THINK LOCALLY, ACT GLOBALLY:
HOW CURBING GLOBAL WARMING EMISSIONS CAN IMPROVE LOCAL PUBLIC HEALTH

Prepared for the New York City Global Partners Summit
"Public Health and Climate Change: The Urban Policy Connection"
June 26, 2008




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This paper is an advance working copy of an article to be published in the November 2008 edition of the *American Journal of Preventative Medicine*, which will focus on the topic of Public Health and Climate Change.

Think locally, act globally: how curbing global warming emissions can improve local public health

Global climate change is, of course, just that: global. We see its impacts around the world. We can measure the increase in carbon dioxide in the atmosphere at the North and South Poles; we see ice sheets collapsing in Antarctica; we see glaciers melting from Peru to Switzerland; and we see increasingly violent storms from New Orleans to Myanmar.

Cities account for a disproportionate amount of the world's carbon emissions. New York City and many other cities have taken the position that cities can, and must, take the lead in adopting low-carbon strategies, from managing traffic better to making our buildings more energy efficient.

Action must be collective; no one city, no one state, no one nation can prevent climate change. If others do not act, we will still face the same fate of an increasingly hostile climate and extreme weather patterns. When any city reduces its carbon emissions, the whole world will share in the benefits of its action, because the climate change impacts of carbon emissions are only felt on the global level.

New York City's sustainability plan, *PlaNYC: A Greener, Greater New York*, recognizes that global climate change is a very local issue. New York City has over 500 miles of coastline, and sea levels have risen by nearly a foot in the last century as measured at the southern tip of Manhattan. Average summer temperatures in New York City have also been rising in recent years, and storms have gotten more intense.

This report, prepared for the New York Global Partners conference "Public Health and Climate Change: the Urban Policy Connection" and undertaken by the Office of Long-Term Planning and Sustainability and the Department of Health and Mental Hygiene, with support from a team from Columbia University's School of International and Public Affairs, assembles existing research and adds new data analyses that show that global climate change mitigation strategies also have direct local public health benefits. Based on these findings, local policies for climate change mitigation turn the standard phrase on its head: we need to think locally, and act globally.[1]

Thinking locally means reducing local air pollution, because local air pollution is directly linked to mortality, cardiovascular and respiratory illness – including asthma attacks among young children. It means promoting walking and bicycling, because exercise helps reduce obesity and obesity is linked to chronic diseases like heart disease and diabetes. It means getting people out of their cars, because auto accidents are a major cause of death in many parts of the world among otherwise healthy adults and young people. And it means that we can do all of these to both reduce our carbon footprint and to make our citizens healthier.

[1]The Office of Long-Term Planning and Sustainability and the Department of Health and Mental Hygiene would like to thank Professor Ester Fuchs, Joshua Cohen, Susanne DesRoches, Holly Ensign-Barstow, and Paul Winters for their help on this research effort.

Table 1. The economic sectors in the United States with the highest contributions to the total amount of greenhouse gases (GHG)[2]

Sector	GHG	NOx	SOx
Industrial Commercial and Residential	36%	22%	21%
Utilities	32%	22%	67%
Transportation	24%	55%	7%
Other	8%	1%	5%

Health is not a minor fringe benefit. The illnesses we can prevent through transportation and other policy changes that reduce combustion emissions – obesity-related, respiratory, and cardiovascular problems – are among the most prevalent and expensive diseases in many developed countries. If we can improve public health in our cities, we can grow our economies and reduce our carbon emissions at the same time. Here in New York City, we estimate that a modest 10% reduction in particulate matter pollution, a by-product of fossil-fuel combustion, would result in 400-500 fewer deaths each year.[3]

Air quality, greenhouse gases, and public health

Carbon dioxide – the gas that makes up 77% of the world's greenhouse gas emissions – is not a direct hazard to human health. However, the fact is that most of these greenhouse gases are a result of the burning of fossil fuels, as is most air pollution. In the United States, the three main consumers of fuel – power plants, buildings, and vehicles (Table 1) -- account not only for 92% of greenhouse gases, but also for 95% of the sulfur oxides that cause acid rain and create particulate matter, and for 99% of the nitrogen oxides that form smog.

This relationship between greenhouse gas emissions and traditional pollution also exists in those parts of the world where deforestation and land use changes are a major source of carbon emissions. The burning of trees, or of underbrush and unwanted wood in logged areas, contributes directly to the poor air quality of many cities, especially in Asia. If we think back to the terrible air quality in the Southern Hemisphere in 2006 – which was mainly the result of massive forest burning in Indonesia – it should surprise no one that Indonesia's largest source of greenhouse gas emissions is deforestation.[4]

[2] United States Environmental Protection Agency. "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005 Executive Summary." ONLINE. 2005. Available: http://epa.gov/climatechange/emissions/index.html. ,United States Environmental Protection Agency. "Six Common Air Pollutants." ONLINE. 2001. Available: http://www.epa.gov/air/urbanair/nox/what.html. United States Environmental Protection Agency. "Six Common Air Pollutants." ONLINE. 2001. Available: http://www.epa.gov/air/urbanair/so2/what1.html

[3] Unpublished analysis, Bureau of Environmental Surveillance and Policy, NYC Department of Health and Mental Hygiene, March 2007

[4] Bettwy M. "NASA Data Links Indonesian Wildfire Flare-Up to Recent El Niño," National Aeronautics and Space Administration. ONLINE. 2007. Available: www.nasa.gov/centers/goddard/news/topstory/2007/elnino_wildfire_prt.htm

The relationship between air quality and public health has been clear for a long time. Air pollution causes respiratory disease; triggers asthma attacks; is increasingly being shown to increase the risk of cardiovascular diseases; and contributes to premature mortality.[5] We also know that improvements in air quality – caused by policies related to the burning of fossil fuels – can have a direct impact on local public health. In New York, 40% of our carbon footprint comes from the heating fuels we burn directly in our buildings, and another 39% comes from fossil fuels burned in power plants that provide electricity. So making our buildings more efficient is therefore a major part of our strategy to reduce carbon emissions. But we know it can also reduce air pollution, as well: in our city, nearly one-third [29%] of locally produced particulate matter in our air comes from the fuel we use to heat our buildings.[6]

Public health can improve quickly from efforts to improve air quality and building efficiency. In 1990, the city of Dublin, Ireland, banned the sale and burning of coal. We all know coal burning is a leading cause of both carbon emissions and smog. The surprise was that impacts were nearly immediate. Within a matter of months, cardiovascular deaths decreased by 10%, respiratory deaths decreased by 15%, and total deaths decreased by nearly 6%. Overall, the ban prevents over 350 deaths each year.[7]

Similarly, cities around the world know that getting people out of their cars is an important part of a carbon reduction plan. And we can see clearly that reducing auto congestion can have direct positive impacts on public health. During the 1996 Summer Olympics, the city of Atlanta, Georgia, implemented aggressive traffic management policies to get people out of their cars. For the two-week period of the Olympics, vehicular traffic in Atlanta during peak periods declined 22.5%. And, again, public health improved immediately. During those same two weeks, ozone levels decreased by 27.9 percent and healthcare visits for asthma attacks declined by 40 percent. After the Games were over, both pollution and asthma attacks returned to their previous levels.[8]

The same thing happened in Busan, South Korea, in 2002, during the summer Asian games. Stringent traffic controls reduced air pollution by up to 25% on some days, and the rate of hospitalization for all causes decreased measurably. After the games were over and the controls were lifted, hospitalization rates returned to normal.[9]

Both greenhouse gases and pollutants are emitted precisely in proportion to the amount of fuel being used (or forestland being burned) – so any steps that increase fuel efficiency or reduce demand will also reduce air pollution. Whether it is improving the heating and cooling efficiency of our buildings and power

[5] Pope, C.A. III, "Epidemiology of Fine Particulate Air Pollution and Human Health: Biological Mechanisms and Who's at Risk?" Environ Health Persect 108 (suppl 4):713-723 (2000).
[6] City of New York. "PlaNYC: A Greener, Greater New York" 120. ONLINE. 2007. Available: www.nyc.gov/html/planyc2030.
[7] Clancy L, Goodman P, Sinclair H, et al. "Effect of air-pollution control on death rates in Dublin, Ireland: an intervention study." Lancet. 2002; 360:1210–1214.
[8] M.S. Friedman et al., "Impact of changes in transportation and commuting behaviors during the 1996 Summer Olympic Games in Atlanta on air quality and childhood asthma." JAMA 2001; 285: 897-905.
[9] Lee JT, Son JY, Cho YS. "Benefits of mitigated ambient air quality due to transportation control on childhood asthma hospitalization during the 2002 summer Asian games in Busan, Korea". J Air Waste Man Assoc 2007 Aug; 57(8): 968-73.

plants, improving the fuel efficiency of our cars, or reducing the amount of electricity we consume, most greenhouse gas strategies will pay off in terms of reduced local air pollution as well as improved public health.

Urban Sprawl, Obesity – and Automobile Accidents

Another area where greenhouse gas policies coincide with public health benefits is in the promotion of walking and bicycling. Low-density urban sprawl makes public transportation less effective and creates distances that are too far to walk easily; once wealth increases enough to allow most citizens to own a car, this leads to driving cities where people hardly walk at all. In cities like Copenhagen, London, and Singapore, clear policies are in place to promote better urban design – with a mix of commercial and residential land uses that reduces sprawl and promotes walking, transit, and biking.

Sprawl and auto-dependence are problems for the wealthy parts of the world. Today, transportation only accounts for 13% of global greenhouse gas emissions – mainly because auto ownership in many of the world's largest countries is still at relatively low levels.[10] But it is clearly catching up, at the same time as population growth is creating sprawl in cities from Mexico to Moscow.

Any visitor to Beijing who also saw the city a decade ago sees immediately that, while European and American cities are seeking to promote bicycle use, Beijing has nearly completed the switch in the opposite direction. Other cities are working on the same unfortunate transition: in Delhi, India, more than a thousand cars are added to the city's traffic every day.[11] And that was even before Tata Motors introduced an auto that will sell for $2,500, doing for India what Ford's Model T did for the United States in 1908.

More walkable, transit-oriented cities that are less dependent on automobiles, such as Copenhagen and Tokyo, have lower per-capita carbon emissions than sprawling, auto-oriented cities like San Diego and Dallas (Figure 1). We know clearly that less driving, more walking, and more transit ridership means less carbon introduced into the atmosphere, and less local air pollution.

At the same time as our cities are expanding and traffic congestion is worsening, our waistlines are growing. Today, two-thirds of all adult Americans are overweight or obese.[12] With clear linkages to diabetes, cardiovascular disease, and other illnesses, it is estimated that obesity accounts for 6% of all US healthcare expenditures, producing more than $75 billion in healthcare costs in the United States in 2004.[13]

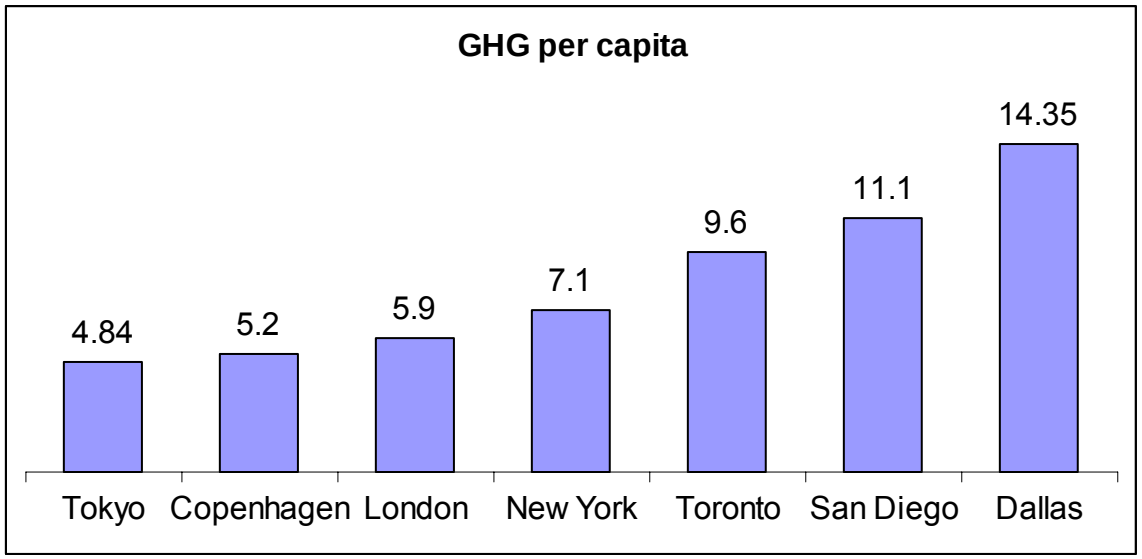
[10] World Resources Institute. "Navigating the Numbers: Greenhouse Gas Data and International Climate Policy." ONLINE. 2005. Available: http://www.wri.org/publication/navigating-the-numbers

[11] Planning Department, Government of National Capital Territory of Delhi. "Economic Survey of Delhi" for years 2001-02, 2004-05, and 2007-08 (supplementary tables). ONLINE. 2007. Available: http://delhiplanning.nic.in/Planning.htm.

[12] Ogden CL, Carroll MD, Curtin LR, McDowell MA, Tabak CJ, Flegal KM. "Prevalence of overweight and obesity in the United States, 1999-2004." JAMA 2006; 295:1549-1555.

[13] Finkelstein EA, Fiebelkorn IC, Wang G. "State-level estimates of annual medical expenditures attributable to obesity." Obesity Research 2004;12(1):18–24.

Figure 1. Greenhouse gases (GHG) per capita for several world cities (metric tons per person). (Source: see Table 4.)

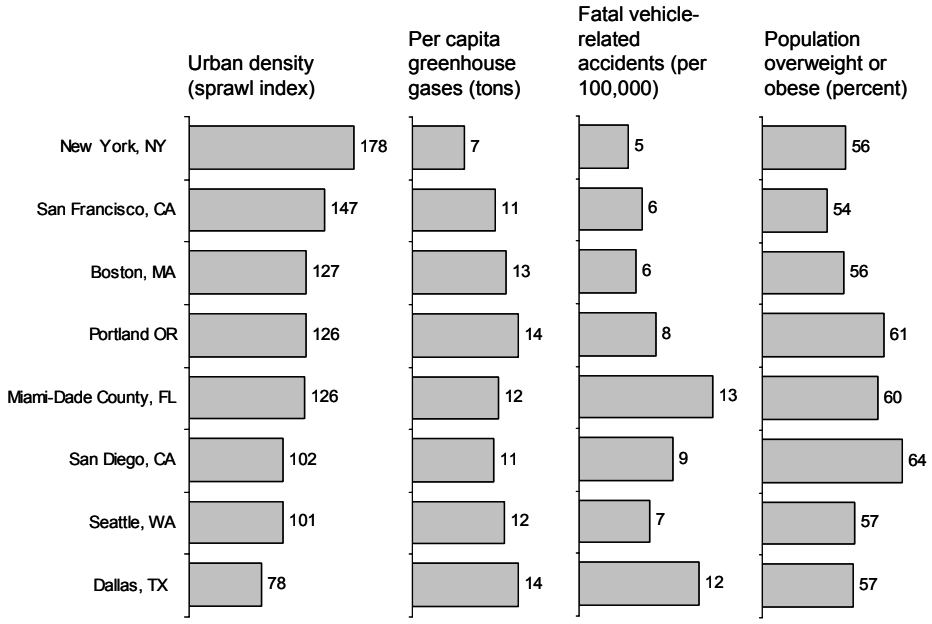


The problem is not uniquely American; from 1991 to 2004 the percentage of Chinese adults who were overweight or obese increased from 12.9% to 27.3%.[14] Among countries in the World Health Organization's European Region, 30-80% of adults are now overweight, with obesity growing at a rate ten times that in the 1970s.[15] And as economies get wealthier, and cities sprawl more, this trend will only continue – and the impact, on both our bodies and our economies, will worsen.

Obesity and auto-oriented, sprawling settlement patterns are clearly related (Figure 2). Walking is a critical component of daily exercise – and the need to walk to get around is the easiest type of exercise a person can engage in on a daily basis. One study in Atlanta, Georgia, showed that each additional hour spent in a car per day is associated with a 6% increase in the likelihood of obesity – and, unsurprisingly, each additional kilometer walked per day is associated with an almost 5% reduction in obesity.[16] Climbing at least 20 floors per week – something that most people who work in an office on the second floor could easily do – has been associated with a 20% lower risk of stroke or death from all causes, as well as an increase in good (HDL) cholesterol.[17] Overall, the residents of sprawling cities drive more, weigh more, and contribute more carbon dioxide to the atmosphere.[18]

[14] Popkin B. September, 2007. "The World Is Fat." Scientific American: 94.
[15] World Health Organization. The challenge of obesity in the WHO European Region and the strategies for response. WHO Regional Office for Europe, Copenhagen Denmark. 2007.
[16] Frank L.D., Andresen M.A., Schmid T.L. "Obesity relationships with community design, physical activity, and time spent in cars." Am J Prev Med, 2004; 27(2): 87-96.
[17] Paffenbarger RS Jr, Hyde RT, Wing AL, Hsieh CC. "Physical activity, all-cause mortality, and longevity of college alumni." N Engl J Med 1997; 314: 605–13.
[18] Ewing R, Schieber RA, Vegeer CZ. "Urban sprawl as a risk factor in motor vehicle occupant and pedestrian fatalities." Am J Public Health 2003; 93:1541-1545; Lopez R. Urban sprawl and risk for being overweight or obese. Am J Public Health 2004: 94: 1574-1579. [18] Ewing R, Penall R, Chen D. "Measuring Sprawl and its Impact." ONLINE. Smart Growth America. 2005. Available: http://www.smartgrowthamerica.org/sprawlindex/MeasuringSprawl.PDF

Figure 2. Comparing relative Urban Densities, Greenhouse gases per capita, Fatal Vehicle Accidents per 100,000, and Percent of Population Overweight or Obese in eight U.S. cities. (Source: see Table 5.)



Better urban design, better transit, and pro-walking policies can clearly make a difference. Several studies have shown that transit riders also walk more – because usually they complete at least one part of their trip on foot. Overall, an American who switches to mass transit for his or her daily commute can be expected to reduce his or her lifetime medical expenses by $5500.[19]

Strikingly, there's an even more obvious public health benefit that transit-oriented cities get from shifting away from the automobile: a reduction in car crashes. Those American cities with less sprawl, more transit usage, and more walking also have fewer fatal automobile accidents. In part, drivers in walking-friendly cities are more conscious of pedestrians.[20] More importantly, however, cities that drive less have, quite simply, fewer cars on the road per person.

The average New York City resident drives only one third the amount that the average American drives.[21] And, we get a public health benefit from that – the rate of fatal motor vehicle crashes in New York City is 71% lower than the national average.[22]

[19] Edwards R.D. Public transit, obesity, and medical costs: Assessing the magnitudes. Preventive Medicine, 2008; 46(1): 14-21.
[20] Freudenberg NS, Galea and D. Vlahov, eds. "Cities and the Health of the Public." 1 ed. 2006, Vanderbilt University Press: Nashville; Pucher J, Dijkstra L. "Promoting safe walking and cycling to improve public health: lessons from The Netherlands and Germany." Am J Public Health, 2003; 93(9): 1509-16.
[21] Hu P.S. and Reuscher T.R. "New York Household Travel Patters: A Comparison Analysis." Prepared for the Office of Transportation Policy and Strategy, New York State Department of Transportation by the Oak Ridge National Laboratory, January 2007. p. 3-15.
[22] Glogowski L.and Mamone S. "2005 Regional Transportation Statistical Report." New York Metropolitan Transportation Council, September 2007. (pp. 68-70)

Greenhouse Gases, Economic Growth, and Public Health

Considering all the reasons why a lower-carbon life leads to a healthier population, why isn't the reduction of carbon emissions a key public health strategy, especially among developing nations? The answer is that national wealth continues to be the key indicator of overall public health. That stands to reason: a wealthier nation will generally be healthier and spend more on health care. A nation whose people are well-fed, well-housed, well-educated, and have the luxury of thinking about more than just the next day's meal will clearly be healthier. And so it stands to reason that – even just looking among the wealthier OECD members – life expectancy is correlated to GDP (Figure 3) as well as health care expenditures per capita (Figure 4), at least until fairly high levels are reached.

Further, when we hear nations such as China and India argue that their economic growth must not be restrained by climate change mitigation policy, the unfortunate fact is that – at first glance – the data would appear to be on their side. Overall, among the same OECD group, per capita GDP does seem to rise with per capita greenhouse gas emissions (Figure 5). Of course, differences are obvious: the geographical size and high dependence on coal of nations like the United States, Canada, and Australia all suggest they are of a different sort than other countries. (This might be comforting until we realize that China and India are also nations of huge distances and large coal reserves.)

But a better measure than overall emissions is greenhouse gas intensity – a measure of how much GHG is produced to fuel each $1 in GDP. This should be uncorrelated to per capita GHG emissions. For example, a nation that has a low standard of living will likely have a low per capita footprint but may well have a high GHG intensity, if its industries and vehicles are inefficient, and if it is relying on dirtier fuels. Similarly, a nation with a higher per capita greenhouse gas footprint could well be much more efficient in its creation of greenhouse gases – yielding more economic activity from every ton of greenhouse gas by having cleaner power plants, more efficient cars, and walkable cities. And this is indeed the case (Figure 6).

What stands out is that there does seem to be a correlation between GHG efficiency and public health. Overall life expectancy increases slightly with GHG efficiency among comparable nations (Figure 7). While the correlation is not ironclad – any public health expert will point out that overall life expectancy is affected by a myriad of causes – there is enough of a correlation to make it seem that GHG efficiency is, indeed, a factor in public health.

Conclusion

So, what does this all mean? First, it means that advocates of climate change mitigation policies should start talking about the sizeable public health benefits that many of those policies can create. Even a politician who is convinced that global warming is a scientific fraud, or who refuses to work to save the world unless every other nation does so first, cannot ignore proposals that will directly improve the health of his or her constituents.

Second, to do this, climate change and public health advocates will also need to take each other's priorities into account as they shape their proposals. Some potential approaches to climate change – switching cars from gasoline to diesel fuel, for example – can reduce GHG while increasing air pollution. The opposite is also true, as some biofuels are proving to have air quality advantages but overall negative GHG impacts. But these are the exceptions. The overlapping areas – in more efficient buildings, cleaner sources of electricity, fewer cars and more transit – is so great that wise advocates should be willing to make common cause even if some specific proposals must be sacrificed.

Finally, it offers us hope that those nations that are most important to the global fight against climate change will find it in their self-interest to join that fight. Polls show that in the United States, voters are highly concerned with health care costs, which are only increased by carbon-intensive policies. China, India, and other fast-growing economies are increasingly confronting the chronic health problems of the West, including obesity, cardiovascular illness, and respiratory disease. As their prosperity grows, their citizens will demand a greater focus on public health, and they may see that a focus on GHG efficiency can accommodate growth while also improving public health and contributing to the global effort that so needs their participation.

This summer, the Beijing Olympic Games will provide an opportunity to do this. The Chinese government is set to implement short-term measures that will reduce pollution during the games. They will almost certainly repeat Atlanta's and Busan's experience of having pollution-related illnesses decline, and then return to pre-Olympic levels following the Games. It may be the most lasting legacy of these Games if leaders around the world watch those statistics and decide that working towards a carbon-efficient future is truly in their own local interests, as well as the world's.

Figure 3. Life expectancy compared with GDP per capita for Organization of Economic Co-operation and Development (OECD) countries. (Source: tables 2 and 3.)

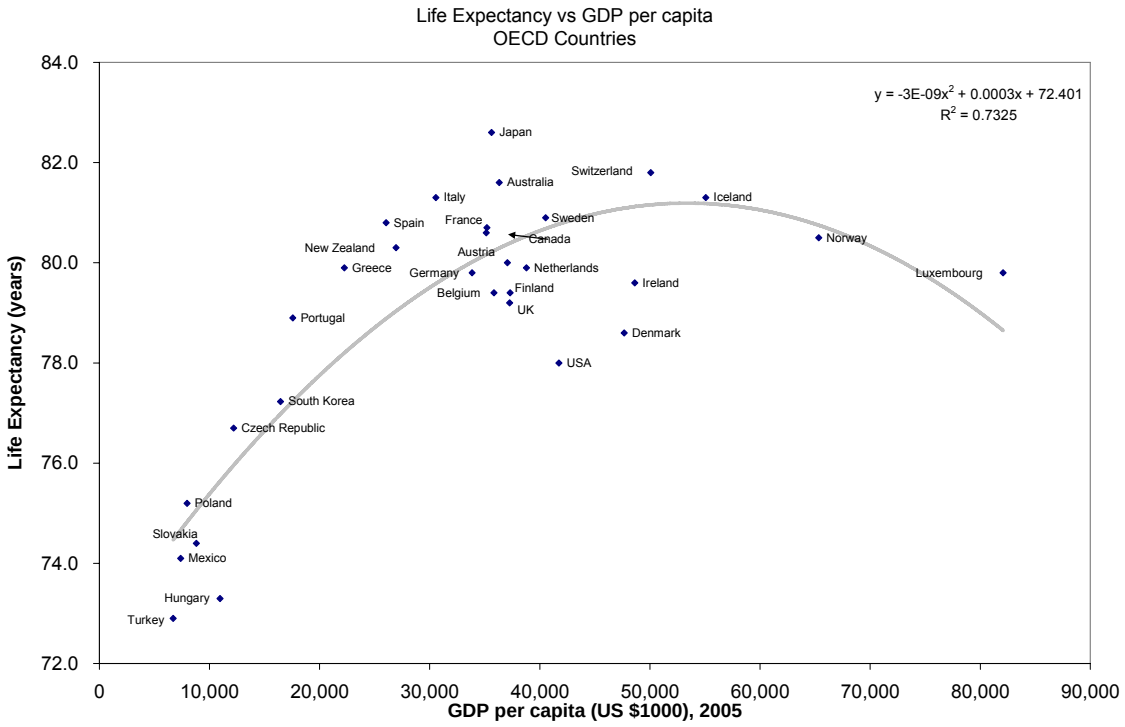


Figure 4 Life expectancy at birth in Organization of Economic Co-operation and Development (OECD) countries compared with healthcare expenditure per capita, 2005. (Source: tables 2 and 3.)

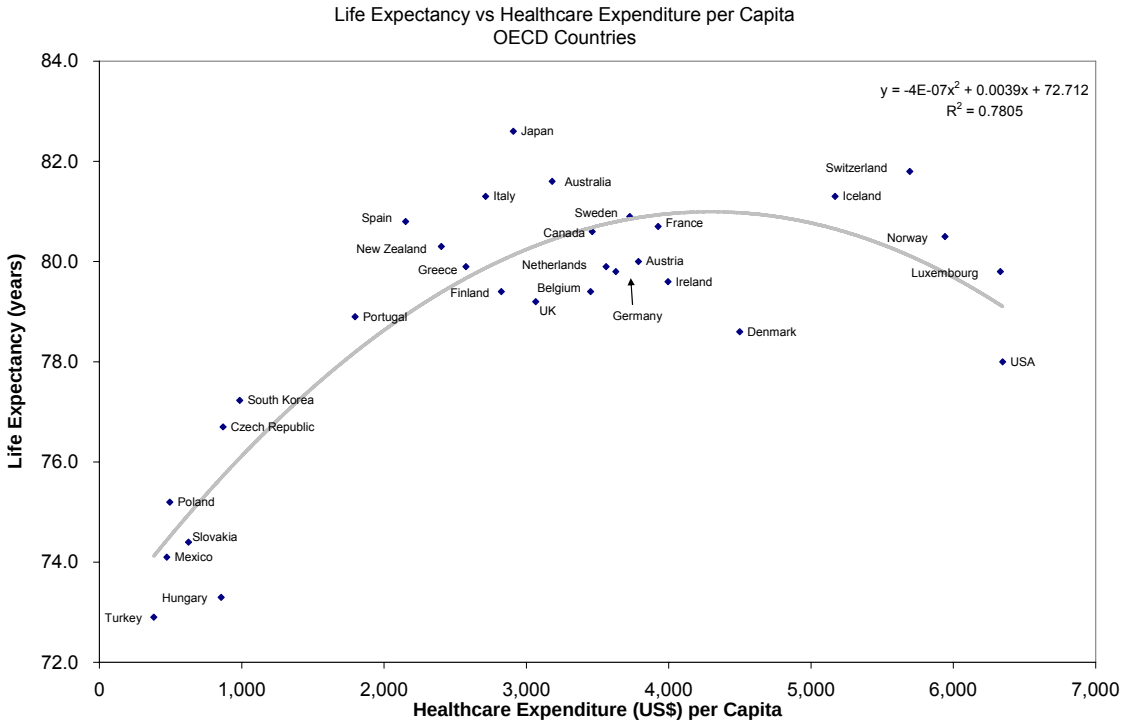


Figure 5 GDP per capita for Organization of Economic Co-operation and Development (OECD) countries compared with Greenhouse Gas emissions per capita, 2005. (Source: tables 2 and 3.)

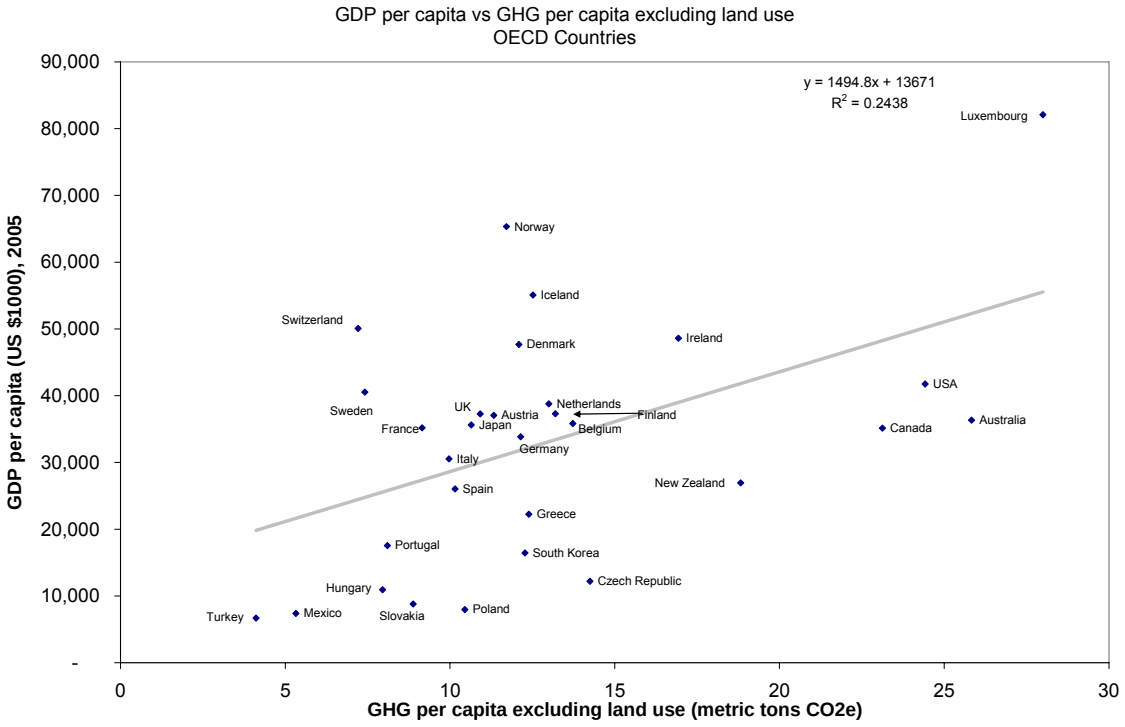


Figure 6. Greenhouse gas intensity (GHG emissions per unit of gross domestic product) for Organization of Economic Co-operation and Development (OECD) countries compared with greenhouse gas emissions per capita, 2005. Metric tons of CO2e, excluding impacts from land use. (Source: tables 2 and 3.)

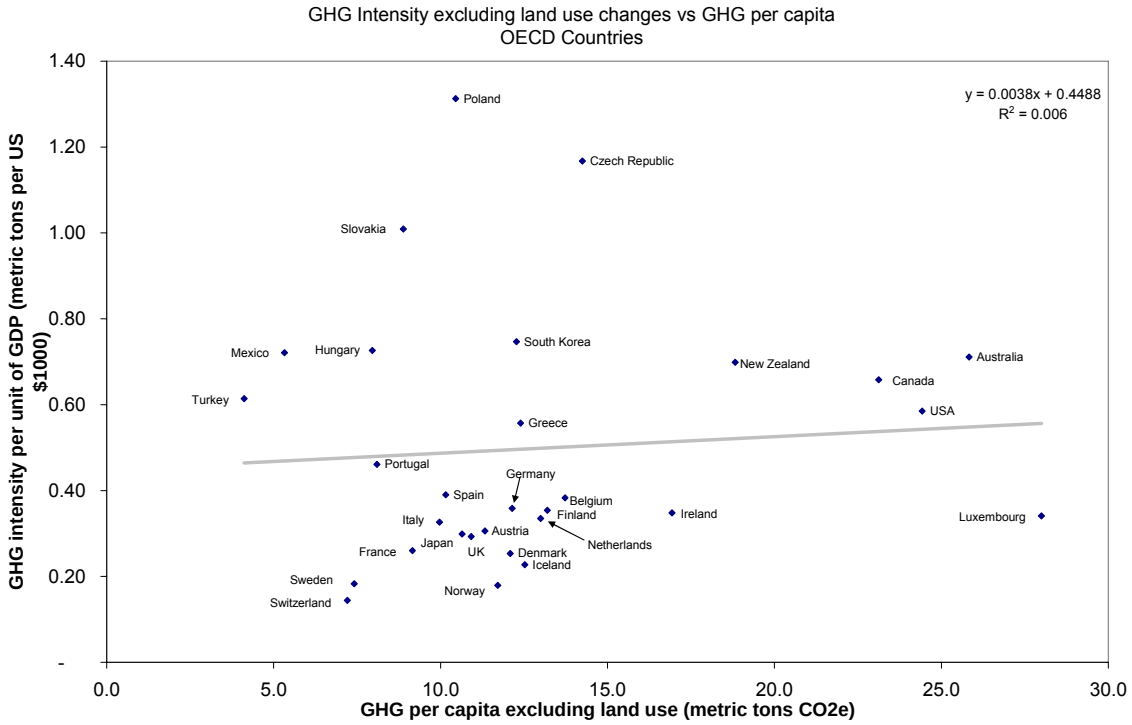


Figure 7. Life expectancy for Organization of Economic Co-operation and Development (OECD) countries compared with Greenhouse Gas intensity (GHG per unit of gross domestic product). (Source: tables 2 and 3.)

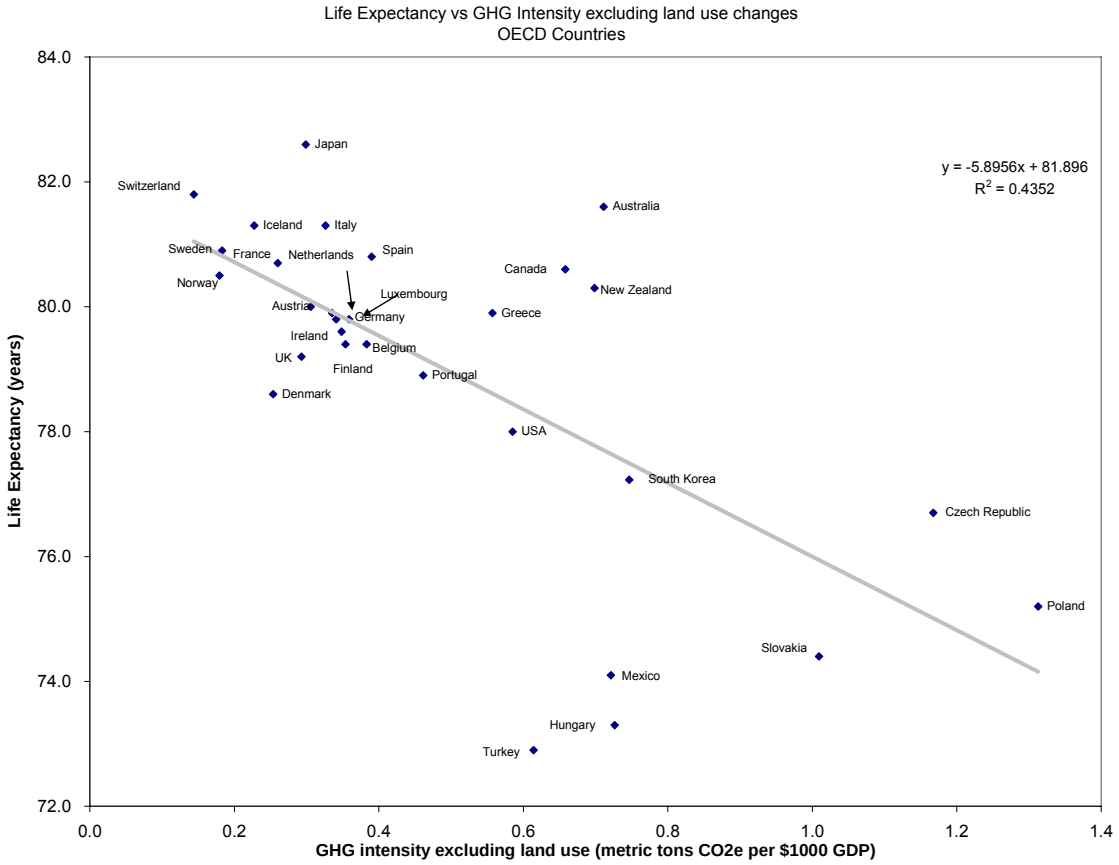


Table 2. Source data for national economic, health, and emissions.

OECD Country	Population (2005)	GDP 2005 ($US at current exchange rate)	Life Expectancy (2006)	Per capita total expenditure on health at average exchange rate (US$) 2005	GHG without impact of land use, 2005 (Gg)	GHG with impact of land use, 2005 (Gg)
Source	OECD	OECD	World Health Organization	World Health Organization	UNFCCC	UNFCCC
Switzerland	7,437,000	372,374,421,054	81.8	5,694	53,636	53,387
Sweden	9,030,000	366,008,973,530	80.9	3,727	66,955	63,042
France	60,996,000	2,146,530,368,602	80.7	3,926	558,392	495,440
Iceland	295,860	16,294,425,514	81.3	5,169	3,705	5,460
Austria	8,233,000	305,091,376,909	80.0	3,788	93,280	76,253
Netherlands	16,320,000	632,945,331,543	79.9	3,560	212,134	214,475
Spain	43,398,000	1,129,744,316,769	80.8	2,152	440,649	390,972
Ireland	4,130,700	200,837,904,891	79.6	3,996	69,945	69,288
Italy	58,134,730	1,776,321,231,972	81.3	2,714	579,548	469,538
Portugal	10,563,100	185,449,311,048	78.9	1,797	85,540	89,467
Denmark	5,415,980	258,158,451,603	78.6	4,499	65,486	64,033
Belgium	10,478,620	375,523,553,698	79.4	3,451	143,848	143,478
United Kingdom	60,209,000	2,243,600,885,821	79.2	3,065	657,396	655,361
New Zealand	4,099,000	110,436,227,196	80.3	2,403	77,159	52,658
Germany	82,466,000	2,791,374,421,728	79.8	3,628	1,001,476	965,400
Greece	11,104,000	246,989,255,335	79.9	2,575	137,633	132,231
Japan	127,768,000	4,552,200,185,088	82.6	2,908	1,359,914	1,263,872
Luxembourg	455,000	37,347,783,913	79.8	6,330	12,738	12,465
Norway	4,623,290	302,012,572,759	80.5	5,942	54,153	26,934
Finland	5,246,000	195,661,095,359	79.4	2,824	69,241	38,308
Australia	20,340,000	738,813,413,060	81.6	3,181	525,408	522,189
United States	296,507,100	12,376,100,000,000	78.0	6,347	7,241,482	6,431,935
Canada	32,299,000	1,134,779,164,191	80.6	3,463	746,889	729,710
Hungary	10,087,000	110,443,210,000	73.3	855	80,219	75,743
Mexico*	103,946,900	767,221,880,000	74.1	474	553,329	643,183
Slovakia	5,387,290	47,427,840,000	74.4	626	47,866	47,017
Turkey	72,065,000	482,987,030,000	72.9	383	296,602	222,528
Czech Republic	10,220,580	124,709,780,000	76.7	869	145,611	140,966
Poland	38,161,000	303,912,250,000	75.2	495	398,952	366,848
Korea**	48,138,080	791,426,660,000	77.2	986	591,000	598,986
Citation	OECD FACTBOOK 2005	OECD FACTBOOK 2005	World Health Organization	World Health Organization	UNFCCC, "National Greenhouse Gas Inventory Data for the Period 1990-2005," 24 October 2007	UNFCCC, "National Greenhouse Gas Inventory Data for the Period 1990-2005," 24 October 2007

*Mexico GHG data is for 2002, from Secretaría de Medio Ambiente y Recursos Naturales (Instituto Nacional de Ecología), "National Greenhouse Gas Inventory 1990-2002, Report of Mexico," Mexico City, 2002.

** Korea data is estimated based on total 2005 GHG emissions of 591 million tons reported by the Associated Press (March 21, 2008) and proportions of energy-related CO2 and land use-related GHG emissions reported for 2001 (Korea Energy Economics Institute, "UN FCCC 2002," available at www.keei.re.kr)

Table 3. Calculated data for national economic, health, and emissions, based on data in table 2.

		Emissions per capita			Emissions intensity		
OECD Country	GDP per capita, 2005, (US$ at current exchange rate)	Per capita GHG without impact of land use, 2005 (metric tons per capita)	Per capita GHG with impact of land use, 2005 (metric tons per capita)	Per capita CO2 emissions, excluding land use, 2005 (metric tons per capita)	GHG without impact of land use, 2005 (Metric tons per US$1000 GDP)	GHG with impact of land use, 2005 (Gg per US$ GDP)	CO2 only, excluding land use, 2005 (Gg per US$ GDP)
source							
Switzerland	50,071	7.21	7.18	6.18	0.14	0.14	0.12
Sweden	40,533	7.41	6.98	5.82	0.18	0.17	0.14
France	35,191	9.15	8.12	6.83	0.26	0.23	0.19
Iceland	55,075	12.52	18.45	9.71	0.23	0.34	0.18
Austria	37,057	11.33	9.26	9.67	0.31	0.25	0.26
Netherlands	38,783	13.00	13.14	10.78	0.34	0.34	0.28
Spain	26,032	10.15	9.01	8.49	0.39	0.35	0.33
Ireland	48,621	16.93	16.77	11.45	0.35	0.34	0.24
Italy	30,555	9.97	8.08	8.49	0.33	0.26	0.28
Portugal	17,556	8.10	8.47	6.43	0.46	0.48	0.37
Denmark	47,666	12.09	11.82	9.58	0.25	0.25	0.20
Belgium	35,837	13.73	13.69	11.77	0.38	0.38	0.33
United Kingdom	37,264	10.92	10.88	9.26	0.29	0.29	0.25
New Zealand	26,942	18.82	12.85	8.75	0.70	0.48	0.32
Germany	33,849	12.14	11.71	10.59	0.36	0.35	0.31
Greece	22,243	12.39	11.91	9.93	0.56	0.54	0.45
Japan	35,629	10.64	9.89	10.12	0.30	0.28	0.28
Luxembourg	82,083	28.00	27.40	26.10	0.34	0.33	0.32
Norway	65,324	11.71	5.83	9.33	0.18	0.09	0.14
Finland	37,297	13.20	7.30	10.87	0.35	0.20	0.29
Australia	36,323	25.83	25.67	18.89	0.71	0.71	0.52
United States	41,740	24.42	21.69	20.54	0.59	0.52	0.49
Canada	35,134	23.12	22.59	18.06	0.66	0.64	0.51
Hungary	10,949	7.95	7.51	6.13	0.73	0.69	0.56
Mexico*	7,381	5.32	6.19	2.97	0.72	0.84	0.40
Slovakia	8,804	8.88	8.73	7.35	1.01	0.99	0.83
Turkey	6,702	4.12	3.09	3.36	0.61	0.46	0.50
Czech Republic	12,202	14.25	13.79	12.32	1.17	1.13	1.01
Poland	7,964	10.45	9.61	8.56	1.31	1.21	1.07
Korea**	16,441	12.28	12.44	10.09	0.75	0.76	0.61

Table 4. Data for Figure 1

City	GHG per Capita (metric tons)
Tokyo, Japan[23]	4.84
Copenhagen, Denmark[24]	5.2
London, England[25]	5.9
New York, NY, USA[26]	7.1
Toronto, Canada[27]	9.6
San Diego, CA, USA[28]	11.1
Dallas, TX, USA[29]	14.35

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Table 5. Data for Figure 2.

City	Urban Density[30]	GHG per capita[31]	Fatal Accidents per 100,000[32]	% overweight or obese[33]
New York, NY	177.78	7.10	4.83	56.00
San Francisco, CA	146.83	11.34	6.24	53.50
Boston, MA	126.93	12.70	5.67	55.80
Portland OR	126.12	14.42	7.72	61.10
Miami-Dade County, FL	125.68	11.70	13.27	60.30
San Diego, CA	101.86	11.10	9.31	63.60
Seattle, WA	100.91	12.43	7.00	57.20
Dallas, TX	78.26	14.35	11.99	57.10

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