist in the EEA (environment of evolutionary adaptedness), including virtually everything in modern society except for people and many social relationships' (Kanazawa 2006, p.625). Although Kanazawa lays claim to this idea the notion has existed in the literature for some time under the title of the mismatch hypothesis (for example see Dickins, 2006; Eaton et al., 2002; Nesse, 2005). The notion of a mismatch between ancestral and

modern environments was at the heart of early evolutionary experiments on reasoning (Cosmides, 1989). These experiments made it clear that the EEA should not be regarded as a specific time and place but as a statistical composite of the selection history for a given trait (Tooby & Cosmides, 2005).

Kanazawa identifies the human EEA with a savanna environment, and is, presumably, alluding to the Pleistocene era which is discussed in some evolutionary psychology literature as an important contributory epoch in our evolution (Badcock, 2000), but is certainly not the whole of it. The notion of mismatch has also attracted criticism (Irons, 1998; Laland & Brown, 2006). There is clear evidence that new physiological adaptations have emerged since the origins of agriculture (for example, lactase persistence and adaptations conferring resistance to malaria e.g. Hill et al., 1991; Holden & Mace, 1997). Behavioural evolution has also probably occurred. Nevertheless, Kanazawa wants to argue for a particularly strong form of the mismatch hypothesis claiming that virtually everything in modern society except for people and social relationships is novel. This cannot possibly be true. The concept of a shelter, for example, is not novel although the particular forms we have adopted and the materials used are. Is Kanazawa seriously saying that the human brain has difficulty comprehending the advantages of running water, windows, and heating mechanisms? Curiously, Kanazawa chooses an experimental game, the one-shot Prisoner's Dilemma, to illustrate how poorly suited humans are to modern environments. Perhaps players of one-shot Prisoner's Dilemma games behave 'irrationally' because completely anonymous social exchange is unlikely in any environment, ancient or modern.

2.3 The evolution of general intelligence

In the third stage of his theory building Kanazawa claims that general intelligence is a domain-specific adaptation to deal with new and non-recurrent problems. Kanazawa is here tackling what Plotkin (1995) has referred to as the uncertain futures problem. The problem exists for any species whose selection history has resulted in a suite of tailored adaptations that represent and deal effectively with past problem spaces. The success of individual members of such a species depends upon the stability of those problem spaces. How can such an organism deal with novelty? Novelty can be thrown up at any point in the organism's future and this possibility introduces uncertainty. Behavioural failure in the face of such uncertainty is at the core of the mismatch hypothesis which argues, in effect, that in many cases novelty cannot be dealt with. Kanazawa's Savanna Principle is an extreme version of this view. His proposed solution suggests that general intelligence affords sufficient flexibility to deal with novelty (see also Hampton, 2004 for an argument very similar to Kanazawa's).

Relying on the concept of general intelligence does not solve the novelty problem (see Dickins, 2005 for a detailed discussion). First, evolution through natural selection operates, as Kanazawa admits, to select specific solutions to specific recurrent problems. There is no such thing as a general adaptive problem that could have a general adapted solution. Second, evolution through natural selection has no foresight and therefore could not select for adaptations to future problems, be they recurrent or non-recurrent. In other words, natural selection cannot represent future environments within the genotype of an organism.

Kanazawa discusses novelty in terms of non-recurrent problems that happen frequently enough to be of consequence. This should strike us as odd. If a problem occurs with sufficient frequency to create a selection pressure it is a problem that evolutionary processes can provide a solution to. The problem will have specific characteristics and natural selection will find a domain-specific solution. If, on the other hand, a problem is

entirely new and never before encountered the only hope of a solution is the introduction of trait variation via the usual means, such as mutation, and subsequent selection. For this to occur, the problem would have to persist which again calls into question the idea that it can aptly be called novel. Kanazawa's attempt to build solutions to novelty into the architecture of the human mind undermines the notion of novelty. Once a solution is instantiated in the architecture the problem is solved, and thus no longer novel.

2.4 Novelty, health and longevity

Once Kanazawa has introduced his theory of general intelligence, he claims that health covaries with intelligence. He supports this claim by citing Deary et al. (2004) who looked at Scottish mental surveys from 1932 and 1947. Deary et al. found a significant relationship between important health outcomes and childhood intelligence but stated that 'caution is needed before inferring any causality in this relationship. The link between childhood psychometric intelligence and either specific pathology (with the exception of dementia) or physical frailty is unproven, and thus the pathway by which childhood psychometric intelligence relates to ill health in old age is unclear.' (Deary et.al., 2004, p.143).

Regardless of Deary et al.'s cautions, Kanazawa invokes the Savanna Principle and the concept of general intelligence to support a causal hypothesis. According to Kanazawa most health risks faced today are evolutionarily novel. He lists challenges that he claims are peculiar to modern environments – these include cigarettes, alcohol, sedentary lifestyles, automobiles and guns; and, later, crack cocaine and vodka. Kanazawa then simply states that "high-*g* individuals can better recognize such dangers to health, deal with them appropriately and so remain healthier and live longer" (p.626).

This argument rests on a large number of unsupported assumptions. First, the list of health risks deserves some attention. Smoking, drinking and taking drugs are all activities with short-term effects, often used to ameliorate stress-related symptoms that are typically associated with elevated cortisol (and thus consistent with Wilkinson's story). Moreover the assumption that smoking, drinking and risk taking are evolutionarily novel behaviours is implausible. Kanazawa buttresses his argument by claiming that modern dangers are more potent but this is pure speculation.

What is more, the health consequences of these risks can equally well be explained in terms of discounting (Dickins, 2006) where the true costs kick in post-reproductive age. If one is socially stressed one might seek to reduce the immediate negative effects, as they are experienced as more pressing than possible long-term negative consequences in the future. Such future discounting effects are well documented (see for example Wilson & Daly, 1997) and clearly relate to socio-economic status, much as Wilkinson would have us believe. Moreover, discounting effects may displace rational thinking about risks and as far as we know there is no relationship between intelligence and consideration for future consequences. Kanazawa presents no hard evidence for a relationship between intelligence and risk-taking behaviour of the kind his theory requires

In addition a link between high intelligence and low rates of risk-taking behaviours assumes that the costs and benefits of engaging or not engaging in risky behaviour are the same in all contexts. If extrinsic mortality is high, then the intelligent decision might be to engage in risky behaviour (with possible immediate benefits), since the risk of dying from causes unrelated to the risky behaviour is high. Under these circumstances the degree of discounting therefore depends on the environment, rather than intelligence.

2.5 Sub-Saharan Africa

The final plank of Kanazawa's argument is the claim that in sub-Saharan Africa "the site of our ancestral environment, where, even today, life in tribal societies is less radically different from the ancestral environment than in the rest of the world" (p.626) there should be no relationship between intelligence and health and longevity. Even if we take at face value Kanazawa's argument for a Pleistocene type of EEA, his suggestion that sub-Saharan Africans are still living in an evolutionarily familiar environment is implausible. The epoch that Kanazawa is alluding to was a time when our ancestors were involved in food production by hunting and gathering, yet only a tiny proportion of modern sub-Saharan Africans are still hunter-gatherers. Much of sub-Saharan Africa is involved in agriculture, both subsistence and commercial. There are substantial differences between agricultural and hunter-gatherer populations, not only in methods of food production, but also in mating, parenting and demography. It has been argued that in some respects the mating and parenting patterns of modern industrialised countries are more like those of hunter-gatherers (and thus less evolutionarily novel) than those of agricultural populations. For example, agricultural populations tend to have higher levels of polygyny and lower levels of paternal investment (Kaplan & Lancaster, 2003). The fertility, mortality and population growth of agricultural populations also seem to be higher than those of hunter-gatherers. In any case, a large and growing proportion of sub-Saharan Africans now live in urban environments which, like the industrialised world, are evolutionarily novel. In 2003 almost 40% of Africa's population lived in urban areas according to UN statistics (this figure includes North Africa, but in all sub-Saharan African regions at least a quarter of the population was urbanised: United Nations, 2004). All of which again calls into question Kanazawa's assertions and assumptions about novelty.

3. Problems with methods.

3.1 Correlation is not causation

Kanazawa finds positive correlations between national IQ and three measures of mortality (except when only sub-Saharan African countries are included in the models). He infers a direct causal relationship between IQ and mortality, but correlation is not causation. If there is an underlying variable which affects both IQ and mortality, then IQ and mortality rates may not be causally linked. Health is a candidate for such an underlying variable. Poor health is clearly related to the risk of death, and has also been correlated with cognitive performance (Ezeamama et al., 2005; Fernando et al., 2003; Liu, Raine, Venables, Dalais, & Mednick, 2003; Pearce, Deary, Young, & Parker, 2005). An obvious analogy is with height. Height, like IQ, is highly heritable, but variation in height also has a large environmental component, particularly in resource-stressed populations. Analysis within societies suggests that height is often negatively related to mortality rates (Costa, 1993; Marmot, Shipley, & Rose, 1984; Waaler, 1984). The usual explanation for these findings is that there is an underlying variable which affects both height and longevity: health. Health and nutritional status influence final adult height, and also affect mortality rates both during childhood and adulthood: height may therefore be a marker of a healthy phenotype. Kanazawa's complete failure to consider alternative explanations for his findings is a serious weakness of the paper. He has simply not considered the possibility that healthy brains might be part of healthier phenotypes more generally.

3.2 Choice of mortality statistics

Kanazawa correlates 3 measures of mortality with IQ: life expectancy at birth, infant mortality rates (< 1 year), and mortality rates of young adults (15-19 years). These three analyses are not independent, as life expectancy at birth is calculated from age-specific mortality rates (including infant mortality and mortality of 15-19 year olds). Quoting from the technical notes provided by the UN for the data Kanazawa uses on life expectancy and infant mortality rates "In areas with high infant and child mortality rates, the indicator (life expectancy at birth) is strongly influenced by trends and differentials in infant and child mortality" (United Nations Statistics Division, 2006).

Kanazawa's choice of infant and young adult mortality rates also raises problems for his theoretical arguments. He claims that the correlation between the infant mortality rate and IQ is seen because there is a link between parents' intelligence and infant mortality. He also finds that economic development and inequality matter not at all if IQ is entered into the regression equation. But it is difficult to envisage exactly how the intelligence of a caretaker could be the only influence on the mortality of very young children. The biggest killers of babies are congenital abnormalities and infectious diseases (Murray & Lopez, 1997). Endogenous causes such as congenital abnormalities are not amenable to changes in the behaviour of caretakers. Exogenous causes such as infectious disease may conceivably be affected by the propensity of the caretaker to seek medical attention (which may be linked to intelligence), but that depends on medical care being available, affordable and of sufficiently high quality. At least when conducting such a crude, cross-national comparison of infant mortality rates, it seems more parsimonious to assume that variation in the mortality of very young children is more strongly affected by variation in the provision of medical care and public health services than in the intelligence of the child's caretaker.

The rationale for choosing to analyse young adult mortality is also unconvincing: Kanazawa argues this is the age at which individuals begin to make their own health related decisions. But variation in mortality at this age for women may be at least partly explained by variation in maternal mortality rates (AbouZahr & Wardlaw, 2003). It is unclear how maternal mortality can be considered a 'choice'. Also, as noted above, many of Kanazawa's supposedly novel hazards have detrimental effects on health largely in the long-term. Even if individuals were beginning to smoke, drink and take drugs in their teens, the effects of these behaviours would probably be most noticeable in later life.

3.3 The analysis is not properly controlled

Kanazawa includes only a control for GDP in his analysis but the factors he really needs to control for are the availability of education and health services, since those are the relevant factors which will affect variation in mortality rates. While economic development and mortality rates are clearly linked (Preston, 1975), countries with similar levels of economic development can display considerable differences in the health of their populations because of differences in spending on health and education (Caldwell, 1986). There are numerous other factors Kanazawa does not consider. For example, countries with the worst mortality statistics tend to be either those which have recently engaged in conflicts or those with high levels of HIV/AIDS.

3.4 Collinearity

Given that Lynn and Vanhanen (2002) find their national IQ data to be highly correlated with economic development, entering both IQ and GDP into the same regression model raises

problems of collinearity. This means that the individual regression coefficients cannot be estimated reliably so that, at the least, the magnitude of the correlation between IQ and mortality (stressed at several points by Kanazawa) cannot be taken at face value.

4. Problems with data.

4.1 Problems with IQ data

One of the principal criticisms that must be made of Kanazawa's paper is its unquestioning reliance on IQ data obtained from Lynn & Vanhanen (2002). Kanazawa says of this source, 'Lynn and Vanhanen compiled a comprehensive list of "national IQs" of 185 nations in the world, either by calculating the mean scores from a large number of primary data or carefully estimating them from available sources.' (Kanazawa, 2006: p627). Primary data were available for eighty one countries only, so the majority of the so-called 'national' figures are estimates. The estimation process was flawed, but this is a secondary concern. The first consideration is the quality of the primary data.

The primary data are grossly inadequate for two reasons: first, the sampling is sketchy at best and ludicrously insufficient at worst; second, the calculations of mean values from multiple samples and the method of adjustment to account for the 'Flynn effect' are both fundamentally inadequate. Consider, first, a few examples of the primary data. The 'national' IQ figure for Barbados is derived from a sample of 108 nine to fifteen year olds. The figure for Ethiopia is derived from a sample of 250 fifteen year old immigrants to Israel. The figure for Nigeria is derived from one sample of 86 adult men and one sample of 375 six to thirteen year olds. The figure for Sierra Leone is derived from one sample of 22 twenty three year old skilled workers and one sample of 60 adults. The figure for Russia is derived from a sample

(no sample size reported) of 14-15 year olds drawn from the city of Briansk. In no case do the data appear to be derived from samples that can plausibly be regarded as representative of the national populations discussed.

We have looked in detail at the sources from which Lynn and Vanhanen derived their 'national' data for Ethiopia, Nigeria and Sierra Leone, choosing these countries because the figures are exceptionally low and because they are sub-Saharan countries which feature prominently in Kanazawa's analysis. The figures in question are Ethiopia (63), Nigeria (67) and Sierra Leone (64). In each case Lynn and Vanhanen have misused data gathered for purposes other than the making of national IQ estimates.

The data used by Lynn and Vanhanen for Ethiopia were taken from a paper by Kaniel & Fisherman (1991) which compared the IQ scores of 250 14-15 year old Ethiopian immigrant Jews with a sample of 1740 Israeli Jews aged 9-15. Kaniel and Fisherman attributed the low IQ test performance of the Ethiopian immigrants, relative to the comparison sample of Israelis of the same age, to cognitive delay rather than to difference. They also pointed out that there is a consensus that minority and immigrant groups score lower than dominant groups in IQ tests. Kaniel and Fisherman explicitly stated that their results do 'not imply that the subjects will exhibit low cognitive abilities over the long term' (op.cit., p.30) and cited another study which showed that immigrant Ethiopian Jews could catch up with their Israeli counterparts given a suitable intervention programme. Given this analysis, it is unacceptable for Lynn and Vanhanen to have used the immigrant sample's average score as a stable representation of the IQ of the Ethiopian population as a whole.

The data for Nigeria and Sierra Leone are equally flawed for purposes of national comparisons. The data for Sierra Leone are taken from two sources. Berry (1966) compared a sample of the Temne from Sierra Leone with an Eskimo sample to examine the effects of cultural and ecological differences on perceptual skills. Binnie-Dawson (1984) carried out

further cross cultural work matching his Temne sample with one from central Australia. In neither case was the Temne sample intended to be representative of the whole population of Sierra Leone.

Berry investigated two groups of Temne in order, in part, 'to eliminate "race" as a comprehensive explanation for any perceptual differences found between the societies.' Berry (1966, p.209). It is not clear which group Lynn and Vanhanen used because the sample size they report does not match either of the groups in Berry's study but it is quite clear that Berry's findings explicitly demonstrate intra-national variation as a result of acculturation. It was therefore inappropriate for Lynn and Vanhanen to take any data from this study as representative of a fixed national IQ value. Moreover, Berry explicitly made the point that the tests used were culturally biased and that culture free tests are unattainable. For cross national comparisons of the kind Lynn and Vanhanen make this is a crucial point and further invalidates their use of the data. Binnie-Dawson (1984) was also explicit about the cultural bias of the tests employed. For this reason his data, too, are fundamentally unsuited for the use to which Lynn and Vanhanen put them.

The data which Lynn and Vanhanen used for Nigeria were drawn from two sources. Wober (1969) tested a sample of Nigerian adults on a range of measures. Fahrmeier (1975) compared a sample of Hausa schoolchildren with a sample of unschooled children. Wober tested his participants twice with a six-month gap between initial testing and re-testing. He stated clearly that 'a strong case can be made that the second testing gave a distinctly more valid measure of whatever abilities the Matrices and EFT [Embedded Figures Test] involve.' Lynn and Vanhanen ignored this point and reported the lower figure from the first test as the sample value without comment or justification.

Fahrmeier (1975) explored the question of whether schooling has an effect on cognitive development. Lynn and Vanhanen simply recorded the average score on Raven's

Coloured Progressive Matrices for 375 of Fahrmeier's subjects without regard either to the purposes of the study or to Fahrmeier's discussion of his results. The 375 test scores used by Lynn and Vanhanen to calculate their average were the aggregate of eight group scores reported by Fahrmeier. The results showed that there were statistically significant differences between different age groups and also between schooled and unschooled cohorts. It is quite obvious from these results that an average derived from the whole set of scores should not be used as a fixed IQ value for the cohort as a whole, never mind for the population of Nigeria as a whole.

It is clear that Lynn and Vanhanen's 'national' data are not accurate, representative or valid for the purposes to which they have been put. We conclude by commenting on the sub-Saharan data in general because of Kanazawa's focus on this area. Lynn and Vanhanen's book gives data for twenty nine sub-Saharan countries but eighteen of the figures are estimates. The primary sub-Saharan African data consist of figures for eleven countries. These data cannot be representative of the populations of sub-Saharan Africa.

The inadequacy of the sub-Saharan African sampling calls into question one of the major features of Kanazawa's results, viz. the finding that mortality data are not predicted by IQ in that part of the world although they are elsewhere. One explanation for this is that the finding is a simple statistical artefact. Inspection of the IQ figures for the eleven countries for which 'primary' data are available shows a range of only 14 IQ points and a standard deviation of 4.34. By contrast, the non sub-Saharan African countries have a range of 35 IQ points and a standard deviation of 7.66. There is, therefore, comparatively little variability in the SSA figures and, consequently, they may have little predictive power for this reason alone.

4.2 Problems with demographic and economic data

Kanazawa uses data on mortality prepared by the UN from national statistical sources. While this mortality data may be the best available, it is important to note that there is considerable variation in the quality of national data collected, and that many of the statistics presented for developing countries are estimates (United Nations Statistics Division, 2006). The quality of the data on young adult (15-19) mortality is particularly questionable. This analysis is based on an extremely small number of deaths for some countries, since mortality rates for young adults are usually relatively low (the 15-19 mortality rates given in the Appendix are expressed per 1000, which is not mentioned in the Appendix nor the text of the paper). In a few cases the rates are based on fewer than 30 deaths, e.g. both male and female rates in Luxemburg, female rates in Armenia, Estonia, Slovenia and Macedonia. Age-specific mortality rates are particularly prone to error because of age misreporting, common in countries with relatively low levels of literacy (Ewbank, 1981). Again referring to the UN: "the reliability of age data should be of concern to users of these statistics" (United Nations, 2002: 5).

Similar data quality caveats apply to the economic data collected by the World Bank (World Bank, 2004). It is also worth noting that data on income inequality is not available for a large number of countries. Lynn and Vanhanen (2002) produced national IQ estimates for 185 countries, but only 126 of these have available data on both GDP and income inequality. The included countries may not be a representative sample of the world's population (it is also worth noting that at no point does Kanazawa explain why only two-thirds of the countries with available IQ data were included in his analysis, indicating a somewhat cavalier attitude to the usual requirements for rigour when describing scientific methodology).

4.3 Comparability of IQ, demographic and economic data

The data used by Kanazawa are not all temporally comparable. Data on GINI coefficients from the World Bank were collected at various times during the 1990s and early 2000s; GDPs are presented for 2004; data on life expectancy at birth and infant mortality are presented for 2000-2005; data on young adult mortality rates were collected variously between 1993 and 2002. Given that economic development and mortality rates both change over time, including data in the analysis collected over a 15 year period introduces both noise and bias. These demographic and economic data are also not comparable to the IQ data. The raw data used to calculate national IQ figures were collected between the 1930s and 1990s. Various adjustments were made to the raw data to account for a potential secular trend over time, but these adjustments involved a variety of questionable assumptions.

5. Conclusion

Our examination of Kanazawa's paper demonstrates clearly the inadequacies of his theory, methods and data. We can see no reason to believe his claim that intelligence is the only significant determinant of mortality. To the contrary, the evidence that inequality, economic development, schooling, health care and nutrition are the principal determinants of mortality remains unaffected by Kanazawa's mistaken and misleading arguments.

Kanazawa's weak analysis does not negate the value of research exploring the relations between IQ test scores and health. As Deary et. al. (2004) have shown there is reliable evidence for just such a relationship in Scotland. Similarly careful studies in other countries will also be useful. It remains unclear, however, that such studies will demonstrate causal relationships between IQ and mortality. If IQ is measuring something that is sensitive

to ecological circumstances and is related to health then generalizing the relationship across ecologies will lose the all important detail. What is needed for all further work is a clear understanding of the relationship between IQ and health within societies.

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