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Rural Air Pollution: A Major But Often Ignored Development Concern

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There is a tendency to think of health-damaging air pollution as an urban phenomenon, but globally the total health burden from air pollution falls predominantly on rural populations, adding to the direct impact from as well as being influenced by urban activities. This pollution is of three types:

- Pollution in and around households from use of simple solid fuels for cooking and space heating
- General rural ambient pollution in many parts of the world due to nearby urban and rural sources
- Widespread exposures to ozone and other health-damaging secondary pollutants that can operate at intercontinental scales and affect rural and urban areas alike.

Here I briefly discuss each in turn along with approaches to their amelioration.

Household use of solid fuels

About half the world's households use biomass or coal fuels for cooking and heating in simple stoves. Such combustion produces substantial amounts of health-damaging pollutants of various kinds including dozens known to be health damaging in animal and human studies. A large, if unknown, portion of this fuel is used in unvented stoves that release the pollution directly into the living area. Simple venting using chimneys and other methods, however, does not eliminate exposures because the pollution is merely shifted a meter or two and, depending on local conditions, can still cause significant human exposures in communities.

Many dozens of epidemiological studies published in the international biomedical literature in the last decade or so have consistently shown significant health impacts of several kinds as the result of household solid fuel use. Most well established are chronic obstructive lung disease in women and pneumonia in young children, multi-causal diseases responsible together for nearly 10% of all lost-life years in the world. Lung cancer is clearly shown to result from coal use and a growing body of evidence links it to biomass smoke as well. It is the strong evidence of solid fuel use as a risk factor for these three diseases that resulted in the recent WHO estimates that it is responsible for some 1.6 (1.0-2.0) million premature deaths annually and is tenth in size among all preventable causes of ill-health in the world.

Every month, however, additional studies are being published and there is a growing body of scientific evidence linking other important diseases to household solid fuel use including tuberculosis, cataracts and other eye diseases, low birth weight, and cancers other than lung. In addition, a few studies are now underway to pin down the effects on heart disease and asthma, both of which are strongly linked to outdoor air pollution and passive and active tobacco smoking.

Rural ambient pollution

In developed countries, rural air pollution levels tend to be much lower than those in cities, although there are exceptions. In many developing countries, however, rural population densities tend to be much higher as are the number and size of pollution sources. In heavily populated rural areas such as the major river basins of South Asia and China, ambient pollution levels can thus be a substantial fraction of those in nearby cities because of

- Pollution from the cities

- Polluting sources forced out of cities as part of their control efforts
- Large “remote” sources such as power and cement plants and ore processing.
- Small sources such as households, brick kilns, agricultural processing, and other small industries.
- Agricultural burning

Although little routine ambient monitoring is done in rural areas for health assessment, emissions inventories done as part of climate and acid precipitation programs and satellite photos show clearly that rural areas can contribute substantially to total emissions. Indeed, in China for example, pollution from small sources in rural areas, which are lumped under “other” in official statistics, exceed urban sources for important pollutants. Preliminary assessment in China estimates that the total human outdoor air pollution exposure in the country may be 1.5-2.5 times that in cities alone, resulting in a significant understatement of the health impact of outdoor air pollution and the benefit of control. Although it is not possible yet to extrapolate globally, it is clear that the WHO estimate of 800 (500-1100) thousand premature deaths from urban air pollution is a substantial underestimate of the total annual impact of ambient air pollution.

#### Widespread secondary pollutants

Recent studies indicate that important secondary pollutants that can form downwind far from primary emissions in cities and elsewhere, such as ozone and small particles, can cause significant exposures to large populations over long distances. Although the resulting concentrations at any one place are low, the size of the exposed population would indicate a significant total impact if, as is currently believed, there are no important thresholds of health effects at low levels. In some cases, the primary pollutants are health-damaging themselves, but in others, hydrocarbon emissions in particular, non-hazardous pollutants are converted to hazardous ones by the action of sunlight and other processes. Such pollution can form and be transported thousands of kilometers from the primary sources even exposing rural and urban populations on different continents. A recent preliminary estimate, for example, indicated that perhaps a 100 thousand premature deaths may occur annually around the world from low-level widespread ozone exposures.

#### What can be done?

Given the importance of rural pollution exposures worldwide and particularly in developing countries, there would seem to be considerable advantage in promoting more integrated assessment and control strategies than what has been typical in the past. The result of such innovation compared to current approaches could be expected as follows;

- The total benefits and relative cost-effectiveness of controls will likely shift somewhat from those that only consider urban impacts. In particular, there is likely to be more initial emphasis on rural sources operating near large populations such as those in and around households.
- In addition, there might well be a shift in the relative importance of different pollutants because the increase in impact due to addition of rural exposures will not affect each pollutant equally. For example, the total impact of hydrocarbons due to their role in ozone formation and of nitrogen oxides because of their impact on small particle formation will likely increase more than that of other pollutants.

A further level of integration would be to consider co-benefits of control from the combined standpoints of climate, health, and ecosystems (managed and natural), which would make sense scientifically and might possibly be advantageous in terms of policy. It is sometimes difficult, however, to effectively make arguments across sectors that have such different patterns of impacts, stakeholders, and funders. The results of doing so might be quite illuminating, however. For example, methane, a non-toxic pollutant of no direct health concern, is a both a major greenhouse gas as well as a major actor in ozone formation. Reducing its emissions by, for instance, improving the efficiency of household solid fuel combustion, would have substantial benefits for climate protection. local and wide-scale rural health-related exposures, and some reduction of crop and forest damage, even though having little or no impact on cities. Many other crosscutting examples could be cited.