Routes to Low Mortality in Poor Countries, Revisited

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Acknowledgements: The author gratefully acknowledge the financial, intellectual, and moral support of the Frederick S. Pardee Center for International Futures at the University of Denver. Drafts of this paper were presented to a workshop on "The Distal Determinants of Health", sponsored by the Clinton Global Initiative and the Frederick S. Pardee Center for the Study of the Longer-Range Future at Boston University, and to numerous students in "Global Health Affairs: Theory and Practice" at the University of Denver. The author wishes to thank Jane Menken, Rick Rogers, Sangeetha Madhavan, Britt Reiersgord, and most of all his wife Linda Mamoun for their advice and editorial support.

Includes 8 tables and 2 figures

October 4, 2010 (draft manuscript: please do not cite or quote)

Abstract

In July 1986, *Population and Development Review* published a highly influential paper by John Caldwell entitled “Routes to Low Mortality in Poor Countries”. Amid growing anxiety over decelerating world mortality decline, Caldwell explored social and political pathways to mortality success on the basis of two lists of exceptional mortality achievers, countries whose mortality rankings drastically differed from their income rankings. To celebrate the anniversary and chart new pathways, this paper looks at the subsequent achievements of Caldwell's original exceptional achievers and develops a modern list of achievers. Analysis highlights the presence of many more poor achievers today; the rising importance of adult mortality as a marker of exceptional achievement; the increasing success of countries in Latin America and the Muslim world; the continued success of China, Vietnam, Cuba, and Costa Rica. Dramatic improvements in schooling outcomes, particularly for women, have reduced its importance as a determinant of superior achievement. Reinforcing Caldwell's original assertions, the synthesis highlights how interactions between social consensus, health care systems, and human capital dependence offer a pathway to superior achievement. These forces may be especially powerful at moments of national crisis.

Introduction

Twenty-five years ago, *Population and Development Review* published a highly influential paper by John Caldwell titled "Routes to Low Mortality in Poor Countries" (Caldwell 1986). Coming at the end of an era of unparalleled mortality improvements in poor nations, the paper sought to reinvigorate the international health paradigm by looking at the successes of three nations (China, Costa Rica and Sri Lanka) and one Indian state (Kerala) that achieved exceptional mortality success at low levels of income. Just as memorably, Caldwell framed his analysis with a simple yet powerful list of the world's superior and poor mortality achievers, based on comparing a nation's ranking on health indicators to its ranking on income per head. The paper was transformative in many respects. While best known for demonstrating the powerful role of women's education in health outcomes, it also described in vivid historical detail the importance of health systems and social consensus during breakthrough periods of health transition. To celebrate the anniversary of Caldwell's achievement, this paper looks at the fates of Caldwell's original exceptional achievers and charts modern routes to low mortality.

The past quarter century has seen dramatic change in international health. In 1986, the post-World War II epidemiologic transition had decelerated, but no country had yet recorded a sustained reversal in life expectancy. The next two decades saw three unique patterns of reversal relating to conflict especially in Sub-Saharan Africa; HIV/AIDS in Southern Africa; and noncommunicable disease and injuries in the former Soviet Union (Wilson 2001; McMichael et al. 2004; Moser et al. 2005). The 2000 Millennium Declaration ushered in an era of programmatic action against disease embodied in the Millennium Development Goals. This effort aimed to harness the untapped economic potential of the world's poor and was rebranded under the term "global health" (McMichael and Beaglehole 2000; Sachs 2001). Progress has been swift, with rapid uptake of antiretroviral treatment (ARTs) for HIV/AIDS, declining child and maternal mortality, and reversal of some mortality setbacks (Reniers et al. 2009; Rajaratnam et al. 2010). Meanwhile, many poor countries have maintained their post-war trajectories of persistent mortality reduction (Hughes et al. 2010).

Amidst all this progress, Caldwell's concerns from an earlier era have already gained salience just a decade into the global health era. Targeted interventions could soon run their course, as HIV/AIDS and preventable diseases give way to a daunting array of life course health issues (Marmot 2005; Beaglehole et al. 2008). The new US Global Health Initiative calls for participatory, sustainable and rights-based health systems, but few scalable models exist and history is littered with failure. We thus find ourselves not merely celebrating the anniversary of a pillar of the demographic literature, but at a propitious time for revisiting the routes to low mortality in poor countries.

This paper represents a follow-up, a replication, and a renewal of Caldwell's work. I begin by exploring the subsequent economic fates of the original exceptional achievers. I then develop a new list of superior and poor mortality achievers, focusing on life expectancy rather than infant mortality. Finally, I explore the pathways to exceptional achievement. Given the paucity of theory and indicator data in 1986, Caldwell's analysis was necessarily inductive, exhaustive, and focused on qualitative relationships. This paper builds on hypotheses developed by Caldwell and others, and incorporates a wider range of quantitative indicators. I begin by charting the influence of Caldwell's paper and our subsequent understanding of the distal drivers of health.

The Power of Exceptional Achievers

The background begins with the work of the author himself. Caldwell is a prolific and peripatetic scholar. Neither a theorist nor an empiricist, he popularized new hypotheses that others would test for decades. A review of the 20 most widely cited papers in *Population and Development Review* finds Caldwell as sole author of three and lead author on two others (Caldwell 1976, 1980, 1986; Caldwell and Caldwell 1987; Caldwell et al. 1989). With a number of co-authors, most notably his wife Pat, he brought a mix of qualitative, survey and contextual data to a prolific body of research on family change and mortality in South India, Nigeria, and Bangladesh. A joke heard in Bangladesh held that "Jack Caldwell learns more on the taxi ride from the airport than you or I learn in a five-year survey." Caldwell's unique methods and aggressive hypothesis formation inspired two generations of demographers to pursue research that mixed qualitative and quantitative methods, accounted for contextual forces, and addressed historical and political narratives. While Caldwell is perhaps most associated with the wealth flows model of fertility, Routes to Low Mortality had an equally enduring influence. It has been cited 210 times according to Web of Science, PDR's eighth most widely cited paper and second among Caldwell's entries. A Google search finds the paper included in 27 publicly available syllabi in demography, sociology and economics.

Such an important work did not emerge in a vacuum, but rather in a period of paradigmatic transition in studies of mortality. In 1971, Abdel Omran described the shape of the epidemiologic transition from high levels of preventable childhood, maternal, and infectious mortality risks toward diseases of adulthood (Omran 1971). Though Omran did not specify the exact determining forces behind the transition, a growing body of evidence had begun to demonstrate the significant role of non-income factors. In 1975, Sam Preston found that only 10-25% of historic variation in life expectancy could be attributed directly to income variation (Preston 1975). These findings stood in sharp contrast to those of Thomas McKeown, who had attributed the historic English mortality decline to economic conditions rather than medicine or public health (McKeown and Record 1962; McKeown 1976). While measures of Gross Domestic Product per capita (hence referred to simple as GDP) remain the single best predictors of health at any single point in time (Pritchett and Summers 1996), Caldwell demonstrated the importance of non-economic factors, especially during breakthrough periods of initial improvement.

By focusing on a country's level of mortality achievement relative to its level of income, Caldwell deftly captured the role of income while proceeding quickly on to other factors. He began with two simple lists of superior and poor achievers, as shown in Table 1. Countries were ranked separately according to GDP and Infant Mortality Rate (IMR). Countries were ranked on the relative ranking on these indicators, or the difference between the IMR and GDP rankings. Countries with IMR ranking 25 or more places ahead of GDP rank were classified as superior, and those with IMR ranked 25 or more places behind GDP rank were poor. Relative life expectancy ranking was reported, but was not used to classify countries. Though not a country, the Indian state of Kerala appeared atop the list of high achievers, catalyzing a sub-field devoted to the "Kerala miracle." These lists of exceptional achievers also provided hours of conversation and hypothesis formation for a generation of students taking Introduction to Demography.

[Insert Table 1 about here]

Fortunately, Caldwell himself provided a laundry list of hypotheses aimed at the factors relating to superior or poor achievement. He was among the first western scholars of his era to highlight the mortality successes of Socialist nations, drawing particular attention to Cuba, whose lack of income data kept it out of the official list. The list of poor achievers included numerous oil-rich states of the Middle East and North Africa, prompting a discussion of the potential role of commodity wealth or Islam. Caldwell dismissed the possibility of a time lag whereby these countries simply had not yet spent their newfound wealth.

Caldwell's towering achievement came in the second half of the paper, an in-depth historical and political treatment of the antecedents of superior mortality achievement in Costa Rica, Sri Lanka and Kerala. He emphasized the "symbiosis between cultural and health inputs," pointing to education as the catalyst for changes in the health system and as a complement to actual health provisioning. Social and political parallels between Sri Lanka, Kerala, and Costa Rica included a substantial degree of female autonomy, a dedication to education, an open political system, a largely civilian society without rigid class structure, and a history of egalitarianism and radicalism. Amidst these numerous overlapping correlates, Caldwell weaved a narrative of the fortunate synergies between health systems, poverty reduction, education and the emergence of a political consensus around health. His conclusions diverged from those of Preston, Mosley, and others who suggested that poor and ill health often emerged in spite of health systems, not because of them (Mosley 1984; Mosley and Chen 1984; Preston and Haines 1991). For Caldwell, health and education investments were not merely cheap and cost effective, they were catalysts for an emerging social consensus in which continued health improvement is expected. Nevertheless, Caldwell himself noted the need for a preexisting consensus:

> There must be a broad social consensus as to the value of educational and health goals, and as to their cost, for successive governments to accept most of their adversaries' innovations instead of nullifying them (Caldwell 1986, p. 210).

This causal challenge was never fully reconciled by Caldwell. What, if anything, could produce such a social consensus? Many have hoped that health spending itself could have such multiplier effects, initiating a virtuous cycle of investment and consensus (Sen and Dreze 1989; Gupta et al. 2002; Baldacci et al. 2008). Yet health spending can just as easily lead to low quality of inputs, bias toward preferred areas, low demand for services, and a disillusioned population (Filmer and Pritchett 1999; Filmer et al. 2000). Caldwell identified factors that could predispose a society towards consensus, including promotion of women's education and autonomy. He also noted the ability of autocratic states such as Cuba and China to take a vanguardist route, establishing health systems by fiat, encouraging their use through control over resources, and promoting consensus through demonstration of results and vertical ideational change (Bryant 1998). Lacking a clear answer to this chicken-egg question, Caldwell concluded the paper somewhat ambiguously:

> What is clearest is that low mortality for all will not come as an unplanned spinoff from economic growth (Caldwell 1986, p. 210).

This is where we remain today. Even mainstream economists agree that mortality improvements are not the inevitable products of economic growth. Rigorous analysis of contemporary and historic data have demonstrated the impact of targeted, cost-effective health interventions (Cutler and Miller 2005; Cutler et al. 2006; Soares 2007). It is also widely accepted that an exogenous

stimulus to health production via externally funded programs could generate some improvements in human capital and income, thus justifying targeted investments in health (Gallup and Sachs 2001; Soares 2005; Weil 2007; Barham 2009). Yet our understanding of the social, political and cultural drivers that might generate sustained improvements in health remains incomplete.

Recent years have witnessed a burgeoning literature on the distal determinants of health, including political, social, macroeconomic, and cultural factors (Subramanian et al. 2002; Marmot 2005; Lieberman 2007). This corpus of research has two interlinked threads. One is aimed at operationalizing the effects of individual distal drivers such as education, women's autonomy, governance, inequality, and health systems factors. As I discuss in reviewing specific distal determinants of health, this effort has provided a mountain of evidence but few definitive, policy-relevant conclusions. There has been more significant progress in building Caldwell's work into a grand unifying theorem of health systems, though success has come in part at the expense of policy relevance. Nathanson (1996), for example, offered a framework for understanding the recurring and remarkably stable role over time of broader national norms of social organization and justice in determining health outcomes, identifying three important traits: (1) degree of state centralization, (2) the presence or absence of active grassroots organizations, and (3) societal constructions of risk towards individual or collective outcomes.

Most recently, the WHO Commission on the Social Determinants of Health (CSDH) offered a new framework for evaluating and addressing the social and political determinants of health (CSDH 2009). These go beyond poverty to include social interactions such as inequality, trade, and migration and their psychological sequelae such as stress and depression. CSDH represents a dramatic reinterpretation of the distal determinants of health from a general set of associations to a specific set of social and political risk factors. At a policy level, CSDH creates new roles for health systems in preventing disease by addressing social inequalities and insecurities. At the same time it could reopens a debate about whether health systems matter at all, or whether political, social, and behavioral risk factors are more important (Rasanathan et al. 2009). Finally, CSDH further emphasized the need for better measurement and targeting of life course health issues that have become increasingly important amid global epidemiologic transition.

National Health Indicators Then and Now

The post-Cold War era has seen dramatic changes in the construction, measurement, and significance of national indicators and in the sheer number of sovereign states. Caldwell drew his list of countries from the 1984 World Bank World Development Report (WDR), which included 99 lower-income, middle-income, or high-income oil-exporting countries with population greater than one million (Caldwell 1986, p.175).[1] The staggering pace of national partition, the entry of Soviet Bloc nations into national indicator systems, population growth, and improved data quality for small nations resulted in a pool of 134 low- and middle-income nations in the World Bank's 2009 World Development Indicators database, which provided GDP data for this study (World Bank 2009). [2] Only three countries – Zimbabwe, Somalia, and North Korea – were excluded due to poor income data, leaving 131 countries. GDP measures have also changed. The 1984 WDR measured GDP in US dollars. Today most sources adjust GDP for purchasing power parity (PPP), or variations in the cost of living across society. All GDP data for this study, including those for Caldwell's original achievers, use PPP adjustments.

Health measures come from the 2009 WHO World Health Statistics Report (WHO 2009). Recent years have seen considerable change in the construction of health measures, reflecting improved capability and changed priorities. In 1984 Caldwell rejected World Bank child death data as unreliable, unstandardized and unadjusted for model life tables. Today, child mortality rate (CMR), or the life table probability of dying before the fifth birthday, is a gold standard indicator of national well-being. The Millennium Development Goals explicitly aim to reduce CMR by two-thirds between 1990 and 2015 (Murray et al. 2007; Mathers and Boerma 2010). CMR also shows considerably more variability than IMR. In 1984, 44 of 99 countries had IMR greater than 100 deaths per 1,000 births. In 2007, only 13 out of 136 countries were at that level, but 36 countries continue to have CMR above 100 per 1,000.

A more momentous shift relates to the increased significance and measurement of adult mortality (Gakidou et al. 2004; Rajaratnam et al. 2010). One measure of adult mortality that has gained increasing salience is the adult mortality rate (AMR). AMR, like CMR, is actually a life table probability, in this case the probability of a 15 year old dying before age 60 ($_{45}q_{15}$), expressed like CMR and IMR in per 1,000 terms (WHO 2009). Recent versions of the UN Population Division estimates, Global Burden of Disease Study and World Health Statistics Report have reported AMR estimates constructed from a combination of improved survey and death registration data, sibling reports, intercensal estimation, model life tables, and HIV prevalence assumptions, though each still depends in some way on maintaining correlations between AMR and CMR. A recent study in *The Lancet* incorporated further corrections for coverage bias in sibling mortality reports (Rajaratnam et al. 2010). AMR has also been utilized as an indicator of survival uncertainty in modeling the economic costs of mortality (de Waal 2003; Weil 2007).

For these reasons, routes to low mortality today require successful reductions in AMR as well as CMR. In 1984, CMR accounted for the great majority of longitudinal improvements and cross-national variations in life expectancy, but this is no longer the case. To gauge the relative importance of mortality indicators, I used life tables from the WHO 2006 series to adjust each country's IMR, CMR, and AMR to the current levels observed for Costa Rica. [3] IMR adjustment increased the unweighted average life expectancy by 2.2 years (from 63.9 to 66.1 years), CMR added 3.2 years (to 67.1 years), and AMR adjustment added 4.6 years (to 68.5). The rise in the significance of adult mortality would be even more pronounced when looking at population-based, rather than life table, mortality given the aging of the global population. From a policy standpoint, continued short-term focus on CMR over AMR remains justified. The 0-4 age range provides a narrower target than 15-49, and many low-cost interventions are known to reduce CMR (Bryce et al. 2005; Boschi-Pinto et al. 2010). Nonetheless, a life course perspective is critical for understanding the distal determinants of health. This analysis of modern health outliers therefore addresses relative life expectancy rankings and explore the unique contributions of CMR and AMR. But first I revisit Caldwell's original outliers.

The Original Outliers: Where are They Now?

A look back at the original superior and poor health achievers offers powerful insight into the potential economic impacts of health, the magnitude of sociodemographic convergence, and the challenge of remaining on a list of exceptional achievers at two points in time. The first three columns of Table 2 look at change over time in GDP.[4] In 1982, superior achievers had a GDP of $1,001, compared to $4,723 for poor achievers. This GDP gap closed considerably over the next

25 years as superior achievers dramatically outperformed poor achievers. Superior achievers saw a four-fold increase in GDP to $3,797 per person. Their 5.5% annualized growth rate was well above the poor country average of 3.0%, even though Congo actually saw declining growth. Poor achiever GDP barely doubled to $8,727, or a 2.5% annualized growth rate. The inclusion of Iraq would have further hindered poor achiever growth. Even the poor achiever with the fastest growth, Oman (5.1%), still fell below the superior achiever average. It is impossible to ascertain whether the impressive economic growth achievements of superior mortality achievers reflect a causal pathway from health to growth or merely a tendency for some countries to produce good health and growth outcomes. The achievements of these countries are nonetheless impressive and reinforce a growing consensus that high levels of survival have positive economic impacts (Sachs 2001; Weil 2007; Hughes et al. 2010)..

[Insert Table 2 about here]

Just as superior achievers closed the income gap, so poor achievers narrowed the mortality gap. Poor achiever IMR fell 61%, from 124 deaths per 1,000 births to just 49. Average relative rank improved from -52 out of 99 countries in 1982 to -15 out of 131 in 2007. Overall success came in spite of faltering progress of the three conflict-affected countries of Iraq, Cote d'Ivoire, and Sierra Leone. Oil producers saw particular progress, with IMR declining 76%, from 102 to 24. For the most part, oil states did spend their way out of the poorest relative health achievement, though even today their IMR rankings remain somewhat lower than their income rankings.

Superior achievers, on the other hand, saw only a 26% reduction in infant mortality rate, from 67 to 50 deaths per 1,000 births. This included slight IMR reversals in Democratic Republic of The Congo, Kenya, and Jamaica. Among the two large countries, China saw continued reductions of 72% (from 67 to 19 per 1,000) but India's IMR fell by only 43% (from 94 to 54). Taking into account income gains and slowed IMR improvement, this earlier group of superior achievers saw their relative IMR ranking fall from +36 out of 99 countries to only +10 out of 131 today.

The final columns of Table 2 look at convergence in life expectancy at birth. Have yesterday's superior IMR achievers maintained more of their relative success in life expectancy? Not necessarily. Superior achievers gained only three years of aggregate life expectancy, from 61 to 64 years, with overall levels of improvement well behind the global average. Only China, Costa Rica, and to a lesser extent Sri Lanka maintained their earlier success. Poor achievers actually achieved a higher absolute level of life expectancy, rising from 51 to 65 years, though they were also far wealthier as a group. Among the eight Middle East nations that topped the original list, all save conflict-affected Iraq added at least 10 years to their life expectancy, with major improvements in Oman (from 52 to 74), Yemen (from 44 to 64), and even oil-poor Morocco (from 52 to 72). Indeed, while Morocco remains merely average in terms of its IMR, its life expectancy now outranks its GDP by 34 spots.

This follow-up illustrates the strong forces of economic and epidemiologic convergence pushing countries away from exceptional mortality achievement relative to income. Exceptional mortality outcomes may place countries on new economic growth trajectories, in the process making it difficult to reappear on the same list. In developing a list of modern-day mortality achievers, the continued success of countries like China and Costa Rica will thus bear special attention.

Modern-day Mortality Achievers

A replication of Caldwell's rankings illustrates the narrowed range of superior achievement as compared to 1982, and the continued extent of poor achievement. Figure 1 plots the 131 nations according to relative CMR rank, which produces almost the same results as if IMR were used. To account for the presence of additional countries, exceptional classification is assigned if CMR ranks 30 spots better or worse than GDP. Today, only nine nations achieve a relative CMR rank at the +30 level. Most of these nations fall quite close to the +30 threshold, with an average +41 relative ranking. In contrast, the 10 countries with CMR rank below the -30 threshold fare very poorly, with a -51 average relative ranking. They are led by Equatorial Guinea, which produces a CMR of 150 on a GDP of $16,347, for a -102 relative rank.

[Insert Figure 1 about here]

The scale of exceptional achievement in adult mortality rate (AMR) is great on both the negative and positive side, as shown in Figure 2. Sixteen countries rank at least 30 spots lower on AMR than GDP, topped by Botswana, which is 22nd in GDP but 6th from bottom in AMR, for a -103 relative rank. The average relative ranking for 16 poor achievers is -61, meaning that the average underachiever ranks almost half a distribution lower on AMR than on GDP. There are also 20 nations that achieve superior AMR outcomes, though they only average a +38 relative rank. Morocco, a poor achiever in 1982, is now the world's leading overachiever in AMR. As rankings are relative, superior achievement is facilitated in part by the exceptionally poor AMR outcomes among other countries. Nonetheless, the presence of historic CMR overachievers like China, Vietnam and Costa Rica suggests that achieving low AMR may indeed be a skill. Since superior achievement on AMR and CMR are also highly related, the remaining analysis shifts focus to relative achievement in life expectancy, which convolutes CMR and AMR.

[Insert Figure 2 about here]

Countries with exceptional life expectancy ranking relative to GDP rank are shown in Table 3. There are 12 high life expectancy achievers with an average relative ranking of +38. The top achievers, Nicaragua and Eritrea, are only +52 and +46 (out of 131 countries) while the 1982 leaders Sri Lanka and China ranked +61 out of 99 countries. Today's 14 poor health achievers look particularly poor, with a -55 average that would look even worse if Zimbabwe had been included. The very poorest achievers look especially poor, with Equatorial Guinea at -97; in 1982, the poorest life expectancy achiever was Oman at a mere -57.

[Insert Table 3 about here]

Much of the shift towards a greater scale of underachievement and a greater contribution of adult mortality can be explained by well-documented patterns of extreme mortality disadvantage relating to HIV/AIDS in Sub-Saharan Africa and non-communicable disease (NCD) and injuries in the Former Soviet Union (FSU). Four underachievers have extremely high HIV/AIDS prevalence, including three of the bottom three: Botswana, South Africa, and Swaziland. These four HIV nations have an average GDP of $8,461, solidly upper-middle income, yet have an average life expectancy at birth of only 54 and an adult HIV prevalence of 21%. These countries also underperform on CMR (-36 on average), due both to pediatric HIV and the socioeconomic

impacts of the epidemic, yet poor achievement is driven primarily by a collective AMR of 504 out of 1,000, or a worse than 50/50 chance of surviving from adolescence through adulthood.

Four underachievers emerged from the FSU, where disadvantage is even more concentrated in adulthood (Chen et al. 1996; Shkolnikov et al. 2001). They are led by the Russian Federation, whose $14,762 GDP is 16th highest while its 66 year life expectancy at birth is only 70th (-54 relative rank).[5] Disaggregating by age, Russia's CMR of 12 per 1,000 is about normal for a country with its income, but its AMR of 312 per 1,000 ranks 77 slots below its income. With an adult HIV/AIDS prevalence around 1%, Russia's disadvantage derives almost exclusively from NCD and injuries (Shkolnikov et al. 2001; Men et al. 2003). For FSU underachievers as a group, their -43 relative ranking was driven primarily by poor relative rankings on AMR (-62), while CMR rankings were close to expectation (-6).[6]

Finally, today's poor mortality achievers still include a number of "oil-rich states", though the current group has little overlap with those observed by Caldwell. Although all of Caldwell's original oil states continue to have moderately poor rankings, only Saudi Arabia remains on the list, improving from -61 out of 99 countries to -42 out of 131 countries.[7] Four poor-achieving made more recent oil discoveries, including three in the Gulf of Guinea region (Equatorial Guinea, Gabon and Angola) plus Trinidad and Tobago (hence referred to as Trinidad). Caldwell asserted that the original oil states had been wealthy for too long for poor achievements to reflect a mere lag effect, yet many of these nations did eventually improve their performance, if not overachieve. It remains to be seen whether today's new oil states will manage the same feat.

Caldwell's discussion of the original oil states centered on the relationship between a majority Muslim population and poor achievement, a relationship that has weakened considerably over time. At the time, Caldwell pointed out that all poor achievers, not merely the oil states, were either majority-Muslim or had large Muslim minorities, while Tanzania was the only majority Muslim state among the superior achievers. Today the situation looks quite different, as a result of 25 years of dramatic mortality reductions in a wide range of Muslim nations (Gerring 2008). Saudi Arabia is joined only by Kazakhstan, whose poor achievement can be more readily attributed to its oil, its former membership in the Soviet Union, and its large Russian minority. Superior achievers include four majority-Muslim nations representing a diversity of ethnic backgrounds. Eritrea is the second best mortality achiever at +46, having a life expectancy of 63 years on a GDP of only $622. The Comoros Islands are 5th at +39 ($1,165 GDP, 65 life expectancy, +38). Further down the list are Morocco (+31, $4,060, 72), which moved from poor achiever in 1982 to superior in 2007, and Bangladesh (+30, $1,315, 64). In total, the top quartile of countries in terms of life expectancy relative rank includes 11 majority Muslim nations.[8]

For several reason this listing should not imply a pattern of universal mortality overachievement in majority Muslim nations. First, Muslim nations appear throughout the list, with 13 in the bottom quartile of relative achievement.[9] Second, superior mortality achievement could surely be viewed instead as GDP underachievement. Third, a number of Muslim nations perform more poorly on female mortality than on total mortality.[10]

Finally, religious identifiers must be handled with care. In 1986, Caldwell took pains to clarify that he spoke of Islam, not of Muslim countries, yet his very next section addressed the potential role of Buddhism in the mortality achievements of Sri Lanka, Thailand, Vietnam, and Myanmar

(then Burma). The limitations of such religious comparisons are well illustrated by comparing the neighboring island nations of The Maldives and Sri Lanka. Sri Lanka is often identified as Buddhist (though it has large Muslim, Hindu, and Christian minorities), while The Maldives is almost entirely Muslim. In 2007, Maldives had a slightly higher GDP than Sri Lanka ($4,967 versus $4,271) and a slightly higher life expectancy (73 versus 71), resulting in a slightly higher relative rank. Yet Sri Lanka is frequently employed as a case study in health success while few would even mention The Maldives', much less attribute its relative success to any aspect of Islam. Yet this is far from the only case of a Muslim nation outperforming an ostensibly comparable non-Muslim nation. Eritrea outperforms Ethiopia (2^{nd} versus 26^{th}), Bangladesh outperforms India (12^{th} versus 65^{th}), and majority-Muslim FSUs outperform non-Muslim ones. Within the Russian Federation, majority-Muslim regions like Ingushetia and Dagestan are far poorer than average, yet have life expectancies of 75 and 73 respectively, making them superior mortality achievers in an overall context of poor achievement (Zaridze et al. 2009). The final section returns to explanations for this striking level of success in Muslim countries.

The remaining superior achievers offers greater continuity to the 1982 list and to well-documented patterns of health achievement. China (GDP $5,427, e_0 74, +35 relative rank) and Costa Rica ($10,513, 79, +33) both return. Vietnam ($2,571, 72, +43) and Cuba ($8,854, 78, +36) both featured heavily in Caldwell's discussion. Looking regionally, Costa Rica and Cuba are joined by three other Latin American nations: Nicaragua is first ($2,619, 73, +52), Paraguay is third ($4,518, 74, +43), and Peru is 9^{th} ($7,668, 76, +33). Another four Latin American nations appear in the top quartile of superior life expectancy achievers. Looking beyond this list, every Spanish-speaking country in Latin America ranks higher on life expectancy than it does on GDP, a regional pattern of success that has been documented in other research (McGuire 2010).[11]

Across all regions, superior mortality performance is driven primarily by low AMR. All but three of the 14 superior achievers have a better relative ranking on AMR than on CMR, though all rank positively on both dimensions. Costa Rica, for instance, has an AMR of 86 per 1,000 (+30 relative rank), lower than the United States, Finland, and France. China was only +15 on CMR (22 per 1,000), but was +41 with an AMR of 115, just behind the United States. Such AMR success certainly challenges the popular perception of an emerging Russia-style NCD crisis in China. AMR estimates may have flaws. Given China's unique age structure, tempo effects might bias AMR downward, but likely not by enough to affect China's superior achiever status. More significantly, the lagged effects of smoking on AMR have yet to be fully realized in China (; Rogers et al. 2005; Peto et al. 2009; Preston et al. 2009). Finally, China and other superior achievers may be receiving credit for low AMR simply because they did not experience the adult mortality spikes afflicting poor achievers. Before exploring the distal drivers of superior mortality achievement, it is worth asking whether such credit is deserved.

Mortality Spikes: Merely Exceptional or Uniquely Identified?

A truly consequential exploration of the distal determinants of health must recognize that some health risks are far outside national control. Indeed the very conceit of this paper is that GDP is such a powerful determinant of health that other distal forces are better understood by first stripping out income effects. Similar, if controversial, arguments can be forwarded with respect to the HIV/AIDS epidemic and the FSU mortality crisis. While these crises may not have been

inevitable in the affected nations, they may nonetheless have been inconceivable in other nations, in which case unaffected nations should not receive credit for having avoided them.[12]

The most heavily HIV-affected countries are easy to identify on a map, yet it is more difficult to say whether their epidemics were inevitable, much less whether other countries could have been affected. All eight countries with adult HIV prevalence over 10% are in Southern Africa and no country in that region avoided high prevalence. All countries with prevalence above 15% are in the former political and economic space of Apartheid South Africa (Caldwell and Caldwell 1996; Campbell 1997; Marks 2002). As to the possibility of a widespread epidemic outside Africa's southern cone, it is fortunate that global and national action against the disease will likely preclude our ever finding out. Uganda may have experienced a peak prevalence above 10%, though estimates are quite uncertain and current prevalence is 5% (Stoneburner and Low-Beer 2004; Allen 2005). Outside Southern Africa, HIV/AIDS prevalence bears a strong correlation to GDP. Thus, it seems reasonable to argue that the extreme HIV/AIDS epidemic affecting Southern Africa is unique, and that countries outside this region should not gain credit for having avoided such an epidemic. Subsequent analysis of distal determinants of exceptional mortality achievement will thus exclude eight countries from the Southern Africa region.[13]

While the inevitability of the post-Soviet mortality spike is debatable, its local specificity is clear. There is nothing inherent in Soviet or post-Soviet government or Russian culture that makes such a mortality pattern inevitable, and alcohol abuse even decline dramatically during *Glasnost* (Gathmann and Miller 2010). Yet evidence from Russian populations at home and abroad points to the unique cultural nature of this excess mortality pattern (Leon and Shkolnikov 1998; Marquez et al. 2007). In Kyrgyzstan, relative risks of multiple NCD and injury mortality risks were 3-8 times higher for the Russian minority than the Kyrgyz majority, resulting in a life expectancy gap of 20 years (Guillot 2007). Relative to income, Kyrgyzstan, Kazakhstan, and other Central Asian countries would all have average or above average mortality in the absence of Russian minorities (Becker and Urzhumova 2005). Kazakhstan is the only Central Asian country with a substantial Russian minority (30%) and also its only poor mortality achiever.[14] Given the specificity of the phenomenon, I exclude Russia and Kazakhstan for having 30% of population of Russian descent and Russian as an official first language (Pavlenko 2006).

The Distal Determinants of Exceptional Mortality Achievement

With these exclusions in place, Table 4 introduces a refined set of exceptional mortality achievers for 121 nations. Eight countries remained above the +30 relative rank indicating superior achievement. Another two, Nepal and Peru, fell just below that threshold at +29, still exceptional given the smaller sample and more exacting standard. No other countries remained even above the +25 relative rank threshold, establishing a distinct group of superior achievers.[15] Eight of the 14 poor achievers from Table 3 remain after the exclusions, in exactly the same rank order, again creating a parsimonious grouping. Twenty-five years of theoretical refinements and improvements to the quality of national indicators facilitate an analysis that is both more quantitative than Caldwell's original analysis and more focused on assessing the relative merit of specific hypotheses, many emerging directly from Caldwell's work. The exploration begins with Caldwell's primary emphasis on education, particularly for women, as a driver of health improvement and a reflection of broader emphasis on human capital.

[Insert Table 4 about Here]

Education and Gender

Perhaps Caldwell's most widely appreciated contribution was his documentation of the country-level association of schooling, particularly for females, to mortality. Caldwell observed a substantial advantage in primary school enrollment for superior achievers compared to poor ones, and more pronounced male-female enrollment ratios among poor achievers. He used gross enrollment ratio, or the ratio of students in a particular level to every 100 age-appropriate children, irrespective of whether the children enrolled were themselves the appropriate age. In aggregate, gross enrollment ratios in superior nations were 90 for females and 102 for males compared to 62 and 91 in poor achieving nations. Caldwell argued that women's schooling was a causal factor driving improved health-seeking behavior, noting that the female schooling disadvantage in poor-achieving nations was even more pronounced when looking back to 1960 enrollment levels. In high achieving countries, males had a 76 to 55 enrollment advantage in 1960, while males in poor achieving countries had a 55 to 23 advantage. In relative terms, every superior achiever had better than expected female schooling outcomes in 1960 (for a +26 average), while every poor achiever was worse than expected (-43 average). For that era, female schooling 20 years prior was as important a predictor of mortality achievement as income itself.

Today schooling is a less powerful driver of exceptional mortality achievement, and women's schooling is scarcely more salient than men's. Partly as a result of Caldwell's work, schooling has gained mainstream status as an important determinant of health and as a valuable public good in its own right (Soares 2005; Grignon 2008). Primary school enrollment levels have risen dramatically, particularly for females, thus narrowing the variation between superior and poor achievers. Table 5 shows net primary school enrollment, or the ratio of age-appropriate children enrolled in primary school to the total number of children of appropriate age, for superior and poor achievers. Schooling data for 2007 come from the UNESCO World Education Indicators Database (UNESCO 2010). Superior achievers outperform poor achievers on aggregate net enrollment (85% vs. 80%), a striking advantage given that their GDP is barely one-third as high, yet the female advantage (84% vs. 78%) scarcely differs from the male advantage (86% vs. 81%). Poor achieving nations have incredibly poor relative schooling outcomes, but they are equally poor for males (-59) and females (-56). For superior achievers, the relative level of schooling overachievement (+17) is far smaller, and the relative advantage is no larger for females (+16) than for males (+17). Analysis of net secondary school enrollment found more limited association to mortality and male-female variations, and thus were not shown.

[Insert Table 5 about Here]

To better gauge the longitudinal association between schooling and subsequent health, Table 5 explores relative levels of adult literacy among exceptional mortality achievers. Poor achievers actually have a four percentage point absolute literacy advantage (81% to 77%) and a slightly greater seven-point male advantage (93% to 86%). Once their substantial income advantage is taken into account, poor achievers do have poor schooling outcomes relative to GDP (-23 for females, -16 for males), though nothing like their disadvantage in current schooling. Superior mortality achievers maintain positive levels of literacy relative to income, but once again with little differentiation between females (+16) and males (+17). All superior achievers except Peru

are superior schooling performers. In two countries, females outperform males in schooling (Nicaragua, Costa Rica), yet in two others males outperform females (China, Vietnam).

Taken together, there remains a strong association between education and exceptional mortality achievement, but the association has diminished since 1982 and the differential association with women's schooling is almost eliminated. Strong associations of mortality achievement with current school enrollment likely reflect the tendency for countries to underperform in both health and schooling. Associations with adult literacy point towards a causal relationship, but the magnitude and consistency of association is attenuated, and male-female differences are minimal. I look next at a more direct input to mortality, the level of health expenditure.

Health Systems Inputs

Inasmuch as a wealthy nation bereft of health services or spending would have very poor health standards, health spending must have an impact on health, yet pinpointing this relationship has often proven difficult. Beyond the direct causal relationship between spending and cure, Caldwell argued that health spending demonstrated a societal commitment to welfare that would be reflected in better outcomes. Several factors undermine such a causal relationship. First, all societies expend some resources on health, limiting the range of variation (Filmer and Pritchett 1999; Baldacci et al. 2008). Second, the share of GDP expended on health tends to rise as nations grow wealthier, making it difficult to separate health expenditures from other forces of societal development (Shang and Goldman 2008). Third, expenditures are preventative, curative, and palliative, so high levels of spending might indicate a particularly unhealthy population (Aisa and Pueyo 2006). Finally, Filmer et al. (2002) point out that health spending is often not intended to address specific mortality targets, whether due to corruption, inefficiency, elite capture or a sincere focus on broader impacts. With these caveats in mind, spending is a natural first approximation of a health system, and studies have found significant associations between spending and outcomes (Anand and Ravallion 1993; Nixon and Ullmann 2006). Table 6 compares the total, public, and private health expenditures of exceptional mortality achievers using data from the WHO national health accounts database (WHO 2010).

Total health spending is not a strong correlate of mortality achievement, and it is primarily related only to poor achievement. Poor achievers spend twice as much per person ($656) as superior achievers ($309), yet they spend considerably less as a percentage of GDP (4.0% versus 6.0%). This is in spite of a tendency for wealthier countries to spend more on health as a share of GDP. The average poor achiever ranks 12 places lower on expenditure per capita than on GDP. Total health spending for overachievers ranks scarcely higher than GDP. Only four superior achievers are relative big spenders (Nicaragua, Vietnam, Cuba, and Costa Rica), while three spend slightly less than would be expected (China, Peru and Comoros). It is important to note the role of reverse causation from poor health to greater spending, particularly in poor countries. For countries with a GDP per capita of $2,000 or less, health expenditures as a percentage actually have a strong positive correlation to AMR (0.29) and CMR (0.34).

[Insert Table 6 about Here]

Perhaps more notable than the pattern of total health expenditure is the public-private mix. Most of the expenditure deficit among poor achievers comes in their private spending. As a share of

GDP they spend half as much as on private expenditures as superior achievers (1.3% versus 2.6%) with a much smaller public expenditure gap (2.7% versus 3.5%). Poor achievers rank 25 spots lower on private health expenditure than on GDP. Superior health achievers derive more of their aggregate health expenditure advantage from public spending ($214, +5), yet this almost entirely reflects the astronomical levels of public health spending in Cuba ($875, 9.9% of GDP, +30 relative ranking) and to a lesser extent Costa Rica. If Cuba were removed, superior achievers would perform as well on private spending as on public. Indeed, Paraguay, Vietnam, China, and Nepal all draw a majority of health spending from the private sector and have a higher relative ranking on private expenditure than on public.

These patterns challenge the policy focus on public health expenditures as a driver of health outcomes. While greater policy leverage over public expenditures may justify this focus, private expenditures are equally significant. Private expenditures can also be stimulated by state policy, for instance through infrastructure investment, regulation, innovation, and prevention (Berman 1995; Mills et al. 2002; Travis et al. 2004). Finally, low levels of private health spending may be driven by high rates of poverty (Anand and Ravallion 1993; Xu et al. 2003)..

Poverty

Even after controlling for income levels, levels of poverty may be critical for health. The undernourishment associated with poverty is perhaps the world's leading proximate cause of excess mortality (Ezzati et al. 2004). As noted above, those in poverty may be unable to purchase even inexpensive medical treatments. Table 7 thus explores the poverty profile of exceptional achievers. Since poverty is highly correlated with income, the analysis identifies counties that have high or low levels of poverty even given their income level. Unfortunately, no single poverty indicator yet exists for all nations. Instead, raw indicators were drawn, when available, for income poverty (percent of population living on less than $2 per day) (World Bank 2009), total percent undernourished (FAO 2009), and percent of children underweight (UNICEF 2010). A poverty index was constructed from a country's average z-score on all available indicators.

Poverty indicators for exceptional achievers display the now common pattern whereby the deficits of poor achievers far outweigh the strengths of superior achievers. Relative to income levels, poor achievers perform below average on each indicator and on the composite index. Latvia and Lithuania perform above expectation on poverty, again marking them as outliers. Trinidad and Gabon perform poorly in relative terms, though better than the worst performers. Superior achievers rank significantly higher on child underweight outcomes than on income (+13 average), but their average performance on income poverty and total undernourishment results in a mere +4 average on the composite index. All of the Latin American countries are strong relative performers on individual indicators and on the poverty index, perhaps reflecting the success of recent income redistribution programs. Outside Latin America, however, superior mortality achievers actually rank lower on the poverty index than they do on income.

[Insert Table 7 about Here]

Poverty is an important dimension of health achievement, perhaps even more significant than health expenditure, but it is more closely associated with poor achievement than with superior achievement. The list of superior achievers actually includes a number of nations with poor

poverty outcomes even relative to GDP. Research in developed countries suggests that levels of inequality, rather than poverty *per se*, might better explain cross-national mortality variations (Macinko et al. 2003; Subramanian and Kawachi 2004; Wilkinson and Pickett 2006). This pathway is difficult to assess given the lack of income Gini coefficient data for most poor countries. A comparison of Gini coefficients for countries with available data found no difference between superior and poor achievers (not shown), while a number of superior mortality achievers actually had notably high (e.g., Latin American nations) or rising levels of inequality (e.g., China). One final pathway that might explain poor mortality outcomes among high-poverty countries is the quality or nature of governance, and so the exploration of distal determinants concludes with governance factors.

Governance and Society

Caldwell's original discussion frequently touched on the role of democracy, social activism, and social solidarity or consensus in driving superior health achievements. Since then, all manner of econometric evidence has been brought to bear on the relationship between quantitative governance indicators and health, with inconclusive results. A number of studies find small but significant effects of democracy on improved health (Szreter 1997; Shandra et al. 2004; Besley and Kudamatsu 2006) , but some have found limited effects (Ross 2006) or even negative effects for specific outcomes such as vaccine coverage (Gauri and Khalegian 2002). A more consistent line of research addresses the role of governance efficacy (Shen and Williamson 2001; Rajkumar and Swaroop 2008; Gupta et al. 2002). Using data from the World Bank Governance Indicators database, Table 8 compares exceptional mortality achievers on measures of democracy, efficacy, and corruption. Indicators of stability, regulation, and law and order were also available, but did not vary between superior and poor achievers (not shown).

As in earlier explorations, each governance indicator is associated with exceptional health achievement in the expected direction, though once again associations are far stronger for poor achievers. On each indicator, poor mortality achievers ranked well below their income ranking (-34 effectiveness, -38 corruption, -42 democracy). As in earlier analyses, Latvia and Lithuania again performed well on all indicators, outperforming most superior achievers, while Gabon and Trinidad and Tobago performed somewhat better than other oil states.

[Insert Table 8 about Here]

Superior achievers do not demonstrate a strong aggregate performance on any single governance indicator, yet significant patterns emerge when looking across the indicators. Confirming the findings of Caldwell and others, there appears to be a distinct democratic and undemocratic route to superior mortality achievement. Four regimes were not at all democratic (Eritrea, Vietnam, Cuba, China), while five were quite democratic at least relative to their GDP (Nicaragua, Paraguay, Costa Rica, Peru, and Comoros). Nepal scored 1 out of 10, though its recent history prior to the royalist coup of 2005 was quite democratic.

A separate look at autocratic societies also highlights the role of other governance factors. Table 5, Column 4 presents the relative ranking on the governance indicator on which a country performs best. Each superior achiever performed positively on at least one indicator. Among the five current autocracies, four rank high on efficacy: China (+25), Vietnam (+22), Nepal (+22),

and Eritrea (+13), while Cuba's -54 relative ranking seems unduly harsh given its success in many areas of social development. Eritrea (+56) and Nepal (+40) also perform well on corruption. In contrast, most poor achievers perform very poorly on all indicators. Even outlier countries like Latvia, Lithuania, and Trinidad do not perform well on any governance indicator. In aggregate, superior mortality achievers average +32 on their best governance indicator while the poor achievers average -27 on their best indicator. In other words, superior mortality achievers are usually strong in one area of governance, while poor achievers never are.

The final column of Table 8 explores one indicator of social solidarity, the population share of the majority ethnic group. Superior achievers tend more than poor achievers to be ethnically homogenous. Four superior achievers had over 90% of the population from a single ethnic group, compared to only one of 8 poor achievers. Additionally, the list of superior achievers includes two other countries, Cuba and Eritrea, that saw strong levels of social solidarity emerge from liberation struggles. Ethnic homogeneity alone is not a strong predictor of health achievement, but it may, along with governance and education, provide clues to the role of social solidarity in health promotion, as I discuss below.

Discussion and Conclusion

John Caldwell's groundbreaking paper offered two routes to low mortality: a direct route involving women's schooling and a circuitous one involving the interplay between governance, social consensus and empowerment. Twenty-five years on, the direct route is almost closed. Thanks in part to Caldwell's voice, a generation of schooling investments has yielded tremendous progress in schooling outcomes and narrowed male-female gaps. While schooling remains associated with mortality, the association is neither as strong nor as consistent as it was, and continued success leaves diminished room for further improvement. Education undoubtedly has a causal effect on mortality, particularly for children, but the relationship may be swamped by factors relating to health systems, poverty, and governance.

The modern path to superior mortality achievement thus requires a more circuitous routes. Superior achievers are identified by success on some development indicators and by the lack of abject failure on any dimensions. Along with schooling, health expenditure and poverty play minor roles. Superior achievers also distinguish themselves from poor achievers by performing well on at least one governance indicator and by avoiding a terrible performances on any. But no simple narrative of success presents itself, much less clear policy prescriptions. This story is made more difficult by the rising significance of adult mortality and the more complex set of underlying social and political risk factors (Rajaratnam et al. 2010).

The significance of adult mortality is also apparent in the number of nations burdened by exceptionally poor adult mortality outcomes relative to GDP, even after accounting for unique burdens like HIV/AIDS in Southern Africa and the post-Soviet mortality spike. Today's poor mortality achievers are overidentified by limitations across the domains of education, health spending, poverty reduction, and governance. There are reasons for guarded optimism that such countries can shift towards less extreme levels of underachievement, including the eventual improvements seen by Caldwell's generation of poor achievers, global progress in HIV/AIDS treatment scale-up, and signs of increased health investment and poverty reduction in some

countries such as Gabon. But moderate levels of achievement are not the goal of global health, and so we inevitably return to the lessons we might learn from superior achievers.

The very idea of a superior mortality achievement should be self-limiting. A follow-up of Caldwell's original mortality achievers revealed the extent of income and mortality convergence between superior and poor achievers. Superior achievers grew wealthier, raising the standard for inclusion. Poor achievers fell behind economically even as they closed the mortality gap. As the systems, technologies, and rules governing health become more globalized, exceptional health outcomes relative to income should grow more unusual (McMichael and Beaglehole 2000; Beaglehole et al. 2004). Given these forces of homogenization, the continued success of China, Cuba, Costa Rica, and Vietnam is both inspiring and puzzling. The fact that each extended earlier child mortality advantages into adult mortality success implies the existence of a path to sustainable health improvement. Yet the few common themes that once unified these nations' routes to successes have lately vanished. While China and Vietnam made considerable efforts to rein in and privatize health expenditures, Cuba and Costa Rica pursued the opposite route.

How do we explain the continued success of China and Vietnam? Concerns over the robustness of these results, most notably the possibility of a coming lagged smoking effect, were noted above. A more positive explanation relies on life-course effects, with the possibility that earlier success in promoting child health has carried into adulthood and future generations. Given considerable micro-level evidence on the effects of health in early life on metabolic and immunologic function in adulthood, comparable macro-level analysis is needed (Barker and Osmond 1986; Preston et al. 1998; Crimmins and Finch 2006). Life course effects may also operate through behavioral pathways. Effective health systems may engender a culture of health demand that can survive the scaling back of public health investment. Some have in fact argued that China's unusually high household savings rate, particularly in rural areas, derives from the anticipation of catastrophic health expenditures not covered by the state (Yip and Hsiao 2008).

Even as national indicators offer little insight into old or new superior achievers, two emerging patterns of regional success, in Latin America and the Muslim world, bear closer scrutiny. The Latin American success story is now increasingly well-understood. Beyond the four superior achievers from Latin America, every Spanish-speaking nation in Latin America ranks higher on life expectancy than on GDP, even as non-Spanish neighbors lag behind. In his history of mortality success in four Latin American and four Asian societies, McGuire (2010) pointed to cost-effective primary health care programs and increasing democratic inclusion as pillars of success in Latin America, though it was often not clear whether democratization was leading to improved health, or health leading to democratization.

Equally significant for Latin America is the relationship between mortality success and processes of peace and reconciliation in the wake of decades of conflict and autocracy (Shiffman and del Valle 2006). Since the unsteady resolution of civil war in 1992, Guatemala, historically the region's most troubled nation, has moved from a relative underachiever (-7 relative ranking) to a relative overachiever (+7). El Salvador has made a similar move from -4 in 1990 to +15 in 2007. Bolivia, perhaps the setting of the region's deepest conflict at present, is also the poorest relative mortality achiever (+1). By contrast, Paraguay, the world's top relative mortality achiever, is notable not just for its ethnic homogeneity (a large majority are Mestizo) but also for the fact that 90% of the population speak both Spanish and the indigenous Guarani language (Rubin 1985).

While the pathway from conflict to health system failure is now well understood, the potential path from conflict resolution or recovery to comprehensive success bears much greater attention.

Recent mortality achievements in the Muslim world are less well-known but equally profound. Substantial reductions in child and adult mortality have taken place in every region, with some of the most striking successes have come in the Arab heartland. While relative success is in part a product of economic failure, even the absolute achievements are phenomenal, particularly in light of the pessimism Caldwell expressed in 1986. At the proximate level, improvements stem from targeted investments in health systems and from a dramatic narrowing of the male-female schooling gap. Muslim populations may also have been less affected by HIV/AIDS and NCD spikes due to protective behavioral factors (Idler 2009; Rogers et al. 2010), though testing such a hypothesis would require great sensitivity to research design, causation, and heterogeneity.

Looking beyond proximate risks, what can we learn from the Muslim mortality decline? The successes and failures of Muslim nations offer a roadmap of the routes to low mortality. First, countries that are dependent on human capital as a source of economic growth saw far greater success than those that were resource dependent. The most successful Muslim nations are those, like Morocco, Syria, Jordan, and Bangladesh, that depend on human capabilities for development, just as China and Vietnam did a generation before. Bangladesh, perhaps the most widely publicized success, reduced mortality in an era of dramatic fertility decline and rising women's status, each driven by the nation's dependence on human capital (Amin et al. 2002; Amin and Lloyd 2002; Trapp et al. 2004).

Human capital dependence may predispose nations to superior mortality achievement, but why do some nations convert this motivation into success and not others? Here we return to the complex relationship between social solidarity, democratic change, health systems and mortality success first introduced by Caldwell. Bangladesh ranks as one of the more democratic nations in the Muslim world, but mortality takeoff came in a period of autocracy from 1982 to 1990 (Cleland et al. 1994; Kabir et al. 2008; Hale et al. 2009). What is perhaps more clear is that the Bangladesh miracle relates in part to the spirit of solidarity and innovation engendered by the country's liberation in 1971 from Pakistan (Basu et al. 2000; Cleland et al. 1994). Contrast this experience with that of Lebanon, which is the most democratic nation in the Arab world but also a poor mortality achiever. A sharp sectarian divide, civil conflict, and Israeli occupation and invasion have hampered both the consistent delivery of health services and the formation of national consensus. Lebanon may offer a different version of the reversed causation between democracy and health. Perhaps autocratic regimes in the region have maintained power because they improved the delivery of basic health and education, while Lebanon's push towards democracy and the rancorous dissent among its Shia population stem from a failure to improve.

This raises a final point relating to ethnic homogeneity and social consensus. The nations of Latin America and the Muslim world tend to be more homogenous than average. The more homogenous nations within each sphere have also achieved greater mortality success. But this should not imply a simple path from homogeneity to health. First, many of the countries in question were homogenous long before they reduced mortality, so homogeneity is not a sufficient condition for success. Second, the study of *imagined communities* points out how fluid the construction of ethnic identity and difference can be, particularly when unity is motivated by collective national interest (Anderson 1991; Hollinger 2006). Jordan has an almost exclusively

Arab population, yet as late as 1970 its population was deeply divided between native Jordanians and Palestinians displaced from Israel and the West Bank. Poor health standards and civil war portended collapse, not the gradual process of multicultural integration that actually unfolded.

Reversing our chain of causation once again, we may ask whether homogenous nations produce better health, or whether healthier populations produce unified nations? The answer, of course, may be both. Partition may have paved the way for success in Bangladesh, Bosnia and Herzegovina, and Eritrea, but collective trauma may also create moments of solidarity in which health systems offer one platform for unity. This would seem to apply in Jordan, in ethnically diverse Eritrea (Muller 2005), and even in Bangladesh, whose ethnic homogeneity in 1971 belied a bloody division between separatists and those who wished to remain in Pakistan. In all cases, dependence on human resources, rather than minerals, may have reinforced incentives for unity.

A quarter-century on from John Caldwell's groundbreaking paper, Caldwell's ideas on the importance of health systems and national consensus remain equally valid, yet it remains unclear whether these lessons can be put into action. The decade of global health has seen incredible progress, but we are now entering the most critical period of all. As poor achievers return to hoped-for health trajectories and Millennium Development Goals are met, there will also be opportunities for governments and donors to declare victory and move on to other priorities. But there will also be opportunities for poor achieving nations to jump directly to superior achievement, to reduce health disparities, and renew their social contracts. These opportunities are further enhanced by new action-learning platforms that allow governments, donors, communities and diasporas to work together on identifying needs, implementing programs and maintaining mutual accountability and sustainability (Gruen et al. 2008). With improved information technologies and a better understanding of the national determinants of health, we may yet find ways for all nations to be superior achievers.

Table 1: Exceptional mortality levels relative to income levels for 99 Third World countries, 1982: Rankings separated by at least 25 places as measured by infant mortality rankings (Reproduction from Caldwell (1986)

	Per Capita GNP	**Infant Mortality Rate (per 1,000 live births)**	**Ranking of IMR relative to income**	Expectation of Life at Birth (years)	**Ranking of life expectancy relative to income**
Panel A: Superior Health Achievers					
(Kerala)	(160-270)	(39)	(+75)	(66)	(+73)
Sri Lanka	$320	32	+62	69	+61
China	310	67	+46	67	+61
Burma	190	96	+39	55	+38
Jamaica	1,330	10	+37	73	+32
India	260	94	+36	55	+33
Zaire (now Congo)	190	106	+31	50	+23
Tanzania	280	98	+31	52	+22
Kenya	390	77	+31	57	+22
Costa Rica	1,430	18	+27	74	+29
Ghana	360	86	+26	55	+19
Thailand	790	51	+25	63	+14
Unweighted Average	$532	67	+36	61	+32
Panel B: Poor Health Achievers					
Oman	6,090	123	-70	52	-57
Saudi Arabia	16,000	108	-61	56	-50
Iran	6,465	102	-52	60	-37
Libya	8,510	95	-50	57	-47
Algeria	2,350	111	-48	57	-32
Iraq	6,465	73	-35	59	-39
Yemen (unified)	500	163	-34	44	-32
Morocco	870	125	-32	52	-18
Cote d'Ivoire	950	119	-28	47	-37
Senegal	490	155	-27	44	-30
Sierra Leone	390	190	-25	38	-25
Unweighted Average					
All poor achievers	$4,462	124	-42	51	-37
Oil producers	7,647	102	-53	57	-44
Non-oil producers	640	150	-29	45	-28.4
Source: Caldwell (1986)					

Table 2: Growth and mortality progress of original Superior and Poor Achievers, 1982 - 2007

	Per Capita GDP - PPP Adjusted			Infant Mortality Rate				Life Expectancy at birth		
Country	**1982**	**2007**	**Annual growth rate**	**1982**	**2007**	**% drop 1982-2007**	**Relative Rank , 2007**	**1982**	**2007**	**Relative Rank , 2007**
Panel A: Superior Health Achievers										
Sri Lanka	918	4,197	6.3%	32	17	47%	+35	69	71	+23
China	325	5,427	11.9%	67	19	72%	+16	67	74	+38
Myanmar	660	1,293	2.7%	96	79	18%	-3	55	56	+2
Jamaica	2,710	7,168	4.0%	10	26	-160%	-13	73	72	+8
India	504	2,741	7.0%	94	54	43%	-6	55	64	+3
Zaire (now Congo)	389	285	-1.2%	106	108	-2%	+8	50	52	+17
Tanzania	533	1,135	3.1%	98	73	26%	+10	52	52	-4
Kenya	716	1,548	3.1%	77	80	-4%	-9	57	54	-9
Costa Rica	2,557	10,513	5.8%	18	10	44%	+18	74	79	+33
Ghana	459	1,354	4.4%	86	73	15%	+2	55	57	+3
Thailand	1,237	6,110	6.6%	51	6	88%	+51	63	70	-1
Unweighted Average	**1,001**	**3,797**	**5.5%**	**67**	**50**	**26%**	**+10**	**61**	**64**	**+10**
Panel B: Poor Health Achievers										
Oman	5,903	20,646	5.1%	123	11	91%	-12	52	74	-15
Saudi Arabia	16,653	22,947	1.3%	108	20	81%	-44	56	71	-45
Iran*	3,918	10,838	4.2%	102	29	72%	-39	60	72	-11
Libya	11,283	14,708	1.1%	95	17	82%	-22	57	72	-25
Algeria	3,512	7,649	3.2%	111	33	70%	-31	57	71	-5
Iraq		3,477		73	36	51%	+2	59	63	-9
Yemen (unified)	1,275	2,436	2.6%	163	55	66%	-2	44	64	+8
Morocco	1,313	4,055	4.6%	125	32	74%	+1	52	72	+34
Cote d'Ivoire	1,289	1,546	0.7%	119	89	25%	-15	47	54	-8
Senegal	1,645	1,723	0.2%	155	59	62%	+7	44	59	+4
Sierra Leone	434	717	2.0%	190	155	18%	-7	38	41	-8
Unweighted Average	**4,723**	**8,727**	**2.5%**	**124**	**49**	**61%**	**-15**	**51**	**65**	**-7**
Oil producers	8,254	15,358	2.5%	102	24	76%	-24	57	71	-18
Non-oil producers	1,191	2,095	2.3%	150	78	48%	-3	45	58	+6

Source: Caldwell (1986), World Bank (2009), WHO (2009)

Table 3: Exceptional mortality levels relative to income levels for 121 low and middle-income countries, 2007: rankings separated by at least 25 places as measured by life expectancy at birth

	Per Capita GDP	Life expectancy at birth (e0)	Rank, e0 relative to income	Child Mortality Rate (CMR)	Rank, CMR relative to income	Adult Mortality Rate (AMR)	Rank, AMR relative to income	Adult HIV %
Panel A: Superior Health Achievers								
Nicaragua	2,619	73	+52	35	+20	164	+34	0
Eritrea	622	63	+46	70	+43	248	+51	1
Paraguay	4,518	74	+43	29	+13	138	+38	1
Vietnam	2,571	72	+43	15	+57	153	+45	0
Comoros	1,145	65	+39	66	+31	211	+48	0
Cuba	8,854	78	+36	6	+37	102	+33	0
Nepal	1,062	63	+35	55	+42	280	+31	0
China	5,427	74	+35	22	+15	115	+43	0
Peru	7,668	76	+33	20	+6	111	+30	0
Costa Rica	10,513	79	+33	11	+18	86	+30	0
Morocco	4,060	72	+31	34	+10	119	+52	0
Bangladesh	1,315	64	+30	61	+27	254	+28	0
Unweighted Average	4,198	71	+38	35	+27	165	+39	0
Median	2,619	73		32		146		
Panel B: Poor Health Achievers								
Equatorial Guinea *	16,347	53	-97	150	-102	372	-95	3
Botswana †	13,341	56	-81	40	-47	514	-103	24
Gabon *	14,123	59	-74	91	-75	325	-81	6
South Africa †	9,505	54	-70	59	-38	520	-89	18
Swaziland †	4,878	48	-62	91	-31	618	-68	26
Russian Federation *,^	14,762	66	-54	12	-4	312	-77	1
Angola *	5,162	53	-52	158	-58	347	-44	2
Trinidad and Tobago *	22,424	69	-50	35	-53	200	-49	2
Kazakhstan *,^	10,859	64	-43	32	-26	307	-60	0
Saudi Arabia *	22,881	71	-42	25	-43	163	-38	0
Namibia †	6,119	59	-37	68	-27	365	-52	15
Lithuania ^	17,828	71	-37	7	+6	231	-59	0
Latvia ^	17,350	71	-36	10	-1	213	-52	1
Congo	3,724	55	-32	125	-36	371	-35	4
Unweighted Average	12,807	61	-55	65	-38	345	-64	7
Median	13,732	59		50		336		3
* Oil producers (6)	17,760	73	-69	84	-60	338	-74	2
^ Former Soviet (4)	15,200	68	-43	15	-6	266	-62	1
† Very High HIV (4)	8,461	54	-63	65	-36	504	-78	21

Source: World Bank (2009), WHO (2009)

Table 4: Exceptional mortality levels relative to income levels for 116 low and middle-income countries with adult HIV/AIDS prevalence below 15%, 2007: rankings separated by at least 28 places as measured by life expectancy at birth

	Per Capita GDP (PPP)	Life expectancy at birth (e0)	Rank, e0 relative to income	Child Mortality Rate (CMR)	Adult Mortality Rate (AMR)
Panel A: Superior Health Achievers					
Nicaragua	2,619	73	+46	35	164
Eritrea	622	63	+38	70	248
Paraguay	4,518	74	+37	29	138
Vietnam	2,571	72	+37	15	153
Comoros	1,145	65	+32	66	211
Cuba	8,854	78	+32	6	102
Costa Rica	10,513	79	+30	11	86
China	5,427	74	+30	22	115
Nepal	1,062	63	+29	55	280
Peru	7,668	76	+29	20	111
Unweighted Average	4,534	72	+34	32	152
Panel B: Poor Health Achievers					
Equatorial Guinea	16,347	53	-92	150	372
Gabon	14,123	59	-73	91	325
Angola	5,162	53	-52	158	347
Trinidad and Tobago	22,424	69	-50	35	200
Saudi Arabia	22,881	71	-42	25	163
Lithuania	17,828	71	-37	7	231
Latvia	17,350	71	-36	10	213
Congo	3,724	55	-34	125	371
Unweighted Average	14,980	63	-52	75	278

Source: World Bank (2009); WHO (2009)

Table 5: Schooling and Literacy Indicators, exceptional mortality achievers

	Net Primary School Enrollment		Adult Literacy		
	Male	Female	Male	Female	Female Relative Rank
Panel A: Superior Health Achievers					
Nicaragua	92	92	79	80	+15
Eritrea	42	36	58	35	+13
Paraguay	92	93	94	93	+27
Vietnam	96	91	94	87	+26
Comoros	79	67	79	68	+33
Cuba	99	99	100	100	+35
Costa Rica	91	93	96	96	+8
China	99	99	96	89	+11
Nepal	84	73	94	82	-17
Peru	97	97	68	40	+10
Average	**86**	**84**	**86**	**77**	+16
Average Rel Rank	**+17**	**+16**	**+17**	**+16**	
Panel B: Poor Health Achievers					
Equatorial Guinea	70	63	93	80	-44
Gabon	81	80	89	80	-42
Angola	74	69	83	54	-35
Trinidad and Tobago	92	91	99	98	-7
Saudi Arabia	85	84	88	77	-55
Lithuania	92	91	100	100	+8
Latvia	89	92	100	100	+12
Congo	62	56	91	55	-21
Average	**81**	**78**	**93**	**81**	-23
Average Rel Rank	**-59**	**-56**	**-16**	**-23**	

Source: World Bank (2009), WHO (2009), UNESCO (2010)

Table 6: Public, Private, and Total health spending per capita and as percentage of GDP for exceptional mortality achievers

	Total spending			Public spending		Private spending	
	Per capita	Relative rank	As % of GDP	Per capita	Relative rank	Per capita	Relative rank
Panel A: Superior Health Achievers							
Nicaragua	216	+14	8.3%	119	+16	98	+18
Eritrea	20	-3	3.3%	9	0	11	-3
Paraguay	258	+3	5.7%	109	-4	149	+14
Vietnam	183	+10	7.1%	72	+5	111	+22
Comoros	37	-10	3.3%	21	+3	16	-12
Cuba	917	+21	10.4%	875	+30	42	-53
Costa Rica	851	+14	8.1%	621	+17	230	+1
China	231	-7	4.3%	103	-13	128	+2
Nepal	54	+2	5.1%	21	+7	32	+11
Peru	327	-12	4.3%	191	-9	136	-9
Unweighted mean	309	+3	6.0%	214	+5	95	-1
Panel B: Poor Health Achievers							
Equatorial Guinea	341	-34	2.1%	274	-24	67	-55
Gabon	647	-12	4.6%	417	-13	230	-15
Angola	131	-19	2.5%	105	-11	26	-50
Trinidad and Tobago	1077	0	4.8%	604	-8	473	+2
Saudi Arabia	782	-16	3.4%	621	-7	161	-38
Lithuania	1109	4	6.2%	809	+4	300	-9
Latvia	1071	3	6.2%	620	-3	451	5
Congo	90	-20	2.4%	63	-9	26	-36
Unweighted Average	656	-12	4.0%	439	-9	217	-25

Source: World Bank (2009), WHO (2009), WHO (2010)

Table 7: Poverty Indicators of Exceptional Mortality Achievers

	Income Under $2 / Day	Total Under-weight	Child under-weight	Poverty Index	Poverty Index Rel Rank
Panel A: Superior Health Achievers					
Nicaragua	32	22	0.6	-0.3	+10
Eritrea	--	68	11.5	2.5	-4
Paraguay	14	11	0.5	-0.7	+22
Vietnam	48	14	5.0	0.1	0
Comoros	65	52	8.5	1.3	-8
Cuba	--	5	0.0	-0.9	+14
Costa Rica	9	5	0.4	-0.9	+14
China	36	9	1.2	-0.5	-8
Nepal	78	15	10.0	0.8	-12
Peru	19	15	0.5	-0.6	+13
Average	**38**	**22**	**3.8**	**0.08**	+4
Average Rel Rank	**+2**	**0**	**+13**		
Panel B: Poor Health Achievers					
Equatorial Guinea	--	--	4.3	0.0	-59
Gabon	20	5	2.1	-0.7	-25
Angola	70	46	8.4	1.3	-51
Trinidad and Tobago	14	10	0.5	-0.7	-24
Saudi Arabia	--	5	2.8	-0.6	-46
Lithuania	1	5	--	-1.1	+6
Latvia	1	5	--	-1.1	+9
Congo	74	22	2.7	0.3	-15
Average	**30**	**14**	**3.5**	**-0.32**	-26
Average Rel Rank	**-18**	**-24**	**-36**		

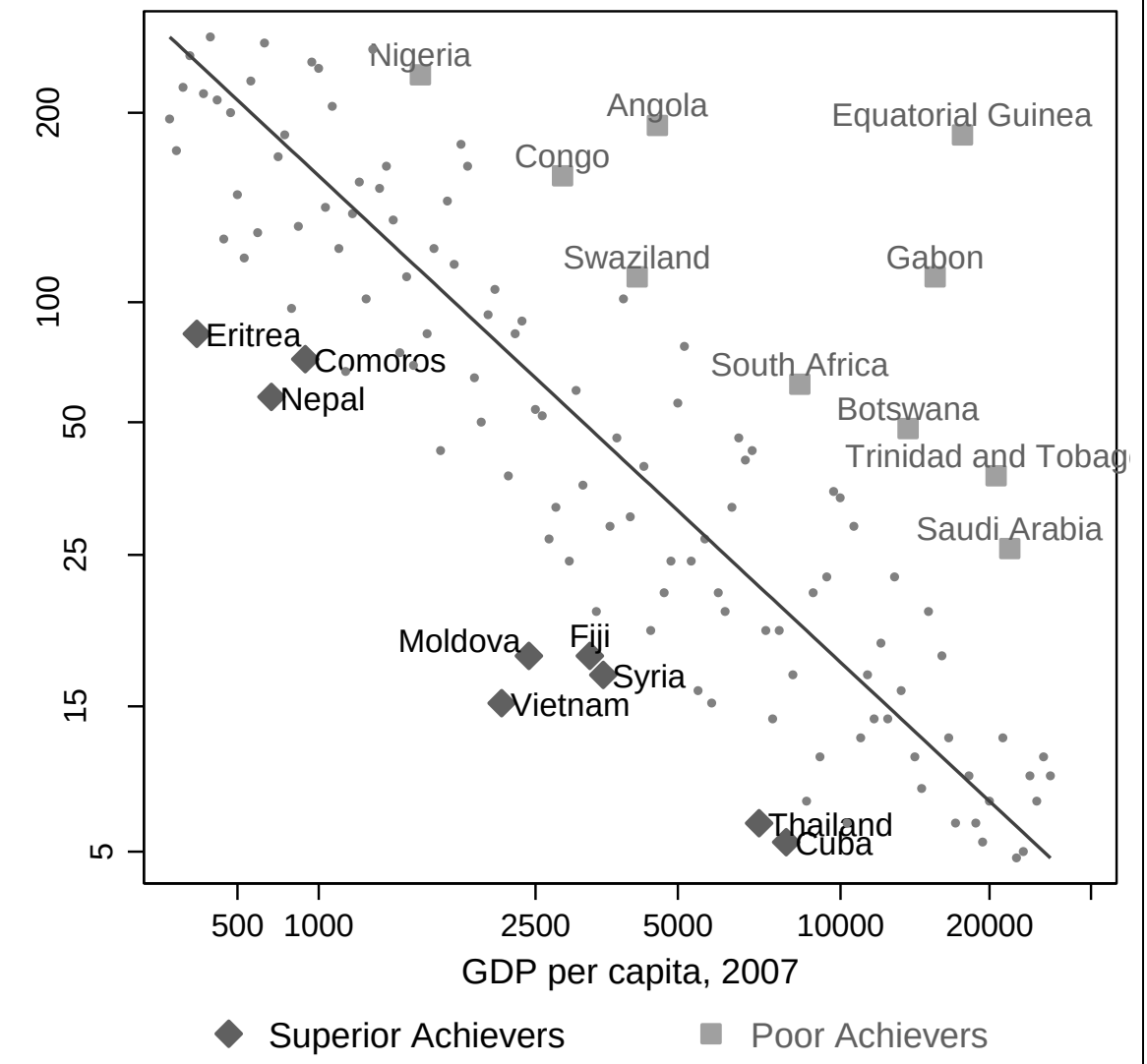
Source: World Bank (2009), WHO (2009), UNICEF (2010), FAO (2010)

Table 8: Governance Indicators of Exceptional Mortality Achievers

	Effect-iveness	Corrupt	Demo-cracy	Best Relative rank	Majority Ethnicity
Panel A: Superior Health Achievers					
Nicaragua	-1.0	-0.8	8	44 (d)	69%
Eritrea	-1.2	-0.6	0	56 (c)	50
Paraguay	-0.9	-1.0	8	29 (d)	**95**
Vietnam	-0.4	-0.7	0	25 (e)	**88**
Comoros	-1.7	-0.7	6	50 (d)	**97**
Cuba	-0.9	-0.2	0	6 (c)	51
Costa Rica	0.3	0.4	10	27 (d)	**94**
China	0.0	-0.7	0	22 (e)	**92**
Nepal	-0.9	-0.7	1	40 (c)	16
Peru	-0.5	-0.4	9	23 (d)	45
Average	**-0.7**	**-0.5**	**4.2**	**+32**	**70**
Average Rel Rank	**-4**	**+10**	**+7**		
Panel B: Poor Health Achievers					
Equatorial Guinea	-1.3	-1.4	0	-89 (d)	83
Gabon	-0.6	-0.9	0	-50 (c)	40
Angola	-1.2	-1.1	2	-19 (d)	37
Trinidad and Tobago	0.2	-0.2	10	4 (d)	40
Saudi Arabia	-0.3	-0.1	0	-16 (c)	**90**
Lithuania	0.8	0.2	10	7 (d)	81
Latvia	0.7	0.3	8	5 (c)	58
Congo	-1.3	-1.0	0	-54 (d)	48
Average	**-0.4**	**-0.5**	**3.8**	**-27**	**60**
Average Rel Rank	**-34**	**-38**	**-42**		

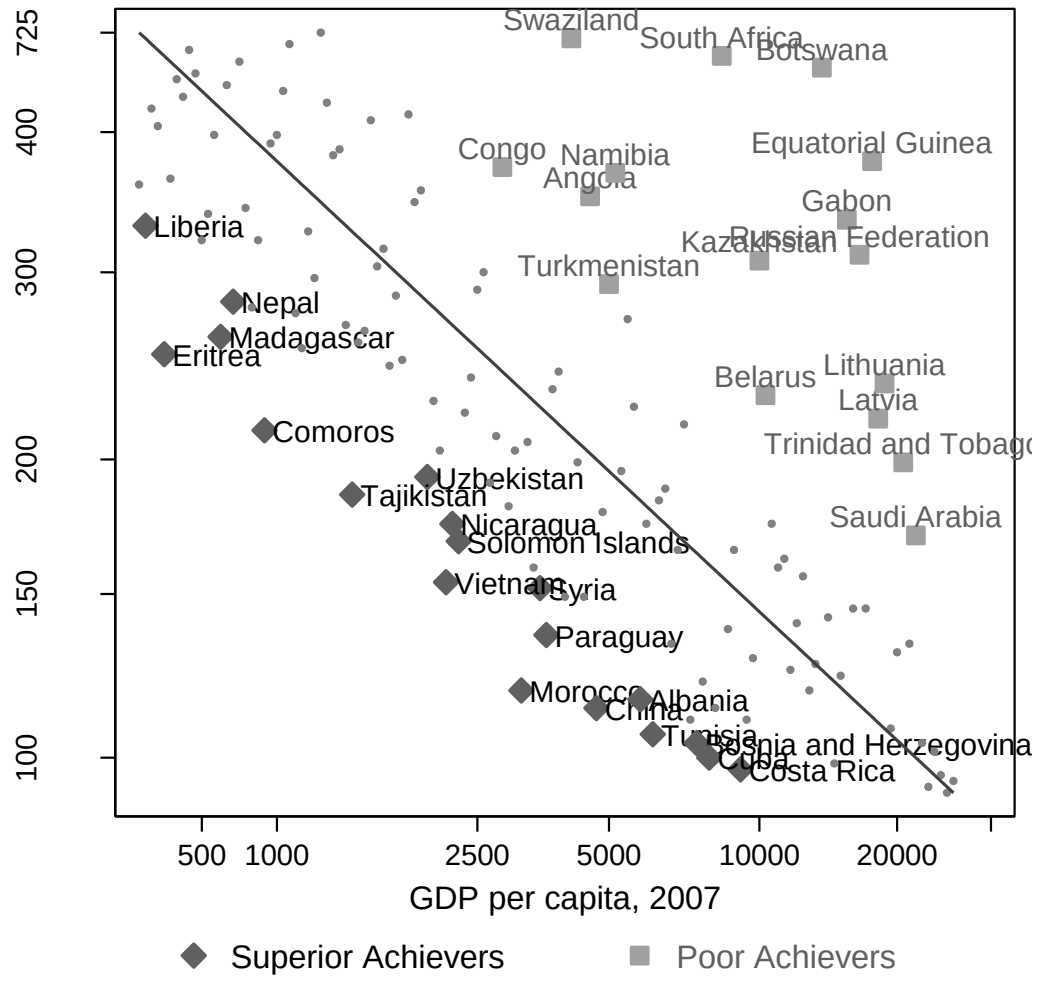
Source: World Bank (2009, 2010), WHO (2009), WHO (2010)

Figure 1: Child Mortality Rate and GDP per Capita, Relative rankings for 131 countries, 2007



Note: Rank-order scale replaced with actual values
Source: World Bank (2009), WHO (2009)

Figure 2: Adult Mortality Rate and GDP per Capita, Relative rankings for 131 countries, 2007



Note: Rank-order scale replaced with actual values
Source: World Bank (2009), WHO (2009)

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Endnotes

[1] WDR included 99 countries having a population over 1,000,000 that were classified as Lower Income (34), Lower Middle Income (38), Upper Middle Income (32), and High Income Oil Exporters (5) (World Bank 1984). Data on IMR and life expectancy were available for all countries, but income data were not available for 13 of these countries, including six Lower Income Countries (Afghanistan, Bhutan, Kamupchea aka Cambodia, Laos, Mozambique, Vietnam); four Lower Middle Income (Cuba, North Korea, Lebanon, Mongolia); and two Upper Middle Income (Iran, Iraq).

[2] Caldwell excluded eight East European non-market economies due to a lack of economic data. These eight subsequently split into 22 nations: Albania, Romania, Bulgaria, Poland, and Hungary emerged as five (5) unitary countries; Czechoslovakia emerged as the Czech Republic and Slovakia (2); USSR split into Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Estonia, Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan (15 countries); while German Democratic Republic dissolved into Federal Republic of Germany (-1). Elsewhere, seven nations were added: Namibia gained independence from South Africa in 1990, Eritrea split from Ethiopia in 1993, Timor-Leste emerged from Indonesia in 2002, and, as of 2007, Yugoslavia was replaced by Serbia, Bosnia and Herzegovina, Croatia, Macedonia (Former Yugoslav Republic), and Slovenia. and two countries Montenegro and Kosovo were not yet included in 2007 statistics. Yemen, PDR and Yemen, AR reunited in 1990, reducing the net total of additional nations to 28. Seven countries passed the one million population mark: Botswana, Gabon, Gambia, Guinea-Bissau, Mauritius, Qatar, Swaziland. Eight countries with between 500,000 and one million people were added: Bahrain, Cape Verde, Comoros, Djibouti, Equatorial Guinea, Fiji, Guyana. Finally, eight countries graduated to high income status: Greece, Republic of Korea, Portugal, Singapore, and Hong Kong, Slovenia, Hungary, and Estonia.

[3] For IMR, 1q0 was adjusted; for CMR, 1q0 and 4q1; for AMR, 5q15, 5q20, …, 5q55.

[4] With the PPP adjustment, the original income gap between superior and poor achievers is reduced from the original 8-to-1 ratio to a still sizable ratio of about 5-to-1.

[5] This gap partly obscures a unique pattern of extreme male mortality disadvantage in the Russian Federation. If Russia's men and women were ranked separately, the women would have a life expectancy of 73, and would fall all the way to 28th poorest (with a -14 relative ranking). Russian men would have a life expectancy of 60 and a relative rank of -73.

[6] Other FSU nations that are moderately poor achievers include Turkmenistan at 19th (-25), Belarus at 21th (-23), Azerbaijan at 26th (-17), and Ukraine at 31th (-11). If Estonia were still considered a developing country it would have entered the list at 24th (-20).

[7] Libya is 22nd poorest (-23 relative ranking), Oman 28th (-15), Iran (-7), Iraq 47th (-4), and Algeria 51st (-3).

[8] Tajikistan is 13th (+30), Syria 15th (+28), Tunisia 19th (+26), Bosnia and Herzegovina 20th (+26), Uzbekistan and Kyrgyzstan are tied for 27th (+21), and Jordan is 29th (+21).

[9] Chad 16th poorest (-27), Nigeria 17th (-26), Turkmenistan 18th (-25), Lebanon 20th (-24), Libya 22nd (-23), Malaysia 24th (-19), Azerbaijan 26th (-17), Djibouti 27th (-16), Oman 28th (-15), Afghanistan 29th (-13), Bahrain 30th (-13)

[10] On the whole, majority Muslim superior achievers do not perform much worse when looking only at females. All 11 countries remain in the top quartile of superior achievement. Bangladesh leaves the list of superior achievers but remains just in the top quartile and is replaced in the group of top superior achievers by Bosnia and Herzegovina. Muslim nations do feature more heavily on the list of poor female life expectancy achievers, however. Qatar, Nigeria, and Lebanon would join the group of poorest achievers and 20 of the 33 countries in the poorest quartile on female life expectancy achievement would be Muslim compared to only 13 for total life expectancy.

[11] Colombia is 21st (+25), Panama 23rd (+24), Honduras is 25th (+23), and Ecuador is 30th (+21). Non-Spanish speaking countries fare worse. In addition to Trinidad and Tobago's poor achiever status, Guyana is has a relative rank of -3 and Suriname -7.

[12] We also should be able to exclude countries on the basis of an independent causal force behind the crisis, not merely mortality itself, so as not to sample on the dependent variable.

[13] I exclude five middle-income countries from the former South African economic space that also happen to have adult HIV prevalence over 15% and poor mortality achievement: Swaziland (26%), Botswana (24%), South Africa (18%), Lesotho (23%), Namibia (15%). Zimbabwe was already excluded for other reasons. The remaining three countries in the region are both poorer and have lower HIV/AIDS prevalence. Only Zambia (15%) would have joined the list of poor mortality achievers with the exclusion of these other five countries, while Malawi (12%) and Mozambique (12%) are even poorer and close to the middle of the relative life expectancy rankings, so their exclusion will not affect subsequent results.

[14] The Russian mortality disadvantage is more difficult to identify in the European FSU nations, where Russian minorities are simultaneously smaller, more similar to the majority ethnic groups, and better assimilated into society. Disparities exist between Russian and majority populations, but after correcting for the inevitable ethnic misidentifications, life expectancy disparities may amount to merely 2 years. Latvia and Lithuania are comparable in terms or relative mortality rank, yet Lithuania's Russian majority amounts to only 9% compared to Latvia's 30%.

[15] From the earlier list, Morocco and Bangladesh fell to a +24 relative ranking, tied with Tajikistan and more distant from Nepal and Peru than they are from a group of ten trailing nations above +20, together constituting a group of strong mortality achievers. These are Tajikistan (+24), Haiti (+22), Tunisia (+22), Bosnia and Herzegovina (+22), Syria (+22), Panama (+21), Liberia (+21), Madagascar (+21), Colombia (+21), Philippines (+20).