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Mind the gap. . .in intelligence: Re-examining the relationship between inequality and health

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Wilkinson contends that economic inequality reduces the health and life expectancy of the whole population but his argument does not make sense within its own evolutionary framework. Recent evolutionary psychological theory suggests that the human brain, adapted to the ancestral environment, has difficulty comprehending and dealing with entities and situations that did not exist in the ancestral environment and that general intelligence evolved as a domain-specific adaptation to solve evolutionarily novel problems. Since most dangers to health in the contemporary society are evolutionarily novel, it follows that more intelligent individuals are better able to recognize and deal with such dangers and live longer. Consistent with the theory, the macro-level analyses show that income inequality and economic development have no effect on life expectancy at birth, infant mortality and age-specific mortality net of average intelligence quotient (IQ) in 126 countries. They also show that an average IQ has a very large and significant effect on population health but not in the evolutionarily familiar sub-Saharan Africa. At the micro level, the General Social Survey data show that, while both income and intelligence have independent positive effects on self-reported health, intelligence has a stronger effect than income. The data collectively suggest 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.

In a series of articles and books, Richard G. Wilkinson argues that economic inequality reduces the health of the whole population and lowers its life expectancy (Marmot & Wilkinson, 1999; Wilkinson 1986, 1992, 2000, 2005). He claims that humans and other primates have an evolved physiological mechanism whereby their cortisol level goes up when they are under attack or in other dangerous situations. Heightened levels of cortisol and other stress hormones allow the individuals to deal with short-term emergencies by preparing them for the 'fight or flight' response. 'When survival depends on alertness, reaction times and the ability to run fast, all the biological 'housekeeping' functions such as tissue maintenance and repair, immunity, growth, digestion and reproductive process can be left until later' (Wilkinson, 2000, p. 37).

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> The chemical signals from the hypothalamus (in the brain), relayed by the pituitary gland (just under the brain) cause the glands to release cortisol into the bloodstream. This is termed the 'hypothalamic-pituitary-adrenal axis' (HPA axis). Cortisol is a central stress hormone. To make energy available, it increases blood sugar (glucose) levels by counteracting the effects of insulin in order to release fatty acid from the body's stores of fat. In the brain it increases vigilance, backing up the effects of adrenaline. In addition, the pituitary gland releases several other hormones during stress, including prolactin – which inhibits reproductive processes – and morphine-like pain-killers, some of which are also produced by the brain. Much of this makes obvious sense in an evolved adaptive strategy whereby short-term emergencies take priority (Wilkinson, 2000, p. 39).

This physiological process for 'fight or flight', however, has negative long-term health consequences. If the dangerous situation is prolonged, the continuously high levels of stress and anxiety damage health. 'Serious consequences for health arise when anxiety and physiological arousal are sustained or recur frequently over weeks, months or years . . . . Because over-activation of the immune system leads to autoimmune diseases, in which the body's defence mechanisms are triggered unnecessarily, the initial heightened immune response during short-term stress would be dangerous if prolonged' (Wilkinson, 2000, pp. 40–41).

Wilkinson then argues that occupying a low status in society is physiologically analogous to being in a constant, prolonged state of arousal and perpetually ready to fight or flee, with the same hormonal consequences. He contends that this is why there is a health gradient, whereby those who occupy a higher status within any society are healthier and live longer than those who occupy a lower status. At the same time, Wilkinson claims that the general level of health is lower and life expectancy is shorter in societies with greater inequality. His conclusion is succinctly captured on the cover of his book *Mind the Gap*: 'Inequality kills. People die younger in countries with greater inequalities in income'. Lynch *et al.* (2004) provide a comprehensive review of recent studies on the 'income inequality hypothesis' from the epidemiological perspective.

Wilkinson's theory, however, does not make sense within its own evolutionary framework. Given that stress and anxiety lead to health problems and early death, and reduce reproductive success (due, for example, to exceedingly high levels of prolactin) with no apparent compensating benefits, any genetic mutation that allows its carrier *not* to experience stress in the face of permanently low status from which it cannot escape (the 'Que sera sera' gene?) will be selected. Chronic low status, being at the bottom of a social hierarchy for life, seems dramatically different from the acute emergency of imminent physical attack which cortisol and other stress hormones are designed to respond to. Any genotype which makes a distinction between short-term emergencies of physical attack and long-term chronic low status and responds differently, with a surge of cortisol, prolactin and other stress hormones to the former but not to the latter, will be favoured by natural selection over another genotype which does not make such a distinction and responds similarly to both. Since all primate societies are hierarchical and there are chronically high- and low-status individuals in them, suggesting that the origins of human social hierarchies go back at least 15–20 million years in evolutionary history, it appears that there should have been enough time for such a genetic mutation to emerge and spread. What is the ultimate function of stress and anxiety in the face of low status? If there is not one, why has natural selection not eliminated such stress and anxiety?

The Savanna Principle

Recent developments in evolutionary psychological theory suggest an entirely different determinant of health and life expectancy. The human brain, just like any other part of any other organism, is an evolved organ adapted to its environment of evolutionary adaptedness (EEA; Tooby & Cosmides, 1990). This fundamental observation of evolutionary psychology leads Kanazawa (2004a) to propose the Savanna Principle, which states that the human brain has difficulty comprehending and dealing with entities and situations that did not exist in the EEA, including virtually everything in modern society except for people and many social relationships (mateships, parenthood, kin relationships).[1] Kanazawa uses the Savanna Principle to explain that some otherwise elegant scientific theories of human behaviour, such as microeconomic subjective expected utility maximization theory and game theory, often fail empirically because they posit entities and situations that did not exist in the EEA and thus are difficult for the human brain to fully comprehend. For example, he speculates that many players of one-shot Prisoner's Dilemma games make the theoretically irrational choice to cooperate with their partner because the human brain has difficulty comprehending completely anonymous social exchange with absolutely no possibility of future interactions, situations that did not exist in the EEA but are logically crucial for the game-theoretic prediction of universal defection (Kanazawa, 2004a, pp. 44–45).

The evolution of general intelligence

In an entirely different line of research, Kanazawa (2004b) advances an evolutionary psychological theory of the evolution of general intelligence. In contrast to views expressed by Cosmides and Tooby (2002) and Chiappe and MacDonald (2003), Kanazawa proposes that what is now known as general intelligence originally evolved as a domain-specific adaptation to deal with evolutionarily novel, non-recurrent problems. The human mind consists of numerous domain-specific adaptations to solve recurrent adaptive problems. In this sense, our ancestors did not really have to think in order to solve such recurrent problems. Evolution has already done all the thinking, so to speak, and equipped the human brain with the appropriate psychological mechanisms, which engender preferences, desires, cognitions, and emotions and motivate adaptive behaviour in the context of the ancestral environment.

Even in the extreme continuity and constancy of the EEA, however, there were occasional evolutionarily novel and non-recurrent problems that, in order to be solved, required our ancestors to think and reason, deductively and inductively. To the extent these evolutionarily novel, non-recurrent problems happened frequent enough in the EEA (different problem each time) and had serious enough consequences for survival and reproduction, then any genetic mutation that allowed its carrier to think and reason would have been selected for, and what we now call 'general intelligence' could have evolved as a domain-specific adaptation for solving evolutionarily novel, non-recurrent problems. Kanazawa (2004b) suggests that general intelligence has only become universally important in modern life (Gottfredson, 1997; Herrnstein & Murray, 1994; Jensen, 1998) because our current environment is almost entirely evolutionarily novel.

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[1] *Kanazawa's (2004a) Savanna Principle about the evolutionary limitations and biases of the human brain is not to be confused with Orians' (1980, 1986) habitat selection theory, sometimes known as the Savannah Hypothesis (Buss, 2004, pp. 88–90), about the innate human preference for savannah-like habitat.*

Kanazawa (2004b) then derives and empirically supports a hypothesis that intelligent (high-*g*) individuals are only better than less intelligent (low-*g*) individuals at solving problems *if* the problems are evolutionary novel and that intelligent individuals are *no better* than less intelligent individuals at solving evolutionarily familiar problems, such as those in the domains of mating, parenting, interpersonal relationships and wayfinding.

The logical conjunction of the Savanna Principle and the theory of the evolution of general intelligence suggests a qualification of the Savanna Principle. The human brain's difficulty in dealing with and comprehending entities and situations that did not exist in the EEA should interact with general intelligence such that the Savanna Principle holds stronger among less intelligent individuals than among more intelligent individuals. High-*g* individuals should be better able to deal with and comprehend evolutionarily novel entities and situations than low-*g* individuals.

Evolutionary psychological perspective on health and longevity in the modern society

Deary, Whiteman, Starr, Whalley, and Fox's (2004) recent longitudinal analysis of the Scottish mental surveys of 1932 and 1947 reveals that childhood intelligence has a positive effect on longevity; more intelligent Scots live longer than less intelligent Scots. This and other similar findings prompt the intelligence researcher Linda S. Gottfredson (2004) to suggest that general intelligence might be the 'fundamental cause' of the health gradient that has long been known to epidemiologists. Since individuals in higher social classes tend to be more intelligent on average than those in lower social classes (Kanazawa & Kovar, 2004, pp. 232–234), a positive effect of intelligence on health and longevity will produce the health gradient where those in higher classes are healthier and live longer than those in lower classes. While there is emerging evidence that intelligence increases health and longevity, neither intelligence researchers nor epidemiologists seem to know why. Gottfredson and Deary (2004) thus ask in the title of their recent article, 'Intelligence predicts health and longevity, but why?'

The Savanna Principle and its interaction with general intelligence discussed above can provide one answer. Most dangers to health today are evolutionarily novel. These include cigarettes, alcohol, junk food, sedentary life (which necessitates regular exercises), automobiles and guns. While our ancestors in the African savannah may have partaken in psychotropic drugs and intoxicating substances (since their use is known among contemporary hunter-gatherers), they certainly did not have anything nearly as potent and, as a result, as potentially dangerous as crack cocaine or vodka. The revised Savanna Principle would therefore predict that high-*g* individuals can better recognize such dangers to health, deal with them appropriately and so remain healthier and live longer.

I thus predict that, in largely evolutionarily novel modern society, more intelligent individuals live longer than less intelligent individuals (as Deary *et al.* (2004) discovered). However, intelligence should not affect health and life expectancy 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. I will first test these two hypotheses with macro data from a large number of countries. I will then use micro data on individuals from the United States to attempt to replicate Deary *et al.*'s finding from Scotland on the positive effect of intelligence on health and longevity.

Macrolevel analysis

Data

All the macro-level data comes from published sources. Data on male and female life expectancy at birth (in years) and on economic development (gross domestic product [GDP] per capita) was obtained from the United Nations (http://unstats.un.org/unsd/demographic/products/socind/health.htm and http://unstats.un.org/unsd/demographic/products/socind/inc-.eco.htm). Data on income inequality (Gini coefficient) was obtained from the World Bank (http://www.worldbank.org/data/wdi2004/pdfs/table2-7.pdf). Data on national intelligence quotients (IQs; the mean IQ of a country's population) was obtained from Lynn and Vanhanen's data (2002). 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. The Appendix presents all of the data used in the following macro-level analyses. The data will allow any interested readers to replicate all of the findings below.

Results

Table 1 shows that income inequality, measured by a Gini coefficient, has a strong and highly significantly negative effect on the life expectancy of men (column 1: $\beta = -0.4883$, $p < .0001$) and women (column 4: $\beta = -0.4870$, $p < .0001$). This bivariate analysis therefore confirms Wilkinson's conclusion that income inequality reduces life expectancy.

Table 1. The effects of income inequality, national IQ and economic development on life expectancy at birth (all nations)

	Male life expectancy at birth			Female life expectancy at birth		
	1	2	3	4	5	6
Gini coefficient	−.5920****	−.1332	−.1245	−.6726****	−.1255	−.1258
	(.0946)	(.0687)	(.0698)	(.1079)	(.0723)	(.0736)
	−0.4883	*−0.1092*	*−0.1021*	*−0.4870*	*−0.0903*	*−0.0905*
National IQ		.8486****	.8214****		1.0130****	1.0138****
		(.0615)	(.0709)		(.0647)	(.0748)
		0.7786	*0.7536*		*0.8156*	*0.8163*
GDP per capita			.0001			−.0000
			(.0001)			(.0001)
			0.0479			*−0.0013*
Constant	86.7792	−5.0476	−3.4222	94.8556	−14.7307	−14.7807
	(3.9230)	(7.1048)	(7.4221)	(4.4731)	(7.4736)	(7.8263)
R^2	.2385	.7003	.7018	.2372	.7446	.7446
N	127	126	126	127	126	126

Note. Main entries are unstandardized regression coefficients.
Numbers in parentheses are standard errors.
Numbers in italics are standardized regression coefficients (betas).
*$p < .05$; **$p < .01$; ***$p < .001$; ****$p < .0001$.

It turns out, however, that his conclusion that 'inequality kills' may be premature because the significantly negative effect of income inequality on life expectancy may be spurious. Once national IQ is entered in the multiple regression equations (columns 2 and 5), income inequality ceases to have any significant effect on either male ($\beta = -0.1092$, *ns*) or female ($\beta = -0.0903$, *ns*) life expectancy. National IQ instead has a very large and strong effect on male ($\beta = 0.7786$, $p < .0001$) and female ($\beta = 0.8156$, $p < .0001$) life expectancy. A comparison of their standardized coefficients reveals that national IQ has seven to eight times as strong an effect on life expectancy as does income inequality ($\beta = -0.1092$ vs. $\beta = 0.7786$ for male life expectancy; $\beta = -0.0903$ vs. $\beta = 0.8156$ for female life expectancy). National IQ single-handedly explains about half of the variance in life expectancy across the 126 countries.

Even though economic development is highly correlated with national IQ (Lynn & Vanhanen, 2002), national IQ is not a proxy for economic development in the present analysis. When entered with the Gini coefficient and national IQ (columns 3 and 6), GDP per capita has no effect at all on male or female life expectancy ($\beta = 0.0479$, *ns*, for male life expectancy; $\beta = -0.0013$, *ns*, for female life expectancy). Note that the unstandardized regression coefficient for national IQ in Equation 6 for female life expectancy is 1.0138. It means that *each additional point in mean IQ of a population increases the female life expectancy at birth by more than a year!* (The correspondent effect on male life expectancy is 8214.)

Figures 1–3 show the partial relationship between male life expectancy, on the one hand, and income inequality (Figure 1), national IQ (Figure 2) and economic development (Figure 3) on the other, and Figures 4–6 show the same partial relationships with female life expectancy. Figures 1 and 4 show that, when national IQ and economic development are controlled, income inequality has no relationship with male or female life expectancy, contradicting Wilkinson's argument. Similarly, Figures 3 and 6 show that when national IQ and income inequality are controlled, economic development has no effect on male or female life expectancy. In sharp contrast, even when income inequality and economic development are controlled, national IQ has a very strong partial relationship with male life expectancy (partial $r = .7236$; Figure 2) and female life expectancy (partial $r = .7752$; Figure 5).

Table 2 presents the results from a limited sample of 29 sub-Saharan African countries.[2] As before, in the bivariate regressions (columns 1 and 4), income inequality has a significantly negative effect on male ($\beta = -0.4946$, $p < .01$) and female ($\beta = -0.4347$, $p < .05$) life expectancy. However, unlike before, the inclusion of national IQ in multiple regression equations does not attenuate the negative effect of income inequality on life expectancy. In clear contrast to the analysis with all 126 nations, the result from the 29 sub-Saharan African nations shows that national IQ has no effect on either male ($\beta = -0.1854$, *ns*) or female ($\beta = -0.1665$, *ns*) life expectancy. The inclusion of economic development in the equations (columns 3 and 6) does not alter the picture at all.

Additional analyses

Limiting the sample to 81 countries for which national IQ was directly measured

Lynn and Vanhanen's (2002) data on national IQs for 185 countries, on which I rely heavily for the macro-level analyses presented above, are quite controversial, partly because Lynn and Vanhanen have direct measures of national IQ for less than half of these nations (81)

[2] *I exclude Madagascar from the subsample of sub-Saharan African nations because it is discontiguous with the rest of sub-Saharan Africa and I do not know if it was part of our ancestral environment. Including Madagascar in the subsample does not at all alter the results presented in Table 2, however.*

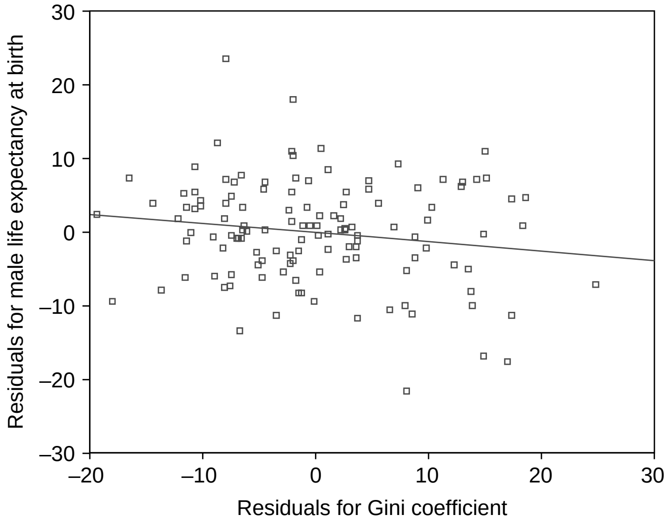

Figure 1. Partial correlation between male life expectancy and income inequality.

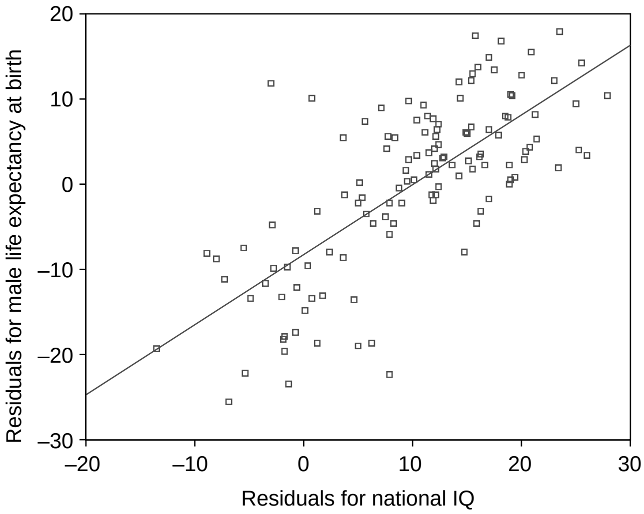

Figure 2. Partial correlation between male life expectancy and national IQ.

and the national IQs of the rest of the nations are carefully estimated from information from the 81 nations. Lynn and Vanhanen (2002, pp. 71–73) explain how they estimate the national IQ of the additional 104 nations but critics have questioned some of the details of Lynn and Vanhanen's estimation methods (Palairet, 2004). It is possible that their estimation is imprecise or even biased, although it is difficult to see how it could be biased *simultaneously* to bolster Lynn and Vanhanen's claims about economic development *and* my claims about health and longevity. At any rate, in order to assess whether my results presented in Table 1 are in any way biased by Lynn and Vanhanen's estimation procedure, I have rerun the analysis with the subsample of 81 nations for which Lynn and Vanhanen have direct measures of national IQ.

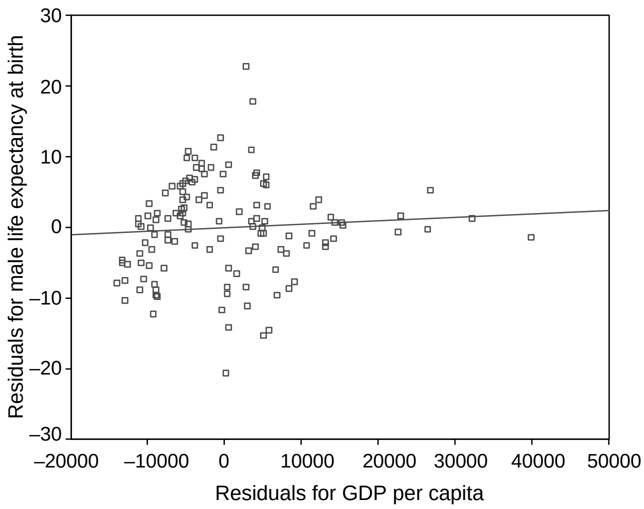

Figure 3. Partial correlation between male life expectancy and economic development.

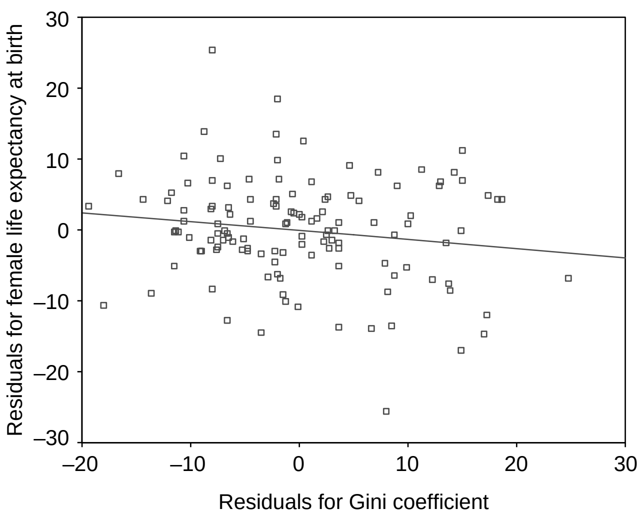

Figure 4. Partial correlation between female life expectancy and income inequality.

Table 3 presents the results from this smaller subsample. Despite the much smaller number of cases ($N = 65$ versus $N = 126$), the findings are identical to those presented in Table 1 for the full sample. When entered alone, income inequality has a large and highly significant effect on male and female life expectancy at birth ($\beta = -0.5163$, $p < .0001$ for male; $\beta = -0.4989$, $p < .0001$ for female). However, as before, when national IQ is entered, it has an even larger effect on life expectancy at birth ($\beta = 0.7785$, $p < .0001$ for male; $\beta = 0.8177$, $p < .0001$ for female) and income inequality ceases to have a significant effect ($\beta = -0.1467$, *ns* for male; $\beta = -0.1106$, *ns* for female). Once again, as before, entering economic development does not change these findings; GDP per capita has absolutely no effect on life expectancy when entered with the Gini coefficient and national IQ ($\beta = 0.0597$, *ns* for male; $\beta = 0.0027$, *ns* for

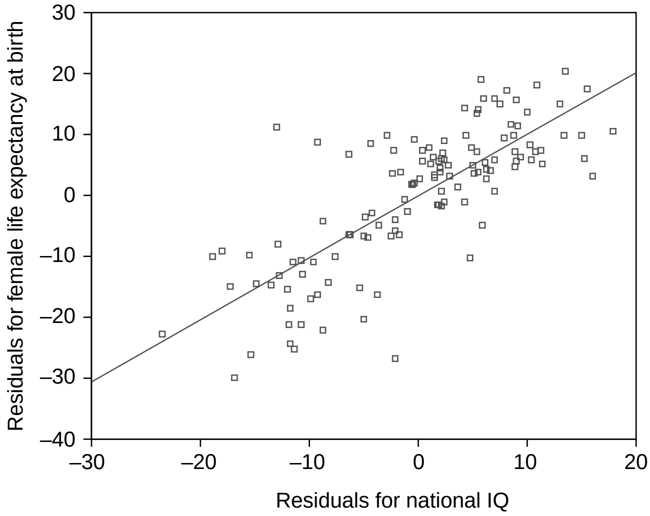

Figure 5. Partial correlation between female life expectancy and national IQ.

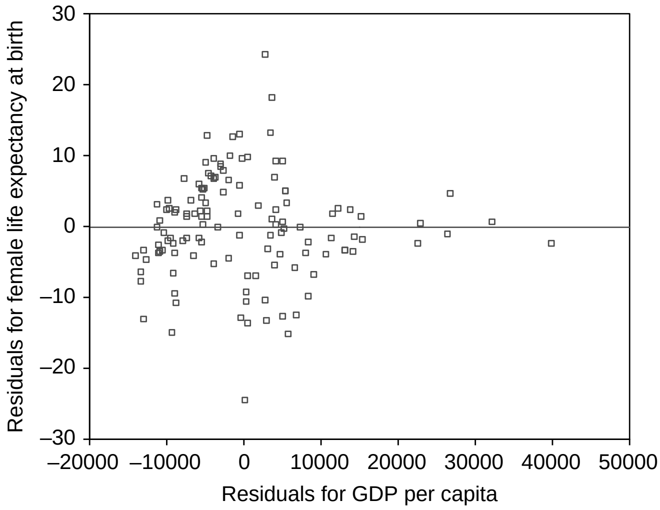

Figure 6. Partial correlation between female life expectancy and economic development.

female). Even when income inequality and economic development are controlled, national IQ has a large and statistically significant effect on life expectancy ($\beta = 0.7469$, $p < .0001$ for male; $\beta = 0.8163$, $p < .0001$ for female). It therefore appears that, at least for the purpose of my substantive conclusions, Lynn and Vanhanen's estimation of national IQs for 104 additional nations does not seem to introduce bias.

There are only 11 sub-Saharan African nations for which national IQ was directly measured. Despite its extremely small sample size, regression analyses performed with these 11 nations replicate the results from Table 2 for the full sample of 29 sub-Saharan African nations. When income inequality and economic development are controlled, national IQ does not have any significant effect on male and female life expectancy while income inequality has a significant ($p < .05$) negative effect.

Table 2. The effects of income inequality, national IQ and economic development on life expectancy at birth (sub-Saharan African nations)

	Male life expectancy at birth			Female life expectancy at birth		
	1	2	3	4	5	6
Gini coefficient	−.2877**	−.2730**	−.3732**	−.2706*	−.2564*	−.3843**
	(.0973)	(.0978)	(.1104)	(.1079)	(.1091)	(.1207)
	−0.4946	*−0.4693*	*−0.6416*	*−0.4347*	*−0.4120*	*−0.6175*
National IQ		−.3594	−.5254		−.3453	−.5572
		(.3260)	(.3281)		(.3635)	(.3589)
		−0.1854	*−0.2710*		*−0.1665*	*−0.2686*
GDP per capita			.0023			.0030
			(.0013)			(.0015)
			0.3454			*0.4119*
Constant	56.4567	80.7380	95.4676	57.5514	80.8815	99.6784
	(4.7645)	(22.5321)	(23.2840)	(5.2825)	(25.1264)	(25.4714)
R^2	.2446	.2784	.3466	.1890	.2161	.3275
N	29	29	29	29	29	29

Note. Main entries are unstandardized regression coefficients.
Numbers in parentheses are standard errors.
Numbers in italics are standardized regression coefficients (betas).
*$p < .05$; **$p < .01$; ***$p < .001$; ****$p < .0001$.

Table 3. The effects of income inequality, national IQ and economic development on life expectancy at birth (nations for which national IQ was directly measured, not estimated)

	Male life expectancy at birth			Female life expectancy at birth		
	1	2	3	4	5	6
Gini coefficient	−.6181****	−.1756	−.1570	−.6822****	−.1513	−.1503
	(.1292)	(.0888)	(.0935)	(.1493)	(.0953)	(.1008)
	−0.5163	*−0.1467*	*−0.1311*	*−0.4989*	*−0.1106*	*−0.1099*
National IQ		.7805****	.7488****		.9364****	.9348****
		(.0743)	(.0888)		(.0798)	(.0957)
		0.7785	*0.7469*		*0.8177*	*0.8163*
GDP per capita			.0001			.0000
			(.0001)			(.0001)
			0.0597			*0.0027*
Constant	90.3660	3.2271	4.7261	97.9652	−6.5832	−6.5046
	(5.1143)	(8.8557)	(9.1832)	(5.9120)	(9.5080)	(9.8946)
R^2	.2666	.7361	.7379	.2489	.7668	.7668
N	65	65	65	65	65	65

Note. Main entries are unstandardized regression coefficients.
Numbers in parentheses are standard errors.
Numbers in italics are standardized regression coefficients (betas).
*$p < .05$; **$p < .01$; ***$p < .001$; ****$p < .0001$.

Using total infant mortality rate

Table 4 presents the analysis of the total infant mortality rate, which is the number of deaths among infants under one year of age per 1,000 live births. The data come from the same United Nations table as male and female life expectancy at birth (http://unstats.un.org/unsd/demographic/products/socind/health.htm). The empirical results for infant mortality are exactly the same as for life expectancy. When entered alone, income inequality has a significantly positive effect on the total infant mortality rate ($\beta = 0.4030, p < .0001$); the more unequal the income distribution, the higher the infant morality rate. When national IQ is entered into the equation, however, it has a very strong and statistically significant negative effect ($\beta = -0.8372, p < .0001$), while income inequality ceases to have any effect ($\beta = -0.0057$, *ns*). This pattern does not change when economic development is entered into the equation; national IQ retains its strong and significant effect on infant mortality rate ($\beta = -0.8021, p < .0001$), while neither income inequality nor economic development has any effect ($\beta = -0.0157$, *ns*, for income inequality; $\beta = -0.0674$, *ns*, for economic development).

Table 4. The effects of income inequality, national IQ and economic development on total infant mortality rates (all nations)

	Total infant mortality rate		
	1	2	3
Gini coefficient	1.4430****	−.0206	−.0566
	(.2931)	(.2044)	(.2069)
	0.4030	*−0.0057*	*−0.0157*
National IQ		−	−
		−2.6946****	−2.5816****
		(.1827)	(.2104)
		−0.8372	*−0.8021*
GDP per capita			−.0002
			(.0002)
			−0.0674
Constant	−17.4126	274.4925	267.7401
	(12.1534)	(21.1217)	(22.0136)
R^2	.1624	.6963	.6992
N	127	126	126

Note. Main entries are unstandardized regression coefficients.
Numbers in parentheses are standard errors.
Numbers in italics are standardized regression coefficients (betas).
*$p < .05$; **$p < .01$; ***$p < .001$; ****$p < .0001$.

The unstandardized regression coefficient of −2.5816 for national IQ in Equation 3 in Table 4 means that *each additional point in the mean IQ of a population saves more than two and half infants from death per 1,000 live births!* Of course, because infants under one cannot choose to avoid evolutionarily novel hazards to health, it is the parents' and other adult caretakers' general intelligence that matters for infant mortality.

Using age-specific mortality rate

Table 5 presents comparable results for age-specific mortality rates for males and females for age 15–19. The data on age-specific mortality rates are also available from the United Nations (http://unstats.un.org/unsd/demographic/products/dyb/DYB2002/Table20.pdf), albeit for a somewhat smaller number of nations than life expectancy or infant mortality. I use information from the latest available year. I choose the 15–19

Table 5. The effects of income inequality, national IQ and economic development on age-specific mortality rates (age 15–19) (all nations)

	Male age-specific mortality rate (15–9)			Female age-specific mortality rate (15–19)		
	1	2	3	4	5	6
Gini coefficient	.04334**	.0049	.0057	.0411**	−.0041	−.0020
	(.0132)	(.0125)	(.0127)	(.0144)	(.0131)	(.0131)
	0.3704	*0.0422*	*0.0483*	*0.3264*	*−0.0322*	*−0.0162*
National IQ		−.0810****	−.0849****		−.0952****	−.1059****
		(.0136)	(.0156)		(.0142)	(.0162)
		−0.6389	*−0.6689*		*−.6980*	*−0.7765*
GDP per capita			.0000			.0000
			(.0000)			(.0000)
			0.0572			*0.1496*
Constant	−.4863	8.4540	8.7271	−.8047	9.7016	10.4693
	(.4989)	(1.5485)	(1.6491)	(.5461)	(1.6242)	(1.7091)
R^2	.1372	.4376	.4398	.1066	.4652	.4799
N	70	70	70	70	70	70

Note. Main entries are unstandardized regression coefficients.
Numbers in parentheses are standard errors.
Numbers in italics are standardized regression coefficients (betas).
*$p < .05$; **$p < .01$; ***$p < .001$; ****$p < .0001$.

age group for two reasons. Firstly, humans in this age group are at or near the height of their health, no longer susceptible to congenital diseases and dangers associated with infant and childhood mortality and too young to be subject to the degenerative diseases of old age. Secondly, and more importantly, individuals in this age group begin to make their own decisions about what to eat (and, more importantly, what not to eat), how to behave and, in general, what to do for the first time in their lives. So late adolescence and early adulthood are when their own intelligence begins to impact on their health.

Despite the fact that the age-specific mortality rate for individuals aged 15–19 is far less than perfectly correlated with life expectancy at birth ($r = -.7741$ between male life expectancy and male age-specific mortality; $r = -.7840$ between male life expectancy and female age-specific mortality; $r = -.7720$ between female life expectancy and male age-specific mortality and $r = -.8081$ between female life expectancy and female age-specific mortality), the results presented in Table 5 are once again identical in substantive terms to those in Table 1. When entered alone, income inequality has a significantly positive effect on male and female age-specific mortality rate ($\beta = 0.3704, p < .01$, for male; $\beta = 0.3264, p < .01$, for female). When national IQ is entered into the equation, however, it has a strong and significantly negative effect ($\beta = -0.6389, p < .0001$, for male; $\beta = -0.6980, p < .0001$, for female) while income inequality ceases to have any effect ($\beta = 0.0422$, *ns*, for male; $\beta = -0.0322$, *ns*, for female). This pattern remains the same when economic development is entered into the equation; national IQ retains its strong and significant effect ($\beta = -0.6689, p < .0001$, for male; $\beta = -0.7765$, $p < .0001$ for female) while neither income inequality nor economic development has any effect (income inequality: $\beta = 0.0483$, *ns*, for male; $\beta = -0.0162$, *ns*, for female; economic development: $\beta = 0.0572$, *ns*, for male; $\beta = 0.1496$, *ns*, for female). It therefore appears that my conclusion that national IQ largely determines the health of a population and that neither income inequality nor economic development has any partial effect on health is independent of a particular measure of population health.

Microlevel analysis

Data

The National Opinion Research Center at the University of Chicago has administered General Social Surveys (GSS) either annually or biennially since 1972. Personal interviews are conducted with a nationally representative sample of non-institutionalized adults in the US. The sample size is about 1,500 for each annual survey, and about 3,000 for each biennial one. The exact questions asked in each survey vary.

Dependent variable

In every survey, the GSS asks all or part of its respondents to rate their health with the question: 'Would you say your own health, in general, is excellent, good, fair, or poor?' The dependent variable is thus a four-category ordinal variable (1 = *poor*, 2 = *fair*, 3 = *good*, 4 = *excellent*). I will therefore use ordinal regression (McCullagh, 1980), rather than the OLS (Ordinary Least Squares), to estimate the effect of the independent variables on health.

Independent variables

Income

The GSS measures the respondents' annual earnings with 12–23 equidistant ordinal categories (1 = less than \$1,000, 2 = between \$1,000 and \$2,999, 3 = between \$3,000 and \$3,999 etc.). Even though it is technically not an interval-ratio variable, I treat it as such in my analysis because the categories are numerous and equidistant.

Intelligence

The GSS measures the verbal intelligence of its respondents by asking them to select a synonym for a word out of five possible answers. The questions are similar to those found in the verbal section of the Graduate Record Exams (GRE). Each respondent answers 10 of these questions and their total score thus varies from 0 to 10. I use the total number of correct responses as a crude measure of verbal intelligence in the following analysis.

Results

Column 1 of Table 6 shows that, when entered alone, the respondents' income has a very strong and highly significant positive effect on their health ($b = .0404$, Wald = 258.4814, $p < .0001$). However, Table 6, column 2 shows that, when entered together, the respondents' intelligence ($b = .1086$, Wald = 129.3146, $p < .0001$) has nearly twice as strong an effect on health as income ($b = .0307$, Wald = 69.4245, $p < .0001$), even though the latter still remains significant. So, while income is a very strong determinant of individual health in the contemporary United States, consistent with Wilkinson's thesis, verbal intelligence appears to be a much stronger determinant than income.

Table 6. The effects of income and intelligence on individual health US general social surveys 1972–2002

	1	2	3	4
Income	.0404****	.0307****	.0427****	.0253****
	(.0025)	(.0037)	(.0039)	(.0043)
Intelligence		.1086****	.1144****	.0521****
		(.0096)	(.0099)	(.0113)
Age			−.0253****	−.0218****
			(.0016)	(.0016)
Sex (1 = male)			−.1108**	−.0743
			(.0408)	(.0412)
Race (1 = black)			−.1492**	−.1601**
			(.0562)	(.0565)
Marital status			.2341****	.2318****
(1 = currently married)			(.0403)	(.0406)
Education				.0882****
				(.0095)
Occupational prestige				.0045*
				(.0018)
Threshold ($Y = 1$)	−3.4352	−3.0293	−3.8782	−2.9590
	(.0562)	(.0968)	(.1152)	(.1411)
Threshold ($Y = 2$)	−1.2192	−.7461	−1.5660	−.6328
	(.0321)	(.0675)	(.0910)	(.1228)
Threshold ($Y = 3$)	1.0084	1.5441	.7802	1.7366
	(.0314)	(.0688)	(.0894)	(.1237)
Pseudo R^2 (Cox & Snell)	.0134	.0246	.0534	.0663
N	19,190	9,615	9,606	9,583

Note. First entries in each cell are unstandardized regression coefficients.
Numbers in parentheses are standard errors.
*$p < .05$; **$p < .01$; ***$p < .001$; ****$p < .0001$.

This conclusion remains even after I enter demographic controls into the equation, such as age (in years), sex (1 = male), race (1 = black) and marital status (1 = if currently married). The result in Table 6, column 3 shows that, even with these demographic controls, verbal intelligence ($b = .1144$, Wald = 133.6335, $p < .0001$) still has a stronger effect on health than income ($b = .0427$, Wald = 120.2008, $p < .0001$). Only age ($b = -.0253$, Wald = 268.4795, $p < .0001$) has a stronger effect on health than verbal intelligence in this equation. It is important to note that verbal intelligence in my analysis is *not entirely* a proxy for education or social status. Even when I enter education (in years of formal schooling) and social status (occupational prestige score) into the equation, verbal intelligence retains its strong and significantly positive effect on health ($b = .0521$, Wald = 21.4326, $p < .0001$), even though its effect is cut roughly in half.

My analysis of the US General Social Surveys thus replicates Deary *et al.*'s (2004) analysis of the Scottish longitudinal data on the effect of intelligence on health and longevity. While income does exert a strong effect on health, intelligence again appears to have an even stronger effect, consistent with recent evolutionary psychological theory (Kanazawa, 2004a, 2004b).

Discussion

The macro-level analysis of 126 nations shows that neither income inequality nor economic development has a significant effect on the health of the population, contradicting both Wilkinson's argument about the detrimental effect of inequality and commonly accepted beliefs about the benefit of economic development. In a multivariate analysis, neither the Gini coefficient nor the GDP per capita has any effect on male and female life expectancy, infant mortality rate or the age-specific mortality rate of males and females aged 15–19. In contrast, national IQ has a substantively very large and statistically highly significant effect on all measures of health and longevity. The macro-level data collectively suggest 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*.

The micro-level analysis of the US general social survey data is consistent with this interpretation. While an individual's income and verbal intelligence both have significant effects on self-reported health, verbal intelligence consistently has a stronger effect, even after controlling for relevant demographic variables. Controlling for education and social status attenuates but does not eliminate the independent effect of intelligence on health.

The convergence of the Savanna Principle (Kanazawa, 2004a) and the evolutionary psychological theory of the evolution of general intelligence as a domain-specific adaptation (Kanazawa, 2004b) can explain these findings. Because most dangers to health in the current environment are evolutionarily novel, individuals with greater general intelligence are able to recognize and deal with them more appropriately than those with less general intelligence. Consistent with this explanation, national IQ does not have any significant effect in evolutionarily more familiar sub-Saharan Africa. This explanation can also account for other recent findings, such as that more intelligent Scots live longer than less intelligent Scots (Deary *et al.*, 2004) and that obese men (though not obese women) have lower intelligence than their non-obese counterparts (Elias, Elias, Sullivan, Wolf, & D'Agostino, 2003).

What other possible explanations can account for these findings? One suggestion from an anonymous reviewer is that IQ may be a consequence of income inequality. More egalitarian societies have more equal opportunities for education and schooling, thus raising the national IQ. Hence, in this view, national IQ is an inverse correlate of income inequality and, since income inequality is less precisely measured than IQ across societies, national IQ appears to have a significant effect on health and longevity, even though it is in fact income inequality which influences the population health.

I discount this explanation for two reasons. First, the suggestion that greater educational opportunities can increase national IQ contradicts the current consensus among psychometricians and intelligence researchers that general intelligence is largely hereditary, with a large genetic component (Jensen, 1998, pp. 169–202). The current estimate of heritability among adults is roughly .80; in other words, 80% of variance in general intelligence is genetic in origin. Much of the remaining variance is due to environmental factors in early childhood and individual IQ is relatively stable after the age of about 10 (Jensen, 1998, pp. 316–318). So there appears little that education can do to significantly alter the general intelligence of a population. Secondly, and more importantly, this explanation fails to account for the fact that income inequality, but not national IQ, has a significant effect on male and female life expectancy among the subsample of 29 sub-Saharan African nations. If national IQ is a mere correlate of income inequality and has a significant effect on population health simply because it is more precisely measured, how does one account for the fact that the empirical pattern is reversed among the 29 sub-Saharan African nations?

The results presented in this paper are consistent with Kanazawa's (2004b) theory of the evolution of general intelligence as a domain-specific adaptation to solve evolutionarily novel problems. However, only further research will show whether my explanation of national health and longevity in terms of the average intelligence of the population is correct. Additional studies and empirical tests are particularly necessary in light of the large number of studies which support Wilkinson's income inequality hypotheses. Researchers will need to revisit the studies in support of the Wilkinson hypothesis to see if including the average IQ of a population can make the inequality effect disappear, as I have done in this paper.

Conclusion

The results from the macro-level and micro-level analyses collectively cast some doubt on Wilkinson's earlier conclusion that 'Inequality kills. People die younger in countries with greater inequalities in income'. It appears that inequality does *not* kill and people do *not* die younger in countries with greater inequalities in income. The macro data from all nations show that, once national IQ is controlled, neither income inequality nor economic development has an independent effect on male and female life expectancy, infant mortality rate or age-specific mortality rate for individuals aged 15–19. Only national IQ has a very strong and significantly positive effect on these measures of population health. Consistent with the prediction from the Savanna Principle, national IQ has no effect on life expectancy among countries in the evolutionarily familiar sub-Saharan Africa. The micro data from the United States show that verbal intelligence has a stronger effect on health than income. These results point to the need for epidemiologists and health psychologists to pay closer attention to the role of general intelligence in health and longevity. General intelligence may be the key that allows individuals in evolutionarily novel contemporary society to recognize health risks and deal with them appropriately.

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Appendix

Macro data

1	2	3	4	5	6	7	8	9
Albania*	28.2	90	1,915	70.9	76.7	25	–	–
Algeria*	35.3	84	2,049	68.1	71.3	44	–	–
Argentina	52.5	96	3,375	70.6	77.7	20	1.0	.5
Armenia*	37.9	93	905	69.0	75.6	17	.7	.2
Australia	35.2	98	26,525	76.4	82.0	6	.6	.3
Austria	30.0	102	31,187	75.4	81.5	5	.7	.3
Azerbaijan *	36.5	87	853	68.7	75.5	29	.7	.4
Bangladesh*	31.8	81	385	61.0	61.8	64	–	–
Belarus*	30.4	96	1,768	64.9	75.3	11	1.1	.5
Belgium	25.0	100	29,257	75.7	81.9	4	.6	.3
Bolivia*	44.4	85	878	61.8	66.0	56	–	–
Bosnia and Herzegovina	26.2		1,613	71.3	76.7	14	–	–
Botswana*†	63.0	72	3,983	38.9	40.5	57	1.8	2.0
Brazil	59.1	87	2,700	64.0	72.6	38	–	–
Bulgaria	31.9	93	2,533	67.4	74.6	15	.6	.3
Burkina Faso*†	48.2	67	294	45.2	46.2	93	–	–
Burundi*†	33.3	70	86	40.4	41.4	107	–	–
Cambodia*	40.4	89	278	55.2	59.5	73	–	–
Cameroon*†	44.6	70	803	45.1	47.4	88	–	–
Canada	33.1	97	27,097	76.7	81.9	5	.7	.3
Central African Republic*†	61.3	68	325	38.5	40.6	100	–	–
Chile*	57.1	93	4,523	73.0	79.0	12	.7	.3
China	44.7	100	1,100	68.9	73.3	37	–	–
Colombia	57.6	89	1,744	69.2	75.3	26	–	–
Costa Rica*	46.5	91	4,189	75.8	80.6	10	.9	.4
Côte d'Ivoire*†	45.2	71	886	40.8	41.2	101	–	–
Croatia	29.0	90	6,398	70.3	78.1	8	.7	.3
Czech Republic	25.4	97	8,834	72.1	78.7	6	.6	.3
Denmark	24.7	98	39,497	74.2	79.1	5	.6	.3
Dominican Republic*	47.4	84	2,408	64.4	69.2	36	–	–
Ecuador	43.7	80	2,108	68.3	73.5	41	–	–
Egypt	34.4	83	1,062	66.7	71.0	41	1.0	.7
El Salvador*	53.2	84	2,302	67.7	73.7	26	1.5	.6
Estonia*	37.2	97	6,232	66.5	76.8	9	1.4	.3
Ethiopia†	30.0	63	91	44.6	46.3	100	–	–
Finland	26.9	97	31,069	74.4	81.5	4	.7	.3
France	32.7	98	29,222	75.2	82.8	5	.7	.3
Gambia*†	38.0	65	224	52.7	55.5	81	–	–
Georgia*	36.9	93	770	69.5	77.9	18	.4	.3
Germany	28.3	102	29,137	75.2	81.2	5	.6	.3
Ghana†	30.0	71	354	56.5	59.3	58	–	–
Greece	35.4	92	15,690	75.7	80.9	6	.7	.3
Guatemala	48.3	79	1,963	63.0	68.9	41	1.7	1.0
Guinea†	40.3	66	424	48.8	49.5	102	–	–
Guinea-Bissau*†	47.0	66	208	43.8	46.9	120	–	–
Guyana*	43.2	84	1,010	60.1	66.3	51	–	–

Appendix (*Continued*)

1	2	3	4	5	6	7	8	9
Honduras*	55.0	84	980	66.5	71.4	32	–	–
Hong Kong	43.4	107	22,618	77.3	82.8	4	.3	.2
Hungary	24.4	99	8,384	67.7	76.0	9	.5	.3
India	32.5	81	555	63.2	64.6	64	–	–
Indonesia	34.3	89	944	64.8	68.8	42	–	–
Iran	43.0	84	2,079	68.9	71.9	33	–	–
Ireland	35.9	93	38,864	74.4	79.6	6	.7	.3
Israel	35.5	94	18,101	77.1	81.0	6	.7	.3
Italy	36.0	102	25,527	75.5	81.9	5	.7	.3
Jamaica	37.9	72	2,802	73.7	77.8	20	–	–
Japan	24.9	105	33,819	77.9	85.1	3	.4	.2
Jordan*	36.4	87	1,803	69.7	72.5	24	–	–
Kazakhstan*	31.3	93	1,785	60.9	71.9	52	1.6	.7
Kenya†	44.5	72	444	43.5	45.6	69	–	–
South Korea	31.6	106	11,059	71.8	79.3	5	.5	.2
Kyrgyzstan*	29.0	87	372	64.8	72.3	37	.9	.5
Laos*	37.0	89	361	53.3	55.8	88	–	–
Latvia*	32.4	97	4,453	65.6	76.2	14	.9	.5
Lesotho*†	63.2	72	594	32.3	37.7	92	–	–
Lithuania*	31.9	97	5,203	67.5	77.6	9	1.3	.4
Luxembourg*	30.8	101	57,379	75.1	81.4	5	.9	.2
Macedonia*	28.2	93	2,225	71.4	75.8	16	.5	.3
Madagascar*	47.5	79	318	52.5	54.8	91	2.7	3.0
Malawi*†	50.3	71	158	37.3	37.7	115	6.5	6.6
Malaysia	49.2	92	4,227	70.8	75.7	10	1.3	.4
Mali*†	50.5	69	298	48.0	49.1	119	–	–
Mauritania*†	39.0	74	381	50.9	54.1	97	–	–
Mexico	54.6	87	5,945	70.4	76.4	28	1.0	.4
Moldova*	36.2	95	459	65.5	72.2	18	.9	.4
Mongolia*	44.0	98	462	61.9	65.9	58	.9	.4
Morocco	39.5	85	1,463	66.8	70.5	42	–	–
Mozambique*†	39.6	72	222	36.6	39.6	122	6.8	6.8
Namibia*†	70.7	72	2,307	42.9	45.6	60	–	–
Nepal	36.7	78	233	60.1	59.6	71	1.1	1.0
Netherlands	32.6	102	31,759	75.6	81.0	5	.4	.2
New Zealand	36.2	100	19,350	75.8	80.7	6	.9	.4
Nicaragua*	55.1	84	750	67.2	71.9	36	–	–
Niger*†	50.5	67	227	45.9	46.5	126	–	–
Nigeria†	50.6	67	390	51.1	51.8	79	–	–
Norway	25.8	98	48,881	76.0	81.9	5	.6	.3
Pakistan*	33.0	81	498	61.2	60.9	87	1.5	1.3
Panama*	56.4	85	3,400	72.3	77.4	21	–	–
Papua New Guinea*	50.9	84	577	56.8	58.7	62	–	–
Paraguay*	56.8	85	1,001	68.6	73.1	37	–	–
Peru	49.8	90	2,238	67.3	72.4	33	–	–
Philippines	46.1	86	1,005	68.0	72.0	29	1.1	.5
Poland	31.6	99	5,355	69.8	78.0	9	.7	.3
Portugal	38.5	95	14,645	72.6	79.6	6	.8	.3
Romania	30.3	94	2,550	67	74.2	20	.7	.3

Appendix (*Continued*)

1	2	3	4	5	6	7	8	9
Russia	45.6	96	3,026	60.8	73.1	16	2.0	.8
Rwanda*†	28.9	70	185	38.8	39.7	112	–	–
Senegal*†	41.3	65	641	50.8	55.1	61	–	–
Sierra Leone†	62.9	64	197	33.1	35.5	177	–	–
Singapore	42.5	103	21,195	75.9	80.3	3	.4	.4
Slovakia	25.8	96	6,019	69.8	77.6	8	.6	.3
Slovenia	28.4	95	13,831	72.6	79.8	6	.7	.3
South Africa†	59.3	72	3,551	45.1	50.7	48	–	–
Spain	32.5	97	20,424	75.9	82.8	5	.7	.3
Sri Lanka*	34.4	81	913	69.9	75.9	20	1.7	2.5
St. Lucia*	42.6	75	4,611	70.8	74.1	15	–	–
Swaziland*†	60.9	72	1,653	33.3	35.4	78	2.2	2.3
Sweden	25.0	101	33,925	77.6	82.6	3	.4	.3
Switzerland	33.1	101	43,486	75.9	82.3	5	.5	.3
Tajikistan*	34.7	87	249	66.2	71.4	50	2.1	.8
Tanzania†	38.2	72	271	42.5	44.1	100	–	–
Thailand	43.2	91	2,273	65.3	73.5	20	–	–
Trinidad and Tobago*	40.3	80	7,607	68.4	74.4	14	.8	.6
Tunisia*	39.8	84	2,561	70.8	74.9	23	–	–
Turkey	40.0	90	3,418	68	73.2	40	–	–
Turkmenistan*	40.8	87	3,078	63.9	70.4	49	–	–
Uganda†	43.0	73	242	45.4	46.9	86	–	–
Ukraine*	29.0	96	975	64.7	74.7	14	1.3	.5
United Kingdom	36.0	100	30,355	75.7	80.7	5	.6	.3
United States	40.8	98	36,924	74.3	79.9	7	.9	.4
Uruguay	44.6	96	3,274	71.6	78.9	13	.9	.4
Uzbekistan*	26.8	87	338	66.8	72.5	37	.9	.5
Venezuela*	49.1	89	2,994	70.9	76.7	19	2.2	.5
Vietnam*	36.1	96	471	66.9	71.6	34	–	–
Yemen*	33.4	83	484	58.9	61.1	71	–	–
Zambia†	52.6	77	398	32.7	32.1	105	–	–
Zimbabwe†	56.8	66	190	33.7	32.6	58	–	–

1 Country, 2 Gini coefficient, 3 National IQ, 4 GDP per capita, 5 Male life expectancy at birth, 6 Female life expectancy at birth, 7 Total infant mortality rate, 8 Male age-specific mortality rate (15–19), 9 Female age-specific mortality rate (15–19).

* National IQ estimated by Lynn and Vanhanen (2002).

† Sub-Saharan African country.