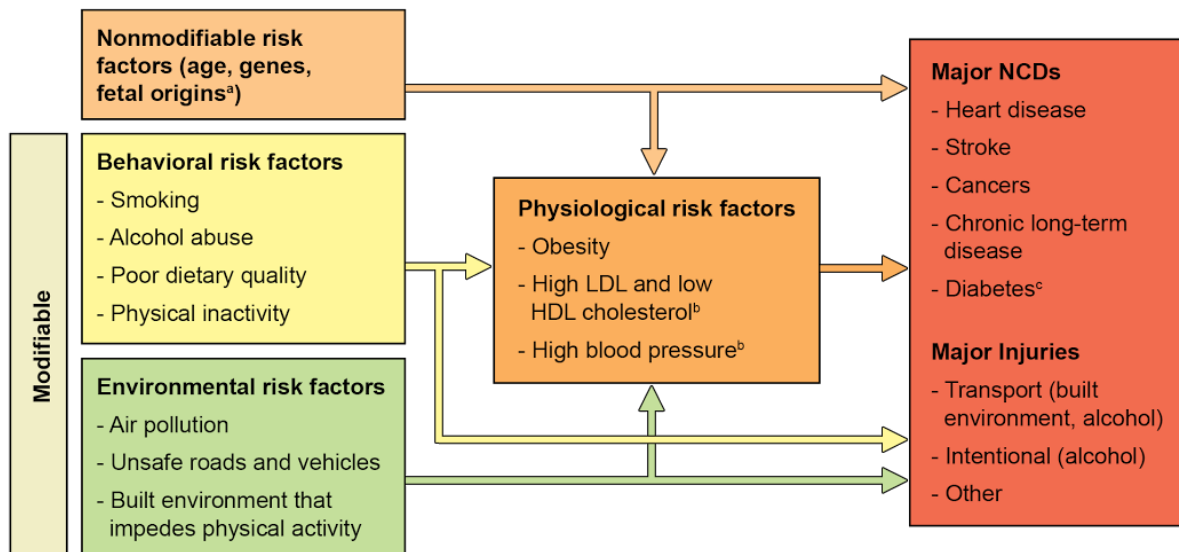


**CIH Working Paper: Population-based Approaches to Reducing  
Non-communicable Diseases and Injuries: a Review of the Evidence**

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The key risk factors for NCDs and injuries can be clustered into behavioral and environmental risk factors, which are potentially modifiable, non-modifiable risk factors such as someone’s age and genes; and physiological risk factors (Figure 1). The focus of this working paper is on modifiable behavioral and environmental risk factors that can be addressed at a population-wide level through broad public policies. These risk factors are principally causes of *adult* NCDs, with the exception of household air pollution from the use of solid fuels such as firewood, dung, and other agricultural residues, as well as charcoal and coal. Household air pollution causes significant disease burden in children (lower respiratory tract infections primarily) in addition to causing adult chronic disease. Governments can adopt specific population-wide measures to reduce the growing trajectory of burden of NCDs and injuries in low- and middle-income countries.

**Figure 1 Relationships among key risk factors for major NCDs and injuries**



<sup>a</sup> Fetal origins linked to the mother’s health and nutrition that raise the risk of NCDs later in life are not modifiable from the affected individual’s point of view, but maternal health and nutrition can be improved over time and this risk factor can be reduced.

<sup>b</sup> Medications are available that can reduce the level of risk from these risk factors.

<sup>c</sup> Diabetes is both a condition and an important risk factor for other conditions.

Source: Adapted from Figure 23-4 in Pearson T, Jamison D, Trejo-Gutierrez J, 1993.

The loss in life expectancy from some of these risk factors is large (Table 1). Smokers in the United States are estimated to lose over 10 years of life expectancy compared to non-smokers, after controlling for age, educational levels, adiposity, and alcohol consumption (Table 1). Stopping smoking before the age of 40 can dramatically cut the risk (Jha P, Ramasundarahettige C, Landman V et al., 2013). Chinese women living in moderately polluted cities lose an estimated 4 years of life expectancy compared to women in cities with good air quality (Wen M, Gu D, 2012). This differential, interestingly, is much reduced for men. The reduction in life expectancy from obesity has also been estimated by body mass index (BMI). For those morbidly obese (BMI of 40-50 kg/m<sup>2</sup>), the loss of life expectancy approaches that of a smoker (Prospective Studies Collaboration, Whitlock G, Lewington S, et al., 2009). While obesity often receives much attention as a risk factor, poor dietary quality and physical inactivity are risk factors for obesity as well as risk factors in and of themselves for heart attacks, strokes, and cancers.

**Table 1. Life Expectancy Losses from Smoking, Air Pollution, and Obesity: Findings from Selected Studies**

Risk Factor	Life Expectancy Decline	Population	Notes	Study
Smoking	Smokers lose at least 10 years of life expectancy compared to nonsmokers. Cessation can greatly reduce the risks. Cessation before the age of 40, for example, is estimated to decrease the risk of death associated with continued smoking by about 90%.	U.S. adults	Hazard rates adjusted for age, educational levels, adiposity, and alcohol consumption	Jha P, Ramasundarahettige C, Landsman V et al., 2013.
Air pollution	Comparing cities in China with good air quality versus moderately polluted cities, the authors find losses in life expectancy of almost 4 years for women at age 65, and almost 1 year for men at that age.	Older Chinese adults	Controlled for sociodemographic factors.	Wen M, Gu D, 2012.
Obesity	For both sexes, at age 60, life expectancy decline of 1-2 years for BMI 27-30; 2-4 years for BMI 30-35; and 8-10 years for BMI 40-50 (measured in kg/m <sup>2</sup> ).	57 prospective studies of 900,000 adults	Controlled for age, sex, smoking status, and study	Prospective Studies Collaboration, Whitlock G, Lewington S, et al., 2009.

We have classified the population-wide instruments that governments can use to alter major risk factors for NCDs and injuries and to prevent injuries into four groups: (1) taxation/subsidies, (2) regulation/legislation, (3) measures to influence the built environment (and how people respond to it) and influence behaviors in the home, schools, and workplace, and (4) empowerment of consumers with better information. Some of these instruments have multiple purposes beyond health, such as addressing climate change or generating revenue.

WHO identified and costed an essential package of “best buy” population-wide interventions that address tobacco use, harmful use of alcohol, and poor dietary quality and physical inactivity (Table 2). These “best buy” interventions rely on three types of instruments: taxation, regulation/legislation, and information. The single most important intervention in this package is tobacco taxation. Steadily phasing in increasing tobacco taxes would avert millions of Disability-Adjusted Life Years (DALYs) due to tobacco use. For all low- and middle-income countries, the “best buy” interventions are estimated to cost about \$2 billion annually (US\$2011). They are all recommended on the basis of their cost-effectiveness, impact on health outcomes, feasibility, and low implementation costs. The Commission on Investing in Health fully endorses this essential package. The discussion that follows discusses these interventions and other priority measures available to governments to reduce NCDs and injuries. The discussion is organized by type of measure, rather than by risk factor.

**Table 2. Essential Package of “Best buy” Population-Based Interventions for NCD Risk Factors**

<b>Government Instrument</b>	<b>Specific Interventions</b>
<b>Taxation</b>	Large tobacco tax increases (reaching over time at least 70% excise tax in final consumer price) Large alcohol tax increases (except in the few countries with very low incidence of harmful alcohol use).
<b>Regulation/legislation</b>	Smoke-free indoor workplaces and public places; bans on tobacco advertising and promotion. Warnings about tobacco’s harm. Restrictions/bans on alcohol marketing; restrictions on retail sales. Regulation to reduce salt content in processed foods; trans fats bans or voluntary reductions.
<b>Better information</b>	Health information about tobacco. Mass media campaigns about salt reduction. Public awareness program about diet and physical activity.

Source: WHO. Scaling Up Action Against Noncommunicable Diseases: How Much Will It Cost? 2011.

### **Taxation and Subsidies**

Taxes on alcohol, tobacco, and fuel have long been a major source of revenue generation worldwide. Increasingly, taxation is recognized as a powerful lever to reduce risks from exposure to or consumption of unhealthy products. Subsidies can increase the risks of NCDs and injuries (e.g. petroleum and coal subsidies that result in increased air pollution) or, less commonly, reduce the risks of NCDs and injuries (subsidies for healthy school lunches, subsidies for healthy foods or nutrients in food voucher programs). Table 3 estimates the share of GDP from tobacco and alcohol taxes in selected countries. These shares vary widely by country. Tobacco tax revenue as a share of GDP is tiny in Ghana (0.02%) but closer to 2%

in Bulgaria. Alcohol taxes are very small in Nigeria, where tax revenue is dominated by oil revenue, but over 1% of GDP in Rwanda and Thailand. There is considerable scope for increasing the use of alcohol and tobacco taxes to both reduce consumption and increase overall revenue.

**Table 3. Tobacco and Alcohol Taxes as a Percentage of GDP in selected countries**

	<b>Tobacco</b>	<b>Alcohol</b>
Armenia	0.54%	0.33%
Bulgaria	1.81%	0.40%
Chile	0.60%	0.38%
Colombia	0.11%	0.67%
Ghana	0.02%	0.19%
Jordan	0.92%	0.19%
Kenya	0.39%	0.68%
Kyrgyzstan	0.16%	0.37%
Mauritius	0.29%	0.86%
Nigeria	0.07%	0.09%
Peru	0.04%	0.32%
Philippines	0.13%	0.13%
Poland	1.17%	0.46%
Russian Federation	0.32%	0.58%
Rwanda	0.14%	1.01%
Thailand	0.62%	1.05%
Ukraine	1.01%	0.52%

Notes: Tobacco estimates refer to 2012, excise taxes only.

Source: WHO for tax revenue, World Bank for GDP.

Alcohol estimates refer to 2012, excise taxes only.

**Economic rationale for taxation.** From an economic standpoint, the case for government intervention to tax commodities such as tobacco, alcohol, fuels, and unhealthy food and beverages rests on the idea of market failures. Such consumption generates negative externalities, and, in some cases, consumers are not fully informed of the consequences of consumption. Tobacco is addictive, and many tobacco users are not fully cognizant of the addictive nature of its consumption and its health consequences, especially youth (Johnston V, Liberato S, Thomas D, 2012). Furthermore, tobacco consumers also impose costs on others through second hand smoke and through societal health care costs.

The economic rationale for taxation of alcohol is similar. Alcohol use affects the drinker's health but also the health of others, sometimes causing violent injuries to others, or affecting fetal development when pregnant women consume it. Large socioeconomic costs include health care expenditures, the toll on families and communities, reduced workers' productivity, and the involvement of the legal system.

The consumption of gasoline and other fossil fuels also generates negative externalities—not just from the health consequences of pollutants, but also traffic-related injuries, climate change, and traffic congestion.

A rationale for taxing unhealthy foods and beverages is suggested by the evidence that some consumers have difficulty making rational dietary choices because they do not understand the close links between poor diet and health, or are time inconsistent (having a preference for short term gratification over longer term well being). Furthermore, under insurance, individuals do not bear the full costs of their dietary choices. Obesity was recently estimated as accounting for close to 21% of health care costs in the United States (Cawley J, Meyerhoefer C, 2012).

A full benefit cost analysis (BCA) of reducing alcohol, tobacco, or unhealthy food and beverage consumption using taxes would quantify the *economic benefits* from the tax in terms of: (1) reductions in health costs (medical care) and in welfare costs (e.g. reduced crime from lowering alcohol use); (2) reductions in labor and productivity losses from reduced ill health; and (3) reductions in pain, suffering, and loss of life to the user and others, as appropriate (e.g. from second hand smoke). On the *costs side*, the BCA would include: (1) the costs of implementing the tax; (2) the job losses and other damage to industry; and (3) the “deadweight loss,” i.e., the consumer loss from the tax that is not transferred to the government in the form of tax revenue. BCAs may also be used to identify the distributional consequences of proposed tax changes. Such analyses are more complex to carry out than cost-effectiveness analyses but generate information that can be compared across sectors. To date, almost all economic analyses of NCD and injury interventions have used cost-effectiveness analyses.

WDR 1993 summarized the evidence on tobacco taxation at the time as follows: a 10% price increase in tobacco would be expected to reduce consumption by about 4% in the population overall and by significantly more in adolescents. Now there are more than 100 studies, including evidence from low- and middle-income countries, showing how tobacco excise taxes can both generate reliable tax revenue as well as reduce tobacco use (Chaloupka F, Yurekli A, Fong G, 2012). In the Philippines, for example, a 10% increase in price is estimated to reduce consumption by about 5% (Quimbo S, Casorla A, Miguel-Baquilod M, Medalla F, Xu X, Chaloupka F, 2012). The evidence is stronger today than in 1993 to show that increasing tobacco taxes is likely to be the single most important measure that governments can take to address NCDs. Excise and other taxes make up about 65% of the average price of cigarettes in high income countries, falling to 51% in upper-middle income countries, 47% in lower-middle income countries, and 41% in low income countries (Chaloupka F, Yurekli A, Fong G, 2012). WHO recommends that the tobacco excise tax make up at least 70% of the final retail price. Tax increases would generate significant fiscal revenues for governments. A recent study estimated that for China, India, the Philippines, Thailand, and Vietnam, taxes that resulted in a 50% price increase would reduce the number of current and future smokers by almost 67 million, would decrease tobacco deaths by 27 million, and would generate over \$24 billion in additional revenue annually. These revenue increases averaged 0.3% of GDP (Jha P, Renu J, Li D et al., 2012). Increases in tobacco taxes not only improve health, they also improve government’s fiscal balances.

Tobacco taxes disproportionately affect the poor, because of their lower disposable income. Therefore some economists and others have argued against tobacco taxes on the grounds that such taxes are regressive. But looking at the full consequences of tobacco taxation, both short and long term, it is clear that the health benefits also disproportionately accrue to the poor. In addition, stopping or reducing the use of tobacco can provide significant benefits in terms of financial protection: NCDs later in life attributed to tobacco could bankrupt a poor family through medical outlays and loss in income.

As with tobacco, consumers respond to alcohol price changes. The cheaper the alcohol is, the more it is consumed and the greater the related harm. Finland cut its alcohol taxes by 33% in 2004, when neighboring Estonia joined the European Union. The Finnish government feared that, without tax cuts, cheaper alcohol would be imported from neighboring Estonia, reducing tax revenue from alcohol sales in Finland and causing unemployment in its domestic alcohol production sector. The tax cuts led to a

large fall in the price of alcohol, after which alcohol consumption increased 12% and overall alcohol-related mortality increased by 16% among men and 31% among women (Herttua K, Mäkelä P, Martikainen P, 2008).

Tax increases are a highly cost effective measure to reduce total alcohol consumption and the number of episodes of heavy drinking, especially in young people. The analysis on alcohol in the Disease Control Priorities in Developing Countries study (2<sup>nd</sup> edition) concluded that taxation was the single most cost-effective population-level strategy to reduce the harmful use of alcohol in Europe and Central Asia, Latin America and the Caribbean, and Sub-Saharan Africa, all regions with a significant prevalence of high-risk drinking (Rehm J, Chisholm D, Room R, Lopez A, 2006). However, some economic studies argue that population level alcohol taxes impose a substantial efficiency cost because most harmful drinking is limited to a small segment of the population.

There is much less experience with taxes on unhealthy food and beverages (other than alcohol). The risk of NCDs is reduced by the promotion of a diet that includes fish and seafood, whole grains, fruits and vegetables, nuts, vegetable oils, and moderate dairy intake, while limiting starches, refined grains, sugars, processed meats, industrially process trans fats, and salt (Mozaffarian D, Afshin A, Benowitz N et al., 2012). Several countries have introduced, or are considering introducing, taxes on unhealthy food and drink.

Denmark introduced the first “fat tax,” i.e. a tax on saturated fats (taxed per kg of saturated fat in meat, cheese, butter, and other foods), with the aim of decreasing consumption of saturated fats by 4% in 2011 (Smed, 2012). However, the tax was criticized for the high administrative costs of implementation (born primarily by the food industry) and for how it spurred consumers to shop for food in other countries. The tax on saturated fats was later revoked at the end of 2012, and at the same time, the Danish government announced it was cancelling plans for a sugar tax (Stafford, 2012).

**Table 4. Dietary Habits to Reduce the Risk of NCDs**

<b>Eat</b>	<b>Limit</b>
Fish and seafood	Starches, refined grains, sugars
Whole grains	Sugar sweetened beverages
Fruits	Processed meats
Vegetables	Industrially Processed Transfats
Nuts	Salt
Vegetable Oils	
Moderate Dairy	

Sources: Mozaffarian D, Appel L, Van Horn L, 2011; Mozaffarian D, Afshin A, Benowitz N et al., 2012.

In late 2011, Hungary increased a tax on certain soft drinks, energy drinks, pre-packed sweetened products, salty snacks, and condiments. France introduced a tax on sugar-sweetened and artificially sweetened beverages in 2012. Finland reintroduced taxes on sweets and increased taxes on soft drinks in 2011 (EPA, 2012). Finland’s Sugar Tax Working Group, in its Final Report to the Ministry of Finance, noted that changes in consumption from the excise duties of sweets are difficult to forecast (Sugar Tax Working Group, 2013). With increased taxes, some of the decrease in consumption of sugar-containing products could be replaced with other unhealthy products such as salty snacks (Sugar Tax Working Group, 2013). A study of soft drink taxation in Ireland estimated a 10% decrease in consumption for each 10% increase in price (Bahl R, Bird R, Walker M, 2003). A recent review of the evidence found that modeling the impact of food and beverage taxes on diet and health outcomes is greatly limited by the

data available. Taxes would likely need to be sizeable (at least 20%) to significantly change behaviors. Taxes would need to be carefully designed, considering substitution effects from untaxed foods (Mytton O, Clarke D, Rayner M, 2012). Policy would need to be guided by research on the effect of such taxes and their feasibility in different countries and different cultural contexts.

While there is less available evidence and experience on taxation of unhealthy foods and beverages than on tobacco and alcohol, cross-cutting lessons are emerging from taxation of all of these commodities. Taxes need to be evaluated in terms of efficiency, equity, and simplicity (minimizing both public administration costs and private compliance costs). Tax avoidance (through loopholes) and tax evasion (through smuggling) need to be considered. For specific commodities, excise taxes are generally easier to administer than sales taxes. Taxes and price increases need to be significant to make the needed changes in consumption and need to be adjusted regularly for inflation. Tax design needs to consider the range of relevant products and the changes in consumption that consumers might make if a tax is imposed in only one area (e.g., from sugar-sweetened beverages to salty, high fat snacks). Youth and low income populations tend to respond most to price increases on unhealthy foods and beverages, tobacco, and alcohol.

Energy subsidies on fossil fuels such as coal, gasoline, and diesel are widespread and have significant health and economic consequences. Subsidies encourage excessive energy consumption with the resultant increase in ambient particulate matter pollution that causes lower respiratory infections (in children), and cancers, heart diseases, and chronic obstructive pulmonary disease in adults. The IMF recently estimated that on a post-tax basis, energy subsidies amounted to US\$1.9 trillion in 2011, or 2.7% of global GDP and 8.1% of government revenue (Clements B, Coady D, Fabrizio S, et al., 2013). High income countries amount for 40 percent of the total. Oil exporters account for about one-third. Removal of these subsidies would drop CO<sub>2</sub> emissions by 13%.

These types of energy subsidies increase the risks of NCDs and damage the environment. They also divert public resources away from spending that could be more pro-poor, such as health interventions that address infectious disease and NCDs, and education, and social protection programs. Subsidy reform, followed by appropriate tax measures, would be priority measures for reducing NCDs. A recent OECD report (2013) found wide variations in the effective tax rates per unit of energy in OECD countries. There are also wide variations in effective tax rates across types of fossil fuels. The OECD report found that, with some exceptions, countries with steeper implicit carbon taxes tend to have lower carbon emissions per unit of economic activity.

Energy subsidy reform, followed by appropriate tax measures, should be a priority measure for reducing NCDs (Aldy, 2013). Iran had some of the highest energy subsidies in the world prior to its 2010 energy subsidy reform. Large fuel price increases reduced carbon dioxide, sulfur dioxide, and nitrogen oxide emissions by 10-20 percent. The government accompanied the reform with cash transfers to households that were estimated, at the time, to reduce poverty incidence from 12 to 2 percent. The energy reform program was later suspended in 2012 due to the macroeconomic situation (Clements B, Coady D, Fabrizio S et al., 2013).

## **Regulation/legislation**

Bans on tobacco and alcohol advertising, the designation of smoke free public places, restrictions on access to retail alcohol, and the establishment and enforcement of drink driving laws are well recognized as important elements of comprehensive efforts to reduce the risks from tobacco smoking and alcohol use. WHO recommends restrictions on marketing of unhealthy food and beverages to children but adoption has been limited to date. Sweden took the earliest action—in 1991, it banned all

television advertising of food to children. Food labeling has been widely accepted in many countries. In response to the rapidly rising rates of obesity among school age children in Mexico, the government introduced regulation to improve access to safe water and healthy foods in schools, and to prohibit sugary drinks and whole milk (Rivera and Cordero, 2012).

One of the most powerful and immediate levers governments can use to reduce dietary risk factors for chronic disease is to regulate the amount of industrially processed trans fats in the food supply. Denmark was the first country to adopt such regulation, in 2004. Foods cannot have more than 2% of trans fats. Denmark's policy has resulted in a remarkable fall in the grams of trans fat in fast food from about 30 g per serving in 2001 to less than 1 g in 2006 (Drostby, 2008). Argentina, Austria, Brazil, Chile, Iceland, Sweden, Switzerland, New York City, and South Africa have since taken measures to reduce or eliminate trans fats from foods. A study of the trans fat content in popular fast foods (McDonalds, KFC) in 20 countries from 2004-05 found huge variations in the amount of trans fat in the servings of similar products, from less than 1 gram in Denmark and Georgia to 10 grams in New York City and 24 grams in Hungary (daily intake of 5 grams of trans fat is associated with a 25% increase in the risk of ischemic heart disease) (Stender S, Dyerberg J, Astrup A, 2006). While the amount of industrially processed trans fat has fallen in the United States from voluntary action in the food industry, the U.S. Food and Drug Administration is taking steps in late 2013 to determine if it should be eliminated (FDA, 2013).

Another focus of regulation is salt in processed foods. WHO recommends that consumption be limited to less than 5 grams of salt per day (or 2500 mg of sodium) to reduce the risk of cardiovascular disease and stroke. A recent Institute of Medicine report endorsed efforts to lower excessive sodium intake, but found that efforts to lower sodium intake to *even lower levels*—less than 1500 mg of sodium per day—is not supported by the evidence on health outcomes (Institute of Medicine, 2013). South Africa has set maximum salt levels for bread, margarine and spreads, savory soups, processed meats, soup powders, and stock cubes. The regulation was a response to research showing that (a) bread accounted for 40% of salt intake in South Africa, and (b) reducing salt in bread to levels that would not affect quality or taste could prevent 2,000 fatal and 2,300 non-fatal strokes annually, and 3000 deaths from ischemic and hypertensive heart disease (Bertram M, Steyn K, Wentzel-Viljoen E, Tollman S, Hofman K, 2012). In South Africa, the regulation was accompanied by technical assistance provided by multinational companies to small and medium enterprises to help with the reformulation of the products (Alexander E, Yach D, Mensah G, Yep G, 2012).

For ambient particulate matter pollution, there are several important regulatory measures that governments can take. Depending upon feasibility of implementation, four key measures are: (1) requirements for emission control devices on new vehicles, (2) standards for cleaner fuels, (3) inspection and maintenance of vehicles, and (4) fuel efficiency standards in vehicles. In areas where household coal use is common, banning of coal for household use—and enforcement of the ban—is important. The Irish Government banned the sale of coal in Dublin in 1990. In the six years after the ban, the standardized respiratory death rate fell by 15.5% and the standardized cardiovascular death rate fell by 10.3%. (Clancy L, Goodman P, Sinclair H, Dockery D, 2002). These reductions translated to about 116 fewer respiratory deaths and 243 fewer cardiovascular deaths per year in Dublin after the coal ban.

The world's leading cause of injury deaths are those related to transportation. Without a change in road safety policies, the World Bank and WHO predict a large increase in transport-related deaths in low and middle income countries in the coming years (WHO, 2004). Chisholm D, Naci H, Hyder A, Tran N, Peden M, 2012, modeled the cost-effectiveness of strategies to prevent road traffic injuries in Sub-Saharan Africa and South East Asia and found that a combination of enforcement of speed limits, drink-driving laws, and motorcycle helmet requirements would be cost-effective. These measures are feasible to institute in low and middle-income countries and can reduce deaths. For example, Vietnam's passage of



a mandatory helmet law in 2007 was accompanied by a 16% reduction in the risk of road traffic head injuries and an 18% reduction in the risk of road traffic deaths (Passmore J, Tu N, Luong M, Chinh N, Nam N, 2010).

The risk of other types of injuries could be reduced with regulatory actions. Self-harm is another leading category of injuries, the second most important cause of injury deaths after transportation, with a particularly high burden among young women in China. Regulation to reduce access to lethal methods can play an important role in reducing deaths from self-harm related to these methods. For example, a 2005 systematic review found evidence showing a reduction in suicide deaths in response to pesticide restrictions; firearm control legislation; detoxification of domestic gas; restricting the prescribing and sale of barbiturates; changing the packaging of analgesics to blister packets; and mandatory use of catalytic converters in cars (Mann J, Apter A, Bertolote J et al., 2005).

### **Home, school, workplace, and built environment**

**Household air pollution.** Household air pollution from solid fuels falls between smoking and exposure to second hand smoke in terms of its harm to health. While the improved biomass cookstoves that have been promoted in recent years can save on fuel, much cleaner technologies will be needed before health benefits are seen. Typical household exposure to fine particulate matter (PM<sub>2.5</sub> i.e. matter less than 2.5 µm in diameter), which is more closely linked to adverse health effects than larger particles, from solid fuel use is about 200 µg/m<sup>3</sup>. Little cardiovascular benefit will result until very clean interventions are introduced that bring down total exposure to PM<sub>2.5</sub> to under 35 µg/m<sup>3</sup> (Baumgartner T, Smith K, Chockalingam A, 2012). Several measures can help promote the substitution of solid fuels with cleaner technologies, including increasing access to electricity. Even though cooking everything with electricity may be too expensive for poor households, certain important cooking tasks—such use of a hot water kettle or rice cooker— could be within reach if a household has access to electricity. Governments can support measures to expand access to liquefied petroleum gas (LPG) for cooking (Box 2 discusses Indonesia’s move to replace the use of kerosene with LPG for cooking).

**Schools and Workplaces.** Strong evidence suggests that public health interventions are most effective when they are reinforced in multiple sites where people make choices about nutrition, physical activity, and tobacco use. Risks for NCDs could be reduced with wellness programs in the workplace and school programs (educational curriculum, healthy school lunches, physical education programs, physical activity breaks during instruction, playground spaces and equipment). In low income countries, ensuring access to safe drinking water in workplaces and schools could reduce the consumption of sugar-sweetened beverages.

### **Box 1. Replacing kerosene with liquefied petroleum gas (LPG) for cooking**

While kerosene is seen as a cleaner choice for cooking than solid fuels (biomass and coal), some kerosene devices, especially wick stoves used by poor communities for cooking, can still emit significant amounts of health-damaging pollutants. While gaps remain in our knowledge of the health impact of kerosene use for cooking, enough is known to promote the replacement of kerosene with cleaner technologies such as LPG and electricity wherever possible (Lam N, Smith K, Gauthier A, Bates M, 2012). In an efficient market with light taxes on LPG, the World Bank estimated that cooking and heating water with LPG would cost a household about \$15 per month, making it a difficult choice for very poor households (Kojima, 2011). But many households could afford LPG if policies were enacted to make the LPG market more efficient and if these efficiency gains could be passed on to the consumer. Universal price subsidies on LPG to promote its use are inefficient. A far more efficient approach, adopted in Brazil and the Dominican Republic, is to include assistance for purchasing LPG in social safety net programs (Kojima, 2011).

In 2007, the Indonesian government introduced a project to convert cooking fuel from kerosene to LPG in 50 million households by 2011 in order to achieve health and environmental benefits and to reduce the government subsidy for petroleum fuels. While kerosene and LPG are both subsidized in Indonesia, considering the energy equivalence of the fuels, and the relative subsidies, the government estimated, based on 2006 data, that it would save about US\$2.2 billion annually from the conversion (Budya and Arofah, 2011). The government market tested its approach, before launching the program in Jakarta, distributing free packages of a 3 kg LPG cylinder, a first gas-fill, a one burner stove, a hose, and a regulator to eligible households. As the program expanded, and conversion packages were distributed, the government withdrew the supply of kerosene from the area. This kerosene to LPG conversion project was facilitated by the fact that Indonesia has just a single state-owned national oil company, Pertamina, so coordinating the distribution of LPG was relatively easy. By the end of 2009, more than 44 million conversion packages had been distributed in 15 provinces; in 6 provinces, all subsidized kerosene had been withdrawn (Budya and Arofah, 2011).

**The built environment.** The built environment, such as streets and sidewalks, influences how safe and accessible it is to bicycling, walking, and the pursuit of other physical activity. This environment can be modified through street connectivity, sidewalk design, dedicated recreation and exercise spaces, set-aside street space for recreation on certain days of the week, and proximity to urban transport (Box 2). Separating four-wheeled vehicles from pedestrians and bicyclists, engineering traffic calming measures to reduce speeds, and identifying and correcting dangerous sections of roadway are important measures to reduce traffic-related injuries. The latter can be done in low cost ways, for example, placing water filled barrels in front of rigid barriers. Changes to the built environment, such as through constructing barriers at bridges and other jumping sites, can also reduce suicide risk (Mann J, Apter A, Bertolote J et al., 2005).

### **Empowering consumers with better information**

Information can improve individuals' knowledge about the health consequences of their choices. Over time, more countries are supporting focused education campaigns and warnings on packaging about the health consequences of tobacco and alcohol use. Efforts to change behavior alone, without the introduction of better stoves, seem to have little impact on household air pollution from solid fuels.

## **Box 2. Improving the built environment in Bogotá and Copenhagen**

Bogotá, Colombia has a network of 128 km of set-aside street space for recreational cyclists and pedestrians on Sundays and holidays, called *Ciclovía* (“cycleway”). *Ciclovía* allows residents from all socioeconomic groups to be physically active in a safe environment. It is hugely popular and has inspired efforts in other cities; over 70 US cities have now instigated such cycleways (Hipp J, Eyer A, Kuhlberg J, 2012). Bogotá’s program has been accompanied by a bicycle path program called *Cicloruta*. A recent cross-sectional study of these two programs found that most *Ciclovía* participants (60%) met recommended levels for physical activity in leisure time and most *Cicloruta* participants (71%) met these levels by cycling for transportation (Torres A, Sarmiento O, Stauber C, Zarama R, 2012). Around 3 in 10 *Ciclovía* participants and half of *Cicloruta* users were of low socioeconomic status. In Copenhagen, where bicycle lanes, special parking, and timed traffic lights all facilitate and encourage cycling, more than 55% of residents bike to and from work. Concerns about cyclists’ exposure to particulate matter air pollution and to traffic accidents in Copenhagen led to a recent health impact assessment to quantify the overall health effects of increased cycling (Holm A, Glümer C, Diderichsen F, 2012). The assessment found that the positive health effects of the physical exercise outweighed the negative effects of pollution and accidents, a finding that is in line with the results of other studies (De Hartog J, Boogaard H, Nijland H et al., 2010).

Product labeling on foods ranges from simple labels, including warnings, to detailed information on calories and food composition. While studies suggest that providing information leads to consumers having greater knowledge, it appears to be relatively ineffective at stimulating behavior change (Sacks G, Rayner M, Swinburn B, 2009; Elbel G, Bersh R, Brescoll V, Dixon L, 2009). However, there is evidence that product labels have resulted in changes in food industry behavior (Mozaffarian D, Stampfer M, 2010). For example, Canada and the United States have mandated the declaration of trans fat and saturated fat on food labels which has resulted in some voluntary reduction by manufacturers in the trans fat content of their products (Ratnayake W, L’Abbe M, Mozaffarian D, 2009). There is some evidence that information on menus at the point of purchase modestly improves food choices, but some studies have shown that food labeling may result in higher energy intake in certain population subgroups (Larson N, Story M, 2009). But information on menus may have an impact on altering the food industry’s choice of product ingredients or menu option choices. India plans to introduce mandatory labeling on the trans fat and saturated fat content of cooking oils. Chile has introduced warning labels on processed foods high in fat, sugar, and salt.

Public information and education campaigns have also been tested as a way to reduce self-injury. However, the research evidence to date shows that while these campaigns can increase awareness of mental illness, they have “no detectable effect on primary outcomes of decreasing suicidal acts or on intermediate measures, such as more treatment seeking or increased antidepressant use” (Mann J, Apter A, Bertolote J et al., 2005).

## **The Way Forward**

Adoption of WHO's recommended "best buys" outlined in Table 2 would make a significant difference in reducing the current trajectory of the growth of NCDs and injuries in low- and middle-income countries. The Commission on Investing in Health strongly endorses the implementation of these measures. Of these, tobacco taxation would have the single greatest impact. The "best buys" are relatively inexpensive and most countries would likely have the fiscal capacity to fund these activities from their own budgets. Several other priority interventions to reduce NCDs and injuries are discussed in this paper, including energy subsidy reform, followed by appropriate tax measures. Some countries have redirected part of the savings from the reduction in fossil fuel subsidies to cash transfer or other social safety net measures to poor households. Governments can also take measures to promote the switch from the use of solid fuels in the home to cleaner fuels for cooking and heating, where solid fuel use is a problem. Injury prevention can be addressed with the enforcement of speed limits, drink driving laws, and motorcycle helmet use. Taxes on alcohol and tobacco can reduce consumption and be an important source of revenue for governments. Some countries are now exploring the use of taxes to promote healthier diets. For example, several countries have introduced taxes on sugar-sweetened beverages. Policy will need to be guided by research and evaluation on the effects of such taxes and their feasibility in different countries and cultural contexts.

International agencies could help in (a) making the investment case for these activities, (b) providing technical assistance (such as on taxation, regulation/legislation), (c) providing some financing in the poorest countries to help introduce the interventions and (d) helping build the evidence base for other cost-effective population-wide measures to address NCDs and injuries.

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