Is Urbanization Good for a Nation's Health?

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> "For the past 200 years, urbanization, the concentration of people and resources in cities, has been a dominant influence on health." [1]

Abstract

Though urbanization once carried a severe health penalty for migrants, we present evidence showing that urbanization today may carry significant health advantages, especially in developing countries. Mortality data suggest an encouraging picture for improved health in urban areas as compared to rural areas, and, therefore, a greater likelihood of improved national health as urbanization continues. For specific health conditions, however, the picture is decidedly mixed. Some health conditions are likely to improve with greater urbanization, and others will worsen. Urbanization would likely result in a higher prevalence of some chronic diseases, HIV/AIDS, schizophrenia, asthma, violence, and osteoporosis. Urbanization would likely reduce the prevalence of malaria, maternal conditions, suicides, and motor vehicle injuries.

During the past half century, the world witnessed a dramatic increase in the share of its population that is urban, especially in developing countries. The same period also witnessed steady increases in global life expectancy accompanied by dramatic declines in infant and child mortality. Is this merely a coincidence or are these trends causally linked with one another? Are some aspects of the urban context contributing to these health improvements? What, then, are the health implications of this historic movement of populations from rural to urban areas? This paper will address these questions.

They are important questions because rapid urbanization is likely to continue. Cities tend to be centers of creativity and technology as well as sources of economies of scale and agglomeration, and thus are an integral part of the development process. Increases in agricultural productivity have meant that fewer workers are required in agriculture; in that sense, urbanization is a *consequence* of economic success. Yet, because productivity is so much higher in urban industry and services than in rural agriculture, it has been a *cause* of economic growth, as well.[2] For example, though Bangkok accounts for only 12 percent of the population of Thailand, it accounts for 40 percent of its GDP.[3]

Unfortunately, not all nations have experienced urbanization in the context of rapid economic growth. In some countries of sub-Saharan Africa, for example, rapid urbanization is occurring in the context of economic stagnation as rural dwellers are being displaced by civil strife and environmental crises.[4]

City living has many important health-related effects—both favorable and unfavorable.. Cities raise per capita incomes and levels of education of their inhabitants and thereby provide better access to health care, improved sanitation, and social support networks. The so-called "economies of proximity" associated with dense populations reduce the costs of providing infrastructure such as that required for clean water and effective social services.[5] On the other hand, city life may promote less-healthful diets and reduced physical activity, leading to a variety of chronic diseases. It may result in greater exposure to air pollution, infectious diseases, and risk of being injured by criminal behavior. It may also cause the weakening of societal norms and erode the social support that is essential for mental health. Therefore, the rapidly growing cities in Africa, Asia and Latin America will present almost intractable challenges to improving the health of those in urban area living in poverty. The Director General of the World Health Organization (WHO) also recently warned that increasing urbanization could threaten public health by facilitating the spread of communicable diseases and increasing the prevalence of non-communicable diseases in poor countries.[6]

In this paper, however, we argue that such fears are not supported by the currently available evidence and that such pessimistic predictions are not likely to be borne out by future events. On the contrary, urbanization is likely to make a significant contribution to improving overall national health, particularly in the case of infants and children in the developing world.

Today, urban death rates are generally lower than those of rural areas. This represents a decisive break with the past, in which urban death rates were higher. In medieval and early modern Europe, life expectancy was as much as 1.5 times greater in the countryside than in the larger towns.[7]

The excess death rate in nineteenth century Europe was called "the urban penalty".[8] That penalty was primarily attributed to communicable disease resulting from overcrowding, poor urban sanitation, and lack of access to clean water. Mortality rates were directly related to city size and density. There was a clear mortality gradient from central cities through the less populated outskirts to the rural areas.[9]

This historical record may be important because the rates of increase over the last 50 years in the urban population of developing countries are similar to those seen in Europe and North America 100 years earlier. Thus, health conditions of nineteenth century Europe—and the potential re-emergence of an urban penalty—may have parallels to conditions in today's urban slums.[10] [11] In addition, urbanization today is associated with increased prevalence of non-communicable diseases. For example, changes in nutrition and activity levels in urban areas are associated with an increasing prevalence of obesity, which in turn is a risk factor for type II diabetes and cardiovascular disease. Growth of the world's urban population is a major driver of a projected increase of more than 50 percent in the global prevalence of diabetes.[12] Furthermore, the level of urbanization in developing countries is significantly associated with greater mortality rates from heart

disease and other chronic conditions.[13] Nevertheless, on balance, today's trends toward increasing urbanization are health improving, particularly in the developing world.

This paper argues that though urbanization once carried with it a severe health penalty, it now provides a significant health reward, especially in developing countries. Nonetheless, the implications of urbanization for specific health conditions and their determinants present a decidedly mixed picture—some favorable, and some not. The next section discusses the concept of urbanization and then reviews past trends and future prospects for global urbanization. The second section reviews factors linking health and urban environments. The third section provides comparative measurements of mortality (a measure of overall health) in urban and rural areas of selected countries. The fourth section, in a more fine-grained approach, examines rural-urban differentials for specific health conditions, and their determinants, and suggests their implications for national health as urbanization increases over time. The final section offers conclusions, needs for research and data collection implied by this review, and implications for health policy formulation.

I. Urbanization

The United Nations defines urbanization as an increase in the proportion of the population living in urban areas.[14] It is a relative concept, unlike "urban growth", which refers to an increase in the absolute size of urban populations. Because of the wide variation among national definitions of the concept of "urban"—including those using administrative, geographic, employment, or density criteria—the United Nations defines the "urban population" as the *de facto* population living in areas classified as urban according to the criteria used by a particular area or country.[15]

Urbanization can occur in three ways: net migration from rural to urban areas, natural increase in urban areas that exceeds natural increase in rural areas, and administrative reclassification of previously rural areas as urban. Globally, natural increase is the most significant driver of urban population growth, accounting for 60% of urban population growth. However, rural-to-urban migration is the most significant driver of urbanization.[16] Furthermore, the three sources of urbanization interact over the medium and long term. Rural-to-urban migrants tend to have greater fertility than urban residents and hence raise the rate of natural increase in urban areas. In addition, the increase in population density resulting from migration and natural increase leads to a reclassification of rural localities as urban.

In the distant past, when most cities had defensive walls, it was relatively easy to identify populations as either rural or urban: those living inside the city walls were urban; those on the outside were rural. Today, there is no internationally accepted standard for dividing areas and their populations dichotomously as "rural" or "urban".[17] In many countries, areas and their populations are designated urban or rural based on population size or density, physical characteristics, administrative function, or the share of agriculture in total employment.[18] Of the 228 countries for which the United Nations has

data, about half use administrative criteria, such as whether an area is a capital city, to classify it as rural or urban. About one fourth of the nations use population size and density as their criteria. The other fourth have a variety of other criteria, only some of which are explicit.[19]

Even among governments that use population size as a criterion for classifying areas as urban or rural, there are significant differences. Some nations set a threshold at settlements of 20,000 or more. Other countries have thresholds as low as 200.[20] Thus, it is almost impossible to make completely valid international cross-national comparisons.

Even within one country, there is intra-national heterogeneity in the ways in which urban and rural areas are classified. Making comparisons over time is also problematic because the definition of urban within countries is frequently modified for each national census.[21]

There is substantial dissatisfaction with the "rural-urban" dichotomy as an analytical tool, and it is occasionally abandoned in favor of a continuous variable, such as population density, sometimes referred to as "urbanicity".[22] [23] [24] Along those lines, the United States Department of Agriculture has classified every county in that nation according to a 10-level scale of "urbanicity".[25]

At the midpoint of the twentieth century, only 30 percent of the world's population lived in urban areas. Though data are quite imprecise, it is estimated that the world's population will have become predominantly urban by 2010. Furthermore, this trend has occurred in all global regions. In sub-Saharan Africa, for example, the proportion urban has risen from 11 percent in 1950 to an estimated 37 percent today.[26]

Regrettably, a large part of the urban growth in developing countries is the growth of urban slums.[27] In 1990, there were nearly 715 million slum dwellers in the world. Today that number has risen to approximately one billion and may reach 1.4 billion by 2020.[28] Though one of every three city dwellers lives in slum conditions, it would not be correct to equate urbanization with the growth of urban poverty.[29] [30] Though still too large, the proportion of the urban population that is living in slums has fallen since 1990.[31]

Virtually all of the world's population growth in the new millennium is likely to take place in urban areas. At the current rate of growth (1.8 percent annually), the urban population will double in about 40 years, whereas the world's rural population will remain almost constant.[32] Much of this growth will take place in Asia and Africa, where more than half the population will live in urban areas by 2030.[33] Thus, it is likely that urbanization will continue apace and will dramatically alter the level and profile of health in both developed and developing nations, especially the latter.

II. Linking Health and the Urban Environment

Health and the urban environment are mutually influencing. In this section, we review the determinants of health in urban-rural environments and the effects of selective migration of individuals with particular health characteristics on the urban environment.

Factors accounting for rural-urban differences in health can usefully be disaggregated into two parts: *compositional* factors, factors arising from differences in the demographic profiles of the residents, and *contextual* factors, arising from differences in the social and physical environment.

Compositional factors may include the following:

- Population characteristics, such as age, sex, ethnicity, immigration status, behavior, culture, and pre-existing health conditions
- Socioeconomic and educational status (in very short-term analysis)

Contextual factors may include the following:

- Population characteristics such as socioeconomic status, education, behavior, and culture
- Physical environment: the built environment, housing density, air and water quality, exposure to noise, access to parkland, climate and geological conditions
- Social environment: characteristics of the relationships among people within a community, e.g., social networks, social capital, social supports.
- Socioeconomic and educational status (in long-term analysis)
- Health/social services: public and private services, informal and formal services, insurance, disparities in services between rich and poor[34]

It is important to consider the time horizon in determining whether certain factors are contextual or compositional. Such factors as socioeconomic status, educational status, employment status, and even nutritional status are compositional in the short term but contextual in the long term.

For example, in the short term, a person who is poor and unemployed (a compositional factor) in a rural area will also be poor and unemployed in an urban area. These short-term compositional factors become contextual over the long term because the longer one stays in an urban area, the more likely one will find employment and escape poverty. Thus in the long term, employment status changes from a compositional factor to a contextual factor.

Neo-classical economic theories of internal migration (urbanization) assume that no matter how bad things are in urban areas, over the long term, they are better in urban areas than in rural areas for the potential migrant. Over time, these changes alter health outcomes for migrants and their descendants (for better or worse). Thus, the long-term impact of urbanization is likely to be much greater than the short-term impact, as factors held constant in short-term analysis (classified as compositional) are allowed to change in long-term analysis (and are classified as contextual).

Not only can rural and urban environments shape health outcomes, health status can also alter the composition of urban and rural populations. Rural-urban health differentials may result from exposure to different health-related conditions in residential locations (contextual factors). Yet, because urbanization mostly results from migration, observed rural-urban health differentials may even be caused by the disproportionate migration (or failure to migrate) of people with different age, gender, or pre-existing condition profiles (compositional factors).

"Social drift", the tendency for people with particular characteristics to move, and "social residue", the tendency of people with other characteristics to be left behind, are factors that can influence the health status of the place of residence.[35] Within any age group, the robust are much more likely than the sickly to migrate to cities; moreover, rural-urban migration is often an age-dependent phenomenon, with younger, and therefore healthier, individuals more likely to leave the countryside. In Australia, for example, those who were ill were less likely to migrate to urban places than were healthy rural residents. After the onset of disease, there was a 31% smaller likelihood of migration to urban areas.[36] A possible explanation is that the onset of disease reduces both the incentive and ability to migrate. Furthermore, after the onset of disease, the accumulated social capital of rural residents takes on greater importance. In Southern Africa, urban dwellers who become very ill often return to their rural homes to die.[37]

As rural areas of China became more urban (as measured by their "index of urbanicity"), the average level of self-reported health status declined.[38] A plausible explanation for this result is that as industrialization raised incomes in rapidly urbanizing rural areas, the younger, more ambitious, and healthier individuals in those areas acquired the skills and resources needed to migrate to cities..

The effects of social drift and social residue can introduce a correlation between health and residence attributable not to contextual attributes of the new environment but to the compositional characteristics of migrating populations.[39] In the Netherlands, movers were healthier than "stayers". Those who moved to the cities had socioeconomic and demographic characteristics (age, income, etc.) associated with good health, causing an association between urban residence and health that was based on compositional rather than contextual factors.[40] These results are largely consistent with more recent findings for Finland and for the Netherlands.[41] [42] Even after controlling for age (another compositional factor), migrants in England and Wales are healthier than non-migrants, and migrants generally flow to urban areas, which are better endowed with health facilities (a contextual factor).[43] Conversely, there is a tendency for people in poor health to move to less well-endowed rural areas. This finding is consistent with the earlier study for Scotland.[44]

Mental illness is an important exception to the usual pattern of drift of healthy people to urban areas. A large part of the association between psychiatric morbidity and urbanization can be explained by urban drift of the mentally ill into poor urban areas

rather than the effect of those areas on the individuals suffering mental illness.[45] Only in the case of the onset of mental disorders was there a "drift" to urban areas.[46]

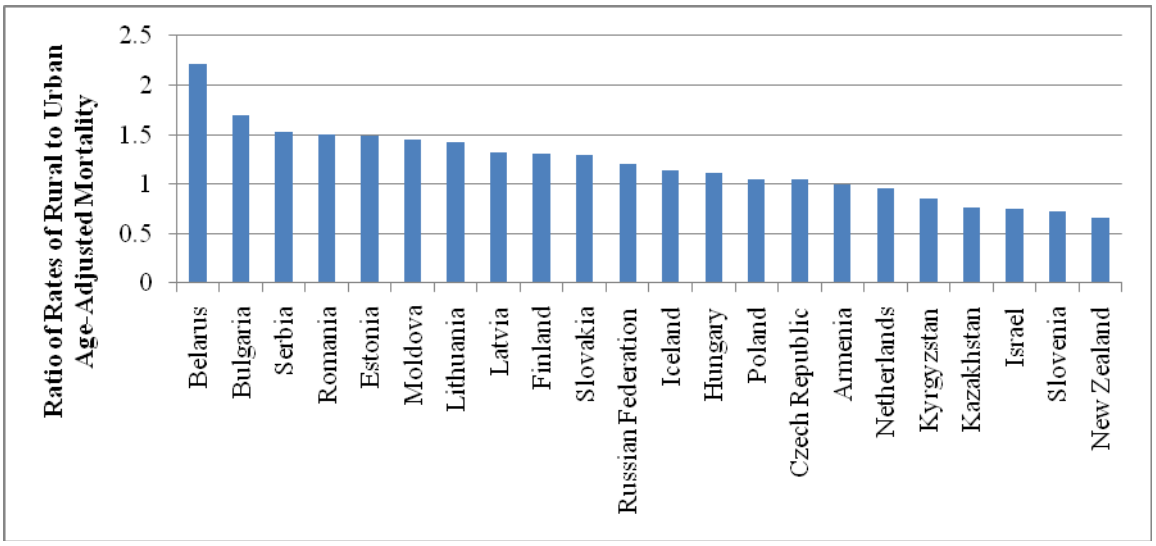
Thus, a portion of the poorer health in rural areas can be explained by selective migration rather than a healthier urban environment. That is, since people in poor health are migrating to rural areas and people in good health are migrating to urban areas, selective migration tends to exaggerate the relationship between the availability of health-related resources (contextual factors) and the health status of rural and urban communities. In the next section, we will address this problem by examining rural-urban differences in infant mortality, which are not likely to be the result of health-selective migration.

III. Cross-Country Comparisons of Mortality Rates by Urban-Rural Residence

One of the most widely used measures of the overall health of a nation is its level of mortality. In most cases, the lower that level, the better the general state of health. The state of health in rural and urban areas can be compared using several different mortality measures. Among these are age-standardized mortality rates, age-specific mortality rates, and child mortality rates. The implicit assumption behind these comparisons is that if overall health is better in urban areas, it may be that migrating from rural to urban areas would improve the national health status. Unfortunately, such cross-country comparisons have at least two major limitations: (1) the countries investigated may not be representative of world-wide patterns, and (2) the validity of cross-country comparisons is uncertain because urban and rural populations may be defined differently from country to country. Nevertheless, these comparisons provide an initial assessment of rural and urban health differentials.

Figure 1 shows the ratio of rates of rural to urban age-adjusted mortality among the 22 countries (both developed and developing) for which residence-disaggregated population and age-specific mortality data are available for 2006.[47] A ratio of rates that is greater than one indicates an urban health advantage. Conversely, a ratio of rates less than one indicates a rural health advantage. In about two-thirds of the countries, age-adjusted mortality rates were higher in rural areas, yielding ratios of rates greater than one. Although the preponderance of nations with an urban health advantage is suggestive, Figure 1 refers to a very small convenience sample of nations. Hence, we cannot be sure that this corresponds to a worldwide pattern. Furthermore, the ratios of rates illustrated in Figure 1 may suffer from a systematic downward bias since death registration is likely to be more complete in urban areas, while mortality is more likely to be under-reported in rural areas (particularly infant mortality in developing countries).

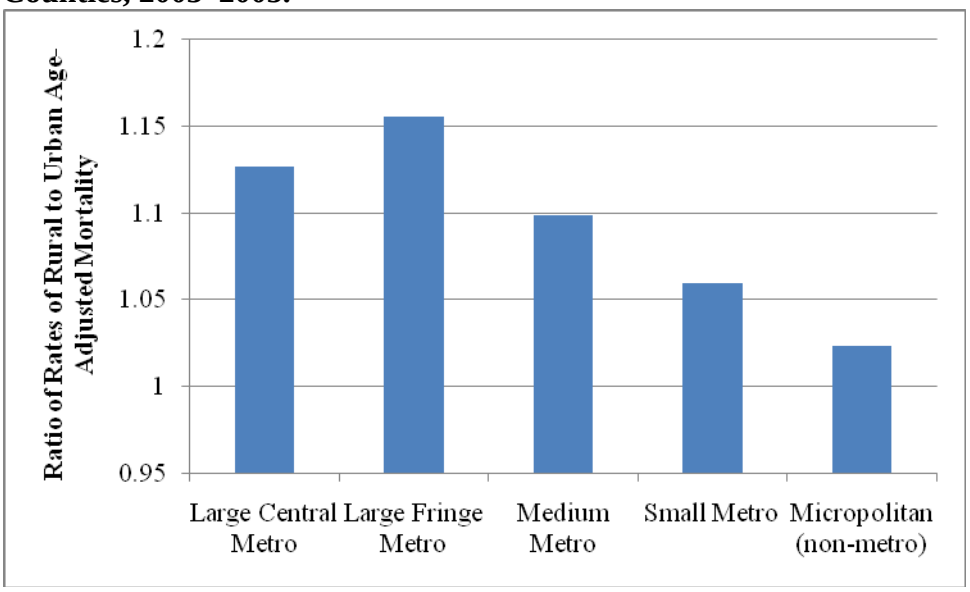
Figure 1: Ratio of Rates of Rural to Urban Age-Adjusted Mortality, 2006, 22 Countries



Source: United Nations Demographic Yearbook 2006, Tables 7 and 20. Rates calculated using 2006 data and 2006 standard population. Note: Age category data for Iceland (0, 1–4, 5–9, 10–14, 45–49,) Estonia (0, 1-4), and Moldova (0, 1–4) were missing.

A six-level urban-rural classification scheme for United States counties, developed by the National Center for Health Statistics, was used in combination with US mortality data to show age-adjusted mortality by urban-rural residence.[48] The most rural areas were classified as "non core" (non metro). Figure 2 shows the age-standardized mortality rates of the rural areas (non-core, non-metro areas) divided by the age-standardized mortality rates of the other areas. The ratios are ordered from the most urban to the least urban. Except for the large central metro areas, the results show a clear gradient as age-standardized mortality decreases from more urban to more rural areas (non-metro areas), an urban advantage that is clearly linked to the "degree of urbanicity". The large central metropolitan areas are thought to have a slight health disadvantage relative to the other urban areas because the availability of public transport in central districts attracts the poor and presumably less healthy migrants relative to urban fringe areas.[49]

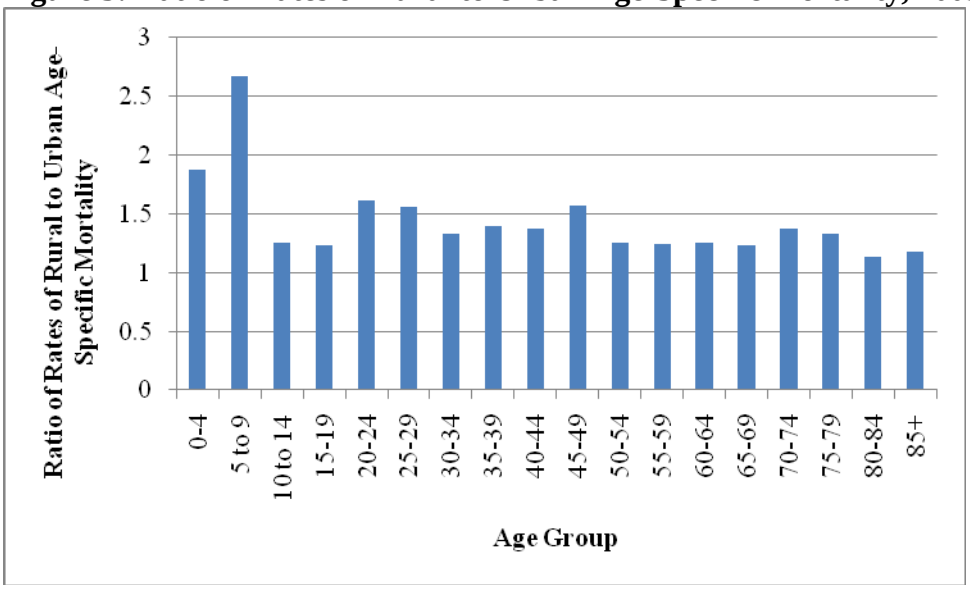
Figure 2: Ratio of Rates of Rural to Urban Age-Adjusted Mortality in United States Counties, 2003–2005.



Source: Centers for Disease Control and Prevention, National Center for Health Statistics. Compressed Mortality File 1999-2005. CDC WONDER On-line Database, compiled from Compressed Mortality File 1999-2005 Series 20 No. 2K, 2008. Accessed at http://wonder.cdc.gov/cmf-icd10.html on Jan 26, 2009.

Figure 3 shows that the ratios of rates of rural to urban age-specific mortality in India exceed unity for all age groups.[50]

Figure 3: Ratio of Rates of Rural to Urban Age-Specific Mortality, 2003, India



Source: 2003 National Registration Data, India

Figure 4a presents the ratios of rates of rural to urban age-specific mortality in China for males in each five-year age group from 0–4 to 75–79, and in the open-ended category 80+ based on 2000 census data. Figure 4b presents the corresponding data for females.

Figure 4a: Ratio of Rates of Rural to Urban Male Age-Specific Mortality in China, 2000

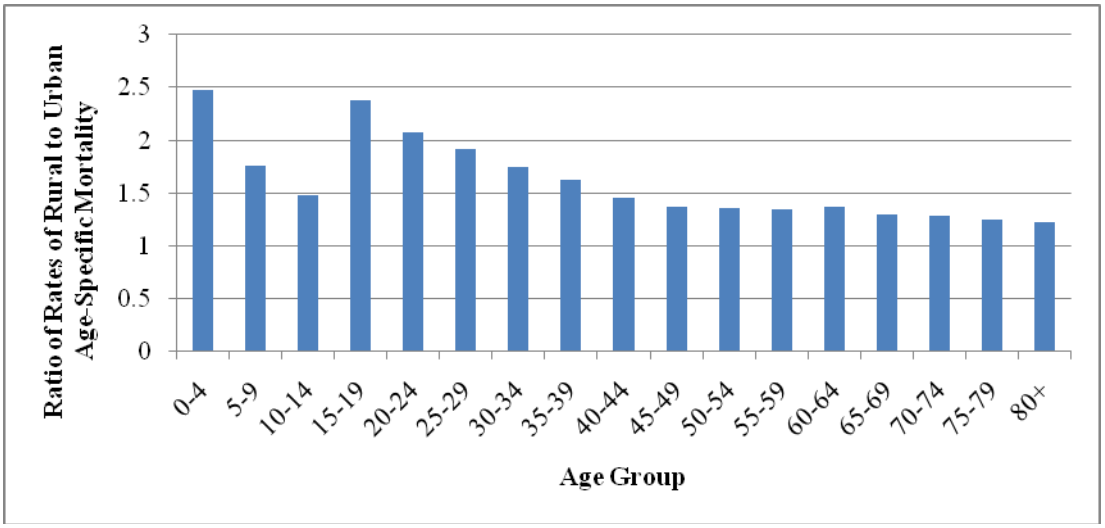
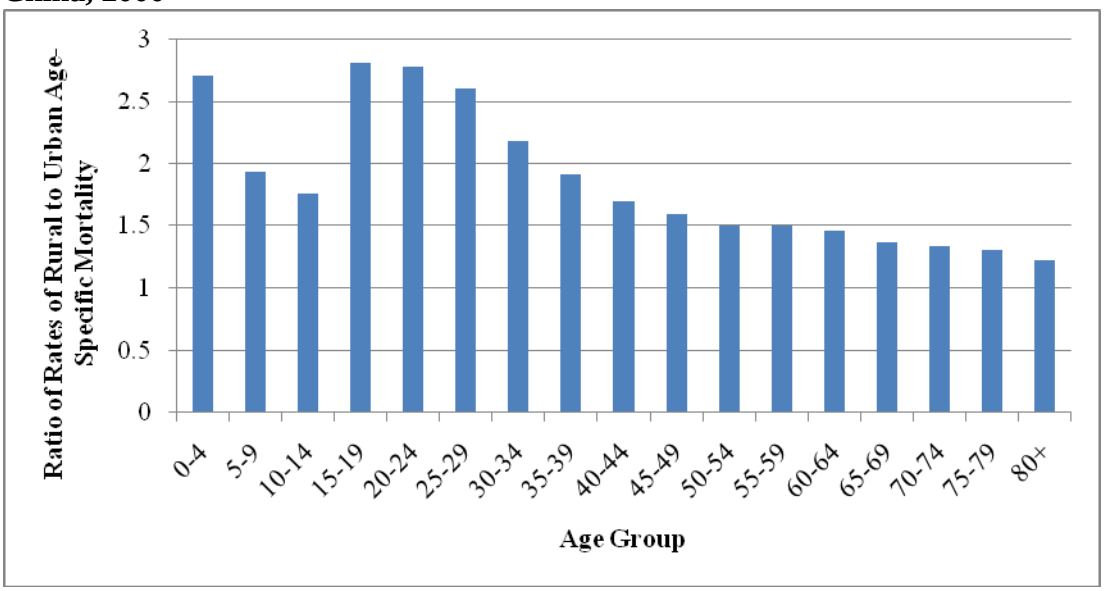


Figure 4b: Ratio of Rates of Rural to Urban Female Age-Specific Mortality in China, 2000



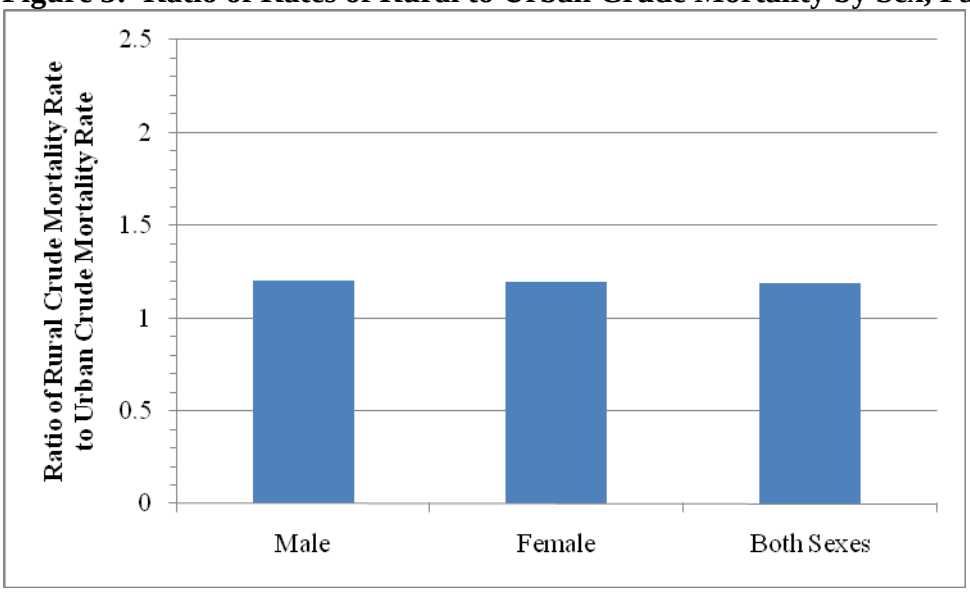
Source: Calculated based on China 2000 Population Census database by Cao, GY, International Institute for Applied Systems Analysis, unpublished data[51]

These figures illustrate clearly that for all age categories and for both sexes, there is a substantial urban health advantage in China.

In the case of Pakistan, crude mortality rates disaggregated by sex are available.[52] The ratios of rates of rural to urban crude mortality are shown for males, females, and both

sexes in Figure 5. For both males and females, the ratios are almost the same. These results suggest that at least for overall health, differentials in migration rates by sex may not be an important cause of observed rural-urban health differentials.

Figure 5: Ratio of Rates of Rural to Urban Crude Mortality by Sex, Pakistan, 2005

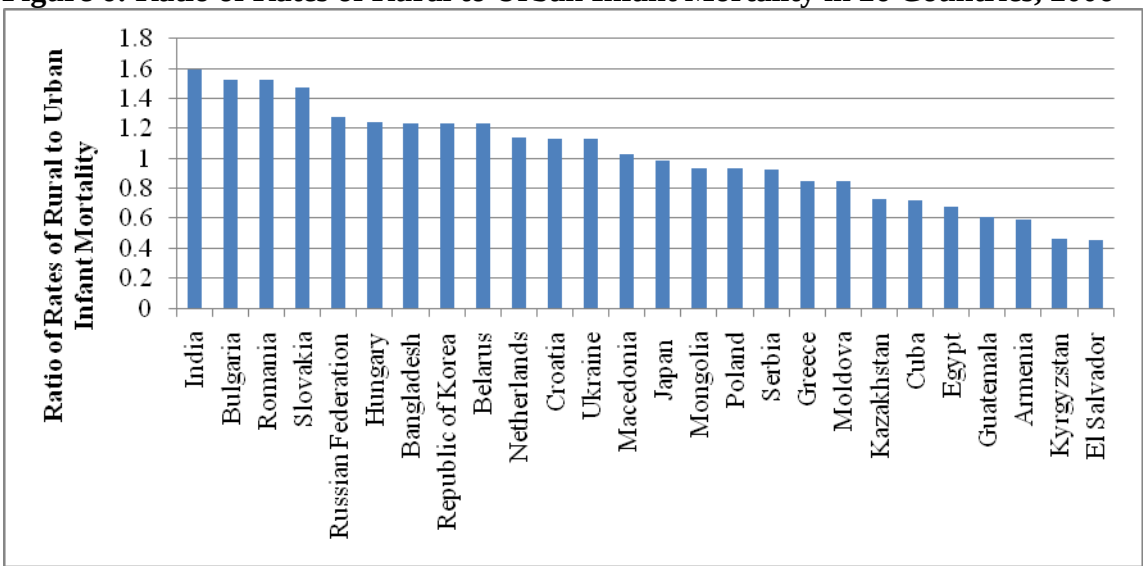


Source: Pakistan Demographic Survey, 2005, Federal Bureau of Statistics, Islamabad, Pakistan. Available at:
http://www.statpak.gov/pk/depts/fbs/staitsitcs/pds2005/pds2005.html

Infant mortality (mortality below age one) and child mortality (mortality between the ages of one and five) are among the most useful metrics for comparing the overall state of health in urban and rural areas since they are only slightly affected by age structure.

Figure 6 shows the ratio of rates of rural to urban infant mortality in 26 developing and developed countries for which data are disaggregated by urban or rural residence.[53] In about half of the countries, rural mortality exceeds urban mortality (the ratio of rates of rural to urban infant mortality > 1). Like Figure 1, Figure 6 refers to a very small convenience sample of nations. Hence, we cannot know whether this corresponds to a worldwide pattern. Furthermore, as in the case of Figure 1, the ratios of rates illustrated in Figure 7 may suffer from a systematic downward bias, since birth and death registration are likely to be more complete in urban areas such that infant mortality is more likely to be under-reported in rural areas (especially in developing countries).

Figure 6: Ratio of Rates of Rural to Urban Infant Mortality in 26 Countries, 2006



Source: United Nations Demographic Yearbook 2006, Table 15

According to a survey of infant mortality conducted in Pakistan in 2005, the ratio of rates of rural to urban infant mortality was 1.21. That is, infant mortality was more than 20 percent higher in the rural areas of Pakistan.[54]

Like infant mortality, under-five mortality (mortality from birth to age five) is not significantly affected by age structure.

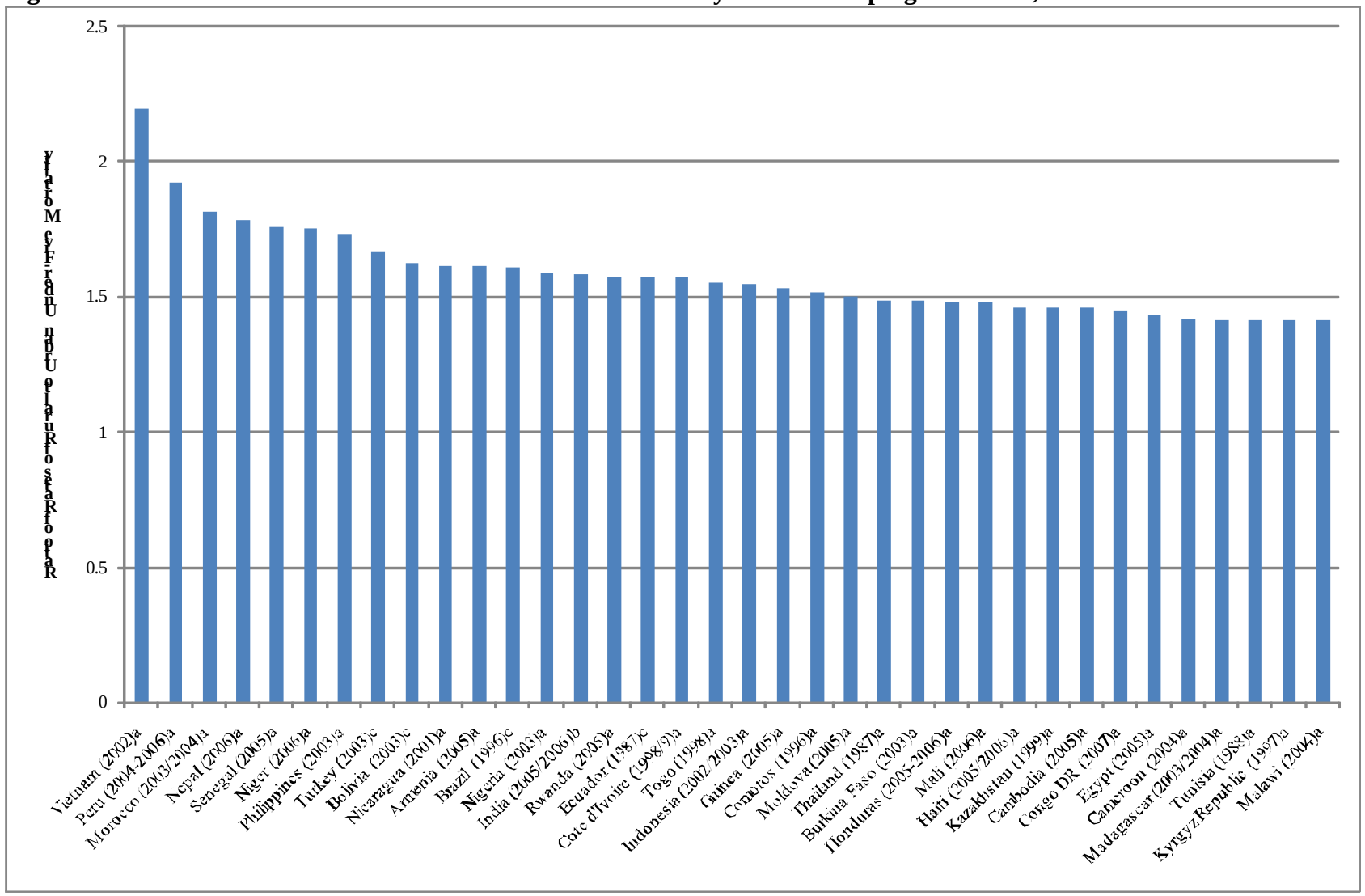
National registration data on under-five mortality in India show an urban advantage. The ratio of rates of rural to urban under-five mortality in India in 2003 was 1.9. That is, under-five mortality was almost twice as high in rural areas as compared to urban areas.[55]

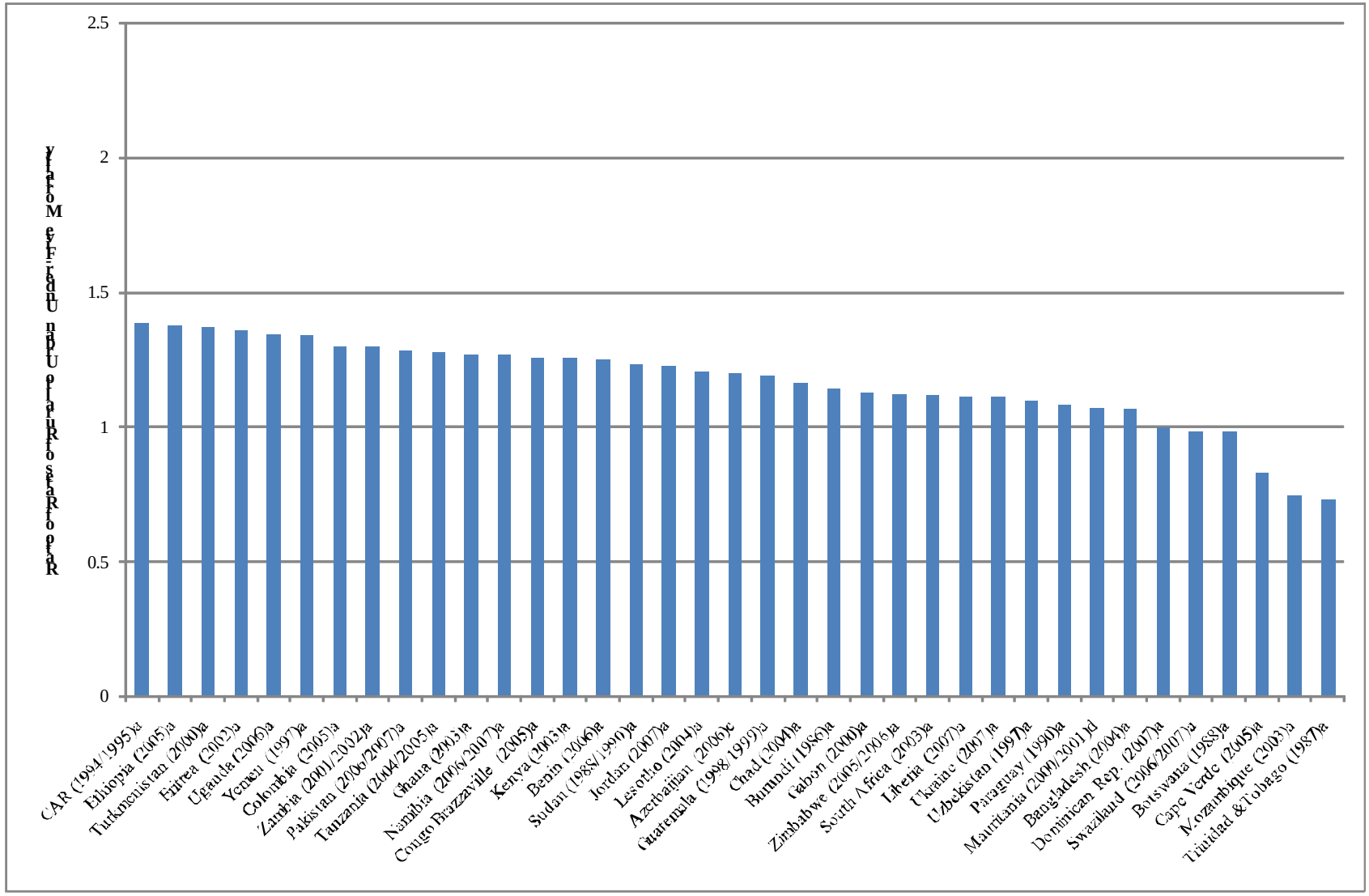
Data on under-five mortality in urban and rural areas also have been collected for many developing countries by the Demographic and Health Survey. Recent data from 73 countries surveyed are presented in Figure 7, which shows the ratio of rates of rural to urban under-five mortality for each country. Table 1 lists the countries at various ranges of the ratio of rates of rural to urban under-five mortality. The data show that there is a substantial urban advantage in under-five mortality in most countries. The rural under-five mortality rate was higher in 67 of the 73 countries. The mean value of the ratio of rates of rural to urban under-five mortality was 1.37. Thus, under-five mortality is almost forty percent greater in rural than in urban areas. This is greater than the standard deviation of the ratios (0.265). The rural to urban ratio of rates was less than unity in only five countries. Rural under-five mortality was 25 percent higher than urban under-five mortality in 51 countries. The modal value of the urban health advantage was 41 percent. Clearly that advantage was large and widespread.

These results suggest that, in developing countries, urbanization is strongly associated with an improved general level of health. This sample of 73 DHS countries, though not random, is undoubtedly representative of the developing world outside of China. In 2000,

the total population of the DHS survey countries described above was 2.948 billion, or 81 percent of the populations of all the developing countries (excluding China). Recall also that Figures 4a and 4b show that the rural mortality rate substantially exceeds the urban mortality rate for almost every age category in China. Given these DHS data and our earlier results for China, we suggest that for the developing world, urbanization is associated with a significantly improved general state of health. The same conclusion is reached in studies of 47 developing countries and of China.[56] [57]

Figure 7: Ratio of Rates of Rural to Urban Under-Five Mortality in 73 Developing Countries, Different Years




2.5
2
1.5
1
0.5
0
CAR (1994/1995)a
Ethiopia (2005)a
Turkmenistan (2000)a
Eritrea (2002)a
Uganda (2006)a
Yemen (1997)a
Colombia (2005)a
Zambia (2001/2002)a
Pakistan (2000/2007)a
Tanzania (2004/2005)a
Ghana (2003)a
Namibia (2006/2007)a
Congo Brazzaville (2005)a
Kenya (2003)a
Benin (2006)a
Sudan (1988/1990)a
Jordan (2007)a
Lesotho (2004)a
Azerbaijan (2006)c
Guatemala (1998/1999)a
Chad (2004)a
Burundi (1986)a
Gabon (2000)a
Zimbabwe (2005/2006)a
South Africa (2003)a
Liberia (2007)a
Ukraine (2007)a
Uzbekistan (1997)a
Paraguay (1990)a
Mauritania (2000/2001)d
Bangladesh (2004)a
Dominican Rep. (2007)a
Swaziland (2006/2007)a
Botswana (1988)a
Cape Verde (2005)a
Mozambique (2003)a
Trinidad &Tobago (1987)a

Source: Demographic and Health Survey. Survey years are noted in parentheses. Lower-case letters denote the period preceding the survey: 10 years (a), 4 years (b), 5 years (c), or 1 year, 1997 (d).

Table I: Developing Countries with Ratios of Rates of Rural to Urban Under-Five Mortality at Specified Values, Based on 73 DHS Surveys

	Ratio of Rates of Rural to Urban Under-Five Mortality					
	0.75–0.99	**1.0–1.24**	**1.25–1.49**	**1.5–1.74**	**1.75–1.99**	**2.0–2.25**
	Swaziland	Sudan	Thailand	Philippines	Peru	Vietnam
	Botswana	Jordan	Burkina Faso	Turkey	Morocco	
	Cape Verde	Lesotho	Honduras	Bolivia	Nepal	
	Mozambique	Azerbaijan	Mali	Nicaragua	Senegal	
	Trinidad and Tobago	Guatemala	Haiti	Armenia	Niger	
		Chad	Kazakhstan	Brazil		
		Burundi	Cambodia	Nigeria		
			Congo Democratic Republic	India		
		Gabon	Egypt	Rwanda		
		Zimbabwe	Cameroon	Ecuador		
		South Africa	Madagascar	Cote d'Ivoire		
		Liberia	Tunisia	Togo		
		Ukraine	Kyrgyz Republic	Indonesia		
		Uzbekistan	Malawi	Guinea		
		Paraguay	Central African Republic	Comoros		
		Mauritania	Ethiopia	Moldova		
		Bangladesh	Turkmenistan			
		Dominican Republic	Eritrea			
			Uganda			
			Yemen			
			Colombia			
			Zambia			
			Pakistan			
			Tanzania			
			Ghana			
			Namibia			
			Congo (Brazzaville)			
			Kenya			
			Benin			
Totals:	**5**	**17**	**29**	**16**	**5**	**1**

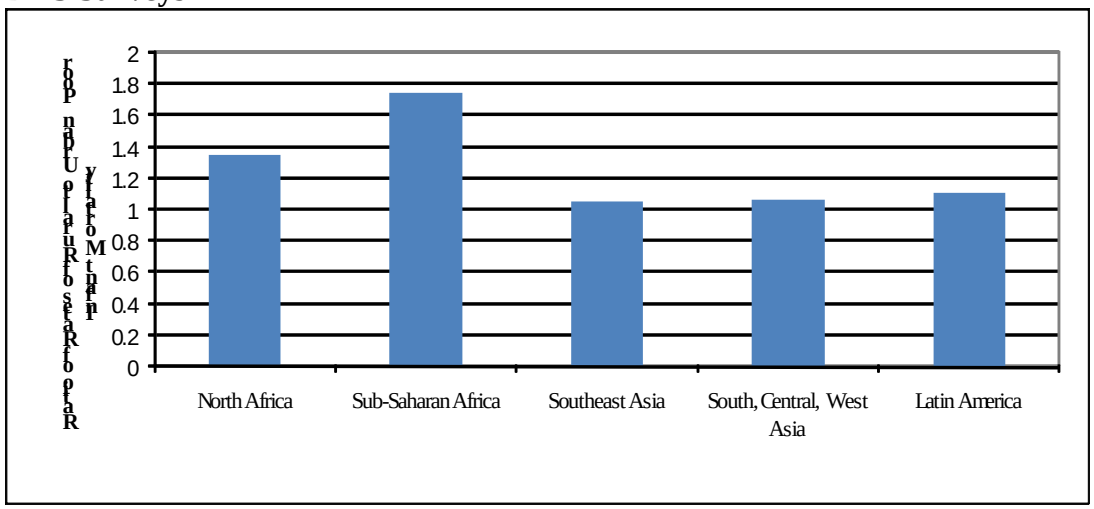
Source: Demographic and Health Survey

A plausible objection to the conclusion of the DHS data is that if health outcomes were very unevenly distributed within urban areas, under-5 mortality in slums may exceed that of rural areas and, as a result, urbanization would have a negative effect on overall national health as people move from rural areas to less healthful urban slums. Among the 73 DHS countries considered above, under-5 mortality could be greater in urban slums

than rural areas if, on average, under-5 mortality in slums were 68 percent greater than in non-slum urban areas (assuming that 1/3 of the urban population lives in slums).

The results of 87 DHS surveys shown in Figure 8 indicate that in all developing country regions, infant mortality rates are higher in rural areas than in poor urban areas. However, in 25 of those 87 DHS studies, infant mortality was higher among the urban poor than among those living in rural areas. Furthermore, several studies have shown significantly higher infant and child mortality rates among the urban poor than among rural children.[58 59 60]

Figure 8: Ratio of Rates of Rural to Urban-Poor Infant Mortality, By Region, 87 DHS Surveys



Source: Montgomery (2003), Table 7-6, p. 281.

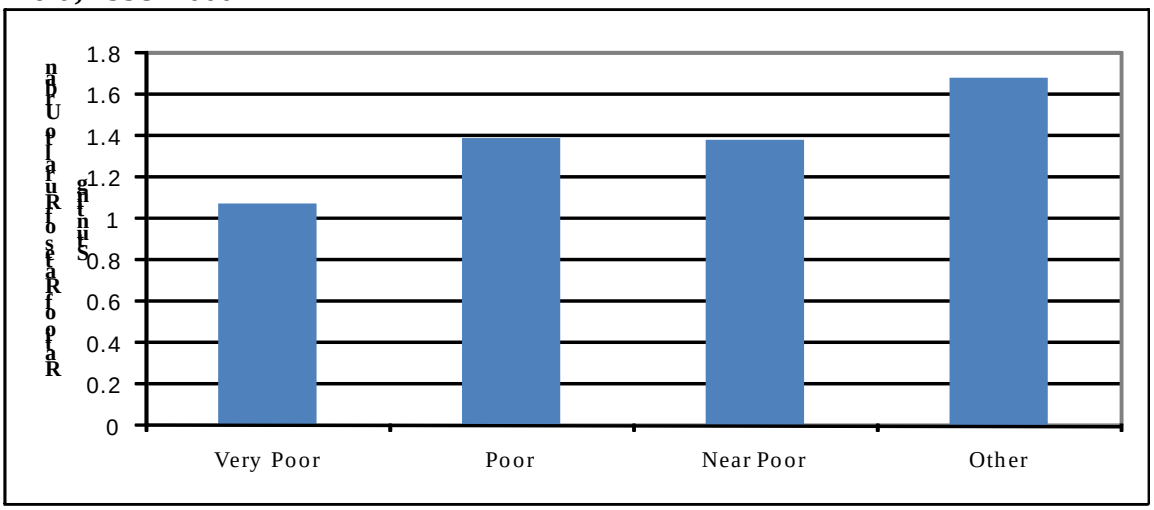
A study conducted in the 1990s in Kenya concluded that infant and child mortality in Nairobi's slums exceeded that of rural Kenya. Under-5 mortality in the slums was 82 percent greater than that in the rest of Nairobi. As a result, under-5 mortality in the urban slums of Nairobi is 30 percent higher than that in the rural areas of Kenya (Montgomery, 2008). However, this figure compares the poorest areas of Nairobi with the entire rural population, of all income levels. We argue that such a comparison may not be useful for assessing the health consequences of rural-urban migration because it is not likely that well-to-do rural dwellers would migrate to the urban slums.[61]

To properly assess the implications of urbanization for under-5 mortality, one must compare under-5 mortality among poor urban dwellers with under-5 mortality among poor rural dwellers. Although the data needed to do this are not available in the case of Kenya, rural-urban comparisons of three other health indicators using comparable income levels have been made for India in 1998–2000, and one such comparison is available for Egypt in 2005.[62]

Figure 9 shows the ratio of rural to urban percentage of children suffering from malnutrition (stunting) in India during the period 1998–2000. For every level of socio-economic status (very poor, poor, near poor and other) the ratio is greater than one,

indicating better health conditions in urban areas for children at comparable socio-economic levels.

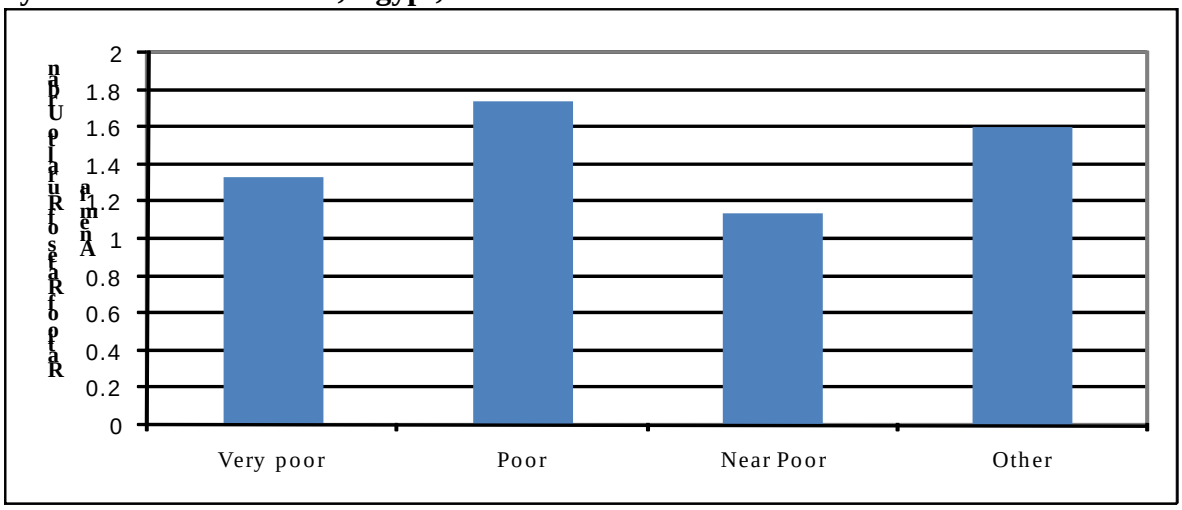
Figure 9: Ratio of Rates of Rural to Urban Child Stunting, by Poverty Status, India, 1998–2000



Source: Montgomery (2008), Figure 4, p. 212.

Figure 10 shows the ratio of rural to urban percentage of children suffering from anemia in Egypt during the year 2005. For every level of socio-economic status the ratio is greater than one in rural areas, indicating better health conditions in urban areas for children at comparable socio- economic levels.

Figure 10: Ratio of Rates of Rural to Urban Percentage of Children with Anemia, by Socioeconomic Status, Egypt, 2005



Source: Montgomery (2008), Figure 5, p. 212.

Two other studies of women's health in India in the period 1998–2000 found that the percentage of women having received any prenatal care, and the percentage of births attended by a physician or a trained nurse-midwife were higher in urban areas for each

poverty status.[63] To make valid health comparisons between rural and urban populations, it is necessary to disaggregate measurements of health by components of urban areas and socioeconomic status.

IV. Specific Rural-Urban Health Differentials

In this section, we present an approach for estimating the health impacts of urbanization using condition-specific rural-urban health differentials. We review the findings of a broad cross-section of studies comparing rural and urban prevalence of specific health conditions in developed and developing country contexts. We also consider the determinants of these differentials. Finally, we assess the likely implications of urbanization on national health for each of these specific health conditions and determinants.

Much of the research on the linkage between urbanization and health has been limited to contrasting the state of health in urban and rural areas at a point in time. Since urbanization is a process that occurs over time, such research—though valuable—does not directly assess the health impact of the process of urbanization. In the absence of panel-based studies, one can approach that task indirectly by first measuring rural-urban health differentials, then identifying those differentials that can be attributed to compositional factors, and finally ascribing the remainder of the differentials to contextual factors. That remainder would be a rough measure the potential long-term health impact of moving people from rural to urban areas (urbanization).

If the only causes of rural/urban health differentials are factors that *do not* change when one moves from rural to urban areas (e.g., compositional factors such as age, sex, race, ethnicity), then moving a person from a rural to an urban area should have no effect on national health but would simply change the locus of health problems from rural to urban. If, however, some of the causes of rural/urban health differentials are factors that *do* change when one moves from a rural to urban areas (e.g., contextual factors such as the urban physical, economic, and social environment), then moving a person from a rural to an urban area should have some effect on average national health as well as change the locus of health problems.

The mortality data reviewed above suggested that overall health status is better in urban areas as compared to rural areas, and, therefore, overall health should improve as urbanization trends continue. This section provides a more fine-grained analysis of rural-urban differences in health—and the determinants of those differentials—for both developed and developing countries. The data supporting this analysis can be found in an exhaustive review of research findings (Annexes A through D, accessible at http://xxx...). Using the indirect approach outlined above, we found that some health conditions are likely to improve with greater urbanization, and others will worsen. For still others, it is not yet possible to discern a clear pattern. For each health condition or health determinant, urbanization could have implications for national-level health. .

Annexes A through D present the findings from individual studies, identified by keywords searches of the literature, conducted in a variety of different geographic contexts. These annexes have aggregated individual studies into meaningful groups, organized following the outline of the WHO Burden of Disease[64] study, and have presented the principal findings in a tabular form. Tables II–V below summarize the findings described in those annexes, showing the number of findings that report an urban causal advantage, a rural causal advantage, or no residence-based causal advantage in three columns. Using the binomial probability distribution, we calculated the probability of finding an observed sample result (see http://www.stat.tamu.edu/~west/applets/binomialdemo.html) if there was no advantage in the universe. In the summary tables, we show results of conditions/determinants for which p is less than 0.4 and for which there were at least than three findings. Our text tables also suggest plausible contextual explanations for the observed rural-urban differentials.

It is important to note that not all studies sampled were conducted with the same design or with comparable quality. The different conclusions of some of the studies may, in part, be a result of using different methodologies, particularly the definition of "urban". There are only a few disease conditions for which the findings of a very clear rural or urban advantage pattern are robust. Although many individual studies of other conditions show a statistically significant urban or rural advantage after controlling for compositional factors, they are offset by other studies of the same condition showing the opposite pattern of advantage. Therefore, the studies are limited in developing a clear picture about the universe of possible studies.

This aggregate presentation, which assumes the absence of compositional influencing factors, enables us to draw potentially useful policy implications from a significant number of already available research findings. It points to the likely direction of the health effects of urbanization. It is not useful in predicting the size of the likely future shifts in relative prevalence of different health conditions. To do that, it would be necessary to more definitively identify and measure the causes of the observed differentials. Ideally, better methodologies for measuring the impact of urbanization will be developed, tested, and applied in the future.

Table II, which summarizes the significant findings from Annex A, looks at the implications of urbanization in developed countries for several specific health conditions. Urbanization should increase the national prevalence of gynecologic cancers (breast, cervical, ovarian, and uterine). Urbanization should also increase the incidence and prevalence of schizophrenia and intentional, violent injuries (homicides and assaults). Urbanization is likely to result in an overall increase in asthma, COPD, and osteoporosis. On the other hhand, urbanization should improve national health by reducing the prevalence of motor vehicle injuries and suicides.

Table III, which summarizes the most significant findings from Annex B, considers the impact of urbanization on the determinants of health in developed countries. Urbanization is likely to worsen national health status by increasing the national consumption of

alcohol. On the other hand, health-seeking behaviors (e.g., the use of counseling and screening) are likely to increase, thus reducing the incidence, prevalence, and mortality from preventable and treatable conditions. Urbanization is likely to improve national health by improving a variety of health determinants related to differential access to health services, including quality of care, financial access, physical access, and access to diagnostic and treatment services, particularly to breast and cervical cancer-related services.

Table IV, which summarizes the most significant findings from Annex C, looks at rural-urban health differentials in specific health conditions and the implications of increasing levels of urbanization in developing countries. Urbanization is likely to increase the national prevalence, incidence, morbidity, and mortality of HIV/AIDS. Urbanization is also likely to increase the national prevalence of diabetes, cardiovascular disease, and respiratory diseases such as asthma. Urbanization is likely to improve national health by decreasing the prevalence, incidence, morbidity, and mortality of malaria, intestinal nematode infections, and maternal conditions.

Table V, which summarizes the most significant findings from Annex D, considers rural-urban differentials in the determinants of health and the impact of increasing urbanization in developing countries. With increasing urbanization, malaria vectors and under-nutrition, particularly among children, will decrease. Urbanization should worsen national health because high-risk sexual behavior is likely to increase, but health-seeking behaviors would also increase with urbanization. Levels of work-related physical activity would likely decrease. Urbanization would lower national levels of health by raising the national prevalence of cardiovascular disease risk factors. As with the developed countries, urbanization is likely to improve national health by providing greater access to health services.

Table VI summarizes the results contained in Tables II through V concerning the implications of increased urbanization for health conditions and determinants in developed and developing countries, with the proportion of the global burden of disease attributed to each health condition indicated.[65] This table shows clearly that in developed countries, urbanization should have adverse effects on health conditions but, partially offsetting that, urbanization should have favorable effects on health determinants. However, this pattern does not pertain to developing countries where there is no consistent impact of urbanization on either health conditions or determinants.

While our earlier analysis of mortality data shows a clear benefit of urbanization to overall national health, especially in developing countries, no clear health advantage emerges when individual health issues and their determinants are considered. Nevertheless, these findings should provide a useful indicator of the areas where more research, planning, and resources will be needed if nations, both developed and developing, are to meet the 21st century health challenges that will almost certainly be posed by a continuing process of urbanization.

Table II: Rural/Urban Health Differentials in Developed Countries and their Implications for National Health

Condition (Incidence, Prevalence, Mortality, and Morbidity)	Number of findings showing causal health advantage in:			P-urban[a]	P-rural	Plausible Explanatory Hypotheses	Likely Impact of Urbanization on National Health
	Urban areas	Rural areas	No Advantage				
Breast, cervical, ovarian, and uterine cancer	2	6	2		0.377	Lower fertility rates may increase breast cancer Greater sexual activity may increase cervical cancer	Increased incidence, prevalence, mortality, and morbidity of breast, cervical, ovarian, and uterine cancer
Schizophrenia	0	6	0		0.156	Greater stresses of urban life Greater access to diagnosis and treatment	Increased incidence, prevalence, mortality, and morbidity of schizophrenia
Respiratory diseases – Asthma, Allergies, and COPD	1	8	4		0.2905	Greater exposure to allergens early in life Easier access to emergency medical care	Reduced incidence, prevalence, mortality, and morbidity of the respiratory diseases asthma, allergies, and COPD
Musculoskeletal Diseases-Osteoporosis	0	11	0		0.0005	Greater work-related physical activity in rural areas More sedentary urban life styles	Increased incidence, prevalence, mortality, and morbidity of the musculoskeletal disease osteoporosis.
Motor vehicle injuries	15	0	1	0.0003		More miles driven in rural areas Greater speeds in rural areas	Reduced incidence, prevalence, mortality, and morbidity from motor-vehicle injury
Intentional injury – Homicide and Assault	0	4	0		0.0625		Increased incidence, prevalence, mortality, and morbidity from violent intentional injuries.

Self-Inflicted Injuries	17	2	5	0.032		Greater social isolation Less access to mental health services	Reduced incidence, prevalence, mortality, and morbidity from self-inflicted injuries

[a] Binomial probability distributions of an observed sample result if there were no urban/rural advantage in the universe, calculated using calculator at http://www.stat.tamu.edu/~west/applets/binomialdemo.html

Table III: Rural/Urban Health Determinants in Developed Countries and their Implications for National Health

Determinant	Number of findings showing a causal health advantage in:			P-urban[a]	P-rural	Plausible Explanatory Hypotheses	Likely Impact of Urbanization on National Health
	Urban areas	Rural areas	No Advantage				
Alcohol abuse	8	4	1	0.2905		Higher levels of stress Less social control Greater availability of drugs	Reduced national health resulting from increased abuse of alcohol
Health Seeking Behaviors (Use of counseling and screening)	17	1	3	0.0036		Easy access to counseling and screening in urban areas Greater rural stoicism and fatalism in rural areas	Improved national health resulting from reduced incidence, prevalence, morbidity, and mortality rates for preventable or treatable conditions
Differential Access to Health Services (Quality of Care)	10	1	0	0.0059		Fewer rural health resources	Improved national health resulting from better quality health services
Differential Access to Treatment (Financial Access)	4	2	0	0.3438		Fewer persons covered by medical insurance	Improved national health resulting from better financial access to appropriate health services
Differential Access to Treatment (Physical Access)	11	1	4	0.1051		Greater distances to specialized caregivers	Improved national health resulting from better physical access to appropriate health services
Differential Access to Treatment (Access to Diagnostic and	40	7	22	0.1142		Lack of access to specialists and technology	Improved national health resulting from better access to diagnostic and treatment services

Treatment Services)						Screening and preventative services more common in urban areas Most-intensive services used in urban areas	
Differential Access to Breast and Cervical Cancer Diagnostic and Treatment Services	10	0	6	0.2272		Lack of access to specialists and radiation technology	Improved national health resulting from better access to appropriate breast and cervical cancer diagnostic and treatment services.
Differential Access to Multiple Sclerosis Diagnostic and Treatment Services	3		3	0.125		Lack of access to specialists	

[a] Binomial probability distributions of an observed sample result if there were no urban/rural advantage in the universe, calculated using calculator at http://www.stat.tamu.edu/~west/applets/binomialdemo.html

Table IV: Rural/Urban Health Differentials in Developing Countries and their Implications for National Health

Condition (Incidence, Prevalence, Mortality, and Morbidity)	Number of findings showing a causal health advantage in:			P-urban[a]	P-rural	Plausible Explanatory Hypotheses	Likely Impact of Urbanization on National Health
	Urban areas	Rural areas	No Advantage				
HIV/AIDS	1	6	1		0.1445	Greater social interaction More risky sexual behavior in urban areas Later marriage in urban areas	Reduced national health resulting from increased incidence, prevalence, and mortality of HIV/AIDS.
Malaria	5	1	0	0.1094		Improved nutrition, increased vaccine coverage, better access to health services, greater use of insecticide treated nets and screens in urban areas Adverse effect of urban water pollution on vector larval habitat Reduced probability of being bitten by a malaria vector where the ratio of humans to mosquitoes is higher	Improved national health resulting from decreased incidence, prevalence and mortality of malaria.
Intestinal nematode	0	3	1	0.3125			Improved national health resulting from decreased incidence, prevalence, morbidity and mortality of

infections							intestinal nematode infections.
Maternal conditions	3	0	0	0.125			Improved national health resulting from decreased incidence, prevalence, morbidity and mortality of maternal conditions.
Diabetes	1	6	0		0.0625	Greater food consumption and richer diets in urban areas Reduced physical activity in urban areas	Reduced national health resulting from increased incidence, prevalence, morbidity, and mortality of diabetes and its adverse consequences
Cardiovascular disease	2	5	1		0.3633	Greater food consumption and richer diets in urban areas Reduced physical activity in urban areas	Reduced national health resulting from increased incidence, prevalence, morbidity, and mortality of cardiovascular disease and its adverse consequences
Respiratory diseases (Asthma)	0	3	0		0.125	Earlier exposure to allergens in rural areas seems to confer some immunity	Reduced national health resulting from increased incidence, prevalence, morbidity, and mortality of asthma

[a] Binomial probability distributions of an observed sample result if there were no urban/rural advantage in the universe, calculated using calculator at http://www.stat.tamu.edu/~west/applets/binomialdemo.html

Table V: Rural/Urban Health Determinants in Developing Countries and their Implications for National Health

Determinant	Number of findings showing a causal health advantage in:			P-urban[a]	P-rural	Plausible Explanatory Hypotheses	Likely Impact of Urbanization on National Health
	Urban areas	Rural areas	No Advantage				
Malaria vectors	3	0	0	0.125		Principal malaria vectors do not reproduce as well in urban areas	Improved national health resulting from decreased incidence, prevalence, morbidity, and mortality of malaria
Differential access to treatment and health services, utilization rates, and quality of care	6	1	2	0.2539		More caregivers Higher quality of facilities Greater proximity to health care facilities	Improved national health resulting from increased access to and quality of health care facilities
High-risk sexual behaviors	2	7	1		0.1719	Less social control in urban environments A greater portion of unmarried people in urban environments	Reduced national health resulting from increased incidence, prevalence, morbidity, and mortality of sexually transmitted diseases (e.g., HIV/AIDS)
Physical activity	1	7	0		0.0352	Greater requirement for work-related physical activity in rural areas	Reduced national health resulting from increased incidence, prevalence, morbidity, and mortality of diabetes, cardiovascular diseases, and other obesity-related illnesses
Health-seeking behaviors	5	0	1	0.1094		Easy access to counseling and screening in urban areas Greater rural stoicism and fatalism in rural areas	Improved national health resulting from reduced incidence, prevalence, morbidity, and mortality rates for preventable or treatable conditions

Under-nutrition	11	3	2	0.1051		Inability to purchase food due to low rural incomes Higher incomes in urban areas	Improved national health resulting from reduced incidence, prevalence, morbidity, and mortality from under-nutrition
Cardiovascular and diabetes risk	1	22	6		0.0041	Greater requirement for work-related physical activity in rural areas Higher proportion of fat in urban diet	Reduced national health resulting from increased incidence, prevalence, morbidity, and mortality of diabetes and cardiovascular diseases

[a] Binomial probability distributions of an observed sample result if there were no urban/rural advantage in the universe, calculated using calculator at http://www.stat.tamu.edu/~west/applets/binomialdemo.html

Table VI: Summary of the Implications of Increased Urbanization for Health Conditions and Determinants in Developed and Developing Countries

Health Conditions			Health Determinants	
Likely to Decrease with Increased Urbanization	**Likely to Increase with Increased Urbanization**		**Likely to Improve with Increased Urbanization**	**Likely to Worsen with Increased Urbanization**
Developed Countries				
Motor-vehicle injuries (2.4)[a] Self-Inflicted Injuries (1.2)	Breast, cervical, ovarian, and uterine cancer (1.1) Schizophrenia (0.8) Respiratory diseases – Asthma and COPD (3.6) Musculoskeletal Diseases-Osteoporosis (1.2) Intentional injury – homicides and assaults (1.2)		Health-seeking Behaviors (Use of counseling and screening) Quality of Care Financial Access to Health Services Physical Access to Health Services Access to Diagnostic and Treatment Services (access to breast and cervical cancers and multiple sclerosis services significant)	Alcohol abuse
Developing Countries				
Malaria (1.9) Intestinal nematode infections (0.3) Maternal conditions (1.9)	HIV/AIDS (3.5) Diabetes (1.6) Cardiovascular disease (13.5) Respiratory diseases -- Asthma (0.9)		Malaria vectors Differential access to treatment and health services, utilization rates and quality of care Health-seeking behaviors Under-nutrition	High-risk sexual behaviors Physical activity Cardiovascular and diabetes risk

[a] WHO (2004) estimated percent of total burden of disease (in 3% discounted, non-age-weighted disability-adjusted life years) is shown in parentheses

V. Conclusions and Implications for Research and Policy

Cross-country comparisons of mortality rates—a rough measure of health—by urban-rural residence suggest that urbanization may be advantageous for health overall. When we examine specific health conditions and the factors that influence them across different geographic contexts, however, the net effects of urbanization on health are less clear. Increasing urbanization is likely to increase the prevalence of some health conditions while reducing the prevalence of others. For still other conditions, urbanization has both positive and negative health impacts. In many cases, the net effect on national health is unclear.

Because of the projected movement of populations to cities, it should be possible to reduce mortality, especially in the developing world. Besides increasing general well being, this will also pose new challenges for policy makers. For example, given the significant increase of the numbers of people who will be able to reach old age as a result of moving to more healthful urban environments, it would be prudent for those policy makers to begin to put in place the economic and social frameworks needed to support a significant increase in the world's elderly population.

Implicit in this analysis is the identification of a number of critical needs for both research and policy on urbanization and health—above all the need for a comprehensive approach that looks at complex linkages.

Future research in assessing the effects of urbanization on health should include efforts to track the health changes of individuals and families over time as they move from rural to urban areas. It would also be useful to track health changes in a cross-section of countries with differing rates of urbanization.[66] There is also a need for area-based panel studies that examine health issues over time as rural areas gradually urbanize. To deal with the problem of health-selective rural to urban migration, these panel studies should follow the health outcomes of panel members who migrate out of the study areas.

Making more valid comparisons will require the application of standardized definitions of urban and rural residence across countries. Standardized scales measuring degrees of rurality/urbanicity should also be developed. Failing that, published data might be grouped by countries with similar definitions of rural and urban areas. In addition, more precise and validated measures of urbanization should be developed in order to identify the specific aspects of urbanization that are associated with different health outcomes.

To quantify the effect of the urban and rural environments on health in developing countries, increased efforts to generate reliable data on vital events—including births, deaths, the incidence of diseases, and the determinants of diseases—should be supported by the international community.

Specific areas in need of research are epidemiological studies on the linkages between urbanization and specific health conditions. These include the growing disease burden from emerging infectious diseases, such as HIV/AIDS, in urban areas. A promising line

of research calls for measuring the impact of urbanization on infectious disease transmission by integrating land-use development models with population projection epidemiology models as has been done for influenza transmission in the United Kingdom.[67]

The very mixed research findings on the impact of urbanization on cardiovascular disease, diabetes, and cancer indicate a need for further study. It is also important to gauge the role played by personal behavior and lifestyle choices in rural-urban health differentials and differences in health determinants. For most health conditions and determinants, some type of behavioral component (e.g., diet, exercise, high-risk behavior, attitudes about health, tobacco use) appears to be a significant factor. Our analysis shows a need for more study of rural-urban differences in health conditions and risk factors in the developing world, notably for conditions that account for a large proportion of the global burden of disease—cancer, neuropsychiatric diseases, and cardiovascular disease.

Urban poverty is a key element to understanding the health implications of urbanization. The fact that there are important links between poverty and health makes a case for developing a systematic and useful body of internationally comparable health, income, and wealth statistics disaggregated on an *intra-urban* as well as rural-urban basis. In order to measure the effects of different degrees of "urbanicity", additional systems of data collection should be designed to facilitate intercity comparisons within countries and between countries. In particular, data are needed on mortality, morbidity, health service delivery, and public health infrastructure for varying degrees of rurality/urbanicity and varying degrees to which rural areas are linked to nearby urban areas. Similar data are needed for cities of different sizes and functions, for various socioeconomic groups (especially income levels), and for neighborhoods within cities.

A central issue for policy consideration from our analysis is that much of the "excess" urban and rural mortality and morbidity may arise from personal behavior, attitudes, and lifestyle decisions pertaining to high-risk behavior, diet, exercise, and substance use. What life-style-improving interventions could be adopted in urban environments to make urban living even healthier? Differences in health attitudes between rural and urban populations also indicate the need for specific policies to target communities in rural areas to increase their demand for diagnosis and treatment.

Designing appropriate health interventions will be critical for targeting emerging health burdens in urban and rural areas as a result of urbanization. As mentioned above, a focus on the urban poor should be a vital element of any policy response. In addition, given the overwhelming number of studies documenting disparities in access to health services and quality of care between rural and urban areas, notably in the area of access to women's health services, the implications of urbanization for health care workforce planning and hospital staffing should be further explored, with concern for meeting the needs of those who remain in rural areas.

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ANNEXES

Is Urbanization Good for a Nation's Health?

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Contents

ANNEX A: RESEARCH FINDINGS ON RURAL-URBAN HEALTH DIFFERENTIALS IN DEVELOPED COUNTRIES

Health Conditions (Incidence, Prevalence, Mortality, and Morbidity):

TABLE A-1: Overall morbidity and mortality

Health Advantage	Study Area(s)	Findings
Urban	Ohio (USA)	In terms of their medical condition, use of medical aids, and symptoms, health status of the elderly improved when they moved from rural to urban areas (Gillanders et al., 1996).
	USA	Premature mortality is higher in rural than in urban areas. The age-adjusted death rate among persons age 1 through 65 was slightly more than 30 percent higher among those who lived in rural areas than among those who lived in urban areas. Rural counties in the US had higher death rates from injuries, suicides, and Chronic Obstructive Pulmonary Disease (COPD). Death rates for cardiovascular diseases and cancer were also higher in rural areas (Eberhardt and Pramuk, 2004).
	the Netherlands	Urban neighborhoods have higher all-cause mortality risks than rural neighborhoods. But this pattern is reversed after adjustment for the contextual factor, neighborhood socioeconomic level. In this sense, urban residence is beneficial to health. This beneficial health aspect of urban life is related to lower cancer- and heart-disease-related mortality, especially for young adults and the elderly (Van Hooijdonk et al., 2008).
	Northern Ireland	There was a positive health gradient from rural to urban areas when young people were considered. Children and adolescents in rural areas had higher mortality rates (O'Reilly et al., 2007).
	Canada	Beyond age 80, rural residents showed greater mortality than urban residents (Song et al., 2007).
	Canada	All-cause mortality rates were lowest in urban areas. All-cause mortality increased with increasing remoteness (Pong et al., 2009).
	USA	Residents of rural counties were at greater risk of reporting fair or poor health compared to residents of metropolitan and central core counties. Personal characteristics accounted for only 30 per cent of this differential (Auchincloss et al., 2002).
	North Carolina (USA)	Rural residents reported poorer self-rated health after adjustment for socioeconomic and demographic controls (Blazer et al., 1995).

	Australia	Both Anglo-Australians and Italian-Australians who were rural residents had poorer perceived health status (Lau and Morse, 2008).
	Kentucky (USA)	Even after controlling for demographic variables, the rural elderly have significantly worse health status than their urban counterparts (Mainous and Kohrs, 1995).
	Quebec, Canada	At birth, rural residents have a life expectancy and a healthy life expectancy of 0.5 years and 1.5 years, respectively, less than their urban counterparts (Pampalon et al., 2006).
	USA	The rural veteran population experiences higher disease prevalence and lower physical and mental quality-of-life scores compared to the urban population (Weeks et al., 2006).
Rural	Japan	Rapidly urbanizing rural regions showed a marked decrease in the excess death rate relative to urban regions over time (Fukuda et al., 2004).
	United Kingdom	Self-reported health was better in rural areas (Riva et al., 2009).
	Scotland	Health, as measured by the average level of self reported "limiting long term illness", (LLTI), a health problem or handicap that limited daily activities or work, was highest in rural areas and lowest in urban areas. With the exception of very remote rural areas, there was a clear gradient in LLTI running from the most urban areas to the most rural (Levin, 2003).
	North Carolina (USA)	The results for total mortality indicate that the greatest risks for dying are in urban areas (Clifford and Brannon, 1985).
	USA	For poor black men and women, life expectancy is greater in rural than in urban areas (Geronimus et al., 2001).
	USA	Americans 55 years and older living in the most rural locales and those living in rural communities have the lowest risk of mortality, while those living in central cities had the highest risk of dying during the study period (Smith, et al., 1995).
	USA	Based on multivariate analysis, the immortality hazard ratio of city residents between 1986 and 1994 was 1.62 times greater than that of residents of small towns/rural areas after adjustment for all socio-demographic, socio-economic, and health predictors. Thus, city residence had significantly higher mortality risks not explainable in terms of their sociodemographic, socieconomic or health status at baseline (House et al., 2000).
	Northern Ireland	There was a positive health gradient from urban to rural areas. Higher urban adult death rates were evident for most major causes of death, especially for respiratory diseases and cancer. Those living in rural areas were 20 percent less likely to report a significant long-term illness. Furthermore, this pattern was not greatly altered when socioeconomic and demographic differences were accounted for. Cited risk factors that are higher in urban areas were air pollution, stress, crime, alcohol abuse, and fragmented social networks (O'Reilly et al., 2007).
No Difference	New York State (USA)	In general, the health of the elderly in New York State is better in rural than in urban areas. However, the rural-urban differential disappeared once socioeconomic and demographic factors are taken into account (Krout, 1989).
	North Carolina (USA)	There was no significant relationship between residence and reporting poorer self-rated physical health (Goins and Mitchell, 1995).
	USA	Among women, there were no significant increased mortality risks of city residence for any cause of death (House et al., 2000).
	Canada	Up to age 80, there were few rural-urban differences in frailty (a composite index combining symptoms, diseases, disabilities, unfavorable living conditions) (Song et al., 2007).
	Wales (UK)	Using all-cause premature mortality (before age 75) as an indicator of health among high income residents, there were few differences in health between urban and rural areas. But among the poor, health was better in rural areas (Senior et al., 2000).
No Gradient	United Kingdom	After adjusting for individual characteristics, the level of self-rated health was highest in villages and Greater London and lowest in semi rural areas and other cities. There was no clear rural/urban health gradient (Riva et al., 2009).

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TABLE A-2: Infectious Disease

Health Advantage	Study Area(s)	Findings
Urban		
	England and Wales	The prevalence of tuberculosis was 6.3 fold higher in urban as compared to rural areas (Abubakar et al., 2008).

Rural	UK	The average annual incidence of meningococcal disease was significantly higher in the urban area. Disease incidence was strongly associated with deprivation in the urban, but not in the rural, areas (Olowokure et al., 2006).
No Difference		

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TABLE A-3: Maternal and Perinatal Conditions

Health Advantage	Study Area(s)	Findings
Urban	USA	After controlling for known risk factors, rural residence is associated with slightly higher risk of post-neonatal mortality (Larson, 1997).
	USA	Babies born to women residing in rural counties weighed on average over 700 g less, were an inch and a half shorter, and were born more than 3 weeks earlier than their urban counterparts. They were 4.5 times more likely to have low birth weight (LBW), 4 times more likely to be born preterm, more than 5 times more likely to be admitted to the neonatal intensive care unit (Bailey and Cole, 2009).
	USA	Rates of encephalocele were higher in rural than urban areas (Luben et al., 2009).
	Australia	Premature births from rural mothers had a higher risk of stillbirth and mortality in neonatal intensive care than urban infants (Abdel-Latif et al., 2006).
Rural	Pennsylvania (USA)	A study of pre-term birth and low birth weight found that women residing in large, rural, city-focused areas had lower adjusted odds of both preterm birth and low birth weight as compared to urban women, controlling for individual risk factors, including maternal demographic characteristics, health conditions, and prenatal care use (Hillemeier et al., 2007).
	Taiwan	Based on multilevel logistic regression analysis, the urbanization level was a major contributory factor associated with the mode of childbirth. A patient residing at the time of delivery in a less urbanized community would be less likely to undergo a caesarian section. The odds ratio declined as level of urbanization declined (Chen et al., 2008).
	Spain	A study of neonatal mortality over the period 1975–1998 showed that for all causes, neonatal mortality rate was more elevated in urban areas (Alonso et al., 2006).
No Difference	USA	After controlling for known risk factors, rural residence is associated with no higher risk of low birth weight or neonatal mortality than urban residence (Larson, 1997).
	USA	There was no evidence that rural/urban residence was associated with the rate of change of anencephaly or spina bifida without anencephaly in adjusted analysis (Luben et al., 2009).
	Pennsylvania (USA)	Risks of adverse birth outcomes were not significantly lower among rural women as compared to urban women (Hillemeier et al., 2007).
No Gradient	Iowa (USA)	The mean gestational age and birth weight of infants born to women living in rural areas adjacent to urban areas were higher than those of infants born to women living in urban areas. However, the opposite was true for rural women, who had the shortest gestations, lowest birthweights, longest length of stay, and highest costs (Hulme and Blegen, 1999).

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TABLE A-4: Breast, Cervical, Ovarian, and Uterine Cancer

Health Advantage	Study Area(s)	Findings
Urban	Western Australia	Adjusting for age and tumor characteristics, rural women had an increased likelihood of death within 5 years of breast cancer diagnosis (Mitchell et al., 2006).

	Lithuania	There is greater cervical cancer mortality for rural than for urban females (Smailyte and Kurtinaitis, 2008).
Rural	Canada	Breast cancer rates were much lower in rural areas (Pong et al., 2009).
	USA, Canada, European Countries and Japan	Reported rates of breast cancer incidence are higher in urban than in rural areas. Possible explanations for this are the lower fertility in urban areas, presence of carcinogens in the urban environment, and the greater likelihood of detection of breast cancers in urban areas (Hall et al., 2005).
	North Carolina	The highest age-adjusted incidence of in situ breast cancer during the period 1995–1999 occurred in the most urban counties and the lowest rates occurred in the most rural counties. (The excess urban incidence for invasive breast cancer only applied in the case of white patients.) However, urban counties were most likely to have registry hospitals and higher physician density, which might attract patients who reside in rural areas. Among counties with registry hospitals, urban-rural differentials in the incidence of breast cancer were reduced or eliminated, indicating that the higher urban rate may largely reflect better access to diagnosis and care in urban areas (Hall et al., 2005).
	The Umbrian region of central Italy	The incidence rates for gynecologic cancers (breast, uterine, and ovarian) were higher in urban than in rural areas. The difference may have resulted from more carcinogens in the urban environment. However, the difference may be due to lesser compliance with screening procedures in rural areas (Minelli et al., 2007).
	Quebec, Canada	Urban areas show significantly higher mortality rates due to breast cancer (Pampalon et al., 2006).
	Lithuania	There is greater breast cancer mortality for urban than for rural females (Smailyte and Kurtinaitis, 2008).
No Difference	New Zealand	Urban/rural residence did not have any statistically significant effect on breast cancer survival (Bennett et al., 2007).
	the Netherlands	There is no significant difference between rural and urban areas in breast cancer incidence (Schouten et al., 1996).

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TABLE A-5: Prostate Cancer

Health Advantage	Study Area(s)	Findings
Urban	USA	The rural excess of nonlocalized prostate cancer among rural blacks was especially pronounced (Liff et al., 1991).
	Australia	Men living in rural areas are less likely to be tested for prostate cancer. As a result, there has been a significantly greater decline in prostate cancer mortality in urban than rural areas (Coory and Baade, 2005).
	Canada	Prostate cancer rates were higher in rural areas (Pong et al., 2009).
	Lithuania	There was greater cancer mortality for rural males (prostate) (Smailyte and Kurtinaitis, 2008).
Rural	Illinois (USA)	Risk of prostate cancer was highest in the most highly urbanized area and decreased as rurality increases. (McLafferty and Wang, 2009).
	Scotland	There was strong evidence that the chances for 1 year survival for prostate cancer were poorest for those living in settlement sizes of more than one million. For all other settlement sizes, there was no evidence that small settlement size was a survival disadvantage (Campbell et al., 2000).
No Difference	Lithuania	The prostate cancer mortality rates among urban and rural populations were not different (Smailyte and Kurtinaitis, 2008).
	Netherlands	There is no significant difference between rural and urban areas in prostate cancer incidence (Schouten et al., 1996).
	USA	Among Medicare beneficiaries, there was no evidence that patients in rural areas have poorer lung cancer survival than those in urban areas. Rather, individual and regional socioeconomic factors and a smaller supply of subspecialists per 10,000 individuals 65 years and older were positively associated with a higher risk of mortality. Rural residents are more likely to live in poorer areas with a smaller supply of health care providers (Shugarman et al., 2008).

TABLE A-6: Colorectal Cancers

Health Advantage	Study Areas(s)	Findings

Urban	France	For females, metastases of colorectal cancers were more common in rural populations. For both sexes, severe clinical symptoms were also more common in rural areas (Launoy et al., 1992).
	France	Among females, the fiv- year survival rate from colon cancer was 40% in the urban and 30.7% in the rural population (Launoy et al., 1992).
	North Carolina (USA)	Rural residence was associated with increased colon cancer risk. The odds ratio (OR) for colon cancer associated with residing in a rural area was 1.4. Rural residence was associated with an increased risk of both local and regional/advanced disease (Kinney et al., 2006).
Rural	Lithuania	Significantly higher mortality rates were observed for colorectal cancer in urban than in rural populations of both sexes (Smailyte and Kurtinaitis, 2008).
	USA	Urban residence appears to be associated with later stages of colorectal presentation (Paquette and Finlayson, 2007).
	Japan	The age adjusted death rate (AADR) for left sided colon cancer was higher in urban than in rural areas (Tajima, et al., 1985).
	Illinois (USA)	Risk of colorectal cancer was highest in the most highly urbanized area and decreased as rurality increases (McLafferty and Wang, 2009).
No Difference	California (USA)	The results of multivariate models stratified on socioeconomic status did not indicate any significant difference in stage at diagnosis of colorectal cancer by rural-urban category (Parikh-Patel et al., 2006).
	France	Among males, there was no difference in survival between urban and rural populations (Launoy et al., 1992).
	Netherlands	There is no significant difference between rural and urban areas in colorectal cancer incidence (Schouten et al., 1996).
	Canada	Colorectal cancer rates are about the same in rural and urban areas (Pong et al., 2009).
	North Carolina (USA)	Overal,l the stage of stage of colon cancer did not vary between rural and urban (Kinney et al., 2006).

TABLE A-7: Lung Cancers

Health Advantage	Study Areas(s)	Findings
Urban	Lithuania	The lung cancer mortality rates were significantly higher among rural males compared to among urban males (Smailyte and Kurtinaitis, 2008).
	France	Based on 2 year survival rates for lung cancer, rural areas were significantly correlated with poor survival as compared to urban areas (Pozet et al., 2008).
	British Columbia	Patients living in very rural areas, 65 years and over, and having small cell carcinoma had a risk of death 1.3 times higher than that of subjects from urban areas. They had significantly shorter survival (Westeel et al., 2007).
	Quebec, Canada	Rural areas show significantly higher mortality rates due to lung cancer (Pampalon et al., 2006).
Rural	Lithuania	The lung cancer mortality rates were higher among the urban females compared to among rural females (Smailyte and Kurtinaitis, 2008).
	Illinois, USA	Risk of lung cancer was highest in the most highly urbanized area and decreased as rurality increases (McLafferty and Wang, 2009).
	Eastern Austria	Urban rates of lung cancer slightly exceeded rural rates (Swoboda and Friedl, 1991).
	Netherlands	For females, lung cancer incidence is higher in urban than in rural areas (Schouten et al., 1996).
	Scania, Sweden	After adjustment for individual and contextual socioeconomic status, there was a dose response association between population density and mortality from lung cancer (Chaix et al., 2006).
No Difference	USA	There was no evidence that lung cancer patients in rural areas have poorer survival than those in urban areas (Shugarman et al., 2008).
	Canada	Lung cancer rates are about the same in rural and urban areas (Pong et al., 2009).

TABLE A-8: All Other Cancers

Health Advantage	Study Area(s)	Findings
Urban	Eastern Austria	Rural rates of oral cavity, oropharnyx, and oesophagus tumors were higher than urban rates (Swoboda and Friedl, 1991).
	South Australia	Of the 31 types of cancer listed, significant survival differences were identified in only ten, in each case survival was higher among urban residents (Wilkinson and Cameron, 2004).

	Lithuania	For males, rural mortality rates from stomach cancer were persistently above urban rates (Smailyte and, Kurtinaitis, 2008).
	Australia	The adjusted case-fatality rate from melanoma was 20% higher in rural versus urban areas (Coory et al., 2006).
	Lithuania	There was greater cancer mortality for rural males (all malignant neoplasms and stomach, colorectal, lung, prostate, breast, and cervical cancers) (Smailyte and Kurtinaitis, 2008).
Rural	South Australia	Of the 31 types of cancer listed, the incidence of eight was significantly higher among rural residents (Wilkinson and Cameron, 2004).
	Scotland	There was strong evidence that the chances for 1 year survival for lung, colorectal, breast, stomach, prostate, and ovarian cancer were poorest for those living in settlement sizes of more than one million. For all other settlement sizes, there was no evidence that small settlement size was a survival disadvantage (Campbell et al., 2000).
	Texas (USA)	Both the incidence and the mortality rates for cancers were higher in urban than rural areas. This was especially true for cancers related to smoking (Risser, 1996).
	USA	Ordinal logistic regression modeling indicated that urban patients were more likely to present with late-stage colorectal and lung cancer, compared with rural patients (Paquette and Finlayson, 2007).
	Lithuania	There is greater cancer mortality for urban females (all malignant neoplasms and stomach, colorectal, lung, prostate, breast, and cervical cancers) (Smailyte and Kurtinaitis, 2008).
No Difference	Mississippi	No difference was found between rural and urban age-adjusted cancer incidence and mortality (Higginbotham, et al., 2001).
	Lithuania	No significant difference was found among rural and urban stomach cancer mortality rates for females (Smailyte and Kurtinaitis, 2008).
	South Ausralia	Of the 31 types of cancer listed, for 20 types the age standardized risk was the same for rural and urban residents (Wilkinson and Cameron, 2004).
	USA	Colorectal and lung cancer patients from rural areas were not more likely to present at a later stage of disease than urban patients (Paquette and Finlayson, 2007).
	Canada	Lung and colorectal cancer rates are about the same in rural and urban areas (Pong et al., 2009).
	USA	Among Medicare beneficiaries, there was no evidence that patients in rural areas have poorer lung cancer survival than those in urban areas. Rather, individual and regional socioeconomic factors and a smaller supply of subspecialists per 10,000 individuals 65 years and older were positively associated with a higher risk of mortality. Rural residents are more likely to live in poorer areas with a smaller supply of health care providers (Shugarman et al., 2008).

TABLE A-9: Diabetes

Health Advantage	Study Area(s)	Findings
Urban	UK and Northern Ireland	A lower incidence of childhood diabetes was found in urban areas (Rytkonen et al., 2003).
	Finland	The highest incidence of type 1 diabetes occurs in rural areas (Rytkonen et al., 2003).
Rural	Republic of Korea	An increase in diabetes mortality, particularly type-2 diabetes, was due the to rapid urbanization, which "tended to reduce physical activity levels and increase animal food consumption" (Choi et al., 2006).
	Norway and Italy	A higher urban incidence of childhood diabetes was found in Norway and Italy (Rytkonen et al., 2003).
No Difference	North Carolina and New York (USA)	There is no difference in the prevalence of diabetes among poor, black rural and urban men and women. (Geronimus, et al., 2006).

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TABLE A-10. Neuropsychiatric Diseorders

Health Advantage	Study Area(s)	Findings
Urban	England	After adjusting for individual characteristics, common mental disorders were less prevalent in rural than urban areas (Riva et al., 2009).
	USA	Multivariate models indicate that rural subjects had 4 times the odds of experiencing a manic episode during the year following the baseline (Rost et al.,1998b).

	Queensland, Australia	The prevalence of diagnosable mental health disorders in the rural sample was found to be higher in comparison to the urban sample (Campbell et al., 2006).
	USA	Rural men reported more mood disorders and anxiety disorders than urban men (Diala and Muntaner, 2003).
	USA	Higher SF-36 Physical Component Summary (SF-36 is a generic quality of life instrument) scores were found among urban as compared to rural elderly primary care patients (Friedman et al., 2007).
	USA	Rural veterans scored lower than urban veterans on mental quality-of-life (Weeks et al., 2006).
	USA	Rural veterans within mental illness cohorts had worse physical and mental quality of life scores than their urban counterparts (Wallace et al., 2006).
Rural	USA	After adjusting for socioeconomic characteristics, urban county residents have a higher likelihood of having either mild psychological distress (MPD) or severe Psychological distress (SPD) (Dhingra et al., 2009).
	North Carolina (USA)	After controlling for major potential confounders, major depressive disorders were found to be twice as frequent in the urban area (Blazer and Landerman, 1985).
	Great Britain	Urban subjects had higher rates of psychiatric morbidity (Paykel et al., 2003).
	England, Wales and Scotland	There are small but statistically significant differences in rates of common mental disorder between urban and rural residents. Rural residents had slightly better mental health than their urban counterparts (Weich et al., 2006).
	UK	There were fewer cases of common mental disorders (e.g. anxiety/depression) in rural areas (Riva et al., 2009).
	the Netherlands	Bipolar outcomes were progressively more common in more urbanized areas. Adjustments for confounding effects of age, sex, and level of education had little effect (compositional factors were not important). There was a positive interaction between urbanicity and psychosis (Kaymaz et al., 2006).
	North Carolina (USA)	After controlling for age, marital status, race, education, and rural-to-urban migrant status, major depressive disorders and antisocial personality disorders were twice as frequent in urban areas as compared to rural areas (Blazer et al., 1985).
	Germany	Higher levels of urbanization were linked to higher prevalence rates for all major psychiatric disorders, except substance abuse and psychotic disorders. The failure to find a link with psychotic disorders probably resulted from a sample size too small to be statistically significant when a 12 month prevalence measure is used (Dekker et al., 2008).
	the Netherlands	Both urbanicity and family history independently increased the risk of psychotic disorder. Specifically, urbanicity was strongly associated with all psychotic outcomes. Furthermore, adjustment for age, sex, level of income, and county of birth did not reduce the associations (Van Os et al., 2003).
	the Netherlands	Psychiatric disorders are both more common and more complex in more urban areas. Furthermore, this remained true even when adjustment is made for age, education, income, living alone and employment status (Peen et al., 2007).
	Sweden	A high level of urbanization was associated with increased incidence rates of psychosis and depression. Furthermore, this association remained after adjustment for age, marital status, and level of education or immigrant status (Sundquist et al., 2004a).
	Belgium, France, Germany, Italy, the Netherlands, and Spain	Urbanicity was linked to a higher risk of mental health illnesses, particularly depressive disorders, whereas the link to anxiety disorders was only moderate (Kovess-Masfeéty et al., 2005).
	USA	All psychiatric disorders except anxiety disorders not related to post-traumatic stress disorder for veterans were more prevalent in urban settings. However, rural veterans with mental illness experienced a greater disease burden than their urban counterparts (Wallace et al., 2006).
No Difference	North Carolina (USA)	There was no significant relationship between residence and reporting poorer self rated mental health (Goins and Mitchell, 1995).
	Texas (USA)	Frequent mental distress (FMD) was not more common among rural respondents than urban respondents. Rural respondents were not at greater risk of FMD than urban respondents (Rohrer, et al., 2005).
	USA	There was no consistent rural-urban differential in psychiatric disorders (Eberhardt and Pramuk, 2004).
	Scotland	The key determinant of admission rates for psychoses for mental illness is the degree of social fragmentation and deprivation. There was no significant relation between admission rates and urbanicity after adjustment is made for social fragmentation and deprivation. The "urban effect" seen in earlier studies may largely be explained by differences in social fragmentation and deprivation (Allardyce et al., 2005).

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TABLE A-11. Schizophrenia

Health Advantage	Study Area(s)	Findings
Urban		
Rural	Various countries	10 studies examining the rate of schizophrenia in urban as compared to rural areas were meta-analyzed, indicating that the rate of schizophrenia in urban areas is around double the rate of that in rural areas (Krabbendam and van Os, 2005).
	Denmark	Schizophrenia risk was higher among individuals who lived in a rural area during their first 15 years of life and had a nearest older sibling born in a capital area as compared to a sibling born in a rural area (Pedersen and Mortensen, 2006).
	Denmark	The most important risk factor for schizophrenia is a family history of the disease; however, urban birth has also been described as a risk factor. When urban birth and urbanicity (urban density) of upbringing were considered together, the effect of urban birth vanished and the effect of urbanicity of upbringing became stronger. The dose-response relationship between schizophrenia risk and urbanicity during upbringing suggests a causal association (Pedersen et al., 2001).
	the Netherlands	The risk of psychiatric disorder was positively and linearly associated with the population density of the place of birth. Individuals born in the most urban locales were about twice as likely to develop schizophrenia as those born in the least urban. However, these findings may simply reflect the fact that urban areas, having more beds available, have lower thresholds for admitting psychiatric patients. Or it may be that rural areas, having stronger social networks, are better able to treat psychiatric patients on an outpatient basis. The differential could be due to the greater stress of city life. The authors note that studies have shown that levels of stress, divorce, noise, pollution and crime are higher in urban areas (Marcelis et al., 1998),
	North Carolina (USA)	After controlling for age, marital status, race, education, and rural-to-urban migrant status, schizophrenia was twice as frequent in urban areas as compared to rural areas (Blazer et al., 1985).
	the Netherlands	Among persons aged 15 to 54, there is a positive correlation between the degree of urbanization and the risk of being hospitalized for schizophrenia (Dekker, 1997).
No Difference		

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TABLE A-12. Unipolar Depressive Disorder

Health Advantage	Study Area(s)	Findings
Urban	USA	Multivariate analyses demonstrated that compared with their urban counterparts, rural patients with depression had significantly higher odds of being hospitalized for physical problems and for emotional problems (Rost et al., 2007).
	USA	Depressed rural individuals had 3.05 times the odds of being admitted to the hospital for physical problems and 3.06 times the odds of being admitted for mental health problems (Rost et al., 1998a).
Rural	Canada	Participants in rural areas had a lower prevalence of major depressive episodes (MDE) than those in urban areas controlling for the effects of race, immigration status, working status and marital status (Wang, 2004).
	Finland, Ireland, Norway and the United Kingdom	The one-month prevalence rate of depressive disorder in urban areas was 10.2 as compared with 7.5 per cent in rural areas. When analyzing by gender, the rural-urban difference was significant for women in the UK and Ireland but not for men in any of the four countries. For women, it was found that the two most important determinants of depression were (a) having difficulties getting practical help from a neighbor and (b) lacking a confidant (Lehtinen et al., 2003).
No Difference	USA	The unadjusted prevalence of depression was significantly higher among rural than urban populations. However, after adjusting for rural/urban population characteristics, the odds of depression did not differ by residence (Probst et al., 2006).
	Ontario, Canada	Mood disorders were found in 4.6 percent of the urban population and 3.6 percent of the rural population. In the case of major depression, the figures were 4.2 per cent for urban areas and 3.2 percent for rural areas. Though they are in the expected direction, the differences are not statistically significant (Parikh et al., 1996).
	Canada	There were no rural-urban differences in depressive symptoms among older adults. Factors associated with depressive symptoms, however, varied by region. In rural regions, living alone,

		perceiving one's income as inadequate, and having functional impairment were associated with depression, whereas in urban areas, poorer self-rated health, functional impairment, and fewer persons providing companionship were significantly related to depressive symptoms (Saint John et al., 2006).

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TABLE A-13. Dementia

Health Advantage	Study Area(s)	Findings
Urban	Canada	Those with dementia were more likely than those without dementia to live in rural areas (Forbes et al., 2006).
Rural		
No Difference		

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TABLE A-14. Eating Disorders

Health Advantage	Study Area(s)	Findings
Urban		
Rural	Italy	There was a greater prevalence of eating disorder cases, both anorexia and bulimia, in urban areas than in rural areas. The differences by place of residence were greater for males than for females (Preti et al., 2007).
	the Netherlands	Bulimia nervosa was associated with the degree of urbanization in a dose-response fashion. This link between urbanization and bulimia became much stronger since the 1980s. It may be that the greater prevalence of bulimia nervosa in urban areas results from the greater anonymity in urban areas that makes it possible to obtain large quantities of food without attracting attention (Van Son et al., 2006).
No Difference	the Netherlands	There was no association between the degree of urbanization and anorexia nervosa, even though it is thought to be closely related to bulimia nervosa (Van Son et al., 2006).

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TABLE A-15. Sense Organ Disorders

Health Advantage	Study Area(s)	Findings
Urban		
Rural	Taiwan	Visual health (less cases of myopia) was better for rural children (Yang et al., 2007).
No Difference	Sweden	No difference was found between the urban and the rural populations regarding the prevalence of symptoms (Jessen and Janzon, 1989).

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TABLE A-16: Cardiovascular Disease

Health Advantage	Study Area(s)	Findings
Urban	Fifty six countries	In developed countries between 1960 and 1990, urbanization was associated with lower mortality from these diseases, presumably as a result of better diagnosis and treatment (Stuckler, 2008).
	Canada	Circulatory disease-related mortality was higher in rural than urban areas (Pong et al., 2009).
	Australia	There was a significantly higher prevalence of chronic heart failure among general practice patients in rural towns compared with capital city and metropolitan areas (Clark et al., 2007).
	Quebec, Canada	Residents of rural areas have higher myocardial infarction (heart attack) incidence than other populations (Loslier et al., 2007).
Rural	Fifty six countries	In developed countries between 1960 and 1990, a one percent increase in the percent urban was associated with 1.4 percent increase in heart disease mortality and a 3.2 percent increase in the chronic non-communicable disease rate (Stuckler, 2008).
	Quebec, Canada	The survival rate in rural areas from angioplasty and coronary bypass surgery was higher in rural than in urban areas (Loslier et al., 2007).
No Difference	Iowa (USA)	Using instrumental variables showed that being admitted to an urban hospital was no longer associated with significantly lower in-hospital mortality in patients with myocardial infarction after controlling for the bias resulting from omitted variables (James et al., 2007).
	Iowa (USA)	Myocardial infarction (heart attack) mortality in rural hospitals is not higher than that in urban hospitals after controlling for unmeasured confounders (James et al., 2007).
No Gradient	Northern Sweden	The age standardized morbidity and 28 day case fatality for myocardial infarction were lowest in the smallest-sized communities and highest in the intermediate-sized communities (Messner and Lundberg, 2004).

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TABLE A-17: Cardiovascular Disease -- Ischemic Heart Disease

Health Advantage	Study Area(s)	Findings
Urban	Norway	For men, ischaemic heart disease, including sudden death of unknown cause (IHD/SUD) mortality in Norway was 8% higher in rural than urban areas (Kruger et al., 1995).
Rural	Quebec, Canada	Urban areas show significantly higher mortality rates due to ischemic heart disease (Pampalon et al., 2006).
	Scania, Sweden	After adjustment for individual and contextual socioeconomic status, there was a dose response association between population density and mortality from ischemic heart disease (IHD) (Chaix et al., 2006).
	Scotland	Mortality was greater in rural than urban areas, and there was a positive gradient according to the degree of rurality. In part, this reflects the older age structure in rural Scotland. When the rates were standardized for age the findings were reversed and mortality fell with increasing rurality (Levin and Leyland, 2006).
No Difference	Norway	For women, ischaemic heart disease mortality, including sudden death of unknown cause (IHD/SUD), is about equal in rural and urban areas (Kruger, et al., 1995).

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TABLE A-18: Cardiovascular Disease -- Cerebrovascular Disease (Stroke)

Health Advantage	Study Area(s)	Findings
Urban	Japan	Mortality due to stroke has decreased "in parallel" with the urbanization of the countryside since the 1970s. Overall, there was a tendency for mortality from stroke to be higher in rural areas, especially for women. Furthermore, this rural disadvantage remained after adjustment for risk factors such as alcohol consumption, smoking, and hypertension. In part the advantage of urban areas may reflect greater medical resources in those areas (Nishi et al., 2007).
Rural	Taiwan	Those living with the highest level of urbanization had the highest stroke prevalence. With decreasing urbanization, there was a corresponding decline in the prevalence of strokes. Even after adjusting for other risk factors, the level of urbanization was an important contributory factor to the overall prevalence of strokes (Lin et al., 2007).
No Difference	Taiwan	The risk of stroke is higher in rural areas. But after taking account of age and other factors, there was no difference in the prevalence or incidence of stroke between urban and rural areas (Liao et al., 2006).

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TABLE A-19: Cardiovascular Disease --Hypertension (high blood pressure)

Health Advantage	Study Area(s)	Findings
Urban	North Carolina and New York (USA)	Poor black rural men had a greater prevalence of hypertension (Geronimus et al., 2006).
	South Carolina (USA)	Rural men are most strongly associated with poor blood pressure control among outpatients (King and Crisp, 2006).
Rural		
No Difference	North Carolina and New York, USA	There was no rural-urban difference among poor black women in the prevalence of hypertension (Geronimus et al., 2006).
	USA	There were no significant urbanization differences with regard to age-adjusted hypertension prevalence, percent hypertension awareness, treatment and control (Obisesan et al., 2000).

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TABLE A-20: Respiratory Diseases

Health Advantage	Study Area(s)	Findings
Urban	Quebec, Canada	Rural areas show significantly higher mortality rates due to chronic obstructive pulmonary disease (COPD) (Pampalon et al., 2006).
Rural	Poland	Allergy prevalence, patterns of allergic sensitization, and allergy risk factors among urban children was significantly higher than that of rural children. An almost four-fold higher percentage was found of allergic urban children sensitized to five or more allergens (Majkowska-Wojciechowska et al., 2007).
	Finland	Asthma was somewhat more frequent among the urban than the rural populations (Heinonen et al., 1987).
	Scania, Sweden	After adjustment for individual and contextual socioeconomic status, there was a dose response association between population density and mortality from chronic obstructive pulmonary disease (COPD) (Chaix et al., 2006).
	Greece	Hay fever was persistently more prevalent in the urban areas than in the rural areas and was independent of farming practices (Priftis et al., 2007a).
	Taiwan	The overall prevalence of asthma was higher in highly urbanized areas than in moderately and less urbanized areas (Lin et al., 2001).

	Israel	Urban children had significantly more SPTs (Skin Prick Test responses) to various allergens. In a multivariate analysis, the most significant independent variable is place of residence (Bibi et al., 2002).
	Greece	In schoolchildren, cough was more prevalent in the urban area over one of the time periods studied. Sub-clinical airway narrowing and slower rate of lung function growth were associated with the urban area (Priftis et al., 2007b).
	Maryland (USA)	Children from rural counties for the most part had fewer emergency department asthma visits than children from urban and suburban counties. The wealthiest suburban county had the highest risk of asthma emergency department visits (Hirshon et al., 2006).
No Difference	Pennsylvania (USA)	For adults (ages 19–64) there was a non-linear relationship between the degree of urbanization and the prevalence of hospitalization for asthma. As the degree of urbanization increases, the hospitalization rate also increases. However, after that, the hospitalization rate increases as areas become more rural (Ramos et al., 2006).
	Finland	The proportions of individuals with any one of the five allergic symptoms recorded did not differ significantly between the urban and rural populations (Heinonen et al., 1987).
	Greece	Asthma and eczema prevalence and sensitization did not differ between rural and urban areas (Priftis et al., 2007a).
	Greece	In schoolchildren, asthma and wheeze did not differ in the rural and urban areas (Priftis et al., 2007b).

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TABLE A-21. Digestive Diseases

Health Advantage	Study Area(s)	Findings
Urban		
Rural		
No Difference	Taiwan	There was a narrowing of differences in incidence rates for ruptured appendix, and, since 1999, few discernible differences between remote and non-remote areas. A steeper narrowing trend was observed in children. Taiwan's universal healthcare system has done much to reduce rural-urban disparities in access to care and health outcomes (Huang et al., 2006).

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TABLE A-22. Oral Diseases

Health Advantage	Study Area(s)	Findings
Urban	Italy	The prevalence of dental caries in schoolchildren was significantly greater among children living in rural areas as compared with those living in urban areas, and these differences were more pronounced in the permanent dentition of the older groups (Perinetti et al., 2006).
	Taiwan	Dental health (fewer caries) was better for urban children (Yang et al., 2007).
Rural	Rural Maine and Urban Boston (USA)	Urban children had a higher mean number of carious primary surfaces and teeth than rural children. This difference was statistically significant even after adjusting for sociodemographic factors and toothbrushing frequency. In permanent dentition, urban children were 3 times as likely to have carious surfaces or teeth as rural children (Maserejian et al., 2008).
No Difference		

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TABLE A-23. Musculoskeletal Diseases -- Osteoporosis

Health Advantage	Study Area(s)	Findings
Urban		
Rural	Norway	The prevalence of forearm fractures increased with the degree of urbanization (the proportion of the population that was urban), even after adjusting for age and gender. Such fractures are a good indicator of post-menopausal osteoporosis and a good predictor of future more serious fractures, such as fractures of the hip or vertebrae. A large number of earlier studies had found a higher incidence of hip fractures among city dwellers compared to rural populations. The relatively sedentary life style of urban dwellers is thought to be the cause of the higher prevalence of hip fractures. The study found that the prevalence of forearm fractures increased with increasing degree of urbanization. Furthermore, the rural urban differential actually increased when the data was adjusted for the older rural age structure (Sogaard et al., 2007).
	Switzerland	After adjusting for age and gender, urban residents have a 31 percent higher incidence of hip fracture than rural residents (Chevalley et al., 2002).
	Sweden	The odds ratio for fracture in an urban area was much higher than in a rural area. Furthermore the differentials widened rapidly as women grew older. The researchers suggest that a more physically active lifestyle in rural communities reduces fracture-causing falls by increasing muscle strength and postural stability (Jonsson et al., 1992).
	Central Norway	The incidence of hip fracture was highest in the urban areas (Finsen, and Benum, 1987).
	Western Sweden	After adjustment for age changes in the population, the incidence of hip fracture was lower in the rural county than in the city of Goteborg during the period 1974–1984 (Mannius et al., 1987).
	Northern Sweden	Comparison of a rural mountain population with an urban population revealed a lower age-adjusted hip fracture incidence rate in the rural area (Larsson et al., 1989).
	Minnesota (USA)	The age and sex adjusted incidence of proximal femur fractures among urban residents of the central city of Rochester was 36% greater than among the residents of the rural remainder of Olmstead County (Madhok et al., 1993).
	Australia	After adjusting for age and sex, the hip fracture rate (incidence per 10,000 person years was 32% lower ant the total fracture rate was 15% lower among rural than among urban residents (Sanders et al., 2002).
	Southern Sweden	A relatively higher incidence of hip fracture was found in the urban population (Sernbo, et al., 1988).
	USA	Rural populations tend to have greater bone mineral content (BMC) than urban populations (Specker et al., 2004).
	Minnesota (USA)	In one county, overall fracture rates, adjusted for age and gender, were 15 percent higher for urban than rural dwellers (Melton et al., 1999).
No Difference		

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TABLE A-24. Chronic Fatigue Syndrome

Health Advantage	Study Area(s)	Findings
Urban		
Rural		
No Difference	Georgia (USA)	There were no significant differences in prevalence of chronic fatigue syndrome between metropolitan, urban, or rural populations (Reeves et al., 2007).

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TABLE A-25. Chronic Pain

Health	Study Area(s)	Findings

Advantage		
Urban		
Rural		
No Difference	Southeastern Ontario, Canada	Rural residence was associated with increasing pain, but residence was no longer significant once depression was considered (Tripp et al., 2006).

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TABLE A-26. Injury -- Motor vehicle injury

Health Advantage	Study Area(s)	Findings
Urban	USA	Motor vehicle mortality has traditionally been higher in rural than urban areas. Though rural areas account for about one third of motor vehicle miles traveled, they account for almost 60 percent of all fatal crashes. A comparison of fatality rates in the from 1970 to 1996, based on population and motor vehicle miles traveled showed that rural fatality rates were higher both on a per person and a per mile driven basis (Brown et al., 2000).
	USA	There was a clear inverse gradient between the likelihood of death following a serious collision and population density, even after controlling for age, speed, and seat belt use (Clark, 2003).
	USA	After controlling for other factors, the increased distance between people and/or medical facilities is a direct determinant of mortality from motor vehicle accidents (Brown et al., 2000).
	United Kingdom, Australia, Canada, Taiwan and Japan	The increased distance between people and/or medical facilities is a direct determinant of mortality from motor vehicle accidents (Clark and Cushing, 2004).
	All 50 states in the USA plus the District of Columbia and Puerto Rico	In an effort to explain why motor vehicle crash fatalities have been consistently higher in rural areas, urban and rural motor vehicle fatalities were decomposed into three factors; the injury/fatality rate, the crash/injury rate, and the crash rate per mile driven. Fatal crashes per mile driven were more than twice as high in rural areas and a larger proportion of rural crashes involved injuries. Only the number of crashes per mile driven was lower rural areas. Thus it is clear that when miles traveled is held constant, a much higher proportion of crashes in rural areas produce injuries, and a much higher proportion of crashes with injuries produce fatalities. In part this may be due to the characteristics of rural drivers, who may be less likely to use seat belts, more likely to drive older vehicles, and more likely to be under the influence of alcohol (Zwerling et al., 2005).
	Alberta, Canada	After adjusting for age and gender, the relative risk of a car crash fatality was 5 times higher in rural than urban areas. The hospitalization rate for children injured in motor vehicle accidents was three times as great in rural vs. urban areas. The differences were attributed to more miles traveled, higher driving speeds, and less well maintained roadways (Kmet and MacArthur, 2006).
	Australia	There is a greater risk of injury for rural than for urban children. After holding other factors constant, the risk was twice as large in rural areas (Du et al., 2007).
	Alabama (USA)	Rural children suffered twice the rate of motor vehicle passenger fatalities as urban children. There was a sharp negative fatality gradient when residence areas were ordered by increasing population densities (King et al., 1994).
	Washington (USA)	Pedestrians are also at greater risk for motor vehicle accidents in rural areas. Rates of pedestrian injuries are higher in urban areas, but the risk of dying once involved in such an accidents was greater in rural areas. This was true even after controlling for the effects of the age and sex of the pedestrian and the posted speed limit. Due to the limited availability of trauma centers in rural areas, a larger portion of the fatally injured pedestrians in the rural areas died out of the hospital and within one hour after the injury (Mueller et al., 1988).
	Canada	The incidence of bicycle-related head injuries was about 60 percent higher in rural than urban areas (18.49 versus 10.93), even after controlling for age, sex, socioeconomic status and collision with an automobile (MacPherson et al., 2004).
	Canada	Adolescents in rural areas were more likely to report medically treated injury compared with a reference population from a large metropolitan area (Jiang et al., 2007).
	USA	The rates for unintentional injuries from motor vehicle traffic were higher in rural populations (Coben et al., 2009).
	USA	A significantly lower percentage of injury crashes occurred in the urban setting. Although the rate of ambulance injuries was greater in the urban environment, the severity of the injuries was worse in rural environments (Weiss et al., 2001).
	Quebec, Canada	Rural areas show significantly higher mortality rates due to traffic accidents (Pampalon et al., 2006).

	Taiwan	The severities of injury among adolescents were not significantly different between urban and rural areas, but the outcomes at discharge were significantly better in urban areas. Craniotomy was performed more frequently in rural areas than in urban areas, and the mean hospital stay was shorter in urban than in rural areas (Chiang et al., 2006).
Rural		
No Difference	Pennsylvania (USA)	Although more people and vehicles are often involved in urban than rural ambulance crashes, the severity of injuries sustained are similar (Ray and Kupas, 2007)

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TABLE A-27. Injury --Other unintentional injury

Health Advantage	Study Area(s)	Findings
Urban	USA	Injury hospitalization generally increased with increasing rurality. The rates for unintentional injuries from falls and poisonings were higher in rural populations (Coben et al., 2009).
	USA	Compared with large urban counties, rural counties had 30% higher injury odds, after adjusting for age, gender, marital status, education, and health insurance (Tiesman et al., 2007).
	Hawaii (USA)	Rates of severe injury were higher in rural locations, but rural mortality rates did not differ significantly from those of urban settings (Chapital et al., 2007).
Rural	Pennsylvania (USA)	Rates of serious firearm injuries among children and adolescents are 120 fold higher in urban than nonurban regions (Nance et al., 2002).
	USA	The number of days off with disability after a work-related bone fracture was greater in urban areas. This may indicate that urban fractures are more serious or that rural cultures and behavioral patterns in the USA lead to an earlier return to work (Young et al., 2008).
	Iceland	The incidence of minimal brain injuries was lower in rural than in urban areas (Halldorsson et al., (2007).
No Difference	USA	For blunt trauma victims transported by helicopter from rural and urban scenes, despite longer flight and accident scene times for rural patients, adjusted in-hospital mortality rates are similar between victims transported from urban and rural scenes. Factors prior to helicopter arrival may contribute to increased mortality rates of rural victims documented nationally (McCowan et al., 2007).

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TABLE A-28. Injury -- Intentional injury -- Homicides and Assaults

Health Advantage	Study Area(s)	Findings
Urban		
Rural	USA	The annual rate of firearm injuries in urban counties was 10-fold greater than in the next highest region (suburban) (283 versus 2.8) (Nance et al., 2002).
	USA	Injury hospitalizations for assaults were highest in urban counties (Coben et al., 2009).
	USA	Homicide rates for persons 15 through 24 years are highest for core metropolitan areas (33.5) and lowest for nonmetropolitan areas (6.5) (Fingerhut et al.,1998).
	USA	The rate of firearm-related homicides increases as counties become more urban. The firearm-related homicide rate in the most urban county was three times that of the most rural county (Branas et al., 2004).
No Difference		

TABLE A-29. Injury -- Intentional Injury -- Self-Inflicted Injury

Health Advantage	Study Area(s)	Findings
Urban	USA	Self-inflicted injuries were highest in rural counties (Coben et al., 2009).
	Belarus	In 1900, 1995, 2000, and 2005, the suicide rate was higher in rural areas for both men and women. In 2000, the ratio of rural to urban suicides was 1.76 (Razvodovsky and Stickley, 2009).
	USA	All three urbanization measures (percent urban, counties divided into 3 equal groups, and 10 strata division measure using rural-urban continuum codes) are significantly related to suicide rates. Rates decrease as urbanicity increases. But links with other variables vary depending on which measure of urbanicity is used (Walker, 2009).
	USA	Firearm-related suicide rates increase as counties became more rural. The most rural counties had more than twice the rate of firearm-related suicides as did the most urban counties (Branas et al., 2004).
	USA	Based on a 10 category rural-urban continuum, suicide rates were generally higher in rural areas than in urban areas. Overall the rural-urban gradient of male age-adjusted suicide rates was positive and statistically significant. Furthermore the gradient has been increasing over time. For women, the suicide rates were generally higher in more urban areas. There was a non-significant positive gradient between the female suicide rate and the degree of urbanization. In the case of women, urban-rural differences were eliminated after adjustment for divorce rates and ethnic composition. In contrast, the positive gradient between degree rural and male suicide rates became greater after controlling for divorce rates and ethnic composition. The results seem to indicate that the higher rural suicide rate is due to social isolation in rural areas, which has been made more severe by declines in traditional farm activity and out-migration from rural communities (Singh and Siapush., 2002).
	England and Wales	During the 1980s and 1990s, the largest increase in suicide rates among young people (aged 15 to 44) occurred in the more rural areas. This trend was most marked among young females aged 15 to 24 living in the most rural areas. For this group, the suicide rate doubled (Middleton et al., 2003).
	England and Wales	Rural suicides in are underreported relative to urban suicides. The higher rural suicide rate may be associated with a lack of employment opportunities (Sanderson et al., 1998).
	Scotland	Increasing suicide rates among young adults are largely due to increasing suicide rates in rural areas that suffer from greater rates of deprivation (Levin and Leyland, 2005).
	Austria	The suicide rate is higher in rural than in urban areas, and the gap has been growing continuously for both genders over the past 35 years. The gender patterns are not the same. While male suicide rates decrease as areas become more urban, the female suicide rate does not seem to be correlated with urbanicity. Since divorce rates are lower in rural areas, that common explanation for the rural-urban difference in suicide rates is not tenable. A more promising explanation for the higher rural suicide rate is the greater availability of firearms in rural areas where there are many hunters and farmers (Kapusta et al., 2008).
	Australia	Suicide rates have consistently been higher in rural areas. This is somewhat surprising since assessments of mental health show no significant difference between rural and urban areas of that country. Also there seems to be no association between place of residence and whether or not residents accessed help from any mental health professional. This suggests that factors other than mental health are responsible for the differential. Across almost all age groups, the suicide rates for men were higher in rural than urban areas, while there was no consistent pattern for women (Caldwell et al., 2004).
	Denmark	Suicide rates are higher in urban than rural areas. This reflects a higher suicide rate among urban women, not urban men. There is a steady positive gradient linking the suicide rate to the proportion of the population that is urban. However, urbanicity seems to be a proxy for more causal factors. When adjustment is made for differences in marital status, birth country, and income, the urban-rural difference is reversed (Qin, 2005).
	Australia	Immigrant males had a higher risk of suicide in rural areas (Morrell et al., 1999).
	Quebec, Canada	Rural areas show significantly higher mortality rates for males due to suicide (Pampalon et al., 2006).
	USA	A multiple regression analysis of county data shows that rurality is the best predictor of the suicide rate (Wilkinson and Israel, 1984).
	Australia	Suicide rates in rural areas were significantly higher for males of all ages compared to rates in urban areas (Taylor et al., 2005).
	USA	Rural subjects reported significantly more suicide attempts during the period of one year (Rost et al., 1998a).
	New Zealand	By the end of the 1990s, there was a narrowing of urban/rural differences in suicide incidence resulting from growth in suicide rates in more isolated rural communities. Potential explanations offered for the urban/rural inequalities include compositional arguments, rural restructuring and economic decline, social isolation, and health service utilization (Pearce et al., 2007).
Rural	Australia	Females, both Australian born and immigrants, had a lower risk of suicide in rural areas (Morrell et al., 1999).

	Taiwan	There is a strong association between urbanicity and methods of suicide, with those residing in the more urbanized areas being more likely to commit suicide by violent methods (Chung et al., 2007)
No Difference	Australia	There were no significant urban-rural differences in suicide rates for females (Taylor et al., 2005).
	Quebec, Canada	Rural and urban areas show the same mortality rates for females due to suicide (Pampalon et al., 2006).
	New Zealand	By the end of the 1990s urban/rural differences in suicide rates were not significant (Pearce et al., 2007).
	Australia	There was no statistically significant difference in suicide risk between rural and urban Australian-born males (Morrell et al., 1999).
	Australia	Across almost all age groups, there was no consistent suicide pattern for women (Caldwell et al., 2004).

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ANNEX B: RESEARCH FINDINGS ON THE DETERMINANTS OF RURAL-URBAN HEALTH DIFFERENTIALS IN DEVELOPED COUNTRIES

Health Determinants

B-1. Health-Related Behaviors -- Tobacco Use

Health Advantage	Study Area(s)	Findings

Urban	USA	Both rural youth and adults had higher prevalence of tobacco use than their urban counterparts (Gfroerer et al., 2007).
	USA	Rural high school seniors had a greater 30 day prevalence in smoking and in smoking a pack or more of cigarettes a day than their urban counterparts (Cronk and Sarvela, 1997).
	Quebec, Canada	The proportion of current and former regular smokers is higher in rural areas (Pampalon et al., 2006).
	South Australia	The prevalence of smoking was greater in rural areas (Wilkinson and Cameron, 2004).
	Montana (USA)	The risk of using cigarettes or smokeless tobacco increased more in rural counties (Hanson et al., 2009).
Rural	Sweden, Finland, Denmark, Germany, Italy and Spain	In most countries, smoking prevalence was highest in urban areas, and there was a positive relationship between the prevalence of smoking and the degree urban. Furthermore, this relationship held for both males and females. In fact the rural-urban differences were largest for the less educated and for females. One explanation for the rural-urban differential in smoking is that urban areas are more stressful and may be more permissive of smoking (Idris et al., 2007).
	North Carolina and New York (USA)	Poor, black, rural men and women are less likely to be smokers than their urban counterparts (Geronimus et al., 2006).
	USA	Black women are more likely to be smokers than black women in rural areas (Duelberg, 1992).
	Germany	Inhabitants of urban areas were more likely to be current smokers than inhabitants of rural areas. Among current and former smokers, those who lived in urban communities had also increased odds for being heavy smokers than those who lived in rural communities. Living in an urban area is therefore both a determinant of smoking and of the severity of current smoking (Völzke et al., 2006).
No Difference		

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B-2. Health-Related Behaviors -- Alcohol Abuse

Health Advantage	Study Area(s)	Findings
Urban	North Carolina (USA)	Alcohol abuse and or dependence were more common in the rural area (Blazer and Landerman, 1985).
	USA	Rural youth had higher rates of alcohol use that urban youth (Gfroerer et al., 2007).
	Belgium, France, Germany, the Netherlands, Spain	Overall, urbanicity did not seem to be linked to alcohol disorders (Kovess-Masféty et al., 2005).
	USA	Rural high school seniors had a greater 30 day prevalence in drinking and binge drinking than their urban counterparts (Cronk and Sarvela, 1997).
	USA	Upward trends in heavy drinking were sharper in rural counties (Jackson et al., 2006).
	Midwest (USA)	The odds of abstinence, a current alcohol disorder, and exceeding daily limits were higher in rural than suburban areas (Borders and Booth, 2007).
	South Dakota (USA)	Heavy drinking increased at a faster rate among youth living in more rural areas (Martino et al., 2008).
	Montana (USA)	The risk of using alcohol increased more in rural counties (Hanson et al., 2009).
Rural	Sweden	For both men and women, hospital admission rates for alcohol abuse increase as the level of urbanization increases. After adjustment for marital status, education status and immigration status, the rural-urban differences remained significant (Sundquist and Frank, 2004b).
	the Netherlands	Higher levels of alcohol abuse in urban areas may, in part, be due to selective migration. A study of migration patterns in found that participants who drank alcohol excessively had an increased probability of migrating to urban areas when compared to abstainers. This "urban drift" would tend to produce a non-causal correlation between the prevalence of alcohol abuse and the degree of urbanization (van Lenthe, 2007).
	USA	Urban areas exhibited higher prevalence of heavy and binge drinking than rural counties in all years (Jackson et al., 2006).
	Iowa and Georgia (USA)	Among African-American adolescents in rural and urban areas, perceived substance availability and use were both higher among the more urban adolescents. Stress or negative affect is an important antecedent to use among African-American adolescents, especially when use occurs at an early age (Gibbons et al., 2007).
No Difference	Quebec, Canada	There is no difference in the prevalence of excessive drinking between rural and urban areas (Pampalon et al., 2006).

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B-3. Health-Related Behaviors - Other Substance Use

Health Advantage	Study Area(s)	Findings
Urban	Kentucky (USA)	Chronic drug abusers from rural and very rural areas have significantly higher rates of lifetime drug use as well ass higher rates of drug use 30 days prior to their current incarceration than chronic drug users from urban areas (Warner and Leukefeld, 2001).
	USA	Rural youth have a higher prevalence of stimulant and methamphetamine use than urban youth (Gfroerer et al., 2007).
Rural	South Dakota (USA)	Marijuana use increased at a faster rate among youth living in urban areas (Martino et al., 2008).
	North Carolina (USA)	Drug abuse and or dependence were more common in the urban area (Blazer and Landerman, 1985).
	Montana (USA)	The risk of using marijuana, LSD, and any drug decreased more in the rural areas (Hanson et al., 2009).
	USA	Ecstasy use is higher among urban youth than rural youth (Gfroerer et al., 2007).
	USA	Rural adults had generally lower rates of illicit drug use than urban adults (Gfroerer et al., 2007).
	Kentucky (USA)	Rural drug users in this study were older at age of first use of marijuana and cocaine; report fewer years of cocaine, hallucinogen and heroin use (Leukefeld et al., 2002).
	Sweden	After adjustment for age, marital status, education and immigrant status, a high level of urbanization was associated with increased hospitalization rates for drug abuse (Sundquist and Frank 2004).
No Difference	USA	Illicit drug use is generally similar among adolescents in rural and urban counties (Gfroerer et al., 2007).
	USA	Rural and urban high school seniors were about the same in their 30 day prevalence in the usage of marijuana, cocaine, LSD and inhalant use (Cronk and Sarvela, 1997).
	Minnesota (USA)	There are few differences between rural and urban settings in substance abuse (Galea et al., 2005; Beebe et al., 1999).
	Kentucky (USA)	There are only marginally statistically significant differences in drug use between incarcerated rural and urban drug users (Leukefeld et al., 2002).

B-4. Health-Related Behaviors -- Health-Seeking Behaviors

Health Advantage	Study Area(s)	Findings
Urban	Minnesota (USA)	Differences in end-of-life care among rural and urban residents cannot be fully explained by differences in access to medical services. Concerning end-of-life care among family members of residents of nursing homes, there were attitudinal differences between rural and urban survey respondents. Rural respondents were more accepting of death than urban respondents and much less likely to endorse interventions to impede death, compared to urban respondents (Gessert et al., 2006a).
	Australia	People with fatalistic beliefs or a high level of stoicism tend to have poor initiative in health matters, which may cause delay in seeking treatment or poor compliance with treatment. Newly diagnosed rural oncology patients scored significantly higher for internal belief and belief in chance (fatalism) than their urban counterparts. Gender may be a confounding factor in the study because women were underrepresented and males scored significantly higher for belief in chance (Howat et al., 2006).
	USA	Rural residents are less likely than urban residents to obtain certain preventive health services and are further behind urban residents in meeting Healthy People 2010 objectives (Casey et al., 2001).
	Alberta, Canada	Despite their similar access to physician care, rural women were less likely to have had a recent clinical breast examination or mammogram than urban women (Bryant and Mah, 1992).
	USA	Rural Medicare enrollees, on a risk adjusted basis, tend to use fewer hospital resources than urban enrollees (Bronstein and Adams, 2002).
	Kentucky (USA)	Being from a very rural area decreased the likelihood of having ever been in treatment after controlling for the number of years using and race (Warner and Leukefeld, 2001).
	USA	Black women are more likely to be screened for cervical cancer in urban than in rural areas (Duelberg, 1992).
	USA	Rural elderly make fewer physician visits than their urban counterparts (Himes et al., 1994).
	North Carolina (USA)	Affordability concerns were associated with poor health treatment adherence and habits for rural residents. Mistrust of doctors was also associated with low treatment adherence for both urban and rural residents and was associated with poorer health habits for urban residents. Fear of hospitals

		was associated with effective compliance for rural residents and good health habits for urban residents (Harju et al., 2006).
	Alabama (USA)	Rural residents are more likely to suffer from a limitation in functioning as a result of sickle cell disease than urban residents. The greater rural prevalence of complications from sickle cell disease reflects the fact that rural clients often fail to use comprehensive sickle cell services. Regression analysis indicates that the utilization rate differential is largely accounted for by socioeconomic factors (Telfair et al., 2003).
	USA	Rural subjects made significantly fewer specialty care visits for depression (Rost et al., 1998a).
	Southeastern Ontario, Canada	Lower rates of health care utilization were reported by rural residents (Tripp et al., 2006).
	Deep South, USA	A study of HIV-infected adults showed that rural residents were less likely than urban residents to report seeing a mental health provider even though there were no differences in level of psychological distress by degree of rurality. Participants living in rural areas also reported significantly fewer mental health visits in the previous month (Reif et al., 2006).
	Alberta, Canada	Rural patients made more emergency room or hospital visits for asthma management than urban patients (Lum et al., 2007).
	USA	Women from rural counties were less likely to report a number of preventive health examinations, such blood cholesterol tests, mammograms, and dental exams, than their urban counterparts (Larson and Correa-de-Araujo, 2006).
	USA	A study of elderly Medicare beneficiaries showed that rural elders are more likely than urban counterparts to live in areas where home health care utilization is low. Fewer than 1% of urban beneficiaries lived in areas where home health care use was low, but over 17% of rural beneficiaries lived in such areas (Hartman et al., 2007)..
	USA	Rural African American women reported more barriers to mammography screening than urban women. Rural women were more likely than urban women not to get a mammogram because they did not perceive a need, because they thought mammography was embarrassing, and because of their religious beliefs (Husaini et al., 2005).
Rural	USA	Rural women were more likely than their urban counterparts to obtain blood pressure checks (Larson and Correa-de-Araujo, 2006).
No Difference	USA	There is almost no difference between urban and rural white women concerning their likelihood of taking a pap test (Duelberg, 1992).
	USA	The proportion of rural residents receiving flu shots was almost the same as that of urban residents. After adjusting for education, household income and health insurance the proportion of rural women receiving pap screening tests and mammograms was not significantly different from that of urban women (Zhang et al., 2000).
	Australia	Hope levels were generally high, with no significant difference between rural and urban patients (Howat et al., 2006).

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B-5. Pollution

Health Advantage	Study Area(s)	Findings
Urban		
Rural	Greece	Nitrogen dioxide and sulfur dioxide were higher in urban areas. Long-term exposure to the urban environment is associated with sub-clinical airway narrowing and slower rate of forced vital capacity growth (Priftis et al., 2007b).
No Difference	Greece	Ozone levevls were similar between rural and urban areas (Priftis et al., 2007b).

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B-6. Nutrition and Diet

Health Advantage	Study Area(s)	Findings
Urban	Kansas (USA)	Rural children consumed more junk food (Davis et al., 2008).
	Poland	There was a higher risk of under-nutrition among rural adolescents; more frequent overweight and obesity in rural girls; a lower protein consumption in rural girls and boys, and a lower percentage of the norm for many mineral components and vitamins in rural girls and boys.(Suliga, 2006).
Rural	Poland	There was more frequent overweight and obesity in urban boys aged 13.5 years (Suliga, 2006).
	Kansas (USA)	Urban children were morer likely to skip breakfast (Davis et al., 2008).
No Difference	Kansas (USA)	Urban and rural children consumed equivalent calories per day and calories from fat (Davis et al., 2008).

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B-7. Cardiovascular Disease Risk Factors: --Obesity, Overweight, BMI, and Waist Circumference

Health Advantage	Study Area(s)	Findings
Urban	UK	There was a greater prevalence of obesity in rural areas (Riva et al., 2009).
	Japan	The prevalence of obesity was greater for women in rural areas (Nishi et al., 2008).
	Italy	Rural children presented a higher risk of overweight and obesity compared with children resident in urban areas (Bertoncello et al., 2008).
	Finland	Among the elderly, rural communities had higher probability of high BMI and high waist circumference (Fogelholm et al., 2006).
	the Netherlands	Over the period 1981–2004, mean BMI was higher with decreasing degrees of urbanization. After correction for age distribution, there were smaller but still significant differences between the degrees of urbanization; the differences were only slightly attenuated (Gast et al., 2007).
	North Carolina and New York (USA)	Poor black rural men and women are more likely to be obese than their urban counterparts (Geronimus et al., 2006).
	Quebec, Canada	Rural residents are more likely to be overweight (Pampalon et al., 2006).
	Iowa (USA)	There was a higher prevalence of overweight among rural children than among children from urban areas (Joens-Matre et al., 2008).
	Kansas (USA)	Rural children are more often overweight than their rural counterparts (Davis et al., 2008).
Rural	Japan	The prevalence of obesity was greater for men in urban areas (Nishi et al., 2008).
	USA	The greatest impact of modernization on obesity would be in areas where "reductions in the time cost of food" was greatest. Because of the higher productivity of urban dwellers, they are the ones most likely to benefit from the great reduction in the time-price of prepackaged foods (Cutler et al., 2003).
	OECD countries	Body Mass Index (BMI) was inversely related to the proportion of the population that was rural. This statistically significant relationship was found using a multiple regression model to account for GDP per capita, age structure, female labor force participation, road traffic volume, agricultural productivity and the proportion of smokers. Overall, a 1 percent increment in the urban share of the population (holding other factors constant) increases the proportion of the population that is overweight (BMI greater than 25) by 0.4 percent (Loureiro and Nagaya, 2005).
No Difference	Taiwan	Among children the degree of obesity was about the same in both rural and urban areas (Yang et al., 2007).
	United Kingdom	After adjusting for individual characteristics, the prevalence of overweight and obesity (BMI >25) was lowest in Greater London and villages. It was highest in semi-rural areas and other cities. There was no clear rural/urban health gradient (Riva et al., 2009).
	10 European countries	There were no differences between rural and urban areas the prevalence of overweight and obesity. Separate analysis by gender, age, education, and income level did not reveal additional rural-urban variations (Peytremann-Bridevaux et al., 2007).
	Kansas (USA)	Rural and urban children show equivalent BMI (Davis et al., 2008).

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B-8: Cardiovascular Disease Risk Factors: Physical Inactivity

Health Advantage	Study Area(s)	Findings
Urban	USA	Rural women were more likely to be classified as sedentary (no reported sports or exercise in the past two weeks). This is true for most age groups (Wilcox, et al., 2000).
	Quebec, Canada	Rural residents are more likely to be sedentary (Pampalon et al., 2006).
	USA	The presence of PIA (Physical Inactivity) was highest in the most rural category. The odds of being physically inactive were 43% higher in the most rural compared with the most urban categories. The prevalence of meeting either the vigorous or the moderate intensity physical activity (PA) recommendation was lowest in the rural categories. Adjusting for socio-demographic variables weakens, but does not eliminate, the R/U differentials (Martin et al., 2005).
	Queensland, Australia	A lower proportion of non-metropolitan residents reported physical activity facilities. A lower proportion of rural residents reported the presence of physical activity-promoting facilities (Duncan et al., 2009).
Rural	Iowa (USA)	Urban children were less physically active overall than their rural counterparts (Joens-Matre et al., 2008).
	USA	Low levels of physical activity in urban areas are associated with an increased urban prevalence of cardiovascular disease, stroke and other causes of ill health. Recent rural-to-urban migrants are at greatest risk because they now expend less energy at work but do not have habits of strenuous recreational exercise (Eberhardt and Pamuk, 2004).
	Ontario, Canada	Women residing in urban areas were more likely to have less self reported physical activity in comparison with women residing in rural areas (Plotnikoff et al., 2004).
	USA	Large urban areas had the highest prevalence of recommended levels of leisure-time physical activity (LTPA). Rural areas had the highest levels of inactivity (Reis, et al., 2004).
	Kansas (USA)	Urban children had slightly higher sedentary activity than rural children and were more often at risk for overweight (Davis et al., 2008).
No Difference	USA	There was no overall urban-rural difference in the proportion of women classified as regularly active (Wilcox et al., 2000).
	Queensland, Australia	After adjustment for socio-demographic variables, there were no significant rural/urban differences in sufficient physical activity (Duncan et al., 2009).
	Cyprus	There is no substantial difference between physical activity patterns and sedentary behavior among children in rural and urban areas (Bathrellou et al., 2007).

B-9: Other Cardiovascular Disease Risk Factors

Health Advantage	Study Area(s)	Findings
Urban	New South Wales, Australia	Rural patients with type 2 diabetes showed more individual cardiovascular risk factors when compared to their urban counterparts (Wan et al., 2007).
	Japan	The prevalence of hypertension was greater in rural areas. The prevalence of obesity was greater for women in rural areas (Nishi et al., 2008).
Rural	Japan	Total cholesterol levels were higher in urban areas (Nishi et al., 2008).
No Difference		

B-10. Differential Access to Health Services - Quality of Care

Health Advantage	Study Area(s)	Findings
Urban	11 states in USA	Rural patients with depression had significantly higher odds of being hospitalized for physical or emotional problems, even when controlling for outpatient specialty care in the last six months (Rost et al., 2007).
	USA	There were statistically significant differences between urban and rural hospitals for 8 out of 12 quality indicators in acute care/critical access hospitals. For 7 indicators, the differences favored urban hospitals. One indicator related to pneumonia favored rural hospitals (Nawal Lutfiyya et al.,

		2007).
	Wales	There are rural-urban differences in the mental well-being of caregivers for people with stroke or dementia, which may relate to the quality of health care services in rural and urban areas. Urban male caregivers reported better mental health than male caregivers in rural areas and female caregivers in both settings (Tommis et al., 2007).
	Iowa (USA)	Rural hospitals lag behind urban hospitals in terms of many clinical information system applications. More than 80% of urban hospitals, but only between 30 and 40% of rural hospitals, reported using computers to collect basic clinical information for potential use in an electronic medical record and computerized provider order entry system (Ward et al., 2006).
	Alberta, Canada	Rural physicians performed more pulmonary function tests and made more referrals to other healthcare specialists. Urban patients had documented their symptoms and triggers more than rural patients and used peak flow monitoring more often. Urban physicians provided more asthma education and prescribed more oral corticosteroids and antibiotics than rural physicians (Lum et al., 2007).
	Sweden	Depression was more often inadequately treated and treated with inappropriate medications in rural areas as compared to urban areas (Bergdahl et al., 2007).
	USA	Rural end-of-life residents had higher rates of congestive heart failure, cancer, renal failure, and emphysema than urban end-of-life residents; however, they were less likely to receive treatments such as IV medications, dialysis, and wound care (Bolin et al., 2006).
	USA	Increasing levels of rurality may be positively associated with hospitalization for ambulatory care-sensitive conditions (those for which hospitalization is thought to be avoidable) (Laditka et al., 2009).
	Nova Scotia	Compared with their urban counterparts, terminal cancer patients in rural areas were less likely to die in their homes, as is more desirable, as opposed to a hospital (Burge et al., 2005).
	Kansas (USA)	In 1994/1995, the quality of inpatient care in terms of 6 major QIs provided to Medicare patients by acute care hospitals in Kansas was inferior in rural hospitals compared with hospitals in urban areas (Sheikh and Bullock, 2001).
Rural	Kentucky (USA)	Performance measures for operations were addressed more consistently by rural surgeons. Operative practice reached very high standards in both settings (Galandiuk et al., 2006).
No Difference		

B-11. Differential Access to Health Services - Financial Access

Health Advantage	Study Area(s)	Findings
Urban	USA	The proportion of the population that had health insurance was lower in rural than urban areas (Eberhardt and Pamuk, 2004).
	Three US states	In 2 of 3 US states surveyed, uninsurance status was significantly associated with residential setting (Hu et al., 2006).
	North Carolina (USA)	Rural elderly residents were less likely to obtain health care at a hospital. They were more likely to have put off hospital care as a result of cost difficulties (Blazer et al., 1995).
	USA	Uninsured persons discharged from rural hospitals were more likely than their urban counterparts to be working-age adults and to reside in a ZIP code area with a median household income of less than $35,000 a year. Rural uninsured hospitalizations were more likely to be for preventable conditions than were urban uninsured hospitalizations. The proportion of total hospital charges related to preventable hospitalizations was higher in rural hospitals as compared to urban hospitals (Zhang et al., 2008).
Rural	Minnesota and Texas (USA)	Medicare hospital charges during the last year of life averaged $12,448 for rural persons and $31,780 for urban (Gessert and Haller, 2008).
	Canada	Per capita costs to diabetes patients for most health care categories were higher for urban dwellers, with the exception of hospitalizations, which were higher for rural residents. Age-adjusted total health care costs and mortality rates were similar, suggesting that rural populations with diabetes may not be as disadvantaged as commonly believed (Pohar et al., 2007).
No Difference		

B-12. Differential Access to Health Services - Physical Access to Health Providers

Health Advantage	Study Area(s)	Findings

Urban	USA	Among trauma patients who were transported to hospitals by helicopter, the total mileage and flight times were significantly greater for rural as compared to urban flights. There were no significant differences between urban and rural patients with regard to gender, vital signs, days hospitalized, and mortality. The difference was where those patients died. Urban patients were 9 times more likely to die in the hospital than rural patients. The higher in-hospital mortality is the result of faster urban emergency medical services response and travel times that minimized out-of-hospital deaths even before the arrival of helicopter transport (McCowan et al., 2008).
	USA	Rural residents traveled significantly greater distances to receive multiple sclerosis-focused care than urban counterparts (Buchanan et al., 2008).
	Croatia	There were significantly fewer general practitioners per 100,000 inhabitants in rural than urban counties (Bagat, 2008)
	Scotland	There were significantly longer pre-hospital transport times for rural trauma and health care patients, including more air ambulance transfers and paramedic presence. The study also found a higher proportion of transfer in the rural major trauma group, more serious head injuries in the urban group, and higher proportion of urban patients with head injuries transferred to regional units. There were no differences in length of total inpatient stay, length of intensive-care unit stay, or mortality (McGuffie et al., 2005).
	USA	Dentists were more concentrated in urban areas; however, 84.7 percent of the population living in the most rural counties lived in a county with one or more private practice dentists (Wall and Brown, 2007).
	Nebraska (USA)	Rural areas consistently had the largest gap between predicted need for RNs and numbers employed an the rural registered nurse shortages were significantly greater than those in urban areas (Cramer et al., 2006).
	Australia	Urban patients with bystander-witnessed cardiac arrest were more likely to arrive at an emergency department with a cardiac output and discharged from hospital alive than rural patients. Distance of the cardiac arrest from the closest ambulance branch was a major factor associated with survival to hospital admission (Jennings et al., 2006).
	USA	Out of a total of 3,140 counties in the US, there are 843 where neither anesthesiologists of Certified Nurse Anesthetists reside. Ninety seven percent (816) of these counties are rural (Fallacaro and Ruiz-Law, 2004).
	USA	There is a clear and consistent pattern: virtually all of the most urbanized metropolitan counties in major and medium metropolitan areas had some mental health service,s and the amount and range of services exceeded all other urbanization and metropolitan status categories. For the remainder of counties, both the availability levels and median number of beds are considerably lower. The availability, volume, and variety of organizations and services were greatest in the most urbanized metropolitan counties and were lowest in the least urbanized metropolitan and non-metropolitan counties (Goldsmith et al., 1995).
	North Carolina (USA)	Rural elderly residents were less likely to obtain health care at a hospital. They were more likely to have put off hospital care as a result of transportation difficulties (Blazer et al., 1995).
	Australia	Specialist health care services are disproportionately concentrated in urban areas (Moorin et al., 2006).
Rural	Australia	Bystander cardiopulmonary resuscitation was more likely in rural than in urban areas (Jennings et al., 2006).
No Difference	Sweden	There was no difference between rural and urban areas in the rate of ambulance use and the long-term prognosis in acute chest pain patients (Herlitz et al., 2006).
	USA	Among trauma patients who were transported to hospitals by helicopter, there were no significant differences between urban and rural patients with regard to gender, vital signs, days hospitalized, and mortality (McCowan et al., 2008).
	Scotland	There were no differences in length of total inpatient stay, length of intensive-care unit stay, or mortality between rural and urban trauma patients (McGuffie et al., 2005).
	Croatia	There was no significant difference in the total number of physicians per 100,000 inhabitants between predominantly urban and rural counties (Bagat, 2008).

B-13. Differential Access to Health Services -- Access to and Outcomes of Diagnostic and Treatment Services

Health Advantage	Study Area(s)	Findings
Urban	USA	*General* There were substantial differences between rural and urban general surgical case mixes. Operations on the bowel, appendix, and gallbladder constituted 61% of general surgical inpatient procedures in rural hospitals, compared with 46% in urban hospitals. Rural practices included substantially fewer operations on the stomach and esophagus, liver and pancreas, spleen and thyroid, and bowel.

	General surgical procedures constituted 42% of inpatient procedures in rural hospitals versus 25% in urban hospitals. A rural general surgeon more broadly trained in selected obstetric and gynecologic operations could potentially perform 66% of all inpatient procedures in rural hospitals (VanBibber et al., 2006).
USA	After adjustments for rural-urban case mix and agency differences, rural compared to urban patients received fewer home health services and attained less favorable discharge outcomes (Schlenker et al., 2002).
USA	Rural Medicare enrollees are much less likely than urban enrollees to receive medical social service or therapeutic visits (Kenney, 1993).
USA	Under controls for predisposing, enabling, and need variables, there were fewer home care provider–days in rural than urban areas (McAuley et al., 2009).
USA	Preventative counseling was more commonly reported in urban practices. Preventive services were more commonly reported in urban practices. Anticipatory guidance for children was more commonly provided during visits in urban practices (Probst et al., 2002).
USA	*Maternal and Perinatal Conditions* After controlling for known risk factors, rural residence is associated with slightly higher risk of late prenatal care (Larson, 1997).
Australia	Premature births from rural mothers had a higher risk of stillbirth and mortality in neonatal intensive care than urban infants (Abdel-Latif et al., 2006).
France	*Colorectal Cancer* Inhabitants of rural areas were less often treated in centers specialized in treating colon cancers (Launoy et al., 1992).
Scotland	Rural patients had lower expectations of care and more hurdles to cross before reaching specialist care (Bain and Campbell, 2000).
North Carolina (USA)	Rural residents report lower colon cancer screening rates than their urban counterparts (Kinney et al., 2006).
USA	About 28.2% of those who resided in rural areas had received a sigmoidoscopy or colonoscopy in the past 5 years compared with 35% in the larger metropolitan areas (Coughlin and Thompson, 2004).
Western Australia	*Breast, Ovarian, Cervical, and Uterine Cancer* Women from rural areas with breast cancer were less likely than urban women to have open biopsy with frozen section, breast-conserving surgery, adjuvant radiotherapy, and hormonal therapy, and were less likely to be treated by a high-caseload breast cancer surgeon. Adjusting for age and tumor characteristics, rural women had an increased likelihood of death within 5 years of breast cancer diagnosis, but this difference was not significant after adjustment for treatment factors (Mitchell et al., 2006).
USA	Rural women were significantly more likely to have mastectomy than their urban counterparts (as opposed to more-breast-conserving procedures). Patient-related factors, including stage at diagnosis, race, and marital status, as well as community factors, such as employment, education level, and density of radiation technologists, have significant impact on the likelihood that a patient received a mastectomy (Jacobs et al., 2008).
Australia	Rural women with invasive breast cancer were less likely to undergo breast-conserving surgery compared with urban women. The same was true for rural women with ductal carcinoma in situ. This difference was independent of patient and tumor characteristics, surgeon caseload, patients, age, and socioeconomic status (Kok et al., 2006).
USA	Among rural women who had breast conserving surgery (BCS) 43.5 percent received radiation therapy (XRT) compared with 50.7 percent of urban women. Based on multivariate regression analysis, women residing in rural areas were 0.58 times as likely to receive radiation therapy after breast conserving surgery for ductal carcinoma *in situ* (Schootman and Aft, 2001).
USA	Based on multivariate analysis, there was a significant difference between urban and rural populations: 44.92% of urban women received mastectomy while 59.90% of rural women received a mastectomy (Jacobs, et al., 2008).
USA	Rural black women are diagnosed with breast cancer much later than are black urban women (Amey et al., 1997).
USA	After multivariate analysis, the percentage of rural women aged 40 years or older who had received a mammogram in the past 2 years was lower than that of urban women (Coughlin et al., 2002).
USA	After multivariate analysis, the percentage of rural women aged 40 years or older who had received a clinical breast examination in the past 2 years was lower than that of urban women (Coughlin, et al., 2002).
USA	After multivariate analysis, the percentage of rural women aged 18 years or older who had received a pap test in the past 2 years was lower than that of urban women (Coughlin, et al., 2002).
California (USA)	Lower percentages of early-diagnosis breast carcinomas were reported for the nonurban counties (Arora, et al., 2001).

USA	*Prostate Cancer* Lower rural access to or utilization of early detection methods may contribute to the rural-urban differential in the extent of prostate cancer at diagnosis (Liff, et al., 1991).
Australia	PSA screening is more common in urban than rural areas, and that is related to lower urban mortality from prostate cancer. The lower urban mortality may result from better access to urologists in urban areas (Coory and Baade, 2005).
Texas (USA)	*All Other Cancers* A larger proportion of total cancer cases was diagnosed at the premalignant stage in urban than rural areas (Risser, 1996).
Alabama (USA)	*Diabetes* Adherence to American Diabetes Association (ADA) standards of care was lower in rural areas. Rural patients were less likely than urban patients to receive screening and preventative services (Andrus et al., 2004).
Norway, Denmark and Sweden	*Neuropsychiatric Disorders - General* There was a positive correlation between the degree of urbanization and treated incidence of psychoses (Saarento et al., 1996).
Maine (USA)	Rural beneficiaries of Aid for Dependent Children (AFDC) and Supplemental Security Income (SSI) rely relatively more on general health care providers for mental health problems than urban beneficiaries (Lambert et al., 1999).
USA	*Neuropsychiatric Disorders -- Unipolar Depressive Disorder* Concerning the effectiveness of depression disease management, antidepressant medication, and specialty care counseling, clinical outcomes from treatment over 18 months were improved in urban, but not in rural, patients (Adams et al., 2006).
Minnesota and Texas (USA)	*Neuropsychiatric Disorders -- Dementia* Rural nursing home residents with severe dementia were more likely to be hospitalized during the last 90 days of life (Gessert, et al., 2006).
Minnesota and Texas (USA)	There were rural-urban differences in medical care for nursing home residents with severe dementia at the end of life. Feeding tube use was more common in urban nursing home residents, whereas rural nursing home residents were at greater risk for hospitalization. Rural residence was also associated with lower likelihood of more than 10 days of hospitalization and ICU admission. Rural nursing home residence was associated with lower likelihood of use of the most-intensive medical services at the end of life (Gessert et al., 2006b).
USA	*Neuropsychiatric Disorders -- Multiple Sclerosis* Significantly smaller proportions of people with multiple sclerosis (MS) from rural areas reported no difficulty getting MS-related care as compared to their urban counterparts (Buchanan et al., 2006a).
USA	A significantly larger proportion of people with MS in rural areas had a family physician or general practitioner as their primary physician while a significantly larger proportion of people with MS in urban areas had a neurologist as their primary physician (Buchanan et al., 2006b).
USA	People living with MS in more remote areas averaged less satisfaction with their access to a neurologist and to MS-focused care than urban counterparts. People with MS in rural areas also tend to report lower physical health-related quality of life (Buchanan et al., 2008).
Australia	*Cardiovascular Disease* Echocardiography was used less often for diagnosis of chronic heart failure in rural areas compared with metropolitan areas. Rates of specialist referral were also significantly lower in rural towns than in metropolitan areas, as were prescribing rates of angiotensin-converting enzyme inhibitors. There was no difference in prescribing rates of beta blockers (Clark et al., 2007).
USA	Admissions to rural hospitals for acute myocardial infarction (AMI) were less likely than admissions to urban hospitals to receive several recommended treatments for AMI (Baldwin, et al., 2004).
Australia	*Musculoskeletal Diseases* Rates of bone densitometry use were lower in rural and remote populations than in urban populations, with people in capital cities about three times as likely to undergo the investigation as those in remote areas, (Ewald et al., 2005)
Iowa (USA)	A greater proportion of urban versus rural respondents had utilized any physician for arthritis care (Saag et al., 1998).
Illinois (USA)	*Oral Diseases* The metropolitan counties had higher proportion of children enrolled in Medicaid who received dental services (35 and 30 percent versus 25 and 27 percent) (Byk et al., 2002).

	North Carolina (USA)	Practitioners in the smallest cities report treatment distributions reflecting more frequent loss of teeth and less frequent replacement (Bader, 1994).
	Colorado (USA)	*Injury* Rural communities had strengths in dealing with brain trauma care but had few resources available for long-term rehabilitation and community-integrated services for its residents with brain injuries. The urban community, in contrast, had an array of alternative treatment approaches available (Sample et al., 2007).
Rural	USA	Rural home health users receive on average three more visits than their urban counterparts, with many more skilled nursing and home health aide visits (Kenney, 1993).
	Virginia (USA)	Discharges from hospitals to rural centers had significantly higher levels of continuity of care (Farrell et al., 1996).
	Kansas (USA)	In logistic regression analysis, urban location was strongly associated with feeding tube use. Feeding tubes were used in 19.3 percent of urban nursing home residents with very severe, chronic, and irreversible chronic impairment; 8.0 percent of such residents in midsize community nursing home residents and 6.4 percent of such residents in rural nursing homes (Gessert and Calkins, 2001).
	Pennsylvania (USA)	In 72% of rural schools children were allowed to self-carry asthma rescue inhalers, as compared to 47% of urban schools (Hillemeier et al., 2006).
	USA	Urban residence appears to be associated with later stages of colorectal presentation (Paquette and Finlayson, 2007).
	South Australia	For melanomas, early detection rates were higher in rural areas (Wilkinson and Cameron, 2004).
	Minnesota and Texas (USA)	Urban nursing home residents with severe dementia at the end of life were more likely to have had more than 10 days of hospitalization, ICU admission and feeding tube use (Gessert, et al., 2006).
No Difference	USA	*General* Under controls for predisposing, enabling and need variables, rural-urban differences in the likelihood of any formal home care use disappear (McAuley et al., 2009).
	North Carolina (USA)	Among elderly people, inpatient and ambulatory health service use did not vary by urban-rural residence in controlled analysis (Blazer et al., 1995).
	USA	Rural elderly have as many short term hospital stays and the same number of days of bed disability as their urban counterparts (Himes et al., 1994).
	England and Wales	*Infectious Disease* Concerning disparities in tuberculosis treatment, while crude odds ratios showed a significantly higher level of treatment non-completion in rural areas, these results became non-significant after adjusting for confounding effects of ethnic group and age (Abubakar et al., 2008).
	Oregon (USA)	*Maternal and Perinatal Conditions* There was no significant association between rural/urban residence and late initiation of prenatal care (Epstein, et al., 2009).
	USA	No differences were shown in patterns of care for the most clinically important aspect of obstetric care (e.g., cesarean delivery rates) and no evidence suggested the outcomes were different (Hart , 1996).
	France	*Cancer - Colorectal* The mean age at diagnosis of colorectal cancer was the same in rural and urban areas (Launoy et al., 1992).
	California (USA)	People in rural and urban areas have their colorectal cancers diagnosed at similar stages (Blair et al., 2006)..
	North Carolina (USA)	There was no significant difference by rural-urban residence in the extent of colon cancer at diagnosis (Kinney et al., 2006).
	New Zealand	*Cancer - Breast* There is no statistically significant effect of urban/rural residence in breast cancer stage at diagnosis and survival (Bennett et al., 2007).
	California (USA)	People in rural and urban areas have their breast cancers diagnosed at similar stages (Blair et al., 2006)..
	USA	There was no significant difference in the stage of breast cancer at presentation for rural and urban populations (Jacobs, et al., 2008).
	New Zealand	Urban/rural residence did not have any statistically significant effect on breast cancer stage at diagnosis (Bennett et al., 2007).
	South Australia	There was no rural-urban difference in early detection rates for breast cancer (Wilkinson and Cameron, 2004).
	California (USA)	There was no rural-urban difference in the percentage of patients presenting with early-stage breast cancer (Blair et al., 2006).

	USA	*All Other Cancers* Lung cancer patients from rural areas were not more likely to present at a later stage of the disease than urban patients presentation (Paquette and Finlayson, 2007).
	South Australia	There was no rural urban difference in early detection rates for bladder cancer (Wilkinson and.Cameron, 2004).
	California (USA)	People in rural and urban areas have their melanoma cancers diagnosed at similar stages (Blair et al., 2006)..
	France	For males, local and distant tumor extension at diagnosis was similar in rural and urban areas (Launoy et al., 1992).
	USA	*Neuropsychiatric Disorders* Multivariate models indicate that rural subjects were just as likely to receive nonacute services for mental health problems as their urban counterparts (Rost et al., 1998a).
	USA	There were no rural-urban differences in the rate, type or quality of outpatient depression treatment (Rost et al., 1998a).
	USA	There were no urban-rural differences in the probability of mental health specialty use for memory related problems (Chumbler et al., 2001).

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B-14. Social Capital

Health Advantage	Study Area(s)	Findings
Urban		
Rural	the Netherlands	Rural areas generally have a higher level of social capital (Van Hooijdonk et al., 2008).
No Difference		

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B-15.Socioeconomic Factors

Health Advantage	Study Area(s)	Findings
Urban	USA	County per capita income was a strong predictor of fair to poor health. Poor health was associated with increasing concentrations of poverty (Auchincloss et al., 2002).
	USA	Factors such as few close friends, several recent emergency room visits, and financial strain were associated with significantly higher likelihood of major depression among rural as compared with urban patients. Probability of depression is lower for rural patients when financial strain is low, about the same for rural and urban patients when strain is intermediate, and higher for rural patients when strain is high (Friedman et al., 2007).
Rural	California (USA)	There is a strong association between socioeconomic status and colorectal cancer stage at diagnosis among individuals living in urban areas. As socioeconomic status increased, odds of late stage at diagnosis decreased. Within socioeconomic status categories, no significant differences in stage at diagnosis by urban/rural status were found (Parikh-Patel et al., 2006).
No Difference		

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B-16: Cancer Risk Factors

Health Advantage	Study Area(s)	Findings

Urban		
Rural	Lithuania	The prevalence of human papilloma virus (HPV)—a risk factor for cervical cancer—was higher in urban women than among their rural counterparts (Kliucinskas et al., 2006).
No Difference		

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ANNEX C: RESEARCH FINDINGS ON RURAL-URBAN HEALTH DIFFERENTIALS IN LESS DEVELOPED COUNTRIES

Health Differentials

C-1. Overall mortality and morbidity

Health Advantage	Study Area(s)	Findings

Urban	Kunming in Yunnan Province	For communicable disease, non-communicable disease, and injury causes, the number of years of life lost per thousand was greatest in rural areas. These results were consistent with measures of average life expectancy at birth: 77 years in the urban region, 74 years in the suburban region, and 71 years in the rural region. When individual causes of death were considered, some patterns resembled those of more developed nations. For example, premature mortality due to perinatal mortality, infectious disease, road traffic injuries, and suicides were greatest in the rural areas (Cai and Chongsuvivatwong, 2006).
	China	After controlling for age and gender, mortality was 32% higher in rural areas (Zimmer et al., 2007).
	China	On a scale of 1 to 4, (1=excellent 4=poor) the mean self-reported health for urban residents was higher than that of rural residents (2.13-rural vs 2.09-urban). This difference was significant at the p<.01 level (Luo and Wen, 2002).
Rural	China	Nine percent of rural residents claimed to be ill/disabled, The figure for urban residents was 11 percent. This difference was significant at the p<.05 level (Luo and Wen, 2002).
	sub-Saharan Africa	UN projections for 2005 implied that urban crude death rate was 19.5 per thousand compared to an implied rural crude death rate of only 13.7 per thousand (Woods, 2004).
No Difference	China	There was no difference in self-assessed poor health between rural and urban elders (21.5%-rural vs 21.0%-urban) (Zimmer and Kwong 2004).
	India	Very little difference in adult mortality between rural and urban areas was found (Subramanian, 2006).

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C-2. Child Mortality

Health Advantage	Study Area(s)	Findings
Urban	57 of 87 developing countries	According to Demographic and Health Survey (DHS) data, infant and child mortality on average is substantially lower in urban than in rural areas in developing countries. In 57 out of 87 surveys, urban mortality was significantly lower than rural mortality (NRC, 2003).
	Benin, Central African Republic, Chad, Guinea, Mali and Niger	According to DHS data from six sub-Saharan countries, rural-urban differences in infant mortality were marked in those countries. On average rural infant mortality is higher by five deaths per one hundred births. This gap results from household level factors, such as large family size and the lack of electricity. Community level determinants, such as the availability of health care, explained only 13 per cent of the gap (Van de Poel et al., 2007a).
	Sub Saharan Africa	According to DHS data, the median urban infant mortality rate was 74.7 as opposed to the rural rate of 96.8. The median under-5 urban mortality rate was 57.3 vs. the median rural rate of 83.1 (Hay et al., 2005).
	47 developing countries	According to DHS data, under-five mortality in rural areas was 14 percent as opposed to 10 percent for urban areas, though the rural-urban differences in under-5 mortality lose their statistical significance after controlling for household wealth (Van de Poel et al., 2007b).
	Over 60 developing Countries	According to DHS data, the under-5 mortality rate were about 30 percent higher in rural areas and that child mortality is falling more slowly in rural areas as compared to urban areas (Wang, 2003).
	India	When rural/urban residence was entered as the only explanatory variable, rural areas showed greater odds of mortality in all three age groups (neonatal 1.28; early post-neonatal 1.32; and late post neonatal 1.43). This relationship remains when controlling for socioeconomic and bio-demographic (compositional) characteristics. When variables indicating contextual factors such as environmental conditions and the use of maternal health services are included in the statistical model, there is no longer a significant relationship between child mortality and rural/urban residence. This means that differences in child mortality between rural and urban places are explained by contextual factors, differential use of maternal health care, and environmental conditions reflecting differing service regimes and socio-environmental infrastructures (Stephenson et al., 2003).
	Nigeria	Urbanization had positive effects on health conditions (lower infant mortality) in Nigeria based on multiple regression study. However, crowding (density) had negative effects (Adegbola, 1987).
	11 developing countries	In 9 of 11 countries, under-5 mortality was lower in urban than rural areas . Lower child mortality in urban areas is attributable to a lower incidence of poverty, lower child malnutrition, higher vaccination coverage, and greater dissemination and uptake of effective of effective health interventions such as oral rehydration therapy (Alderman, 2001).
Rural	Kenya	Infant and child mortality in Nairobi's slums in the 1990s exceeded that of rural Kenya, urban Kenya, and Nairobi overall (NRC, 2003).
	47 developing countries	In 9 of 47 developing countries, under-5 mortality is even higher among the urban poor than it is among the rural poor (Van der Poel et al., 2007b).

	25 developing countries	Significantly higher infant and child mortality rates are found among the urban poor than among the urban non-poor. In comparing urban poor and rural children, in 57 out of 87 surveys, urban mortality was significantly lower than rural mortality; however, in 25 surveys, urban poor faced significantly higher risks than rural children (NRC, 2003).
No difference	India	The children of rural non migrants had significantly higher odds of mortality than the children of rural to urban migrants. But this relationship was no longer significant once maternal education was controlled for. Thus differences between rural migrants and rural to urban migrants could be explained by two factors: the greater propensity of those with higher educational attainment to migrate from rural to urban areas or the greater availability of maternal health care service in urban areas (Stephenson et al., 2003).
Additional Information	Developing countries	Even in developing countries, where infant and child mortality are significantly lower in the urban areas, it would be inappropriate to assume that rural to urban migrants will find that the mortality levels of their own children fell to that of the urban residents. That is because such migration is often a two stage process in which the migrants first move into periurban slums in which conditions are only marginally better (and sometimes worse) than the rural areas from which they came. As a result, mortality of rural-to-urban migrants is generally much higher than that of urban residents (Brockerhoff, 1995).
	Bangladesh	The effect of rural-urban migration on under-five mortality was higher among children born to urban migrants compared with children born to life-long urban natives (102 and 62 per 1000 live births, respectively), and this corresponds to difference in socioeconomic status. Rapid urbanization and greater mortality of recent migrants may contribute to diminishing urban advantage over rural areas in the future (Islam and Azad, 2008).

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C-3.Communicable Diseases, Maternal and Perinatal Conditions, and Nutrition: HIV/AIDS

Health Advantage	Study Area(s)	Findings
Urban	China	A qualitative study on rural-to-urban migrants points out that about 70% of HIV infection is among rural residents and that HIV prevalence among rural-to-urban migrants is 1.8 times higher than among rural residents who did not migrate (Hong et al., 2006).
Rural	Eastern Europe, the States of India and countries in Eastern and South Africa	The prevalence of HIV/AIDS tends to increase with population density. Social interaction tends to be higher in urban areas. Couples tend to marry later and high risk behavior tends to be more prevalent. Since these factors are associated with economic development, the degree urban may be a proxy for the level of development. In the countries studied, there was a consistent positive association between HIV prevalence and the percent urban (Woods, 2004).
	Burundi, Lesotho, Malawi, Namibia, Rwanda, Zambia, and Zimbabwe	Estimates of HIV prevalence obtained from the testing of pregnant women between 1998 and 2001 were considerably lower in rural than in urban sites. The countries were (Dyson, 2003).
	Tamil Nadu, India	HIV-2 antibodies were found in 0.8% of the urban and 0.3% of the rural population (Solomon et al., 1998).
	Tamil Nadu, India	HIV prevalence is highest in urban areas. The prevalence of HIV infection in persons aged 30 to 34 years was 4% in urban areas and 1.53% in rural areas. This difference was statistically significant (Kang et al., (2005).
	Arusha, Tanzania	HIV-1 Prevalence in the Arusha region was higher among the urban population than among the rural population (Mnyika et al., 1994).
	North West Province of South Africa	Groups 1, 2, and 3 (rural) had lower HIV infection rates than group 4 (urban). There is a steady increase with group number (degree urban) (Vorster et al., 2000).
No Difference	Tamil Nadu, India	HIV-1 antibodies were found in 7.4% of the urban and 7.1% of the rural population, and this is well within the 95% confidence intervals (Solomon et al., 1998).

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C-4. Communicable Diseases, Maternal and Perinatal Conditions, and Nutrition: Malaria

Health Advantage	Study Area(s)	Findings
Urban	East Africa	Rural settlements reported significantly higher prevalence of malaria among children aged 0–14 than urban settlements (Omumbo et al., 2005).
	Zambia	There was a seasonal as well as a rural-urban pattern in the prevalence of malaria parasitaemia (parasites in the blood). During November, the urban rate was 2.4 percent as compared to the rural rate of 10 percent. In April, the urban rate was 10 percent compared with 27 percent in the rural area (Watts et al., 1990).
	Cameroon	There was a reduced density of malaria parasites and reduced prevalence of malaria in the urbanized area. The differential is attributed to improved nutrition, increased vaccine coverage, better access to health services, greater use of insecticide treated nets and screens in urban areas, the adverse of effect of urban water pollution on vector larval habitat, and to reduced probability of being bitten by a malaria vector where the ratio of humans to mosquitoes is higher (Kimbi et al., 2006).
	Sub-Saharan Africa	The entomological infective inoculation rate (infective mosquito bites per year) was 7.1 in urban areas, 45.8 in periurban areas, and 167.7 in rural areas (Robert et al., 2003).
	Malaysia	There were low malaria transmission rates in urban areas as compared to rural areas; the mean inoculation rate in rural areas was twenty-fold higher than that in urban areas (Nimir et al., 2006).
Rural	Malaysia	The geometric mean parasite count in urban patients was significantly higher than that of rural patients. Coma and death were more common among the cases seen at the urban hospital, whereas severe anemia was the significant complication in the rural setting (Nimir et al., 2006).
No Difference		

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C-5. Communicable Diseases, Maternal and Perinatal Conditions, and Nutrition: Tropical Diseases: Leishmaniasis, Schistosomiasis, Trypanosomiasis, Leptospirosis, Yellow Fever

Health Advantage	Study Area(s)	Findings
Urban	southwest Nigeria	There was a higher prevalence of intestinal helminths and schistosomiasis infection among rural children than among urban children (Oninla et al., 2007a).
Rural	Latin America	As cities have grown closer to rural areas, leishmaniasis is now increasingly an urban problem. Urban encroachment on previously wild habitat has also increased the prevalence of other previously zoonotic infections in urban areas such as leptospirosis (also known as Weil's diseases) and yellow fever (Moore et al., 2003).
No Difference	southwest Nigeria	There was a similar prevalence of intestinal helminths and schistosomiasis parasites in school children of urban and rural areas (Agbolade et al., 2007).
	Town of Daloa in Cote d'Ivoire	Urbanization did not end the transmission of human African trypanosomiasis (HAT) or sleeping sickness, but it did result in the concentration of the tsetse flies in the town outskirts. In these locations, conditions are favorable to the survival of the tsetse pathogens because of plentiful man-vector contact (Fournet et al., 1999).

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C-6. Communicable Diseases, Maternal and Perinatal Conditions, and Nutrition: Intestinal Nematode Infections

Health Advantage	Study Area(s)	Findings
Urban		

Rural	southwest Nigeria	Intensities of roundworm infections (excreted eggs/g feces) lower among infected rural school children than among infected urban school children (Oninla et al., 2007a).
	China	Self-reported gastrointestinal disease was most prevalent in urban areas (12%-rural vs. 19%-urban). (Zimmer and Kwong 2004).
	India	The highest prevalence of intestinal parasitic infections was in urban slums as compared to rural and urban areas (Khurana et al., 2005).
No Difference	southwestern Nigeria	There was no significant difference between urban and rural hookworm infections in school children of urban and rural areas (Oninla et al., 2007a).

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C-7. Communicable Diseases, Maternal and Perinatal Conditions, and Nutrition: Maternal Conditions

Health Advantage	Study Area(s)	Findings
Urban	Iran	Among normal and underweight women, a significantly greater proportion of rural than urban women had lower-than-recommended pregnancy weight gain (Maddah and Nikooyeh, 2007).
	South Africa	The number of pregnancies per woman increased as the proportion who owned rural property increased. Women born in rural areas had more pregnancies than those born in urban areas. There was an inverse relationship between years lived in an urban area and having more than five pregnancie (Pick and Obermeyer, 1996.
	South Africa	Being born in a rural area was not significantly associated with infertility; but there was a significant inverse relationship between length of stay in an urban area and reported infertility (Pick and Obermeyer, 1996).
Rural		
No Difference		

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C-8. Non-Communicable Diseases: Diabetes

Health Advantage	Study Area(s)	Findings
Urban	southern India	There was a higher prevalence of diabetic foot infection in rural areas of compared to urban areas (34 percent versus 26 percent). Surgical intervention and amputation were also more prevalent in rural areas. The greater prevalence was attributed to walking barefoot and rodent bites to the feet (Viswanathan, 2006).
Rural	Oman	The prevalence of diabetes in urban areas was almost 18 percent compared with 10.5 percent in rural areas. Furthermore, the impact of urban residence on the likelihood of diabetes persisted after adjusting for demographic and educational variables. There was a greater prevalence of hypertension in urban areas compared to rural areas (26 percent versus 20 percent). Both the prevalence of diabetes and hypertension may be associated with higher food consumption and reduced physical activity in urban areas of Oman (Al-Moosa et al., 2006).
	India	The lowest prevalence of self-reported diabetes was in rural areas. About the same prevalence (3.2 percent) was found in periurban slums. The highest prevalence was found in urban areas (7.3 per cent). The prevalence of urban diabetes has increased over time: in 2000, the prevalence of diabetes in the urban areas was reported to be 12.4 per cent compared with 2.5 percent in rural areas. In 2004, the prevalence in urban areas was reported to be 15.5 per cent compared with 2.7 percent in rural areas (Mohan et al., 2008).
	India	Diabetes prevalence in urban areas is three to four times that of rural areas (Reddy, 2002).

	southern India	The prevalence of type-2 diabetes is around 2 percent in rural areas and 12 percent in urban areas. The differential is attributed to richer diets, less physical activity and greater likelihood of urban residents to know that they suffer from diabetes (Ramachandran et al., 1999).
	Bangladesh	Type 2 diabetes in rural and urban populations showed increased prevalence in urban communities compared with rural communities, despite similarities in risk factors (Hussain et al., 2005).
	Mexico	While prediabetes was similarly distributed in rural and urban children, the frequency of insulin resistance was higher in urban groups (Aradillas-Garcia et al., 2007).
No Difference		

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C-9. Neuropsychiatric Disorders

Health Advantage	Study Area(s)	Findings
Urban	Oyo State, Nigeria	Depression was more common in the rural areas than in the urban areas (Amoran et al., 2007).
	India	Acute onset of schizophrenia was most frequent in rural areas. Claiming impossible things, feelings of being persecuted, and hearing voices were most common in the rural sample (Varma et al., 1997).
Rural	Developing countries	Urbanization is associated with non-psychotic psychological problems such as juvenile delinquency, dysfunctional families, and adult criminality. The differential is attributed to the stress of moving from rural to urban culture, the stress of changing from an economic system dominated by agriculture to one dominated by industry, and to the social disorganization characterizing urban systems (Loudermir and Hartman, 1998).
	India	Loss of appetite, loss of sleep, and loss of interest in sex, normal activities and appearance were most common in urban areas. There was a much higher proportion of the catatonic type and acute schizophrenic episode and paranoid type in the urban area (Varma et al., 1997)
No Difference		

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C-10. Sense Organ Disorders -- Common Ear Infections

Health Advantage	Study Area(s)	Findings
Urban	India	Middle ear pathology was present in 20% of the rural primary school residents and 12.6% of primary school residents in urban slums (Bandyopadhyay et al., 2005).
Rural		
No Difference		

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C-11. Sense Organ Disorders - Vision Disorders

Health Advantage	Study Area(s)	Findings
Urban		
Rural	China	The prevalence of self reported cataracts was higher in urban than in rural areas (4%-rural vs. 11%-urban) (Zimmer and Kwong, 2004).
No Difference	Beijing, China	The frequency of optic disk hemorrhages was not significantly associated with rural vs. urban residence (Wang et al., 2006).

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C-12. Non-Communicable Diseases: Cardiovascular Disease (Hypertension and Stroke)

Health Advantage	Study Area(s)	Findings
Urban	China	Age-adjusted stroke mortality was higher in urban areas until the end of the 1990s, when the burden of stroke shifted from urban to rural areas (Zhang et al., 2007).
	Tanzania	Before migration, rural to urban migrants had significantly higher blood pressure than rural non migrants. Six moths after migration, the rural to urban migrants had higher LDL cholesterol, lower triglycerides and lower blood pressure than rural non migrants (Unwin et al., 2006).
Rural	Northwest Province of South Africa	Hypertension rates showed the effects of urbanization in men and women. An urbanized environment was associated with significantly higher hypertension prevalence rates than in rural areas (Malan et al., 2006).
	China	Self-reported cardiovascular disease was highest in urban areas (12%-rural vs. 29%-urban) (Zimmer and Kwong, 2004).
	China	Urban elders were substantially more likely than rural elders to report a chronic condition (e.g., cardiovascular disease) (51.5% vs 65.6%) (Zimmer and Kwong, 2004).
	Ghana	Both men and women in rural areas had lower age-adjusted mean systolic and diastolic blood pressure levels than their counterparts in urban areas, and hypertension was associated with smoking and alcohol consumption in men (Agyemang, 2006).
	Ghana	Urban boys had significantly higher mean blood pressure than rural boys, and BMI was independently associated with blood pressure (Agyemang et al., 2005).
No Difference	Ghana	No differences were found in girls' blood pressure between urban and rural areas (Agyemang et al., 2005).

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C-13. Respiratory Diseases -- Chronic Obstructive Pulmonary Disease

Health Advantage	Study Area(s)	Findings
Urban		
Rural		
No Difference	Nanjing, China	There was no statistical significance between participants in rural and urban areas in the prevalence of chronic obstructive pulmonary diseasea health condition associated with cigarette smoking (Xu et al., 2006).

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C-14. Respiratory Diseases -- Asthma

Health Advantage	Study Area(s)	Findings
Urban		
Rural	China	Living in rural agricultural settings is protective against adult asthma because it involves proximity to animals at an early age (Chan-Yeung et al., 2002).
	Palestinian Authority	Urban prevalence is significantly higher in every measure (Ever wheeze, Recent wheeze, Exercise Wheeze, Night Dry Cough). There is a positive association between wheezing illness and its severity with urbanization. This association was independent of age or gender of the child (Hasan, et al. 2000).
	Kenya	The prevalence rates of attacks of shortness of breath with wheeze were 9.5% for urban children and 3.0% for rural children. This urban-rural gradient persisted after adjusting for urban-rural differences in a host of factors but was largely explained by urban-rural differences in environmental factors. Similar results were obtained for all other symptoms (Odhiambo et al., 1998).
No Difference		

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C-15. Musculoskeletal Diseases -- Osteoporosis

Health Advantage	Study Area(s)	Findings
Urban	China	Urban men and women had significantly higher spine bone mineral content and bone mineral density and bone area than their rural counterparts. This difference could be explained by body size in men but remained unexplained after adjusting for body size and certain lifestyle risk factors in women (Gu et al., 2007).
Rural		
No Difference		

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ANNEX D: RESEARCH FINDINGS ON THE DETERMINANTS OF RURAL-URBAN HEALTH DIFFERENTIALS IN LESS DEVELOPED COUNTRIES

Health Determinants

D-1. Vulnerability to Disasters

Health Advantage	Study Area(s)	Findings
Urban		
Rural	Mexico City	An erosion-caused disaster occured in a periurban area outside of Mexico City (Aragon-Durand et al., 2007).
No Difference		

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D-2. Pollution and Sanitation

Health Advantage	Study Area(s)	Findings
Urban	China	The contribution of indoor air pollution to particulate matter exposure was higher in rural populations (8090%) compared to urban populations (5060%). Exposure to indoor air pollution in rural areas was approximately double that of exposure in urban areas, and this was attributed to a higher level of biomass burning in rural areas (Mestl et al., 2007).
	rural Thailand and urban Singapore	Dust endotoxin levels were found to be significantly higher in homes in rural environments. The difference in levels was attributed to a greater use in urban environments of detergents and disinfectants to clean floors and mattress protectors (Lee et al., 2006).
Rural	India	A study comparing emission patterns in industrialized urban and rural areas by measuring suspended particulate matter distributiona significant criterion of air quality and a factor strongly associated with human mortality. Values in urban areas were well above standard limits, and values in rural areas were well below standard limits (Shandilya et al., 2007).
No Difference		

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D-3. Malaria Vector

Health Advantage	Study Area(s)	Findings
Urban	West Africa	As urban areas have occupied previously agricultural land, most of the natural breeding sites of malaria vectors have disappeared (Oyewole and Awolola, 2006).
	Nigeria	The increase in urban population has had major adverse implications for malaria vectors and host-vector contact. Though slums may provide new breeding sites, cities are very unhealthy places for the malaria parasite, which requires clean freshwater breeding sites. Urbanization not only eliminates open space for breeding, it results in pollution of the remaining breeding sites. Furthermore, with increasing human population densities, malaria exposure per capita decreases (Hay et al., 2005).
	South Cameroon	Anopheline mosquito densities were significantly higher in rural than in urban environments. Greater anopheline diversity was observed in the rural villages (Antonio-Nkondjio et al., 2005).
Rural		
No Difference		

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D-4. Other Disease Vectors

Health Advantage	Study Area(s)	Findings

Urban	Malaysia	Filariasis (elephantiasis) is caused by a microscopic worm that is spread in rural areas by mosquito bites. As a result of industrialization and urbanization, there has been a dramatic decline in the prevalence of this disease. Scrub typhus is a bacterial infection that is spread by mites, which are carried by rodents that flourish in palm plantations. However, the rodents and their mites do not follow urbanizing populations to the cities, so the prevalence of scrub typhus is declining with urbanization (Kwa, 2008).
Rural	Thailand	The mosquito vectors of dengue fever, a viral infection causing hemorrhagic fever and shock syndrome, have adapted well to life in urban areas, especially urban slums. A study of the spatial distribution of dengue vectors A. aegypti and A. albopictus along an urban-rural gradient found a larger number of A. aegypti larvae in the urban areas than in the rural areas. However, the opposite was found for A. albopictus. Thus, at least one of the vectors transmitting dengue fever has followed urbanizing hosts. As a result, dengue fever rates have been steadily increasing in tandem with the rapid urbanization of the population (Tsuda et al., 2006).
	China	Schistosomiasis japonica, often called bilharzia, is almost entirely a disease of rural areas in East Asia, especially those lacking good sanitation and water supplies. Rural to urban migration of workers may introduce new infections into the urban areas (Huang and Manderson, 2005).
No Difference		

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D-5. Differential Access to Health Services and Quality of Care

Health Advantage	Study Area(s)	Findings
Urban	sub-Saharan Africa	Perhaps the greatest health advantage of urban areas is easier access to health services when they are needed. DHS data show that the median distance to health services in urban places is 16 kilometers. In rural places it is three times that distance (Hay et al., 2005).
	China	Rural residents used hospitals less than urban residents. The study found significantly less utilization of health services (either physician or hospitals) among ethnic minorities, males, seniors, the poorly educated, and uninsured persons residing in rural areas (Liu et al., 2007).
	the Ujjain district in Madhya Pradesh state, India	A simulation exercise showed a marked shortage of accessible practitioners in rural areas as compared to urban areas, even after accounting for the large numbers of unqualified doctors in rural areas, rural-urban differences in access, and rural-urban differences in the incidence of health hazards (Katrak, 2008).
	South Africa	A greater percentage of rural than urban mothers indicated that they were giving un-prescribed medicines to their children (MacKeown and Faber, 2002).
	China	Health insurance coverage was 4 times greater in urban than rural areas. This difference was significant at the p<.001 level (Luo and Wen, 2002).
	China	Access to health care often requires an ability to pay for it. Thus having health insurance is an important aspect of access to health care. Urban health insurance programsthe Government Insurance Program (GIP) and the Labor Insurance Program (LIP)are being merged into a community-based insurance system that will unfortunately not extend to the rural population. However, urbanization may serve as a driving force for the development of the health care market in rural areas and can generate a sizeable income effect that will increase the demand for community-based health insurance in rural areas (Liu et al., 2003).
Rural	China	Rural residents used physicians more than urban residents (Liu et al., 2007). A short distance (<3km) to the medical facility was a factor associated with increased use of physician utilization.
No Difference	China	Urban residents living in communities with more doctors tend to rate their health as better. Rural residents living in communities with more doctors tend to rate their health as worse (Luo and Wen, 2002).
	Thailand	There was no significant difference between urban and rural patients in quality of life, functional outcome, and psychological outcome after stroke rehabilitation (Manimmanakorn et al., 2008).

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D-6. Health-Related Behaviors: Alcohol and Other Substance Abuse

Health Advantage	Study Area(s)	Findings
	China	Heavy use of alcohol was more likely to be reported in rural areas (Zhou et al., 2006).

Urban	Hubei Province in China	The prevalence of alcohol use was higher in rural than in urban areas across age groups. Patterns of alcohol use differed between men and women: rates of use among women increased as age increased, especially among rural residents (Mao and Wu, 2007).
Rural	Lao People's Democratic Republic	There was a close positive correlation between recognition of drug abuse and the stage of urbanization of villages represented by the urban index (Fujiwara et al., 2005).
	Thailand	There was a marginally significant differential with regard to excessive consumption of alcohol by migrants to urban areas (Jirapramukpitak et al., 2008).
	North West Province of South Africa	The percentage of drinkers and mean alcohol intake of drinkers were highest in the urban group (Vorster et al., 2000).
	North West Province of South Africa	Alcohol consumption was higher for urban men and women than for rural men and women (Malan et al., 2008).
	Yunnan Province, China	The likelihood of being a drug user and having casual sex in the last 30 days was significantly higher in urban (0.17) than in rural places (0.06). Urban residence also more than doubled the odds of both using drugs and having casual sex (OR=2.35) (Yang and Luo, 2009).
	China	Drinking rates were higher in urban areas than in rural areas (Zhou et al., 2006).
No Difference	China	Self-reported heavy drinking was higher in urban than in rural areas. The difference was not statistically significant (Luo and Wen, 2002).
	Yunnan Province, China	There was no statistically different difference in the prevalence of active drug use between urban and rural residence (Yang and Luo, 2009).
	Thailand	There was no clear association between migrant and non-migrant illicit drug use (Jirapramukpitak et al., 2008).

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D-7. Health-Related Behaviors: Use of Tobacco

Health Advantage	Study Area(s)	Findings
Urban	China	Smoking rates were higher in rural areas than in urban areas. Heavy use of tobacco was more likely to be reported in rural areas (Zhou et al., 2006).
	Hubei Province in China	The prevalence of cigarette use was higher in rural than in urban areas across age groups. Patterns of tobacco use differed between men and women: rates of use among women increased as age increased, especially among rural residents (Mao and Wu, 2007).
	North West Province of South Africa	The percentage of persons who were currently smoking was higher for rural men and women than for urban men and women (Malan et al., 2008).
	India	Smoking prevalence is now higher in rural than in urban areas (Leon, 2008).
Rural	North West Province of South Africa	The percentage of smokers was highest in the urban group (Vorster et al., 2000).
No Difference	China	Self-reported heavy smoking was lower in urban than rural areas. The difference was not statistically significant (Luo and Wen, 2002).
	Pakistan	Children's (10–12 years of age) response as to whether any family members smoked did not have any relation to the urbanization rank (Hakeem et al., 2001).

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D-8. Health-Related Behaviors: High-Risk Sexual Behaviors

Health Advantage	Study Area(s)	Findings
Urban	Nyanza Province, Kenya	Rural women reported less-frequent virginity at marriage, a higher number of lifetime partners, and less consistent condom use with nonspousal partners than their urban counterparts (Voeten et al., 2004).
	Tanzania	Rural-urban migrants—both married and unmarried—are not having sexual relations in urban areas. The result challenges the view that HIV in sub-Saharan Africa is largely transmitted to rural areas by return migrants (Coast, 2006).

Rural	China	The proportions of urban migrants who had premarital sex and multiple sexual partners were significantly higher than those of non-migrants. Condom use and knowledge of HIV were similar among the two groups (Hu et al., 2006).
	China	Premarital sex, commercial sex work, and poor knowledge of HIV/STI prevention were common among rural migrants to cities (Hong et al., 2006).
	Burkina Faso	Respondents in urban areas were much more likely to report sex work at sexual meeting venues than rural counterparts. New and multiple partnerships and sex work were more common in urban than in rural areas, though these behaviors were also reported by important proportions of rural women. The majority of respondents in the interviews had not received HIV/AIDS education, but lack of education was particularly pronounced in rural areas. Urban women were also more likely to report condom use with a recent new partner than their rural counterparts. Multivariable regression analysis showed that teenage women in rural areas were much more likely to report new/multiple partnerships than older women; in urban areas, women who had received primary school education or higher were less likely to report new/multiple partnerships. Differences in risk behavior provide a window into patterns of HIV prevalence, in which prevalence rapidly increases in the presence of a core group with high levels of new or multiple partnership and a high degree of sexual mixing (Khan et al., 2006).
	Kenya	Urban sex workers were younger, had started sex work at an earlier age, and had had more recent clients than had rural women (Voeten et al., 2007).
	Kenya	There is a significantly earlier sexual debut and greater incidence of multiple sexual partnerships among the urban poor as compared to the rural poor. The authors note that among married women, the differential is particularly high: women in Nairobis slums are at least three times as likely to practice high-risk behaviors as rural married women (Dodoo et al., 2007).
	Yunnan Province, China	The thirty day prevalence for casual sex among urban residents was more than double that among rural residents. The likelihood of being a drug user and having casual sex in the last 30 days was significantly higher in urban (0.17) than in rural places (0.06). Urban residence increased the odds of having casual sex in the last 30 days by more than 50% (Odds Ratio-OR = 1.55). Urban residence also more than doubled the odds of both using drugs and having casual sex (OR=2.35) (Yang and Luo, 2009).
	China	There are high levels of high-risk sexual behavior among "return migrants"individuals who have returned to rural homes from urban areasas compared to rural residents. After controlling for sociodemographic characteristics, return migrants in rural areas had higher levels of sexual risk, including unprotected sex, than rural residents who had never migrated (Li et al., 2007).
No Difference	Nyanza Province, Kenya	For men, sexual risk behavior was equally high in rural and urban areas (Voeten et al., 2004).

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D-9. Health-Related Behaviors: Physical Activity

Health Advantage	Study Area(s)	Findings
Urban	China	Urban persons have a higher rate of leisure time physical activity than their rural counterparts (Mao and Wu, 2007).
Rural	China	Urbanization has altered the "occupational landscape". There have been major shifts from agricultural to industrial, commercial and service-based employment, which require far less physical activity (Mao and Wu, 2007).
	China	Using data from the China Health and Nutrition Survey, the authors found that a 1 percent change in the proportion urban results in an almost 7 percent increase in light (as opposed to heavy) occupational activity (Monda et al., 2007).
	Developing countries	The shift to urban occupations in developing countries results in more sedentary behavior (Cutler et al., 2003).
	China	Urban residents have adopted a life style more sedentary than their rural counterparts (Popkin, 1999).
	India	A survey of patterns of diet, physical activity, and obesity in urban and rural populations showed that rural men and women reported five and seven times, respectively, the physical activity of their urban counterparts (Yadav and Krishnan, 2008).
	Pakistan	The degree to which children (10–12 years of age) overestimated their physical activity level (PAL) increased with urbanization rank (Hakeem et al., 2001).
	Tanzania	Rural populations were found to have a substantially higher physical activity level than the urban population (Mbalilaki et al., 2007).
No Difference		

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D-10. Health-Related Behaviors: Health-Seeking Behaviors

Health Advantage	Study Area(s)	Findings
Urban	Hubei Province, China	The percentage of urban residents seeking health-related knowledge was higher than that of their rural counterparts across all age groups. The percentage of survey respondents seeking health-related knowledge decreased as age increased in rural areas. The percentage of urban residents who sought health-related knowledge was relatively stable across age groups (Mao and Wu, 2007).
	China	Urban elders were more likely than were rural elders to visit health care professionals (Zimmer and Kwong, 2004).
	Pakistan	Among children 10–12 years of age, cardio-vascular nutrition knowledge score increases with the urbanization status. Children's perception of whether they control their own health (HLC score) increased with urbanization status. Therefore, behavior modification is likely to be easier in more urbanized Pakistani groups (Hakeem et al., 2001).
	Jamaica	Among rural and urban populations afflicted with sickle cell disease, the rural sample assessed their quality of life—as measured by physical and mental health scores and perceptions of limitations on daily living activities as a result of their disease—as higher than the urban sample, in spite of more limited access to health care (Asnani et al., 2008).
	Nigeria	A comparison of maternal responses to childhood fever showed that while rural mothers were more likely to recognize danger signs and symptoms than urban mothers, urban mothers' responses were generally better than those of rural mothers. Rural mothers were more likely to use informal health services and manage fevers at home than urban mothers. Urban mothers sought action faster than rural mothers, were less likely to use leftover drugs from previous treatment, and were more likely to use preventive measures than their rural counterparts (Uzochukwu et al., 2008).
Rural		
No Difference	Ghana	In 3 multiple regression models for general health knowledge of (a) contagion index, (b) contagion or hygiene index, or (c) prevention index, respectively, the coefficient of "urban or semi-urban residence" was negative but not statistically significant (Andrzejewski et al., 2009).

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D-11. Under-Nutrition

Health Advantage	Study Area(s)	Findings
Urban	5 geographic regions	A comparison of children's height for age (stunting) and height for weight (wasting) in rural and urban sectors across using DHS data showed that children in urban areas were significantly healthier (NRC, 2003).
	Oaxaca, Mexico	Stunting in 2000 was 14.5% for urban areas and 28.8% for rural areas. This was a statistically significant difference (Malina et al., 2008).
	China	The multiple regression coefficients for the urban dummy variable are all significant and negative for the five years surveyed, which suggests that urban children achieved better nutritional status than their rural counterparts. The absolute values of the estimates suggest that the rural-urban gap increased over time (Chen et al., 2007).
	Eastern Africa	Stunting (low height-for-age) is less common among urban than among rural children (Engle et al., 1997).
	36 countries in South Asia, sub-Saharan Africa, and Latin America and the Caribbean	Based on DHS data, child nutrition was better in urban areas with considerably lower levels of stunting and wasting. There were few differences in the determinants of child nutrition—women's education and status, access to safe water and sanitation, and household economic status—between rural and urban areas, but the levels of these socioeconomic determinants were higher in urban areas (Smith et al., 2005).
	10 nations (2 in Asia, 5 in Latin America and 4 in Africa)	Based on DHS data, the prevalence of stunting was higher in rural areas for all countries studied. However, when the urban and rural populations were divided into quintiles according to socioeconomic status, in most cases stunting among the poorest urban quintile was as prevalent as stunting among the poorest rural quintile (Menon et al., 2000).
	15 sub-Saharan African countries	Based on DHS data, in all countries and in all periods, rural children are in greater risk of stunting. The urban advantage in child health disappears, however, after controlling for socioeconomic status (Fotso, 2007).
	North West Province of South	The diet of the urban groups was more adequate than the rural diet with regard to micronutrients (Vorster et al., 2000).

	Africa	
	47 developing countries for which DHS data were available	43 percent of rural children were stunted as compared to only 28 percent of urban children. The stunting differential between rural and urban areas in 47 developing countries can be explained by differences in household wealth. When only the poor in rural and urban areas are considered, in more than half of the countries, there was no significant difference in stunting between the urban and rural poor (Van de Poel et al., 2007b).
	Nigeria	Mean nutritional indices (weight for age, weight for height, and height for age) were significantly lower among the rural pupils than urban pupils. The prevalence of underweight, wasting, and stunting was also higher in the rural areas (Oninla et al., 2007b).
	26 sub-Saharan African	A meta-analysis of DHS data for the years between 1995 and 2006 showed that rural women were 68% more likely than their urban counterparts to be malnourished (Uthman and Aremu, 2008).
Rural	67 DHS surveys	While on average poor urban children were taller and heavier than their rural counterparts, in a few studies, urban poor children were shorter and weighed less for their age than rural children. In Comoros, Madagascar, Bangladesh, India, and Guatemala, there was evidence for poor urban children being significantly shorter than their rural counterparts. In comparing weight for height in urban vs. rural areas, in 16 surveys, urban poor children weighed significantly less than their rural counterparts (NRC, 2003).
	15 countries of Sub-Saharan Africa	Data from DHS surveys showed that the number of urban poor and undernourished is increasing more quickly than the number of rural poor (Fotso, 2006).
	15 countries of sub-Saharan Africa	DHS data showed that the migration streams that are fueling urbanization in Africa are largely composed of disadvantaged families. As a result, in countries such as Kenya, poor urban children have worse nutritional outcomes than poor rural children (Fotso, 2007).
No Difference	Oaxaca, Mexico	There was no significant rural-urban difference in underweight (Malina et al., 2008).
	East Africa	The prevalence of wasting (low weight for height) among rural and urban children is similar (Engle et al., 1997).
Additional Information	15 countries of sub-Saharan Africa	There were large intra-urban nutritional gaps between periurban slums and more privileged urban neighborhoods. In all but two countries, intra-urban differentials in stunting exceeded the rural-urban differential (Fotso, 2006).

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D-12. Breastfeeding

Health Advantage	Study Area(s)	Findings
Urban		
Rural	African and the Latin American and Caribbean Region	The mean duration of breastfeeding was higher in rural than in urban areas (Perez-Escamilla, 1994).
	East Africa	The median breastfeeding duration was greater in rural than urban areas (Engle et al., 1997).
No Difference		

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D-13. Cardiovascular Disease and Diabetes Risk Factors

--Overweight--Obesity--BMI--Waist Circumference
--Insulin resistance-- Blood lipids

Health Advantage	Study Area(s)	Findings
Urban	West Bank, Palestine	A study of two communities, one rural and one urban, found a greater prevalence of central-body obesity in the rural women (Abdul-Rahim et al., 2001).
Rural	Northwest Province of South Africa	Total cholesterol (TC) and low-density lipoprotein cholesterol (LDLC) were lower in rural areas (Oosthuien et al., 2002).
	Northwest Province of South Africa	PAI-1 levels (a risk factor for cardio-vascular disease) tend to increase with urbanization (Pieters and Vorster, 2008).
	Kenya	Values for both abdominal visceral fat and subcutaneous fat were higher in urban than rural areas for both genders. Obesity based on BMI was substantially higher in urban compared to rural populations among both genders. This was true after controlling for age and ethnicity (Christenson et al., 2008).
	Papua New Guinea	In a study comparing individuals of common genetic background, urban women, but not men, had become significantly heavier than their rural counterparts. Urban men were significantly taller, but without a significant difference in the body-mass index (BMI) compared to their rural counterparts, because the increased bodyweight was offset by the increased size. The study found that rural residents consumed low-protein, low fat diets, mainly sweet potatoes and greens, while the urban residents depended on purchased food, such as rice, fish and chicken (Yamauchi et al., 2001).
	Northwest Province of South Africa	Percentage of energy consumption from fat and BMI were highest in the urban groups (Vorster et al., 2000).
	Developing Countries	Urban residents consume higher levels of fats and animal foods and lower levels of vegetables than rural residents. In particular, increased urbanization of lower income countries is accelerating the shift to increased consumption of sweeteners and fats (Mendez and Popkin, 2004).
	India	Two groups of tribal population had common genetic backgrounds.The prevalence of metabolic syndrome was much higher in the Bhutia community (who live in both rural and urban areas) than the Toto community (who live only in rural areas) (Sarkar et al., 2006).
	Pakistan	The prevalence of obesity (BMI equal or greater than 25) in 25–44 year olds was lower in rural areas (9% for men and 14% for women). In urban areas, prevalence was 22% and 37% for men and women respectively. Obesity in 45–64 year olds was lower in rural areas (11% for women and 19% for men). In urban areas it was 23% and 40% for women and men respectively (Nanan, 2002).
	eight provinces of China	Urban residents consumed higher levels of fats and animal foods and lower levels of vegetables than rural residents (Popkin, 1999).
	China	Urban dwelling has been associated with a rapid rise in cardiovascular disease, which has now become the leading cause of death. This is related to the increased prevalence of metabolic syndrome, a cluster of metabolic disorders that include central obesity, insulin resistance, and hypertension. It is a major risk factor for type 2 diabetes mellitus and cardiovascular disease. There was a higher prevalence of metabolic syndrome among urban than rural men (Weng et al., 2007).
	India	Mean body mass index was also higher in urban vs. rural men and women, and prevalence of obesity highest in the urban populations (Yadav and Krishnan, 2008).
	India	Urbanization is associated with unhealthy changes in diets, reduced physical activity and addiction to tobacco, contributing to risk factors such as overweight, obesity, high blood pressure and diabetes (Reddy, 2002).
	Kazakhstan	Among male Kazakhs, urban children were almost three times more likely to be overweight their rural counterparts. The same was true among male Russian children (Facchini et al., 2007).
	Thailand	In 2004 there were significantly lower odds of being overweight or obese in rural men compared with urban men (Aekplakorn et al., 2007).
	Thailand	A comparison of lipid levels and the prevalence of dyslipidemia (another risk factor for cardiovascular disease) in urban and rural settings found that total cholesterol and low-density lipoprotein cholesterol were significantly higher in urban vs. rural subjects; prevalence of dyslipidemia was higher in urban men (Pongchaiyakul et al., 2006).
	Bangladesh	A significantly higher percentage of poor urban women were overweight or at risk of overweight as compared to poor rural women (Shafique et al., 2007).
	Cameroon	A comparison of age-standardized prevalence of obesity conditions in rural and urban areas showed that while urban areas were characterized by an increase in waist circumference, a factor also associated with heart disease risk, rural areas were also characterized by an increase in BMI over time (Fezeu et al., 2008).
	Northwest Province of South Africa	Total cholesterol (TC) and low-density lipoprotein cholesterol (LDLC) were lower in rural areas. Serum lipid levels increased with increasing urbanization in both men and women. The main factor responsible for this seems to be increased Body Mass Index (BMI) due to decreased physical activity (Oosthuien, et al. 2002).
	Northwest Province of South Africa	Triglycerides were lower for rural men and rural women than for their urban counterparts. Hypertension prevalence was much lower for rural men and rural women than for their urban counterparts. Urbanization is associated with enhanced vascular activity, hypertension prevalence and fibrinogen (Malan et al., 2008).
	Tunisia	The prevalence of obesity (BMI>30) in urban big cities was 30.2%. In other cities, it was 25.9%. In clustered rural areas, it was 19.4% and in dispersed rural areas it was 9.4% (Beltaifa et al., 2008).

	India	Rural vs. urban residence had a significant impact on a variety of cardiovascular disease risk factors, including central adiposity, lipids, lipoproteins, and blood pressure measures, even after adjusting for age and sex. Metabolic syndrome prevalence was found to be significantly higher in urban as compared to rural females (Das et al., 2008).
	West Bank, Palestine	A study of two communities, one rural and one urban, found that the body mass index (BMI) was higher for both men and women in the urban area (Abdul-Rahim et al., 2001).
No Difference	West Bank region of Palestine	A study of two communities, one rural and one urban, found no significant differences in the presence of hypertension or diabetes between the two communities. The prevalence of metabolic syndrome was equal (17 percent) in both the urban and rural communities (Abdul-Rahim et al., 2001).
	China	There was no difference in the prevalence of metabolic syndrome between urban and rural women (Weng et al., 2007).
	Thailand	There were similar odds of being overweight or obese between urban and rural women (Aekplakorn et al., 2007).
	Nothwest Province of South Africa	Urbanisation had no effect on high density lipoprotein cholesterol (HDLC). Multivariate analysis, controlling for age and fasting state, showed no effect of urbanization on total cholesterol (TC). All these differences were within the range of normal levels (Oosthuien et al., 2002).
	Oaxaca, Mexico	There was no significant rural-urban difference in overweight and obesity (Malina et al., 2008).
	sub-Himalayan region	The rural Bhutia are more physically active than the urban Bhutia. When considered separately, the prevalence of metabolic syndrome was remarkably similar among the rural and the urban Bhutia (Sarkar et al., 2006).

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D-14. Level of Social Capital

Health Advantage	Study Area(s)	Findings
Urban		
Rural	Malaysia	Rural elderly respondents had a higher level of social capital than their urban counterparts and higher participation in political and religious organizations and neighborhood groups. Living a more isolated lifestyle in cities can cause loneliness and depression (Selvaratnam and Tin, 2007).
No Difference		

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D-15. Socio-Economic Factors

Health Advantage	Study Area(s)	Findings
Urban	Malaysia	Rural elderly are economically less well off than their urban counterparts (Selvaratnam and Tin, 2007).
	China	Poverty status was lower in the urban area. Urban residents have significantly higher income than rural residents (Luo and Wen, 2002).
Rural	China	With regard to self-reported chronic conditions there was an interaction with socio-economic status in urban but not in rural areas. In urban areas, those with higher socio-economic status were more likely to report that they suffered from chronic conditions. This may be because they could afford to get earlier diagnosis (Zimmer and Kwong, 2004).
	Tunisia	Among the differences between environments regarding obesity in women, the economic level of the household appeared to be a major mediating factor. Obesity remained more a rich than a poor women's disease (Beltafia et al., 2008).
No Difference	China	There are no significant differences in the associations between socio-economic status and self-reported health across rural and urban China (Zimmer and Kwong, 2004).

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