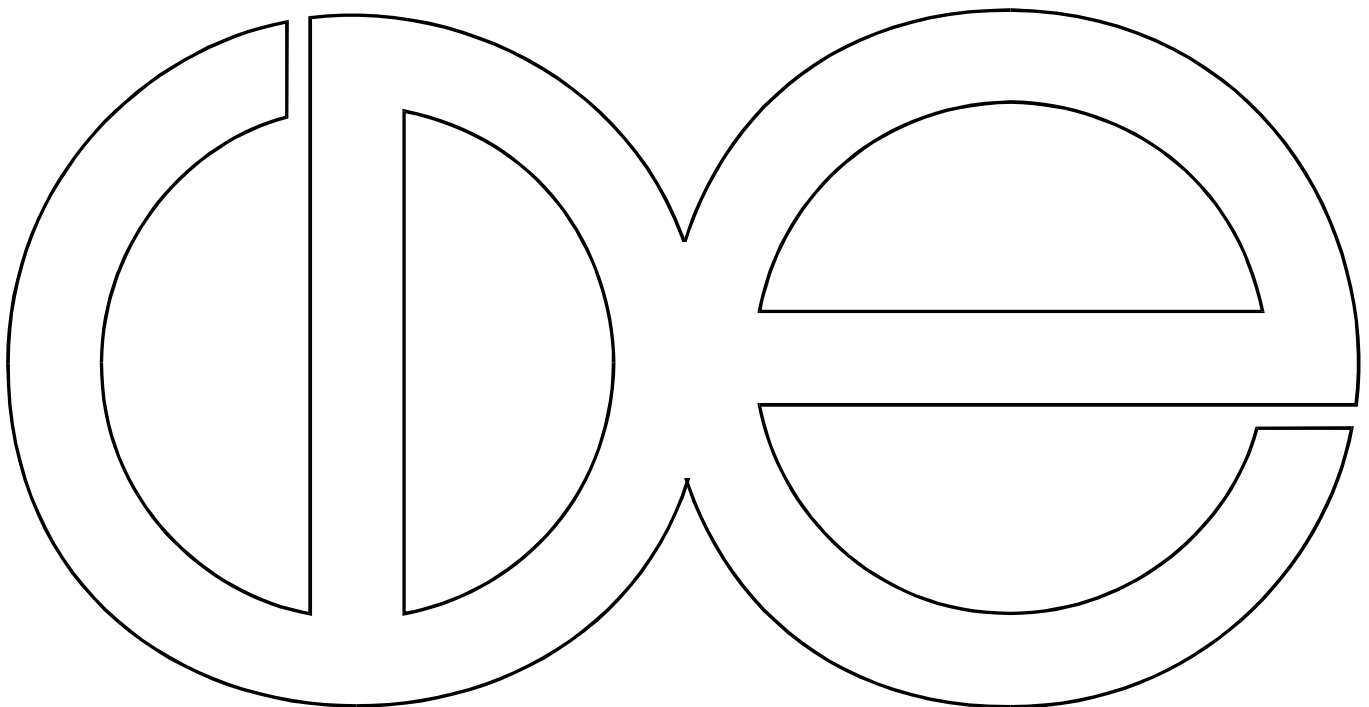


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Health in the U.S. at Young Ages: Preliminary Findings

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Abstract

We review a broad set of health-related indicators—mortality, health outcomes, proximate health determinants, and distal health determinants—for the US and a comparison group of peer OECD countries. The principal findings are: (a) the US ranks consistently worse than peer countries on all but a few indicators; and (b) there is a strong relationship between the US health rankings across the life cycle: performance at one stage predicts performance in subsequent stages.

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1 Mortality at Older Ages

A recent NAS report found that the US lags behind other high-income countries in life expectancy (a summary measure of the mortality experience across the life course), that the disadvantage is large, and that it has grown steadily for the past 30 years {1}. For completeness, we present some of our own analyses of trends in life expectancy. Figure 1 (page 27) shows life expectancy at birth for the US and a composite average of five selected nations¹ from 1990 to 2005. Males and females in the US consistently lag behind their peers, and this disadvantage appears to grow for females. Figure 2 (page 28) shows overall life expectancy as two components: (a) the interval life expectancy between ages 0 and 50 (maximum 50 years), and (b) conditional life expectancy at age 50. Between the ages of 0 and 50, US disadvantage remained fairly constant. Above age 50, US male disadvantage was relatively stable, but US female disadvantage grew.

The previous NAS report sought to quantify and explain the US health and mortality disadvantage at older ages (over 50 years). While many factors contribute to these trends, the panel found two main determinants: (a) relatively high adult tobacco consumption and (b) an unfavorable balance of diet and physical activity. The evidence suggested that the health impacts of long-term tobacco consumption and deleterious dietary and activity patterns explained an important part of the US disadvantage. However, with increasing age the ripple effects of lifetime smoking and the combination of poor diets and low physical activity recede as the surviving population is progressively depleted of its most at-risk members, and the US ranking in mortality after about age 75 is among the five best.

The panel's conclusions are interesting for two reasons. First, given that the US outspends every other peer country on health care, one might expect the US to lead the pack in terms of desirable health outcomes. This is clearly not so, but the reasons for the inconsistency are not well understood. Second, tobacco consumption, obesity, and metabolic disorders—the main risk factors responsible for mortality excesses due to heart disease, lung cancer, and COPD—are associated with behaviors that start early in life, commonly during adolescence and early adulthood, and are, at least until recently, abandoned rarely or too late. Lung cancer and emphysema are illnesses associated with behaviors that have an early onset and which require a long period of cumulated physiological damage before they are expressed. Similarly, strokes, heart attacks, circulatory impairments, and diabetes require long latency periods and sustained exposure to the physiological consequences of deleterious behaviors. Thus, the US mortality disadvantage during older ages is partially explained by behaviors and exposures that often start before entering old age—during young adulthood, adolescence, and even as early as childhood. These and related exposures may also be implicated in the US mortality disadvantage at younger ages that we describe below.

Quite apart from the fact that the US health disadvantage at older ages may have roots in early life, a fact-finding

¹ Canada, France, Japan, Sweden, and the UK

exploration focused on the health and mortality of the younger sector of the population is of interest in itself: this is the most productive segment of the population, one that contains not just the most active portion of the labor force but also the population that will constitute the labor force in the next generation and the one that will produce future generations of workers and professionals. Health disadvantages among those 0 to 50 years not only reflect potential limitations to current health and well-being but also potential direct and indirect threats to future health and well-being.

2 Mortality at Younger Ages

Though the poor ranking of US life expectancy at birth is partly attributable to relatively higher mortality rates for ages 50 and above, this is not the entire story. The US compares unfavorably on mortality rates across all ages, including the age interval from birth (age 0) to age 50. During this stretch of the life course, US performance is particularly poor, ranking near the bottom among peer countries.²

We again compared the US to the average composite of five selected countries³ and decomposed the difference in overall life expectancy by age group (0-50 and 50+) and cause of death for 1990, 1995, 2000, and 2005. Table 1 (page 22) shows these findings expressed as days, where positive values indicate age-cause combinations that contribute to US life expectancy disadvantage and negative values that reduce US disadvantage. Overall US female disadvantage grew dramatically from 677 days in 1990 to 1352 days in 2005. The striking change was the relative importance of mortality above age 50. In 1990, about 44% of the US female life expectancy disadvantage was attributable to deaths before age 50 and 56% above age 50. By 2005, the ratio was 35% vs 65%. The pattern for males is very different. The overall gap in life expectancy at birth fluctuated and grew modestly—nowhere near as much as for females—and the ratio of under 50/over 50 contribution is *reduced* from 68% vs 32% in 1990 to 55% vs 45% in 2005. Focusing just on deaths before age 50, the main causes contributing to US life expectancy disadvantage (for females and males) were: (1) accidents, homicides, and suicides; (2) congenital anomalies and diseases of infancy; and (3) circulatory system diseases.

Table 2 (page 23) displays results from a difference-in-difference analysis and identifies age-cause combinations that contributed to the *change* in US life expectancy disadvantage. Positive values indicate age-cause combinations that contribute to increased US disadvantage relative to the composite average and negative values indicate those

² The OECD countries used for comparison in the previous NAS report are not identical to the “peer” sets used herein. The former was Australia, Austria, Belgium, Canada, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Ireland, Israel, Italy, Japan, Latvia, Lithuania, the Netherlands, New Zealand, Norway, Poland, Portugal, Russia, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Taiwan, and the United Kingdom. Here we use two sets. For the life expectancy decomposition we use Canada, France, Japan, Sweden, and the UK. For the remaining analyses we use a broader set of countries: Australia, Austria, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. For the bulk of the report and unless otherwise stated, when we refer to “US peer countries” or “US peers” we use the second, broader set as reference.

³ Canada, France, Japan, Sweden, and the UK; same as in Figures 1 and 2.

that decreased the life expectancy gap between the US and the composite average. The upper three panels show the period to period change, and the final panel shows change over the entire 1990 to 2005 period. Without going into great detail, the US female disadvantage grew dramatically between 1990-1995 and 1995-2000, and this was almost entirely the result of relative mortality deterioration above age 50. US males experienced improvements under age 50 thus contributing negatively to the gap and partially offsetting the disadvantage that originates at ages above 50.

In short, over the last twenty or so years the US has stubbornly lagged behind in mortality at all ages. However, the gap between the US and peer countries has changed in nature. Indeed, the contribution to the overall mortality gap that originates at ages younger than 50 has declined relative to the contribution rooted in mortality disparities at ages older than 50. This pattern is particularly strong among females and much less so among males. Throughout the period under examination the relative mortality disadvantage at ages below 50 has persistently been associated with mortality due to unintentional injuries, violence, and suicides prevailing in the age interval 15 to 30, congenital disorders that dominate during infancy or childhood, and diseases of the heart and circulatory system in the age group 30 and 50 years. The next section argues that these mortality disadvantages have a counterpart in more general indicators of health status (i.e., morbidity) for the age group and that the US is also at a disadvantage in a broad array of health indicators, including some that are in all likelihood implicated in the production of mortality excesses in this age group.

3 Health Status at Younger Ages

The quantity of life lost is one indicator of health conditions, but it is not always the most revealing. While more terminal and definitive, mortality rates—and the indicators that summarize them, like days or years of life lost—are the complex result of exposure to risks, robustness of individuals to illness, and their ability to recover from illness. To better assess all these factors and the individual and aggregate characteristics that modify them we also need to examine more general indicators of health status. There are numerous conditions experienced during childhood, adolescence, and young adulthood that, while not resulting in death and translating directly into years of life lost, have serious health consequences for individuals. These conditions may lay out the foundations for excess mortality and poor health at older ages. They are known to complicate early intellectual and emotional development, impede normal physiological growth, disrupt standard education, distort family formation and attachments to the labor force, and derail occupational careers and socioeconomic attainment—all departures from expected and desirable paths {2}. Child mortality, deaths by suicide, homicide, and accidents are not linked to clear-cut conditions in the same way that older age mortality is linked to recognizable chronic illness, and the behaviors involved are similarly not always well-defined. These causes of deaths reflect factors that are difficult to identify, fuzzier, and with weaker or less understood links to individuals' behaviors, individuals' social and economic conditions, and overall societal

characteristics. Furthermore, the same factors that account for the US poor standing in child mortality due to homicide, suicide, and injury-related deaths at ages below 50 may well be the result of an underlying malaise that influences overall health status, not just mortality rates.

In what follows we assess this possibility. We find that the US ranks poorly on general health indicators in the age group 0 to 50. We show evidence that the US lags in health indicators during early childhood, adolescence, young adulthood, and mature adulthood. While smoking, obesity, diets, and lack of physical activity are part of the story, they are neither the most important parts nor do they offer the most consistent interpretation of observed conditions. There is not a single culprit for the US health disadvantage. Our description below shows that the relatively poorer health of US individuals in the age segment 0 to 50 cannot be attributed to the operation of factors neatly packaged in a finite number of behaviors. And while we do not understand all the mechanisms involved, there is mounting evidence that conditions and health status early in life—particularly during infancy, early childhood, and adolescence—influence health status and conditions at older ages. If not a complete explanation for health disadvantages experienced at older ages, health disadvantages at ages 0 to 50 years are, under the lens of a life course approach, consistent with it.

4 Health across the Life Course

To facilitate examination of health status indicators and to ensure that we leave ample room for variability in the outcomes we study, we divide the age span between ages 0 and 50 into the following age segments: infancy and early childhood (ages 0 to 4), late childhood and adolescence (ages 5 to 19), early/young adulthood (20 to 34), and late/mature adulthood (35 to 49).⁴

4.1 Stages

Dividing the life course into stages is largely a matter of convenience but we respect important boundaries to ensure consistency with the literature on the life course. We start out with the period from 0 through 4 years of age. The first year of life is a phase of growth and development of a live birth when the influence of maternal health conditions, maternal nutrition, and maternal exposures are significant. An important part of physical growth and development is accomplished during ages 1 to 4 and it is during this life period when language and mathematics skills are acquired and put in place. Children at these ages are most sensitive and vulnerable to adverse experiences and environments—when personality features begin to set irreversibly, when connections between the self, wider social contexts, and narrower peer groups are defined.

⁴ Due to data limitations we sometimes use different age groups, but in all cases we attempt to adhere as closely as possible to the stages defined here.

The second stage (ages 5 to 19) includes late childhood and the classic period of adolescence, with all its traumas, insecurities, and vulnerabilities. It is when self-images consolidate, when discipline is learned and practiced (or not), when individuals learn to calculate and extrapolate the future, when deviance is most attractive and experimentation with substances, drugs, sex, smoking, and alcohol consumption is most common. This is a stage in life when the foundations of adult performance are decided. It marks the difference between a high school graduate and a high school drop-out, and this, in turn, differentiates those who will join the lines of the unemployed from those who will be recruited into the class of successful professionals. Since adult employment, educational attainment, and income are key determinants of adult health status, it is plausible to suspect a strong association between these early experiences and adult health.

Life between ages 20 and 34 is mostly about labor market participation and family formation. Most behaviors are established and well-entrenched and, although a few can be and are indeed subsequently changed, the burden of past experiences generates constraints and limits opportunities later in life.

Finally, during mature adulthood (ages 35 to 49) all processes of development peak. It is a stage when the benefits of past investments begin to be reaped and the disadvantages brought about by past conditions are felt in full. It is also when chronic conditions appear in earnest, the force of mortality starts an irreversible rapid increase, and there is ample room for the expression of early deleterious experiences in the form of chronic illnesses and disabilities.

4.2 Indicators across the Life Course

We distinguish between health outcomes, proximate determinants, and distal determinants. (See Figure 5, page 31 for a conceptual model.) Health outcomes refer to the statuses we are interested in evaluating, ranking, and comparing. A death rate at a given age or the numbers of years lost due to death or disability within an age interval are health outcomes. Proximate determinants are conditions that directly influence health outcomes. Smoking behavior is a proximate determinant of lung cancer and heart diseases, whereas physical inactivity and diet are two of the proximate determinants of metabolic syndrome. Finally, distal conditions are characteristics that determine and shape proximate determinants and can also modulate their effects on health outcomes. For example, aggregate inequality and racial discrimination (distal factors) may expose some individuals to high levels of stress (proximate determinant) and this, in turn, may have harmful physiological effects, leading to ailments such as heart disease, hypertension, or impaired immune function (health outcomes).

Admittedly, the foregoing classification is somewhat arbitrary. First, depending on the resolution one would like to attain, some conditions treated as mediating determinants in one study may be considered as distal causes in others. Furthermore, some factors play different roles at different stages on the life cycle so that what is a health outcome in one stage may correctly be considered a proximate determinant in another. This is consistent with a life course

perspective: events that occurred early in life (health outcomes at earlier stages) may become conditions (proximate determinants) that influence health outcomes at later stages. Maternal health, for example, is an outcome generated during a mother's early adulthood but also a proximate determinant of her child's infant health and mortality. A final complication is that the magnitude and even direction of effects of proximate determinants are not always the same in every society, across regions in a country, or over time as they can be modified by more distal characteristics. Thus, although it is known that individual access to health care or preventative behaviors are both efficient proximate determinants of health, the social and institutional context may attenuate or exaggerate them.

With two exceptions the health indicators we use in this report are somewhat different across stages of the life course. The two indicators that are common across stages are life lost due to mortality and life lost to disability—broad summary measures of mortality and morbidity experiences, respectively. All other indicators refer to different dimensions of health appropriate for each stage. Most of the proximate determinants we identify refer to behaviors, and these too vary across the life course, though we do not explicitly classify them accordingly. Finally, indicators of distal conditions are by nature very similar across the stages though their effects may vary considerably.

Our description of each stage in the life course assembles information collected in recent reports by the World Health Organization, the Global Burden of Disease, UNICEF, and summary statistics produced by the Organization for Economic Cooperation and Development. We also rely on a report that examined mortality rates in the US and 26 high income countries compiled from the WHO mortality data base {3}.

Tables 3-5 (pages 24-26) show indicators for health outcomes, proximate determinants, and distal determinants, respectively. They each contain information on the average value of each indicator (column 5) as well as the best (column 4) and worst (6) values.⁵ The estimates for the US appear in column 7 whereas the ranking scores (lowest is best, highest is worst) are in column 8. The last column is a composite rank calculated by standardizing each measure, averaging them, and establishing a ranking order.

4.3 Health in the Age Group 0 to 50

Figure 6 (page 32) evaluates health conditions not reflected in mortality, indicators and life lost per person due to disability or incapacitation associated with illnesses during the period 2002-2006 in each of five age groups stretching up to age 60.⁶ The columns in each figure show days of life lost due to disability for the most important conditions in each age group. US females lose 362 days in the age segment 0 to 59 whereas US males lose slightly less, about 336. These values place the US in the bottom quartile of the distribution of peer OECD countries. Simple calculations

⁵ For some measures it isn't readily clear whether low or high values are more desirable for health. In these cases we simply present the data from lowest to highest.

⁶ These age groups are not identical to those defined before. The figure was derived from the WHO Burden of Diseases Tables by dividing the total life lost to disability by the estimated total population in the age group 0 to 59.

show that the contributions of age groups to the total losses are unequally distributed: the proportionate losses in the age groups 0 to 4 and 15 to 29 are the largest whereas those in the age group 5 to 14 are the lowest. Thus, the proportionate male losses in the age group 0 to 4 is about 14% but this age group only contributes about 8% of the total duration in the 0 to 59 interval. There are no differences by gender in these distributions. A salient feature is the relatively large impact of neuropsychiatric disorders and of injuries among males in the age group 15 to 29 and the equally large contribution of chronic conditions among those older than 30. Excluding the first age group, the most important factors responsible for lost to disability are intentional and unintentional injuries, mental illness, and chronic conditions.

4.3.1 Infancy and Early Childhood (ages 0 to 4)

According to recent reports, the US does not fair well on indicators of overall child well-being. In fact, the US ranks 24th out of 30 in child well-being scores for health and safety {4}. This finding is confirmed by a collection of somewhat different indicators assembled in Table 3. The composite rank (average rank of all standardized indicators for the age group) is 17 out of 17—the very worst. The most glaring deficiencies are percentage born with low birth weight, neonatal mortality rate, infant mortality rate, and days of life lost to mortality (both females and males). Figure 7 (page 33) shows infant mortality rates for the US and peer nations for the period 2005-2009. The US has the highest level of infant mortality at 6.7 per 1,000 live births. We show below that the US poor rank is somewhat recent (post 1990) and the result of relative stagnation in the decline of infant mortality in the US over the last ten to twenty years {5, 6}.

The most important determinants of infant mortality are birth weight, prematurity, and maternal background and conditions—including maternal health status, maternal age, and behaviors. One would expect that statistics on birth weight and maternal health to be consistent with the findings on infant mortality. Figures 8-10 show that this is indeed the case. First, as shown in Figure 8 (page 34), the US percent of low birth weight babies is the second highest among peer comparison countries (8.2%). Second, two antecedents of infant and child health—the adolescent fertility rate and the maternal mortality rate (which we classify in Table 3 as health outcomes in later age groups)—show consistent patterns of US disadvantage. Figure 9 (page 35) shows that the adolescent fertility rate in the US is higher than all peer countries (41 per 1,000), nearly 3.5 times higher than the group average. The maternal mortality ratio, an indicator of maternal health in the perinatal period, behaves consistently with infant mortality, low birth weight, and adolescent fertility (13.7 per 100,000). As shown in Figure 10 (page 36), the US maternal mortality ratio ranks second to last. The magnitude of differences in maternal mortality ratios are quite large and should be taken as a signal suggesting that conditions into which children come to life in the US are not among the best.

Could it be that differences in national practices regarding the identification of death of very small infants

(preterm births or those with gestation length of 22 weeks or less) who die soon after birth vitiates the comparison? Alas, this is not the case. Indeed, relative country rankings remain identical even when calculations exclude preterm births (less than 22 weeks of gestation) {7}. Moreover, estimates derived from national vital statistics show that the infant mortality rate in the US is worst for term births (37+ weeks of gestation): it is the excess death among term babies that explains the US higher levels of overall infant mortality. Since the US has the highest percentage of preterm births among peer countries, a counterfactual scenario where all countries had the same length of gestation composition of births, would yield a US infant mortality rate even higher than what it is now.

Infant mortality and high proportion of low birth weight are indicators of extreme conditions (in utero and perinatally). Infants who die during the first year of life, particularly term infants, are those at the lower tail of a distribution of underlying newborns' by health status. Babies born with low birth weight are also at the extreme of this distribution. Both infant mortality and low birth weight are influenced by maternal conditions, including maternal behaviors (smoking, drinking, and diet), marital and family status, maternal education, access to pre- and postnatal care, as well as household and family conditions. A ranking based on infant mortality and birth weight is indirectly a ranking of these factors that are themselves outcomes of larger individual and societal shortcomings.

In high-income societies, breastfeeding is not as important a determinant of infant mortality as it is in lower income countries. However, among the most disadvantaged subgroups, levels and patterns of breastfeeding are part of the postnatal factors implicated in elevating infant mortality. Lack of breastfeeding results in growth faltering and insufficiencies that undermine the immune system, complicates brain growth and development, and hinders the formation of other organs {2, 8}. Figure 11 (page 37) displays the percent of newborns who are ever breastfed for various recent years. Although the US level is quite high (74%), it is at nearly the bottom of the comparison countries, higher than only Spain and France.⁷

Infant mortality is one of the indicators for which we have some information over time. The origin of the US disadvantage in infant mortality can be traced back to the early 1970s when, for the first time, US levels rose above those of other high-income countries {3}. Far from becoming less sharp, the initial disadvantage has grown over time. Figure 12 (page 38) plots the infant mortality rate in the US compared to the average of the other countries during the period 1990-2010. At the beginning of this period the US infant mortality rate was high (9 per 1,000) and fell to just 7 per 1,000 by 2010—equivalent to a decline of about 20%. Other high-income countries experienced much sharper declines than the US. By 2010 the average infant mortality rate in other countries was half the rate in 1990.

One could raise the objection that the US rankings on infant mortality and low birth weight are mostly driven

⁷ To avoid misinterpretation of these figures note that neonatal mortality accounts for over 70% of infant deaths in just about all the countries contained in our sample. Since most infants who die before the first month of life have lower or no chances to breastfeed it is death that prevents breastfeeding and not the lack of breastfeeding that precipitates death. Thus, it is possible that part of the association of rankings of infant mortality, low birth weight, and breastfeeding are an artifact of preexisting ill health.

by the disadvantageous conditions of one ethnic group, African Americans {7, 9}. But this is not the case. The 2007 estimate of infant mortality for African Americans was 13.3, more than twice that of non-Hispanic Whites (5.5) {7}. If one were to calculate ranks using only the population of non-Hispanic Whites, the US would still place unfavorably. Similarly, if low birth weight were recalculated considering only non-Hispanic Whites, the US would rank in the middle of the pack. Strikingly, similar conclusions follow when instead of race we use an indicator of socioeconomic status, such as maternal education. The 2006 infant mortality rate among the US population with at least some college education, a highly select group, is of the order of 5.0 per 1,000 births. This is still at or near the bottom of infant mortality rates for peer countries. Thus, the US disadvantage in low birth weight and infant mortality cannot be attributed to the poor conditions of just one particular social group.⁸

US performance on other indicators appropriate for this age segment is equally poor. Mortality below age 5 is higher in the US than in any of 17 OECD countries {10}. The leading cause of death in this age group is injuries as they account for 11% of all death, the highest percentage of 17 OECD countries {11}. Strikingly, the rate of child deaths due to negligence, maltreatment, or physical assault is the highest among 35 OECD countries {12}; and the rate of deaths attributable to violence exceeds the OECD average and has done so for over twenty years. Together the mortality and health indicators for the age group (0-4 years) paint a rather dismal picture: this is the life stage when children attain some important milestones. It is a period in life during which the foundation of skills for later acquisition of language and mathematical proficiency are set and marks the onset of emotional development. It is a critical window where exposure to risk such as abuse, neglect, insecurity, and lack of access to nurturing and protective relations could derail permanently the life trajectories that toddlers may follow {13}.

4.3.2 Childhood and Adolescence (ages 5 to 19)

The US mortality disadvantage during the first five years of life is reproduced during this stage of the life course. If anything the gap between the US and peer high-income countries grows and solidifies in the adolescent years. Thus, US adolescents aged 15-19 in 2005 experienced the highest mortality rate of 26 high income countries {3}, continuing a trend already established for over fifteen years. Similar gaps relative to the mean of OECD countries exist in the age group 15-24 {3}. We show below that this glaring gap in mortality in the age group 5-19 is mirrored in a gap for health indicators, including obesity, some chronic illness, adolescent pregnancy, STDs, mental illness, and injuries.

The composite rank of the US's health indicators in this age group is 17 out of 17 (see Table 3), and key health indicators contributing to this rank are overweight youth (girls and boys), youth HIV (girls and boys), and adolescent

⁸ One may well question the justification of the original objection: Is it appropriate to exclude certain groups in a cross-national comparison of health indicators? It could be argued that exclusion of groups should be done in all countries as each has some subgroups that may lower the national standing. In addition, at least in the case of birth weight and infant mortality, there are US minorities that produce exactly the opposite effect: they lower the proportion of low birth weight and levels of infant mortality. In fact, excluding the contribution of Hispanic Whites worsens the US levels of infant mortality and birth weight.

fertility. The suicide rate in the US for this age group is somewhat higher than average and, as pointed out before, is among the most important causes of loss of life in the age group 0 to 50.

It is well known that the prevalence of obesity⁹ has increased worldwide and that the age of onset has decreased. As a result, obesity is no longer, as it once was, a condition confined to the adult population. Furthermore, the experience with obesity at early ages is known to be a good predictor of obesity later on in life {14–16}. And indeed, as expected, the US ranks poorly on prevalence of obesity at older age groups as well. Figure 13 (page 39) shows that the US has the highest percentage of overweight girls (35.9%) and is tied with Spain for the highest percentage of overweight boys (35.0%).

Nationally representative data for a cohort of US children (ECLS-K) enrolled in kindergarten in 1998 shows a consistently growing obesity prevalence from ages 5 through age 13 for all subgroups of the population. Startlingly, the prevalence nearly doubles from about 12 percent to about 20 percent in only eight years {17}. This trend is much more pronounced among African Americans and Hispanic Whites than among non-Hispanic Whites and among children of mothers with lower education than among those from more educated mothers. And yet, as was the case with infant mortality and low birth weight, obesity is not confined to minority groups. In the ECLS-K cohort the average prevalence of obesity over the course of 10 years of observation, from about age 5 to about age 14–15, is 18% among non-Hispanic Whites, the best performing group. This is about twice the level found in the best performing country in the OECD in the population 5 to 19, a comparison group likely to experience higher obesity rates simply because it is older than the benchmark in the US. Results are similar if we compare only children of highly educated (more than college) US mothers and the best performing countries in Europe {17}.

Why is early obesity important? Some of the physiological consequences of obesity are well established: there is consensus that it is a condition that increases the risk of diabetes, circulatory problems, and heart disease and that the longer an individual is exposed to it the more likely these conditions are to emerge. The US standing on this health indicator is consistent with the cause-specific mortality at ages over 30 and with the distribution of conditions accounting for disability (see above). Since we lack suitable cohort data and because the connection between adult obesity and adult mortality is more fragile than that between cigarette smoking and lung cancer, we cannot make strong inferences, but it is likely that the high prevalence of obesity in these younger age groups eventually translates into excess mortality and ill-health at older ages.

A less established, less well-known but potentially significant relation is that between early obesity and cognition, scholastic achievement, and labor market success. Although these are outcomes outside the realm of health status as conventionally defined, they are conditions consequential for health and well-being during subsequent stages of the life cycle. According to recent research, children who experience obesity are less likely to perform well on tests

⁹ Overweight or obese is defined as scoring above the 95th percentile of the standard CDC sex-age specific BMI distribution. “Boys” and “girls” refers to corresponding male and female populations ranging from ages 2 to 17.

of cognitive and non-cognitive abilities and have comparatively lower rates of high school completion {17–20}. To the extent that these mechanisms are strong, the US ranking in early life obesity does not bode well for the cohorts affected by the condition as their members will be exposed to higher risks and lower social and economic standing. Furthermore, because maternal obesity can compromise maternal health and thus affect the likelihood of pregnancy complications and birth outcomes, the conditions that lead to either higher prevalence of adolescent pregnancy could potentially have significant spillover effects, reverberate across subsequent stages of the life cycle, and ultimately have an impact on younger generations.

Outcomes other than obesity reflect poor underlying health as well. Of the many conditions responsible for high risk of low birth weight and infant mortality discussed above, early age at childbearing is one of the most important. That the US has the highest rate of teenage fertility (refer back to Figure 9) by a substantial margin is entirely consistent with the high prevalence of lower birth weight and elevated infant mortality rates. Teenage childbearing is a singularly important health outcome since it affects two generations, children and their mothers. There is an extensive literature on the effects of early childbearing on mothers, among which the most important are truncated educational experiences, poor labor market attachments, and disadvantaged family and household environments {21, 22}. There is also extensive research on the consequences of early child bearing for the children—including poor child care, weak maternal attachment, poverty, and generalized exposure to adverse conditions {23, 24}. Furthermore, female children of teen mothers tend to become teen mothers themselves, thus reproducing adverse conditions over two or three generations {25}.

As shown in Figure 14 (page 40), the US suicide rate in this age group is about three times as high as in the best performing country and slightly higher than the average among peer countries. Its magnitude almost surely reflects generalized conditions that affect not just one age group but contiguous ones as well. In fact, the rank order of US suicide rates in this and the next two older age groups is near the bottom, suggesting that the conditions responsible for deaths due to suicide are likely to influence several age groups simultaneously and/or produce lagged effects over time, e.g. sizeable impacts that reverberate across several stages of the life course. This interpretation is consistent with, an maybe even explained by, high levels of life lost to disability attributable to mental disorders (of the bipolar and depressive type) in this and older age groups.

While the general picture for this group is comparatively poor, there are a few salient meritorious features in the US. In terms of health outcomes, the percentage of youth aged 15 to 24 who self-report good health is the highest among all countries. The meaning of this finding is unclear as it contradicts the available evidence from objective markers. Self-reported health status may be affected by biases induced by cultural idiosyncrasies or disparate benchmarks across countries, themselves the result of nation-wide health conditions. But if self reported health reflects health outlooks, however idiosyncratic, it should probably be taken as a good signal.

The US also has health advantages in terms of proximate determinants. Youth in the US are on the more desirable

end of the spectrum in terms of moderate physical activity, drinking, and, importantly, smoking. Lower smoking prevalence rates will inevitably result in lower rates of COPD, lung cancer, heart disease, and stroke when these cohorts attain older age, and this alone could suppress the US disadvantage at older ages over the next fifty to seventy years.

In sum, the US standing in this age group is at best mediocre. This is significant because of what this implies for subsequent stages of the life course. Early obesity is not the only trait that has a long reach and produces lagged effects during adulthood and old ages. The influence of events and experiences in early adolescence mark individuals and set the foundations of subsequent performance, educational attainment, employment, and career development. But they also supply the materials with which individuals can build their physical, emotional, and mental health {3, 26}. It is during early adolescence that individuals adopt (or not) behaviors that expose them to lifetime health risks, including experimentation with drugs, sex, smoking, and alcohol.

4.3.3 Young Adulthood (ages 20 to 34)

The indicators for this stage of the life cycle are mostly disappointing for the US. First, death rates due to unintentional injuries remain high in this age group and are among the five highest compared to other high income countries. Deaths from transport and non-transport injuries have been higher in the US than in OECD countries since the 1950s {3}. The same applies for suicides and homicides {27}. Second, obesity continues to emerge as a serious problem as the average BMI of males and females in both the 20 to 24 and 25 to 34 age groups is greater than 25 (see Figure 15, page 41)—the highest of all comparison countries. Second, Figure 16 (page 42) shows that US prevalence of type II diabetes in this age group is higher than in the other countries for both females and males. Consistent with this, the US also ranks poorly on plasma glucose levels (Figure 17, page 43). And finally, as we saw before, US maternal mortality ratio, which partially explains the US disadvantage in infant mortality, also performs quite poorly (see Figure 10 and Table 3).

Measured levels of cholesterol and self-reported hypertension among males and females rank close to the median and, as was the case in the previous age groups, the US stands out with much lower smoking rates and high proportions of individuals who self-report in good health. While indicators of smoking and self-reported health status are a very positive sign, both the lower prevalence of high cholesterol and high blood pressure are less unequivocally interpreted as a positive sign because the indicators may reflect better diagnosis and treatment rather than lower incidence.

4.3.4 Mature Adulthood (ages 35 to 49)

Figures 15 through 17 tell a rather disheartening story for this age group: chronic conditions become highly salient and drag down the US rankings with respect to mortality levels due to heart and circulatory diseases. Consistent with this poor performance, these are the conditions responsible for the highest fraction of life lost to disability in

the age group. Furthermore, a review of the health indicators for this stage in Table 3 reveals an entirely consistent scene: with the exception of blood pressure and total cholesterol, all others indicators continue to behave as before and paint a rather dismal picture, conspiring to place the US in a poor position vis a vis the remaining countries. Disturbingly enough, nothing is new in this part of the life cycle: it could all have been predicted from what was observed in preceding stages.

The inferences we can draw from the indicators in the last two age groups, respectively representing early and older adulthood, are not unequivocal. Admittedly, the indicators about obesity, diabetes and plasma glucose tell a completely consistent story in both stages: the US experiences high levels of obesity and high prevalence of markers of metabolic disorder. In addition, the markers are highly correlated across age groups as one would expect if these indicators reflect the influence of common factors or if the status in one stage is highly correlated with the health status at subsequent stages. But the same consistency is not found when it comes to measures of circulatory problems. Not only are average levels of systolic blood pressure and prevalence of high cholesterol somewhat low but these ranks are at odds with the US ranking regarding obesity. It is possible that the inconsistency is only apparent in that it reflects either measurement errors or better diagnosis and treatment in the US.

Finally, health indicators for ages 50 and above are equally disappointing for the US. Comparisons between the US and the UK using national population surveys show that US adults at ages 55-64 report higher rates of diabetes, hypertension, heart disease, stroke, lung disease, and cancer. The disparity remains even after controlling for risk behaviors, such as smoking. And while larger among individuals with low socioeconomic conditions, they persist in the most advantaged groups {28}. Comparisons with countries other than the UK reveal systematic US disadvantage in obesity and diabetes {29}, as well as in other chronic conditions, like heart disease, stroke, cancer, disability, multiple comorbidities, and poor oral health {30-33}.

Finally, the US fares poorer in the age group 50-64 than in older groups and does so even after accounting for risk factors such as obesity. This suggests that health impairments not only have an early onset in the US but also that their determinants cannot be reduced to a single, well-defined condition such as excess obesity.

4.4 Correlation Across Stages of the Life Course

The US relatively poor performance in the earlier part of the life cycle could be accounted for by two sets of factors. The first include determinants that bridge early and late life: individuals' health status and exposures during childhood and adulthood, and the conditions that sustain them across the life cycle, are tightly interwoven. Experiences early in life could have a long reach and contribute to the production of health status much later in life. Under this lens, it should not be surprising that if the US lags in health and mortality above age 50 it could also experience a similar, if not larger, lag at younger ages. Similarly, the regularities we uncovered above (e.g., the

close association of rankings of indicators for one life stage with those in the preceding and following stage) would be expected if conditions in one part of the life cycle influence and constrain conditions in subsequent stages. The argument rests on a large and speculative leap and its relevance remains to be explored but it contains more than a modest dose of plausibility. Even though we cannot demonstrate its validity due to lack of suitable information, explicit consideration of relationships across the life course is useful as a guiding conjecture and as a tool to generate corollaries and secondary hypotheses to interpret observed patterns. The second set of factors are conditions that affect simultaneously the entire life course of cohorts without there being direct relations across stages. These are macro-social forces that have durability and persistence and can color the experience of different cohorts, such as aggregate income inequality, poverty, relative magnitude of social expenditures, richness of welfare programs, etc.

The data available to us are not suited for rigorous falsifiability tests to adjudicate between these alternative explanations. In fact, the evidence we require can only come from longitudinal data following several cohorts and assessing time-varying macro-social conditions. However, with the data at hand we can conduct simple analyses to assess the consistency of observed relations with a simple life course perspective. Appendix D (page 47) contains details of the estimation whereas Figure 18 displays the set of relations we wish to identify. Note that the figure leaves out macro-social conditions. Their inclusion in the analysis is possible only with indicators of macro-social factors corresponding to different periods of time that overlap with stages in the life cycle of each cohort. Thus, to understand health outcomes among those in the last age interval we need macro-social indicators corresponding to the period when members of that cohort were aged 0-4, 5-19, etc. This information is not readily available. Thus the model we estimate only identifies relations across stages.

The upper portion of Figure 18 (page 44) shows a simple model where health at one life stage is potentially affected by preceding stages. The black paths ($\beta_{2,1}$, $\beta_{3,2}$, $\beta_{4,3}$) represent relationships between adjacent age groups. The gray paths ($\beta_{3,1}$, $\beta_{4,1}$, $\beta_{4,2}$) represent relationships between non-adjacent life stages. The latter can be thought of as lagged effects of health at earlier life stages not accounted for by paths between adjacent life stages.

When we apply this model to our data we find that a basic simplex model fits best—one where health at life stage k is affected only by health at life stage $k - 1$. We do not find evidence supporting effects of longer lags.¹⁰ The bottom portion of Figure 18 shows our preferred fitted model with standardized path coefficients. In this formulation these coefficients are essentially correlations and suggest that overall health outcomes in the first life stage explain about 41% of the variability of health outcomes in the second life stage; health outcomes in the second explain 32% of the variability in the third; and health outcomes in the third stage explain 66% of the variability of health outcomes in the fourth stage. These estimates reflect a dynamic system with a strong memory (e.g., one where past states matter for the value or distribution of future states). In such systems, and unless an exogenous corrective influence

¹⁰ See Appendix D. A larger sample or focus on specific health outcomes may support some lagged effects, but this is not the case for the composite measure of health outcomes.

is introduced, a small shock in an early stage can have a huge influence in subsequent stages.

Because the system represents relations across stages of the life of individuals there is also the possibility of influences across generations. Thus, changes in stages that occur prior to the childbearing period constrain the conditions that a cohort's children will be exposed. A non-ergodic system such as the one we suspect operates here implies that a small exogenous shock in an early stage of the life course for a cohort in generation T may not only influence subsequent outcomes for this cohort but also early and late stages of their offspring, generation $G + 1$. The persistence and aggravation of the US poor health status standing over the last two decades is consistent with a system fitting this description.

Although the magnitudes of these effects are quite large and consistent with the idea of a strong tug exerted by experiences early in life, the estimated model is too simple to support a causal explanation as one cannot rule out the possibility of alternative explanations. In particular, distal determinants, such as aggregate inequality, poverty, or levels of social mobility, simultaneously influence conditions at all stages. These distal conditions reflect systemic properties, not individual attributes, which may be implicated as determinants of physiological deterioration and responsible for behaviors that spread health risks throughout the life cycle and influence not just one part or age group—but all of them simultaneously. They are thus factors that could partially account for the correlation of health status across the life cycle and explain the processes through which poor initial conditions in one's life can translate into poor conditions during adulthood.

5 Consistency with Other Research

The evidence discussed above is far from conclusive. The main weakness is that it blends disparate data that, regardless of adjustments, harmonization, and fine-tuning, were not collected to falsify the hypotheses we put forward in the paper. No matter how consistent the evidence is with expectations we can only draw tentative conjectures that require further testing. Analyses of the type we undertake here lead to inferences that are inevitably dependent on the models we use to represent relations of interest, the decisions made about the key concepts and indicators used, the nature of the data sets and, finally, the procedures we use to reduce the observables to interpretable relations. For these reasons it is important to establish whether studies with objectives similar to ours, though differing in one or more of the dimensions identified above, produce results that are consistent with ours. Consistency of empirical findings is not an unequivocal signal of flawlessness, but it is a step in the right direction. By contrast, lack of consistency should raise a red flag and would require us to step back and examine the causes of the differences. Below we summarize results from a handful of extant studies and argue that they are entirely in line with our findings.

In a recent report on the well-being of children (individuals aged 0 to 17), the research office of the OECD ranked

the US and other countries on six dimensions of “well-being.” These included the following: material well-being, housing and environment, educational well-being, health and safety, risk behaviors, and quality of school day. Each dimension included multiple indicators that were averaged within each dimension and country rankings in each of these were calculated from the distribution of this average. Out of 30 countries the US ranked 23rd in material well-being, 12th in housing environment, 25th in educational well-being, 24th in health and safety, 15th in risk behaviors, and 14th in quality of life. Of particular importance to us is the ranking on health and safety which includes proportion of low birth weight, infant mortality, total death rates, and rates of suicide mortality in addition to other indicators we do not consider health outcomes by definition (breastfeeding, vaccination rates, and physical activity). Since the OECD report refers to a broad age group that combines two of the stages distinguished before and uses a classification of indicators that is not consistent with ours, their results are not strictly comparable to those we obtain here. And yet, despite these differences, our results and the inferences we can draw from them are similar: the US ranking for all stages of the life cycle and for the bulk of health outcomes and proximate determinants in each of them falls below the middle of the pack and often is among the worst performers.

A second report on the burden of disease in younger people (ages 10 to 24) carried out at WHO headquarters uses an indicator of Years Lost to Disability and Years Lost of Life (DALY) for three broad subgroups (10 to 14, 15 to 19, 20 to 24), for broad world regions (not countries) and again refers to a most recent period (2004). The main conclusion from this report is that globally at least, the most important conditions accounting for DALY’s in these age groups are, in descending order of importance, traffic accidents, mental disorders (depression), violence, alcohol use, mental disorders other than depression, suicide, HIV/AIDS, and then respiratory TB and asthma. Remarkably most of the conditions that apply globally are the most salient in determining the rankings of OECD countries and the relatively poor position of the US within those rankings.

Finally, there are other studies where measures of the US population health status is contrasted with different countries but that instead of using aggregate, country level data, as we do here, they utilize fine-tuned, individual level information. Even though these studies probe in depth what we were not able to probe, (e.g., disparities between subgroups within and across countries), they reach conclusions about the US ranking that are in line with those we derived {3}.

6 Summary and Conclusions

Two findings stand out. The first is the consistently poor performance of the US on a number of health indicators and measures of mediating behaviors or mechanisms. When the data permitted, we showed that the gap between the US and peer high-income countries is a relatively recent phenomenon, dating not further than a decade or two ago. Thus, the causes that precipitate a decline of US health status relative to other countries must be set forth relatively

recently and must be conditions that continue to operate more or less undisturbed. This finding is supported by evidence that is not just hard but broad and systemic (e.g., pertains to many domains of health). While we refrain from calling it irrefutable, the empirical evidence does not appear to contain areas of obvious weakness. It points to a generalized malaise that impregnates multiple daily life domains raising risks and levels of exposure to ill-health of all members of US society, not just of a few fringe groups.

The second finding is admittedly less robust but is supported partially by evidence we marshal here and aligns well with theoretical expectations. This is the association between the magnitude and rank of key health indicators across most stages of the life course. Levels of obesity and diabetes in one age group are similar to those in the preceding age groups; the rank order of plasma glucose in the youngest age group for which we have data predicts the rank order of plasma glucose in older groups; levels of diabetes in younger age groups are always in line with levels of diabetes in older groups. Furthermore, the connections across the life course go beyond simple correlations between the same indicators across various ages groups. They extend to encompass mediating conditions expressed in one age group and health outcomes manifested in another. Thus, maternal health status—an outcome pertaining to relatively young females—is an antecedent or mediating factor of prematurity, low birth weight, and infant mortality. And low birth weight and prematurity are, for the most part, adverse conditions that could be consequential later in life.

The visible association of health indicators along the life course could be a result of a number of processes, not all of them with the same implications. First, it could simply reveal the operation of macro-social mechanisms that influence conditions at all ages. Thus, it has been conjectured that the US lower health standing has to do with aggregate income inequality, lack of cohesion, individualism, poverty, and reduced social spending. Second, it could be that a cross section of cohorts reflects connections across the life cycle that each one of them experiences. Adverse conditions in infancy and early childhood trigger processes that reverberate across the life cycle as they induce lower educational attainment, poor labor market performance, deprived family conditions, and poor adult health (including maternal health). These conditions, in turn, will influence the distribution of exposure to adversity of children belonging to the next generation. A process of this nature is self-perpetuating and can persist or grow worse over time, just as happened in the US.

The third possibility is that both explanations are correct and what we observe is a result of the combination of common conditions simultaneously influencing the fate of several cohorts and multiple mechanisms with strong built-in memory that enable events of one stage of life to contaminate events on subsequent stages. Teasing these explanations apart is a complicated business and it is unlikely we will be able to have suitable data to do so anytime soon.

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A Tables

Table 1: *Decomposition of Life Expectancy Difference by Age Group and Cause, United States Compared to Composite Average, by Sex (1990, 1995, 2000, 2005)*

Females					Males				
Year	Cause of Death	Age Group		Total	Year	Cause of Death	Age Group		Total
		0-50	50+				0-50	50+	
1990	Neoplasms	17.5	132.0	149.6	1990	Neoplasms	-5.8	-31.5	-37.3
	Circulatory	38.6	279.3	317.9		Circulatory	60.3	313.3	373.6
	Respiratory	7.0	16.7	23.7		Respiratory	6.3	-3.1	3.2
	Digestive	10.6	-4.1	6.4		Digestive	17.1	-18.4	-1.2
	Diabetes	9.4	53.9	63.4		Diabetes	9.4	31.5	40.9
	Infections	9.8	20.7	30.6		Infections	14.9	8.1	23.0
	Accidents/Homicide/Suicide	85.7	-38.5	47.2		Accidents/Homicide/Suicide	269.3	-9.4	259.9
	Senility/Ill-defined	9.7	-91.2	-81.5		Senility/Ill-defined	10.1	-41.5	-31.3
	Pregnancy	0.9	0.0	0.9		Pregnancy	0.0	0.0	0.0
	Congenital and Infancy	70.1	1.3	71.4		Congenital and Infancy	79.2	1.1	80.3
	Residual	41.9	6.2	48.1		Residual	146.9	32.1	179.0
Total		301.1	376.3	677.4	Total		607.7	282.5	890.2
1995	Neoplasms	6.8	149.9	156.8	1995	Neoplasms	-9.1	-66.1	-75.2
	Circulatory	46.9	412.3	459.2		Circulatory	74.5	353.7	428.3
	Respiratory	5.2	-21.2	-16.0		Respiratory	0.3	-51.2	-51.0
	Digestive	9.2	-1.9	7.3		Digestive	15.7	-14.4	1.4
	Diabetes	9.6	72.1	81.7		Diabetes	9.7	42.5	52.2
	Infections	10.0	14.4	24.3		Infections	12.2	0.6	12.8
	Accidents/Homicide/Suicide	83.4	-45.7	37.8		Accidents/Homicide/Suicide	258.6	-25.7	232.9
	Senility/Ill-defined	17.2	-74.1	-57.0		Senility/Ill-defined	18.7	-28.4	-9.7
	Pregnancy	0.4	-0.0	0.4		Pregnancy	0.0	0.0	0.0
	Congenital and Infancy	50.1	2.4	52.5		Congenital and Infancy	55.3	2.0	57.4
	Residual	68.9	98.1	167.0		Residual	191.2	90.7	281.9
Total		307.8	606.2	914.0	Total		627.2	303.8	930.9
2000	Neoplasms	7.3	168.2	175.4	2000	Neoplasms	-3.0	-84.5	-87.6
	Circulatory	48.9	532.7	581.7		Circulatory	63.4	394.7	458.2
	Respiratory	11.9	85.8	97.7		Respiratory	9.8	1.9	11.7
	Digestive	10.9	14.3	25.2		Digestive	13.7	-7.8	6.0
	Diabetes	10.5	86.0	96.5		Diabetes	10.5	55.3	65.9
	Infections	29.4	33.3	62.6		Infections	53.4	26.1	79.4
	Accidents/Homicide/Suicide	88.1	-29.1	58.9		Accidents/Homicide/Suicide	216.0	-32.7	183.3
	Senility/Ill-defined	19.7	-68.7	-49.0		Senility/Ill-defined	22.4	-29.0	-6.6
	Pregnancy	1.9	-0.0	1.9		Pregnancy	0.0	0.0	0.0
	Congenital and Infancy	61.3	1.3	62.6		Congenital and Infancy	67.0	1.1	68.1
	Residual	21.5	161.6	183.2		Residual	16.2	85.4	101.6
Total		311.4	985.4	1296.8	Total		469.4	410.6	880.0
2005	Neoplasms	11.6	143.5	155.2	2005	Neoplasms	5.5	-90.6	-85.1
	Circulatory	50.3	455.3	505.6		Circulatory	64.7	337.6	402.3
	Respiratory	13.3	77.4	90.7		Respiratory	9.8	-20.7	-10.9
	Digestive	10.6	15.7	26.3		Digestive	11.4	-1.1	10.3
	Diabetes	10.8	87.1	97.9		Diabetes	12.8	67.9	80.7
	Infections	26.9	43.0	69.9		Infections	42.5	40.0	82.5
	Accidents/Homicide/Suicide	116.6	-8.2	108.5		Accidents/Homicide/Suicide	284.3	-1.0	283.2
	Senility/Ill-defined	15.5	-76.8	-61.3		Senility/Ill-defined	11.6	-40.9	-29.2
	Pregnancy	5.1	0.2	5.3		Pregnancy	0.0	0.0	0.0
	Congenital and Infancy	61.8	1.0	62.8		Congenital and Infancy	67.5	0.8	68.2
	Residual	27.1	263.8	290.9		Residual	24.5	140.2	164.7
Total		349.7	1002.1	1351.7	Total		534.6	432.2	966.8

(a) Comparison is composite average of Canada, France, Japan, Sweden, and the UK.

(b) Results expressed in days of life expectancy difference.

(c) Positive values indicate life expectancy advantage for composite comparison. Negative values indicate US advantage.

Table 2: *Decomposition of Change in Life Expectancy Difference by Age Group and Cause, United States Compared to Composite Average, by Sex (1990–2005)*

Females					Males				
Period	Cause of Death	Age Group		Total	Period	Cause of Death	Age Group		Total
		0-50	50+				0-50	50+	
1990–1995	Neoplasms	-10.2	15.2	4.9	1990–1995	Neoplasms	-2.6	-28.1	-30.8
	Circulatory	7.6	135.4	143.0		Circulatory	13.4	35.5	49.0
	Respiratory	-2.0	-40.9	-42.8		Respiratory	-6.2	-45.1	-51.3
	Digestive	-1.5	3.8	2.3		Digestive	-1.5	6.6	5.1
	Diabetes	-0.1	15.4	15.3		Diabetes	-0.0	8.5	8.5
	Infections	-0.1	-8.0	-8.1		Infections	-3.0	-8.3	-11.4
	Accidents/Homicide/Suicide	-3.2	-5.0	-8.2		Accidents/Homicide/Suicide	-13.2	-15.2	-28.4
	Senility/Ill-defined	7.6	22.7	30.3		Senility/Ill-defined	8.9	17.3	26.2
	Pregnancy	-0.4	-0.0	-0.4		Pregnancy	0.0	0.0	0.0
	Congenital and Infancy	-19.7	1.1	-18.6		Congenital and Infancy	-23.3	0.8	-22.5
	Residual	24.9	94.0	118.8		Residual	38.7	57.7	96.3
Total		3.0	233.5	236.5	Total		11.1	29.6	40.8
1995–2000	Neoplasms	1.1	12.0	13.2	1995–2000	Neoplasms	7.2	0.4	7.7
	Circulatory	1.0	131.6	132.6		Circulatory	-13.1	20.2	7.1
	Respiratory	6.4	114.2	120.6		Respiratory	9.5	67.4	76.9
	Digestive	1.2	18.2	19.4		Digestive	-2.5	9.7	7.1
	Diabetes	0.6	7.9	8.5		Diabetes	0.4	6.5	6.9
	Infections	17.6	15.2	32.8		Infections	38.2	23.4	61.6
	Accidents/Homicide/Suicide	3.5	21.6	25.0		Accidents/Homicide/Suicide	-47.6	-2.6	-50.1
	Senility/Ill-defined	2.2	13.3	15.5		Senility/Ill-defined	3.3	5.6	8.9
	Pregnancy	1.4	-0.0	1.4		Pregnancy	0.0	0.0	0.0
	Congenital and Infancy	10.4	-1.2	9.2		Congenital and Infancy	10.6	-1.1	9.5
	Residual	-45.3	49.9	4.6		Residual	-171.6	-14.9	-186.5
Total		0.1	382.7	382.8	Total		-165.6	114.7	-50.9
2000–2005	Neoplasms	5.2	-19.3	-14.1	2000–2005	Neoplasms	9.6	14.3	23.9
	Circulatory	0.6	-55.3	-54.7		Circulatory	-0.2	-70.8	-71.0
	Respiratory	1.2	-9.8	-8.6		Respiratory	-0.1	-10.8	-10.9
	Digestive	-0.4	3.6	3.1		Digestive	-2.3	8.9	6.6
	Diabetes	0.1	-2.8	-2.7		Diabetes	1.9	7.5	9.4
	Infections	-2.7	5.3	2.6		Infections	-11.6	11.8	0.3
	Accidents/Homicide/Suicide	25.7	24.1	49.9		Accidents/Homicide/Suicide	62.7	34.8	97.4
	Senility/Ill-defined	-4.1	2.6	-1.5		Senility/Ill-defined	-10.7	-5.5	-16.3
	Pregnancy	3.0	0.2	3.1		Pregnancy	0.0	0.0	0.0
	Congenital and Infancy	0.2	-0.2	-0.1		Congenital and Infancy	-0.2	-0.4	-0.6
	Residual	5.0	73.0	77.9		Residual	7.7	40.3	48.0
Total		33.8	21.1	55.0	Total		56.7	30.1	86.8
1990–2005	Neoplasms	-4.0	9.6	5.7	1990–2005	Neoplasms	14.2	-14.3	-0.1
	Circulatory	9.6	200.1	209.7		Circulatory	0.8	-9.0	-8.2
	Respiratory	5.6	59.2	64.8		Respiratory	3.0	9.0	12.1
	Digestive	-0.7	25.4	24.8		Digestive	-6.4	25.7	19.3
	Diabetes	0.6	21.5	22.2		Diabetes	2.3	23.0	25.3
	Infections	15.2	13.4	28.6		Infections	24.5	26.4	50.8
	Accidents/Homicide/Suicide	26.1	39.3	65.4		Accidents/Homicide/Suicide	0.0	13.4	13.5
	Senility/Ill-defined	6.1	39.7	45.8		Senility/Ill-defined	2.1	18.7	20.8
	Pregnancy	4.0	0.1	4.1		Pregnancy	0.0	0.0	0.0
	Congenital and Infancy	-9.0	-0.4	-9.5		Congenital and Infancy	-13.5	-0.6	-14.1
	Residual	-15.7	228.3	212.6		Residual	-126.5	83.9	-42.6
Total		37.9	636.4	674.3	Total		-99.6	176.2	76.6

(a) Comparison is composite average of Canada, France, Japan, Sweden, and the UK.

(b) Results expressed in days of life expectancy difference.

(c) Positive values indicate increased life expectancy advantage for composite comparison. Negative values indicate reduced composite comparison advantage.

Table 3: *Health Outcomes by Life Stage*

Age	Measure	Countries	Best	Average	Worst	US	Rank	Composite
0 to 4	Stillbirth Rate (Per 1000 Total Births, 2009)	17	2.0	2.9	3.9	3.0	11	17
	Low Birth Weight (Percent, 2005-2009)	17	4.2	6.6	9.6	8.2	16	
	Perinatal Mortality Rate (Per 1000 Total Births, 2005-2009)	17	3.0	5.7	11.9	6.6	13	
	Neonatal Mortality Rate (Per 1000 Live Births, 2005-2009)	17	1.3	2.7	4.4	4.4	17	
	Infant Mortality Rate (Per 1000 Live Births, 2005-2009)	17	2.5	3.9	6.7	6.7	17	
	Life Lost From Mortality (Days), 0-4, Females (2009)	17	4.5	6.7	11.8	11.8	17	
	Life Lost From Mortality (Days), 0-4, Males (2009)	17	4.5	7.8	14.0	14.0	17	
5 to 19	Overweight Girls (Percent, Various Years and Ages)	17	13.1	22.6	35.9	35.9	17	17
	Overweight Boys (Percent, Various Years and Ages)	17	12.9	22.4	35.0	35.0	16	
	Bad Teeth Per Child (2004)	17	0.7	1.1	2.1	1.2	11	
	Self-Reported Good Health (Percent), 15-24, Females (2005-2009)	16	96.6	86.4	45.3	96.6	1	
	Self-Reported Good Health (Percent), 15-24, Males (2005-2009)	16	97.1	89.8	49.8	97.1	1	
	Youth HIV (Percent), 15-24, Females (2007)	16	0.0	0.2	0.5	0.3	14	
	Youth HIV (Percent), 15-24, Males (2007)	16	0.1	0.3	0.7	0.7	16	
	Adolescent Fertility Rate (Per 1000 Females 15-19, 2010)	17	5.0	12.0	41.0	41.0	17	
	Teen Suicide Rate (Per 100000 Aged 15-19, Average 3 Most Recent Years)	17	2.4	6.5	12.2	7.7	11	
	Life Lost From Mortality (Days), 5-19, Females (2009)	17	18.9	26.5	45.0	45.0	17	
	Life Lost From Mortality (Days), 5-19, Males (2009)	17	19.7	32.0	55.9	55.9	17	
20 to 34	Self-Reported Good Health (Percent), 25-44, Females (2005-2009)	16	93.4	80.5	41.1	92.6	2	17
	Self-Reported Good Health (Percent), 25-44, Males (2005-2009)	16	93.9	83.4	42.8	93.9	1	
	BMI (Average), 20-24, Females (2008)	17	20.1	22.9	25.6	25.6	17	
	BMI (Average), 20-24, Males (2008)	17	22.2	24.1	26.3	26.3	17	
	BMI (Average), 25-34, Females (2008)	17	20.9	24.0	27.1	27.1	17	
	BMI (Average), 25-34, Males (2008)	17	23.3	25.8	27.8	27.8	17	
	Diabetes (Percent), 25-34, Females (2008)	17	0.9	1.6	2.3	2.3	17	
	Diabetes (Percent), 25-34, Males (2008)	17	1.6	2.9	4.1	4.1	17	
	Fasting Plasma Glucose (Average mmol/L), 25-34, Females (2008)	17	4.6	4.9	5.1	5.1	17	
	Fasting Plasma Glucose (Average mmol/L), 25-34, Males (2008)	17	4.9	5.2	5.4	5.4	17	
	Systolic BP (Average mm Hg), 25-34, Females (2008)	17	106.5	111.3	115.9	107.9	3	
	Systolic BP (Average mm Hg), 25-34, Males (2008)	17	118.8	124.0	129.8	118.8	1	
	Total Cholesterol (Average mmol/L), 25-34, Females (2008)	17	4.4	4.7	4.8	4.8	11	
	Total Cholesterol (Average mmol/L), 25-34, Males (2008)	17	4.7	4.9	5.1	4.8	6	
	Maternal Mortality Ratio (Per 100000 Live Births, 2005-2009)	17	2.0	6.0	14.9	13.7	16	
	Life Lost From Mortality (Days), 20-34, Females (2009)	17	35.8	45.0	76.7	76.7	17	
	Life Lost From Mortality (Days), 20-34, Males (2009)	17	58.1	75.0	134.1	134.1	17	
35 to 49	BMI (Average), 35-44, Females (2008)	17	21.9	25.6	28.8	28.8	17	17
	BMI (Average), 35-44, Males (2008)	17	24.0	27.0	29.0	29.0	17	
	BMI (Average), 45-54, Females (2008)	17	22.7	26.9	29.9	29.9	17	
	BMI (Average), 45-54, Males (2008)	17	24.1	27.7	29.5	29.5	17	
	Diabetes (Percent), 35-44, Females (2008)	17	1.7	3.1	4.7	4.5	16	
	Diabetes (Percent), 35-44, Males (2008)	17	3.2	5.1	7.1	7.1	17	
	Diabetes (Percent), 45-54, Females (2008)	17	3.6	6.2	9.7	9.3	16	
	Diabetes (Percent), 45-54, Males (2008)	17	6.4	9.9	14.1	14.1	17	
	Fasting Plasma Glucose (Average mmol/L), 35-44, Females (2008)	17	4.8	5.1	5.4	5.4	16	
	Fasting Plasma Glucose (Average mmol/L), 35-44, Males (2008)	17	5.1	5.4	5.7	5.7	17	
	Fasting Plasma Glucose (Average mmol/L), 45-54, Females (2008)	17	5.0	5.4	5.7	5.7	16	
	Fasting Plasma Glucose (Average mmol/L), 45-54, Males (2008)	17	5.4	5.7	6.0	6.0	17	
	Systolic BP (Average mm Hg), 35-44, Females (2008)	17	110.7	115.9	120.5	112.4	2	
	Systolic BP (Average mm Hg), 35-44, Males (2008)	17	119.7	126.1	130.9	119.7	1	
	Systolic BP (Average mm Hg), 45-54, Females (2008)	17	119.0	124.1	129.7	120.3	3	
	Systolic BP (Average mm Hg), 45-54, Males (2008)	17	123.3	131.1	135.7	123.3	1	
	Total Cholesterol (Average mmol/L), 35-44, Females (2008)	17	4.7	5.0	5.2	5.0	7	
	Total Cholesterol (Average mmol/L), 35-44, Males (2008)	17	5.1	5.3	5.6	5.2	4	
	Total Cholesterol (Average mmol/L), 45-54, Females (2008)	17	5.2	5.5	5.7	5.4	3	
	Total Cholesterol (Average mmol/L), 45-54, Males (2008)	17	5.3	5.5	5.8	5.3	1	
	Life Lost From Mortality (Days), 35-49, Females (2009)	17	74.5	93.4	158.7	158.7	17	
	Life Lost From Mortality (Days), 35-49, Males (2009)	17	124.1	169.9	281.8	281.8	17	

Table 4: Proximate Health Determinants

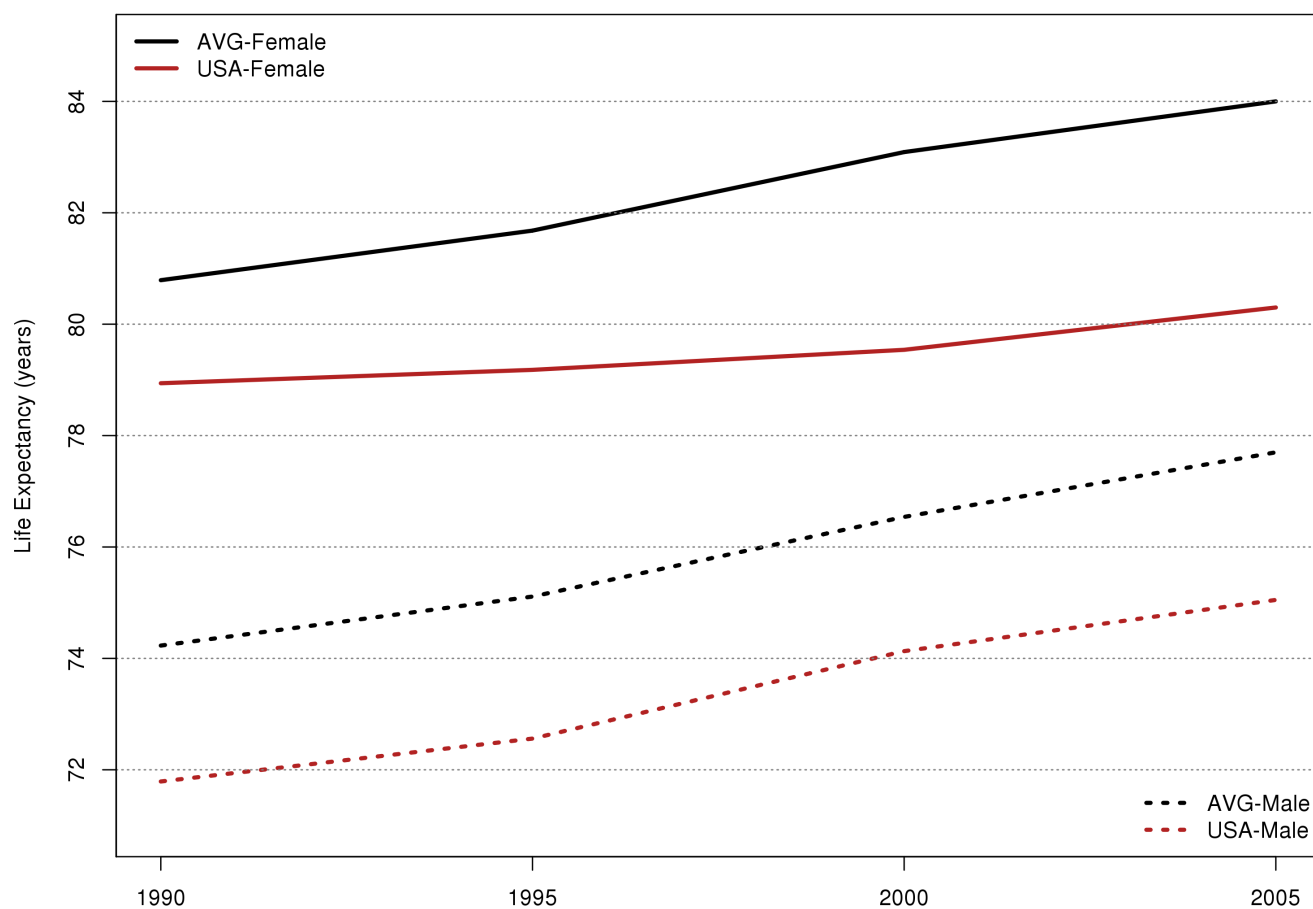
Age	Measure	Countries	Best	Average	Worst	US	Rank	Composite
Prevention and Health Behaviors	Breastfeeding Rate (Ever, Various Years)	17	99.0	87.1	63.0	74.2	15	5
	Vaccination DPT1B, 1yr (2009)	17	99.0	96.8	90.0	98.0	3	
	Vaccination DPT3B, 1yr (2009)	17	99.0	93.6	80.0	95.0	9	
	Vaccination HIB, 1yr (2009)	16	98.0	93.2	80.0	93.0	11	
	Vaccination Measles, 1yr (2009)	17	98.0	92.3	83.0	92.0	10	
	Vaccination Polio, 1yr (2009)	17	99.0	93.7	80.0	93.0	11	
	Contraceptive Use, Any (Various)	17	88.4	73.2	50.9	78.6	5	
	Contraceptive Use, Modern (Various)	17	84.0	68.0	40.6	73.0	7	
	Contraceptive Use, Traditional (Various)	17	22.1	7.0	1.7	5.6	9	
	Moderate Physical Activity (2005)	15	26.8	18.9	13.1	26.8	1	
	Percentage 13, 15 Drunk 2+ (2005)	15	10.0	15.4	24.8	10.2	2	
	Percent daily smoker, 15-24, females (2005-2009)	15	13.9	19.7	27.7	13.9	1	
	Percent daily smoker, 15-24, males (2005-2009)	15	10.1	23.8	34.1	18.5	5	
	Bullied 2+ (2005)	15	4.2	10.3	15.6	11.9	9	
Education	Mean Years of Schooling (2010)	17	12.6	10.8	8.0	12.4	2	12
	Expected Years of Schooling (2010)	17	20.5	16.3	15.0	15.7	11	
	Children Enrolled in Care, 0-2 (2008)	16	65.7	36.7	12.1	31.4	9	
	Children Enrolled in Care, 3-5 (2008)	17	99.9	80.1	47.5	55.7	15	
	Tertiary Graduate Rates (2000-2007)	16	47.1	34.0	19.2	33.8	9	
	Children Liking School (2005)	15	41.7	28.0	12.8	26.4	8	
	Mean Math Score (PISA, 2009)	17	541	506	483	487	14	
	Mean Reading Score (PISA, 2009)	16	536	503	481	500	8	
Care Availability	Mean Science Score (PISA, 2009)	17	554	511	488	502	9	10
	Physician Density (2005-2009)	17	47.5	33.9	19.1	26.7	15	
	Nurse Density (2005-2009)	17	159.6	94.7	1.5	98.2	9	
	Dentist Density (2005-2009)	17	16.3	7.6	4.9	16.3	1	
	Pharmacist Density (2005-2009)	17	13.6	8.1	1.7	8.8	7	
	Medical Graduates (2005-2009)	17	21.9	9.9	5.6	6.4	14	
	Doctor Consultations per Capita (2005-2009)	16	13.5	6.0	2.8	3.9	15	
	Average Length of Stay, Acute (2005-2009)	16	19.1	7.1	4.6	5.5	12	
	Average Length of Stay, Delivery (2005-2009)	16	5.3	3.0	1.8	2.0	14	
	Total Hospital Beds (2005-2009)	17	13.9	5.2	2.9	3.1	16	
	Acute Care Hospital Beds (2005-2009)	17	8.2	3.5	2.0	2.7	12	
	Psychiatric Hospital Beds (2005-2009)	17	2.7	0.8	0.1	0.3	16	
	CT Scanners (2005-2009)	13	97.3	28.7	7.6	34.2	3	
	MRI Scanners (2005-2009)	12	41.6	14.5	5.1	26.3	2	
Household Economic	Mammographs (2005-2009)	11	40.2	24.9	3.9	40.2	1	13
	Mandatory Federal Maternity Leave Days (2007-2009)	17	365.0	124.9	0.0	0.0	16	
	Percent with Income Difficulties (2010)	16	5.9	15.3	32.9	21.2	13	
	Household Income w/Children (2005)	17	29000	22000	14000	29000	1	
	Children in Poor Homes (2005)	17	2.7	11.0	20.6	20.6	17	
	Children in Poor Environments (2006)	15	10.5	25.9	38.7	25.4	7	
	Child Overcrowding (2006)	15	10.3	22.2	47.9	26.2	12	
	Broadband Households (2009)	17	79.5	65.0	39.0	63.5	10	
Household Economic	Educational Deprivation (2006)	17	0.5	1.7	5.6	4.8	16	7
	Not in Education/Employed (2005)	17	2.5	6.5	11.2	6.1	7	

Table 5: *Distal Health Determinants*

Age	Measure	Countries	Best	Average	Worst	US	Rank	Composite
Macro Economic	Gross National Income Per Capita (2010)	17	59000	37000	22000	47000	2	15
	Unemployment Rate, 15-19 (2010)	17	6.1	23.6	61.4	25.9	10	
	Unemployment Rate, 20-24 (2010)	17	6.7	14.7	37.0	15.5	11	
	Unemployment Rate, 25-34 (2010)	17	4.1	8.5	22.2	10.1	13	
	Unemployment Rate, 35-44 (2010)	17	2.8	6.4	17.8	8.1	15	
	Unemployment Rate, 45-49 (2010)	17	1.8	5.8	15.8	7.8	15	
	Health Care Expenditures, % GDP (2005-2009)	17	8.3	10.0	16.3	16.3	17	
	Health Care Expenditures, PPP (2005-2009)	17	2360	3707	7378	7378	17	
Equality	Education Spending per Capita (2007)	17	12000	9000	6000	11000	2	15
	GINI Income Inequality (2000-2010)	17	24.7	31.5	40.8	40.8	17	
	Gender Inequality Index (2008)	17	17	27	40	40	17	
	Human Development Index (2010)	17	94	88	79	90	3	
	Non-Income HDI (2010)	17	99	90	82	92	3	
Social Context	Ratio 90/10 Reading Score (PISA, 2009)	16	1.53	1.64	1.77	1.68	13	10
	Pro-Social Behavior Index (2010)	17	60.3	43.1	22.1	60.3	1	
	Anti-Social Behavior Index (2010)	17	4.8	7.6	12.0	7.9	13	
	Negative Experience Index (2009)	17	15.1	21.9	28.8	28.1	14	
	Positive Experience Index (2009)	17	79.8	74.2	68.0	76.3	5	
	Tolerance of Gay/Lesbian Index (2010)	17	82.9	62.6	28.7	65.6	8	
	Tolerance of Immigrants Index (2010)	17	88.3	71.9	50.4	78.9	5	
	Tolerance of Minorities Index (2010)	17	88.0	73.0	48.4	84.9	4	
	High Level of Trust (2008)	15	88.8	68.1	38.1	48.7	14	
	Feeling Unsafe/Very Unsafe After Dark (2005)	16	14.0	23.9	35.0	19.0	6	
	Political Engagement (2008)	17	37.0	26.5	14.0	32.0	5	
	Voter Turnout (Most Recent National Election)	17	95.2	70.9	47.5	47.5	17	
	Press Freedom Index (2009)	17	12.1	4.0	0.0	4.0	5	
	Satisfaction: Freedom of Choice (2009)	17	96.0	82.7	60.0	83.0	11	
	Human Rights Violations (2009)	16	1.0	1.7	3.0	3.0	15	
Crime	Confidence in National Institutions Index (2010)	17	43.1	62.4	81.6	58.5	6	
	Prison Population per 100000 (2009)	17	63	137	760	760	17	17
	Victimization across 10 crimes (2005)	17	9.1	14.8	21.0	17.5	13	
	Homicide Rate (2003-2008)	17	0.5	1.6	5.2	5.2	17	
	Robbery Rate (2003-2008)	17	3.4	155.6	1067.0	141.8	13	
	Consumer Fraud Victimization (2005)	15	1.9	9.0	15.7	12.5	13	
	Corruption Victimization (2005)	15	0.0	0.5	1.1	0.5	8	
	Corruption Index (2010)	17	83.5	47.6	14.9	67.2	5	

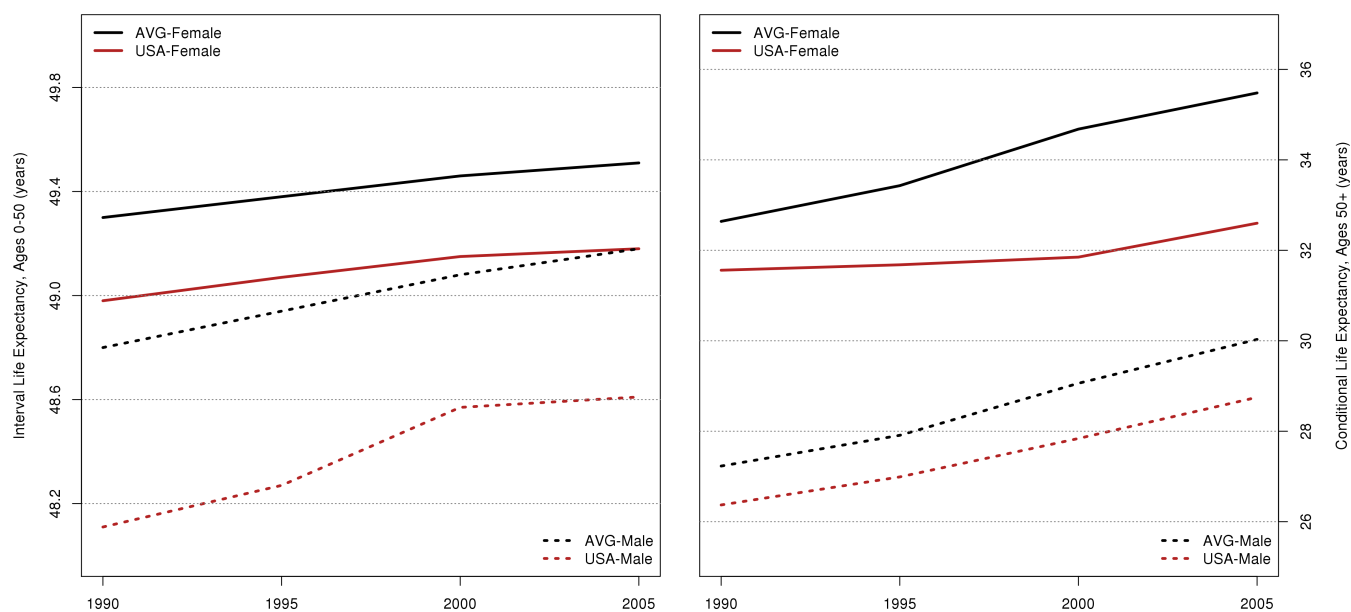
B Figures

Figure 1: *Life Expectancy at Birth, United States Compared to Composite Average, By Sex (1990, 1995, 2000, 2005)*



Source: WHO (http://www.who.int/healthinfo/statistics/mortality_life_tables/en/)

Figure 2: *Interval (0-50) and Conditional (50+) Life Expectancy, United States Compared to Composite Average, By Sex (1990, 1995, 2000, 2005)*



Source: WHO (http://www.who.int/healthinfo/statistics/mortality_life_tables/en/)

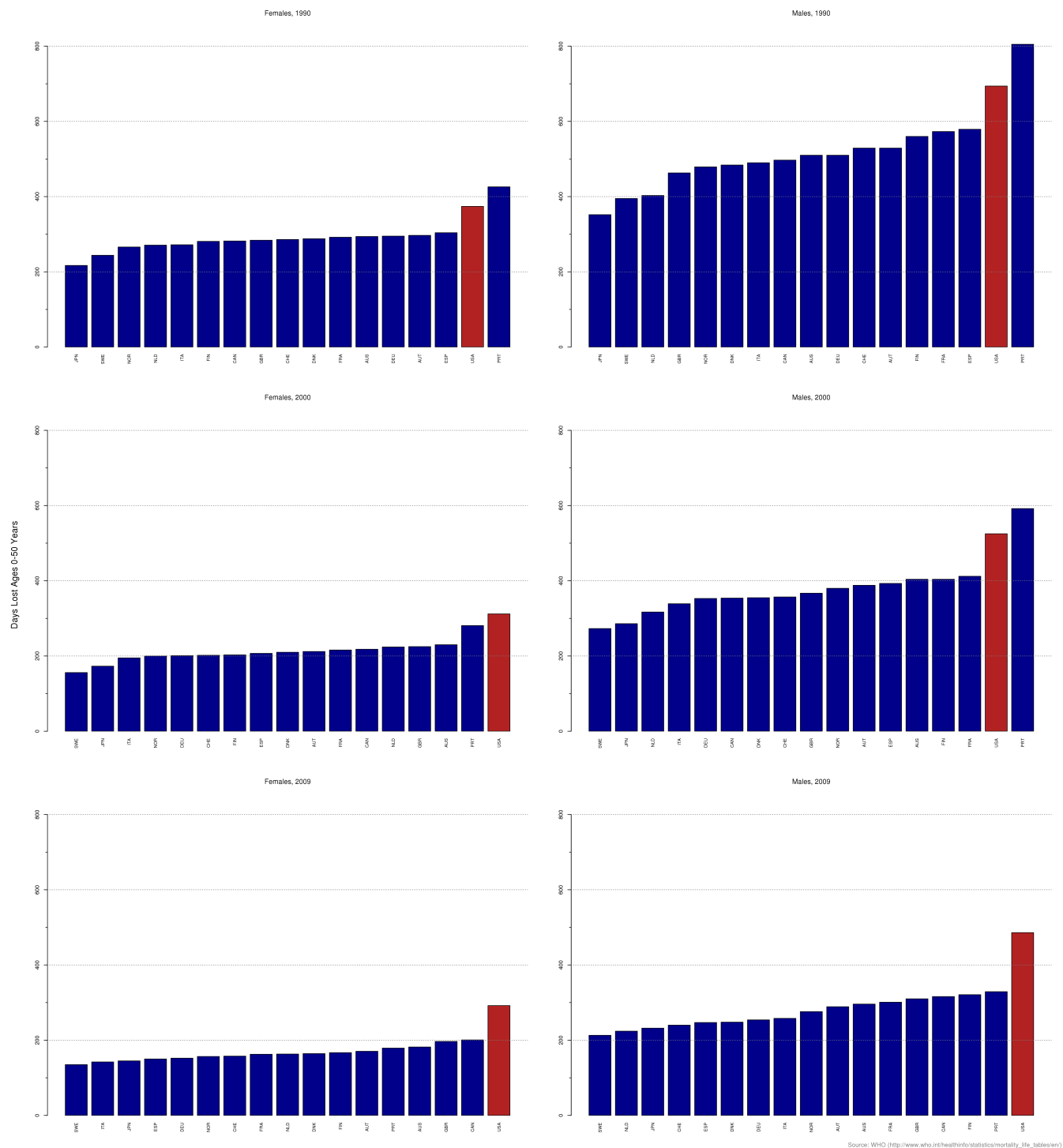
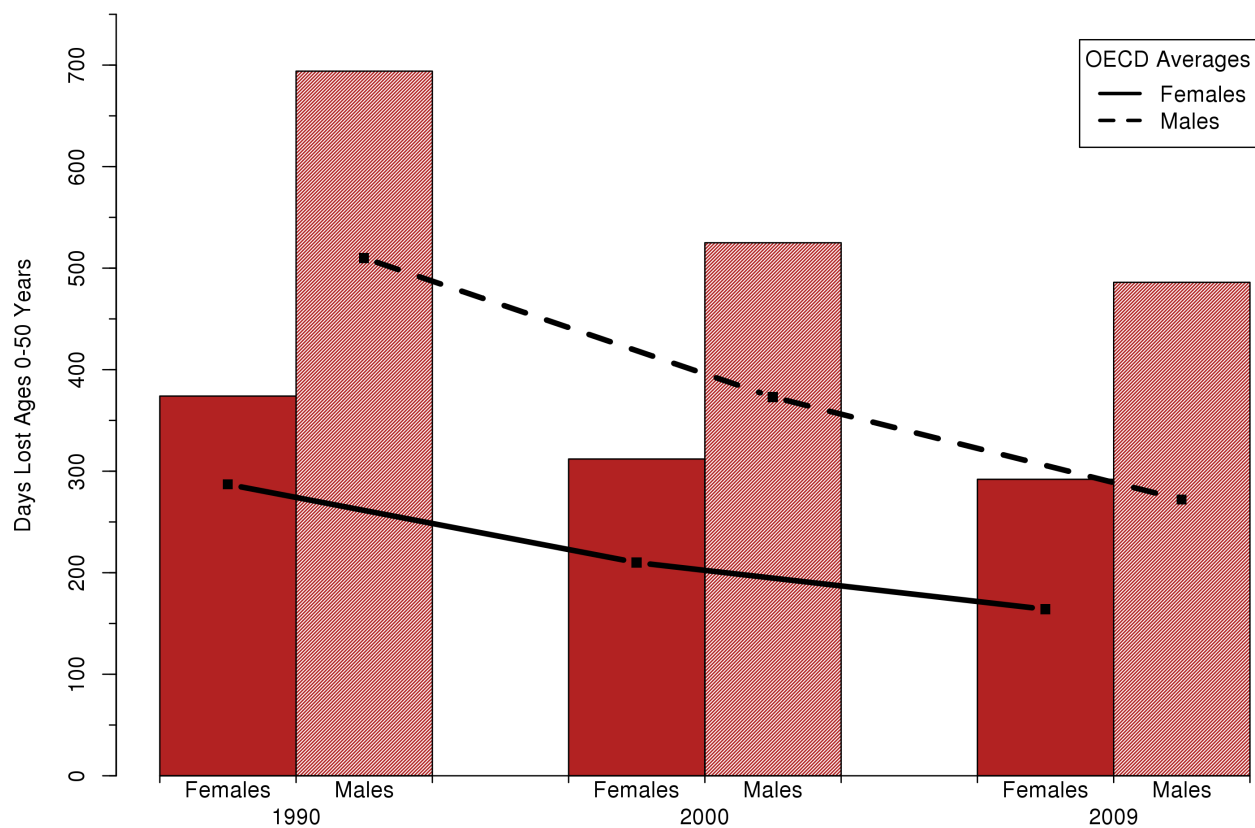
Figure 3: *Life Lost Due to Mortality, By Sex, Age Interval 0-50 (1990, 2000, 2009)*

Figure 4: *Trends in Life Lost Due to Mortality, By Sex, Age Interval 0-50 (1990, 2000, 2009)*



Source: WHO (http://www.who.int/healthinfo/statistics/mortality_life_tables/en/)

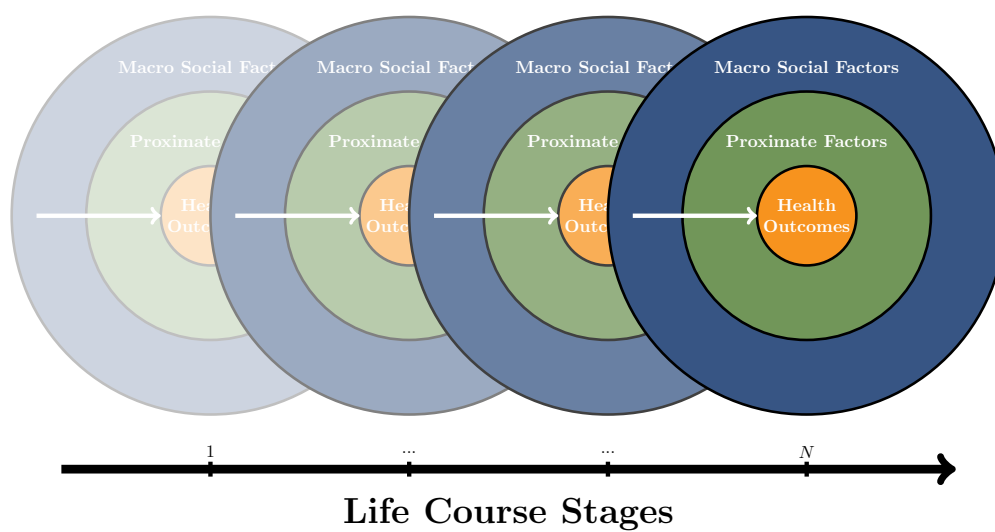
Figure 5: *Life Course Ecological Model of Health Production*

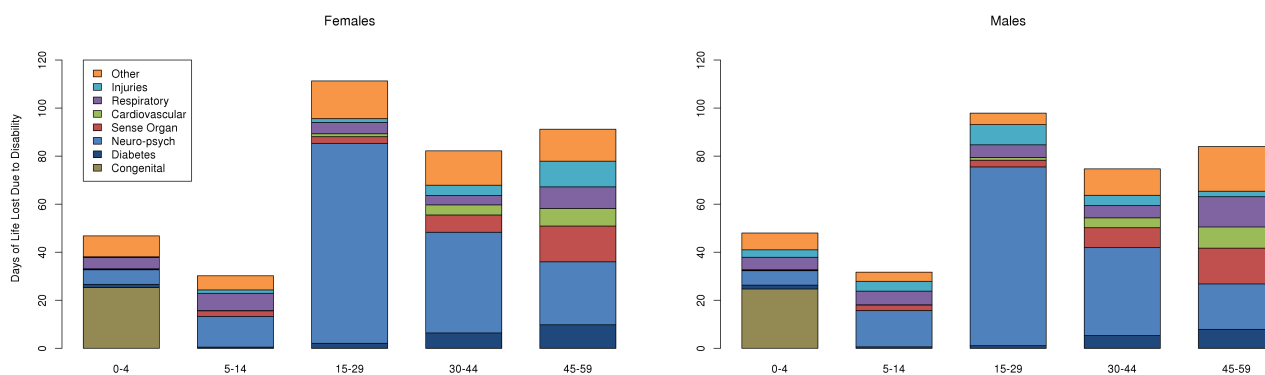
Figure 6: *Life Lost Due to Disability, By Sex and Age Group, Age Interval 0-60 (2004)*Source: WHO (<http://apps.who.int/ghodata/>)

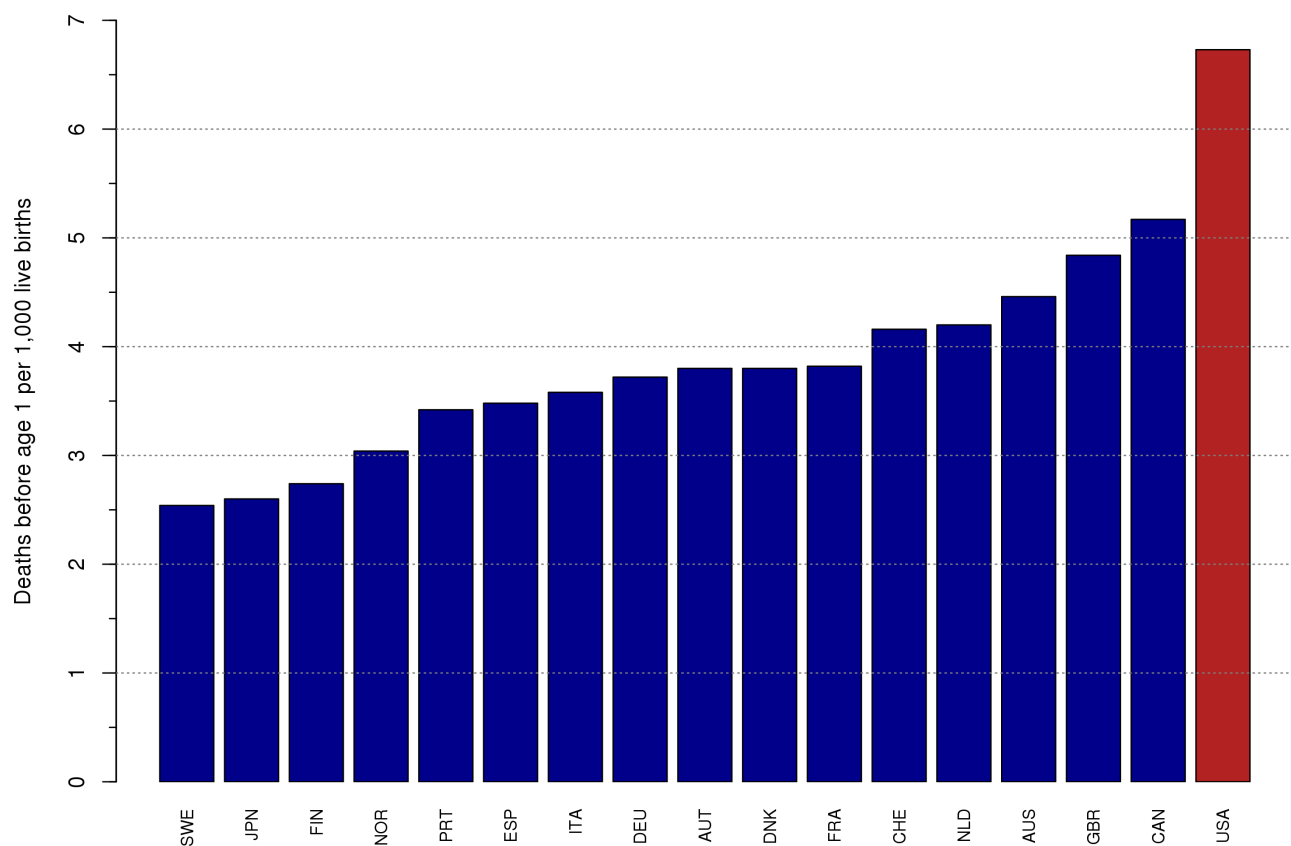
Figure 7: *Infant Mortality Rate (2005-2009)*Source: OECD (<http://stats.oecd.org/>)

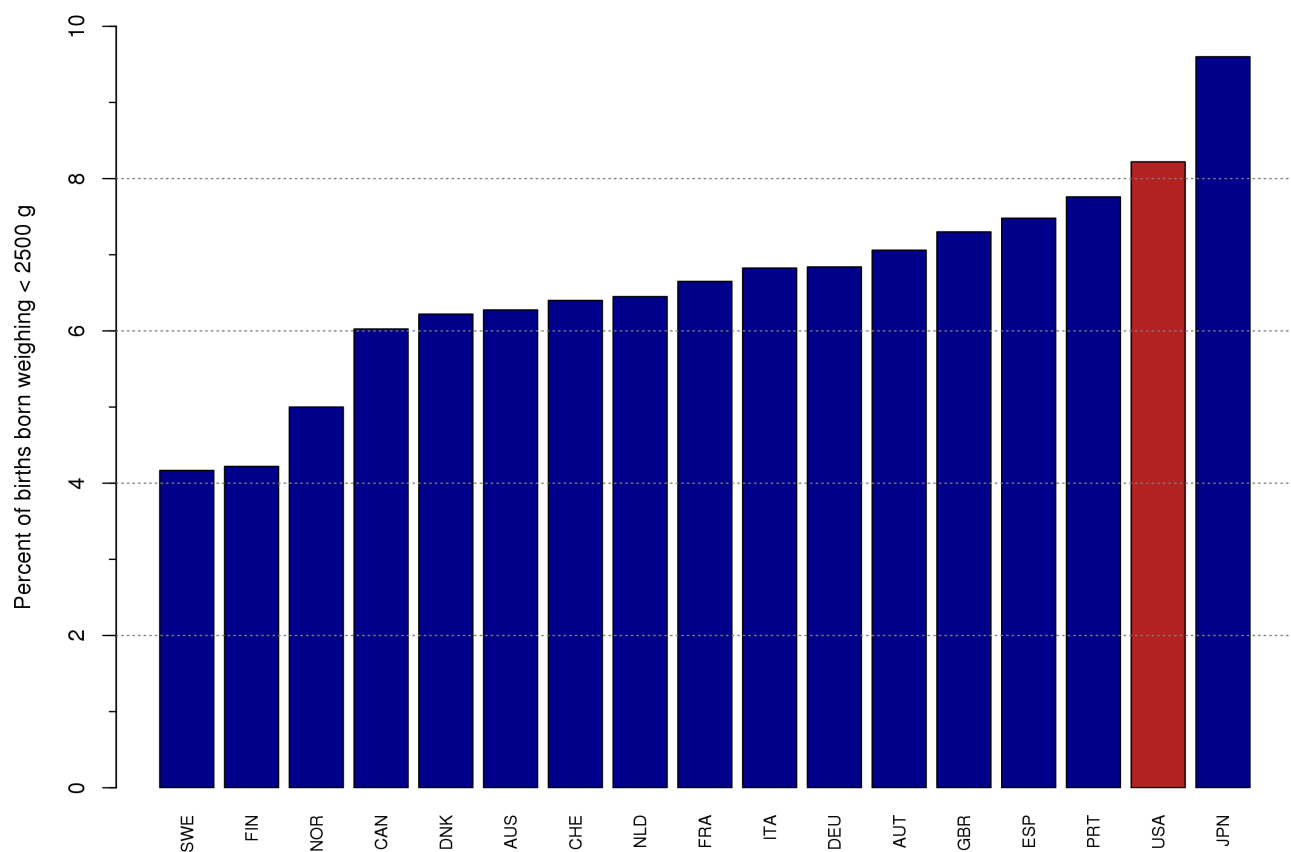
Figure 8: *Low Birth Weight (2005-2009)*Source: OECD (<http://stats.oecd.org/>)

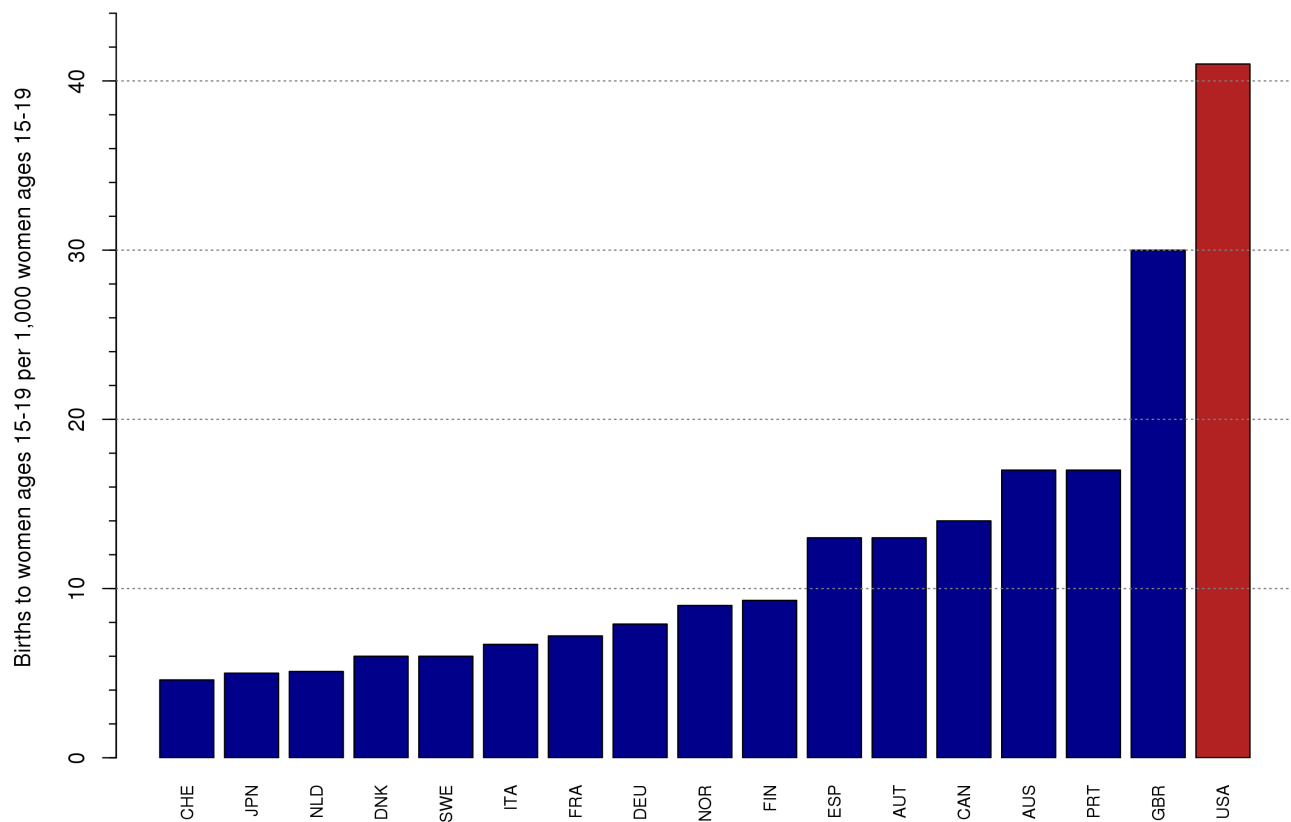
Figure 9: *Adolescent Fertility Rate (2010)*Source: UN (<http://hdr.undp.org>)

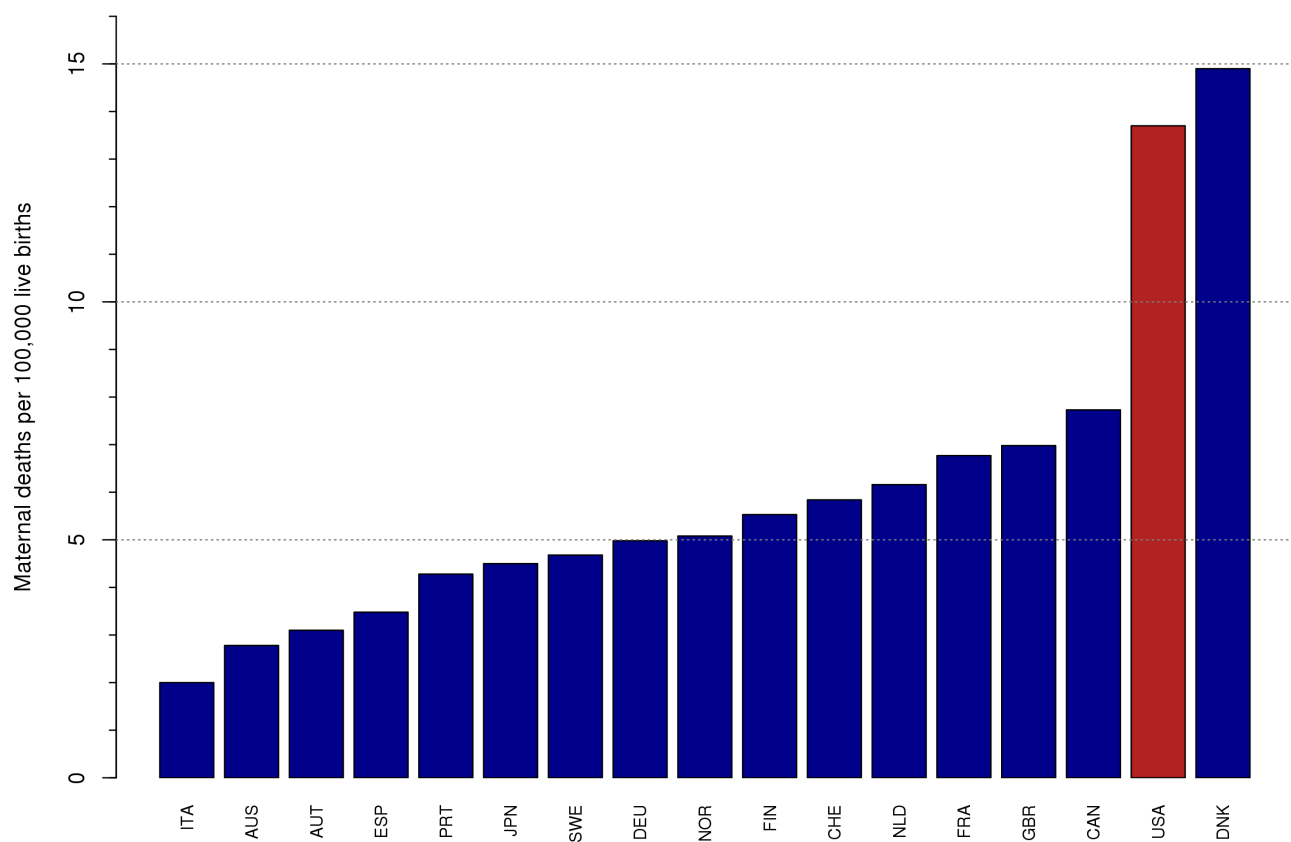
Figure 10: Maternal Mortality Ratio (2005-2009)Source: OECD (<http://stats.oecd.org/>)

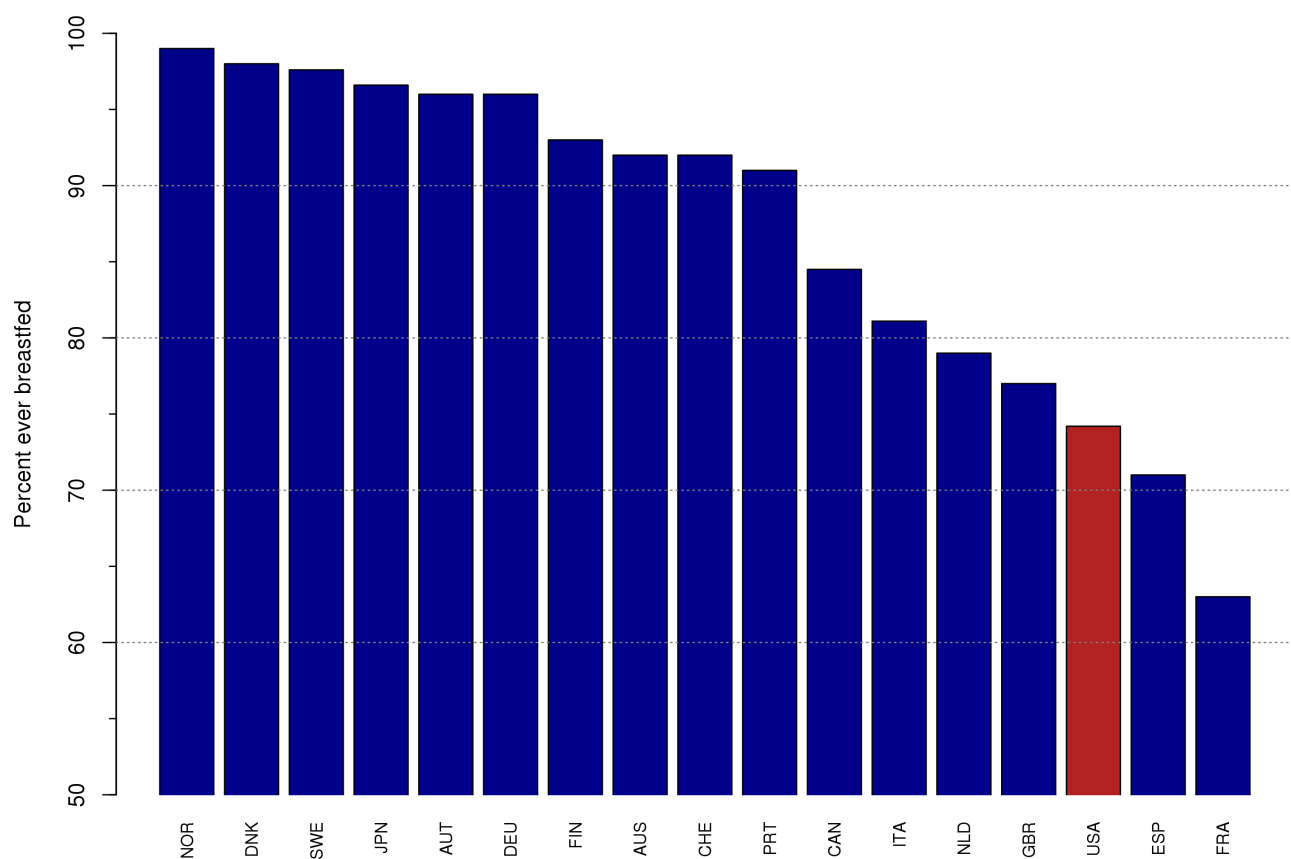
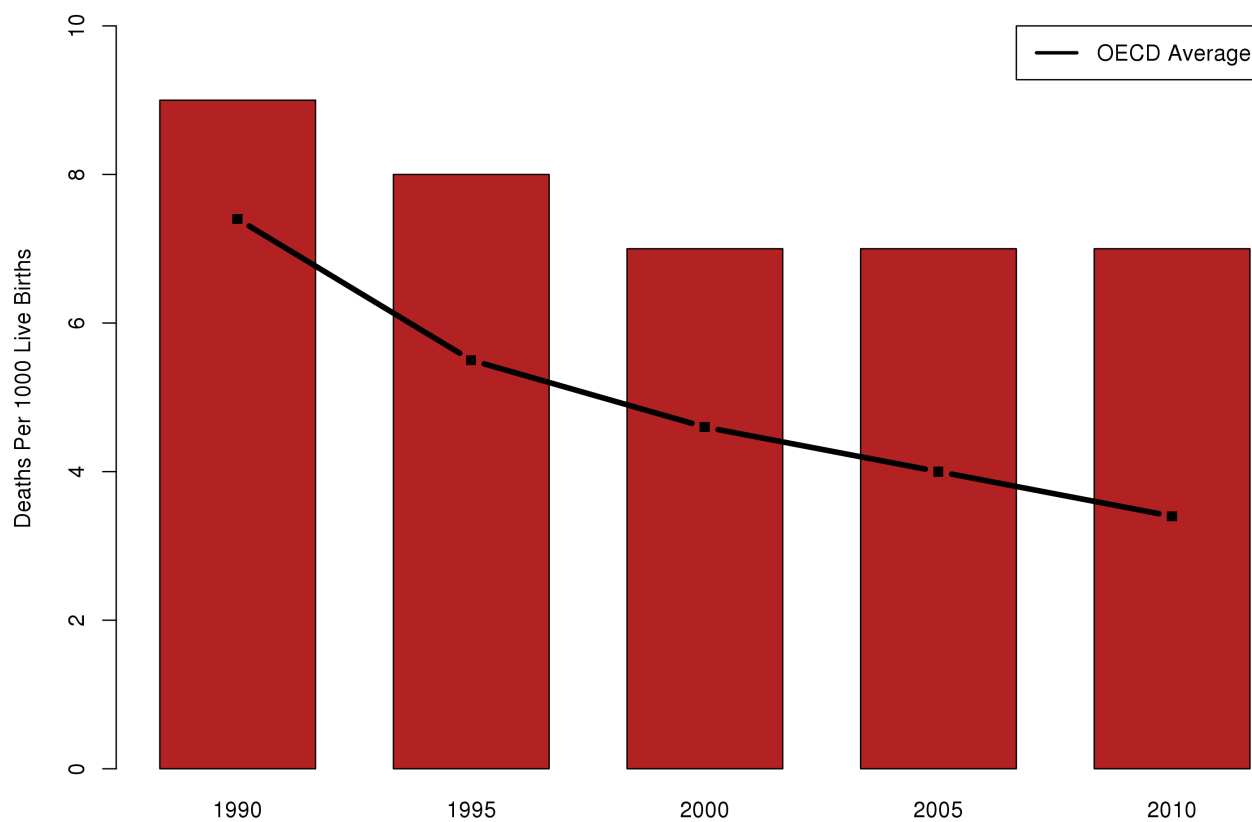
Figure 11: *Breastfeeding Rate (Various Years)*Source: OECD (<http://stats.oecd.org/>)

Figure 12: *Trend in Infant Mortality Rate (1990-2010)*

Source: WHO (<http://apps.who.int/ghodata/>)

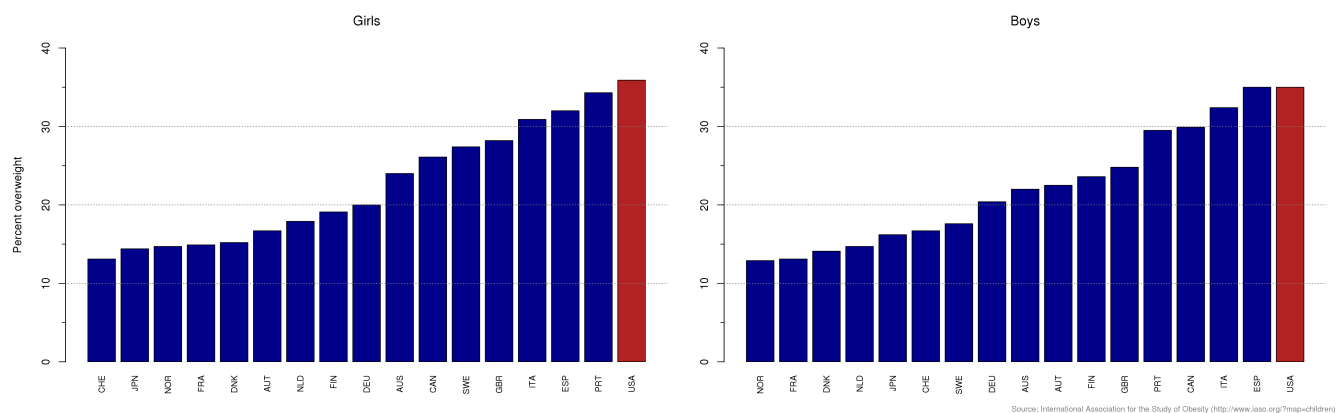
Figure 13: Overweight Youth, By Sex (Various Years, 1996-2008)

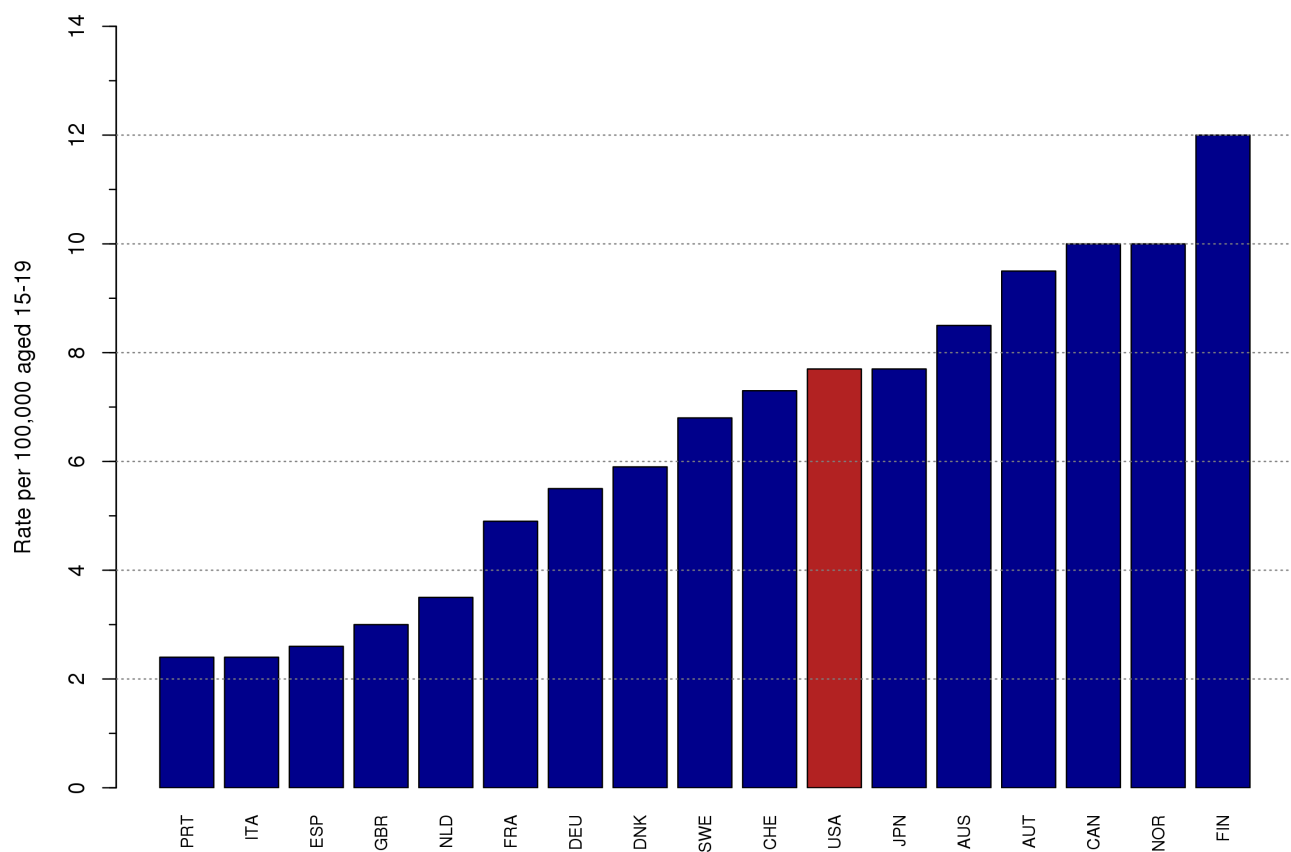
Figure 14: *Teen Suicide Rate (Three Most Recent Years)*Source: OECD (<http://stats.oecd.org/>)

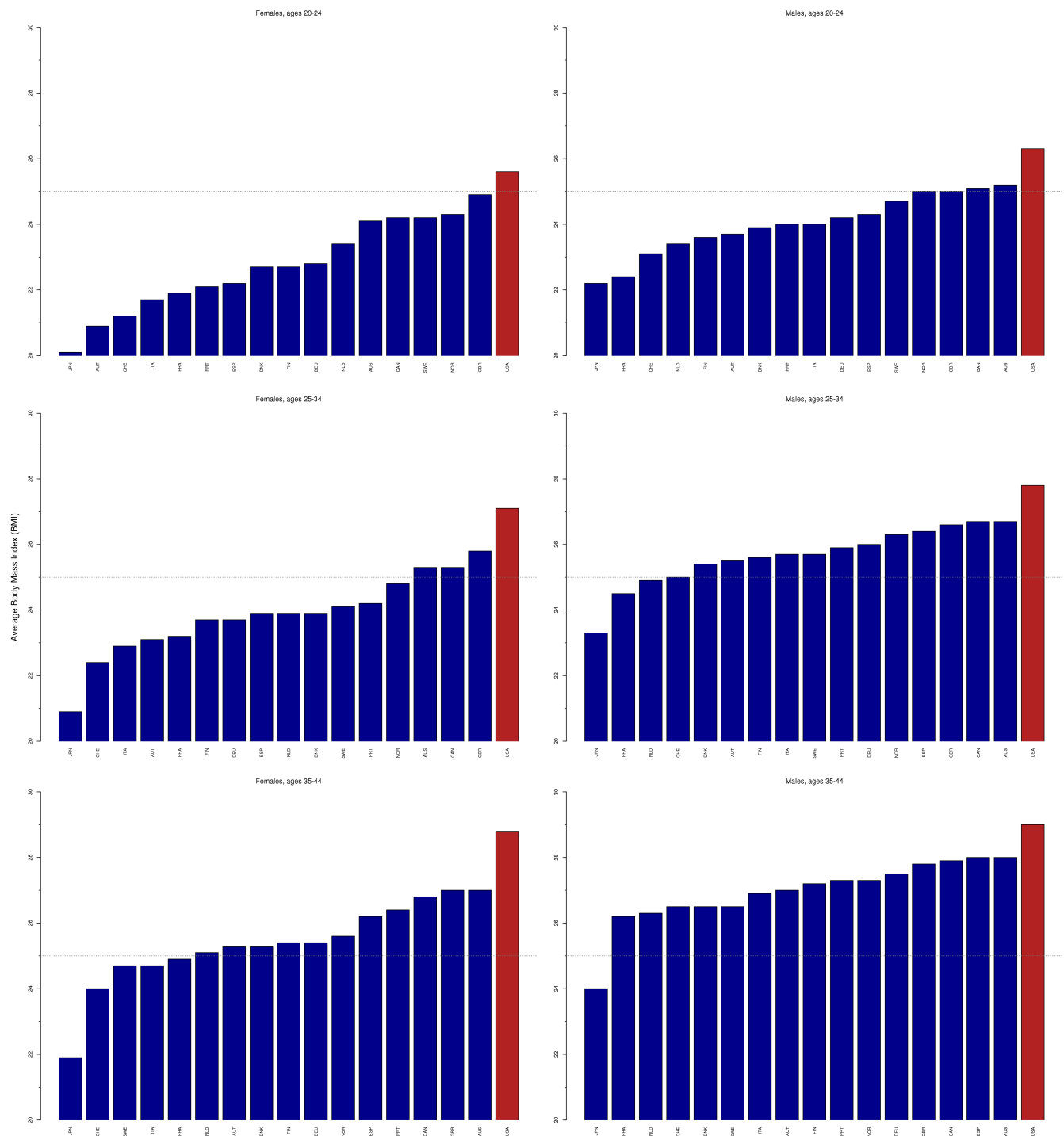
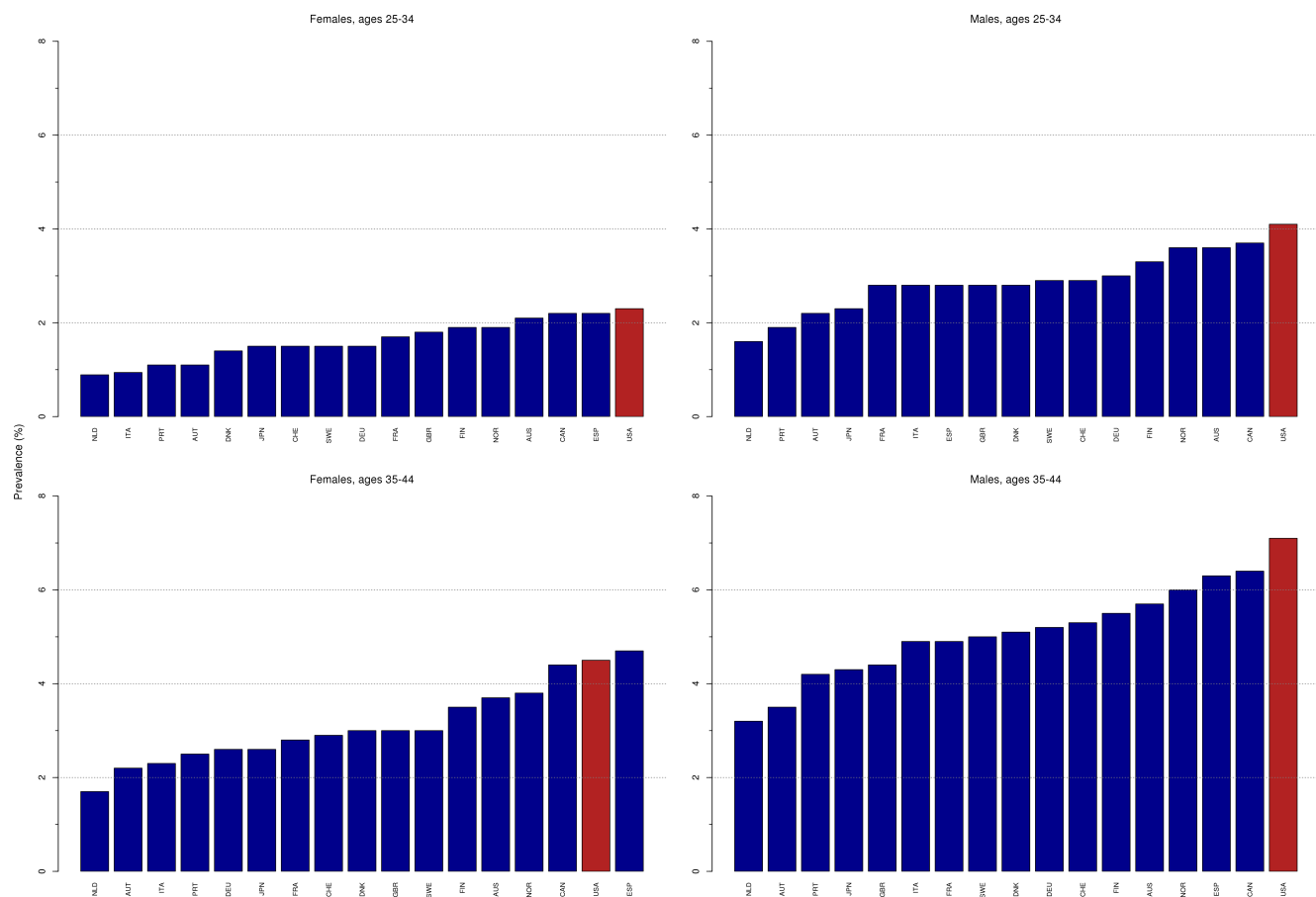
Figure 15: *Body Mass Index (BMI), By Sex and Age Group (2008)*Source: Imperial College, London (<http://www1.imperial.ac.uk/publichealth/departments/eha/projects/eresh/maj/dezzati/healthmetrics/metabolisr/factors/>)

Figure 16: *Diabetes Prevalence, By Sex and Age Group (2008)*

Source: Imperial College, London (<http://www1.imperial.ac.uk/publichealth/departments/ebs/projects/eresh/majidcazzali/healthmetrics/metabolisriskfactors/>)

Figure 17: *Fasting Plasma Glucose, By Sex and Age Group (2008)*

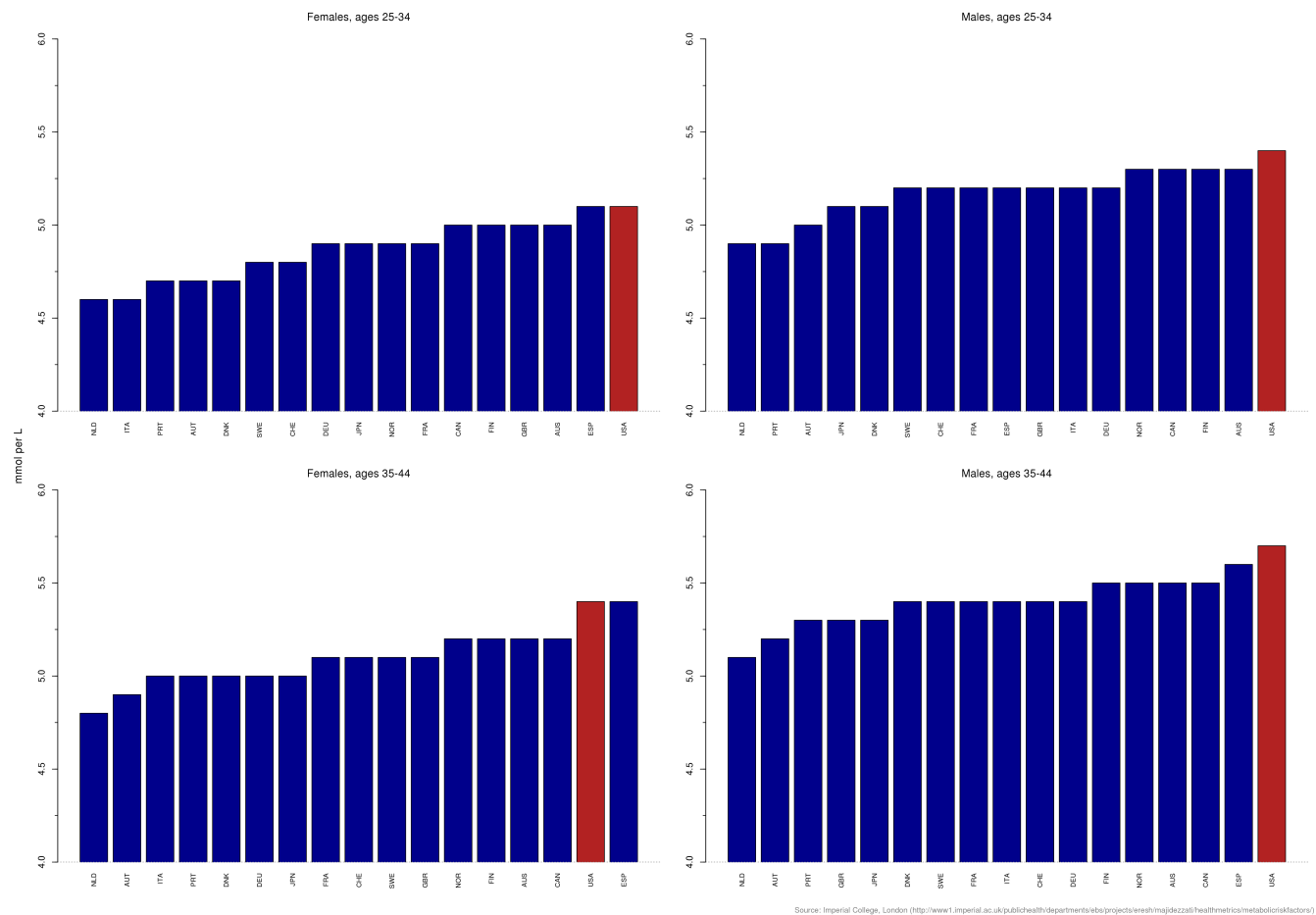
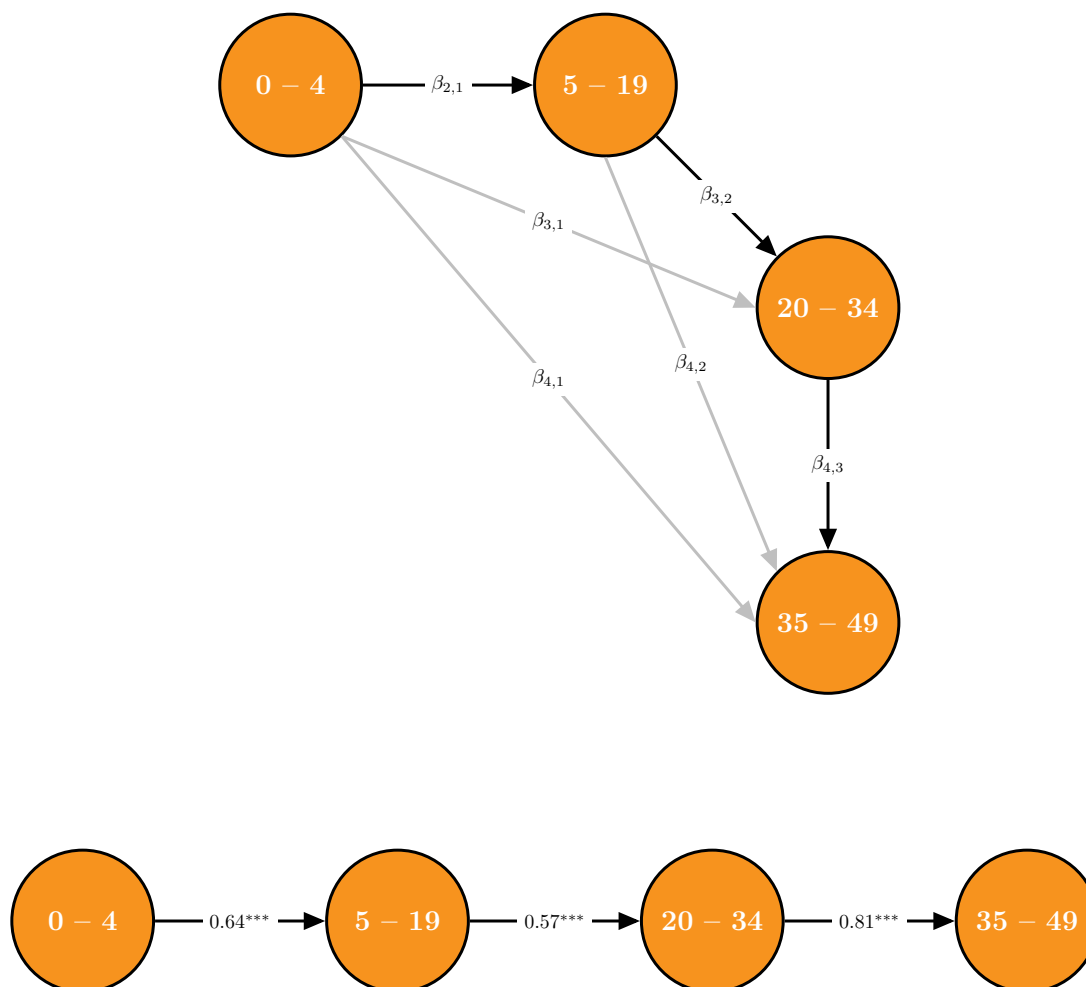


Figure 18: *Health Outcomes Structural Models*

C Data limitations

With a few exceptions noted in the text we use data collected, organized, and published by other agencies and/or their sources. For mortality we use vital statistics as stored and distributed by WHO. For estimates of life lost to disability we employ the Burden of Diseases project data base. We also extracted information collected and processed by UNICEF and OECD which, in turn, is a blend of information gathered from a number of national sources and household surveys conducted within each country. We chose sources containing indicators already standardized to ensure comparability across countries. We show indicators for age groups that are consistent with the life stages described before and their ranking are calculated from a standardized distribution that includes all OECD countries in the comparison set. For all health indicators the principal unit of analysis is always the individual belonging to a particular age group.

The assembled data have a number of limitations and we might as well spell them out at the outset. First, with a few exceptions we only report for a very narrow (most recent) time period. Although we do not estimate trends in any systematic way, references to time trends are made and properly documented. This report cannot establish if the health status reflected by the indicators characterizes only the current state of affairs, is a lagged response to past conditions that may no longer apply or, as is the case for older mortality, is a more or less persistent feature over the last ten years or so. We do not know if the US is in the midst of a deterioration trend or moving across a through on its way towards improvement.

Second, comparisons of national indicators are silent on within-country heterogeneity—across regions, social classes, and ethnic groups. In most but not all cases we are able to retrieve gender heterogeneity. This is desirable but not enough. Ranking of countries conceals the fact that poor scoring on any indicator can be driven by one or a handful of groups or regions and that if contrasts excluded these clusters the calculus and inferences could be different. The only defense against such a charge is that if the power of a few groups or regions in a country is enough to drag down the ranking of an entire nation it is reason enough to campaign for an understanding of group disparities.

Third, the indicators are very broad and refer to disparate dimensions, some of which pertain to contextual characteristics, others to more evanescent dimensions generated by the averaging individual statistics, some to the nature of institutions, some to individual behaviors and, finally, others to actual health status itself. Unlike the study of mortality, there is no single target for the analysis of health status across the life course. Though we do combine the various measures into a set of composite variables, choose to examine each indicator separately in our analysis. This is desirable since it provides opportunities for richer interpretations and a more abundant set of clues to identify the underlying causal processes.

Finally, we present lots of data from numerous sources. In each of the figures we include references to online

databases, but we do not provide detailed documentation for each source. See the authors for information regarding specific measures.

D Structural Equation Modeling Notes

1. The general data limitations listed in the preceding section (Appendix C) apply equally here.
2. Our sample consisted of 17 comparison countries. We acknowledge that this is not sufficient to make strong claims about structural relationships across the life course. The findings we present are suggestive but nonetheless consistent with the life course conceptual framework.
3. We do not have cohort data. For these analyses we assume that they operate like cohort data, but we cannot verify this assumption.
4. We estimated these models using the standardized composite scores (z-scores) found in Table 3. We found similar results when estimating these models using ranks, though the effects were moderately attenuated.
5. We first estimated the full structural model (upper portion of Figure 18) then iteratively constrained non-significant paths until no further paths could be eliminated. The lower portion of Figure 18 is the final model preferred model, $\chi^2(3) = 4.69$, $p = 0.20$.

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