70–80% of individuals infected with hepatitis C virus are asymptomatic; up to 85% of those asymptomatic infections may become chronic hepatitis C, approximately 20% of which will become cirrhotic, including 5% or so who will develop hepatocellular carcinoma and eventually die of the liver damage (*4, 5*). However, most of those deaths are not classified as caused by hepatitis C in mortality statistics (Health Canada, unpublished data). Secondly, many infectious diseases have multiple chronic sequelae such as cancer, liver diseases and infertility, which have not been taken into consideration in burden analysis. Furthermore, the transmissibility of this group of diseases is probably its most important characteristic, but the burden that could be induced from such transmissibility has not been appropriately included in burden analyses such as the DALY measure. For example, each blood donor infected with a bloodborne pathogen may be able to spread the infection to several recipients through blood transfusion or to a larger number through blood products; among injecting drug users, one infected individual could spread a bloodborne infection to a whole network of users in a relatively short period of time; and contamination of a water or food supply by an enteric pathogen may cause infections in hundreds of individuals. Without inclusion of this aspect of infectious diseases, any analysis would result in significant underestimates of both the burden and its reduction through intervention such as vaccination, one of the most effective means.

Failure to recognize the above unique aspects of infectious diseases may in part explain the puzzling fact that the public, health care professionals and governments all express concern about infectious diseases, yet these diseases are always ranked low or at the bottom of most disease burden analyses. Measures for burden analysis should take into account the unique aspects of infectious diseases so that the derived burden estimates correctly reflect the impact of this group of diseases and can be used to evaluate the effectiveness of intervention strategies. ■

Shimian Zou
Centre for Infectious Disease Prevention and Control
Health Canada, Postal Locator 0601E2
Bldg #6, Tunney's Pasture
Ottawa, Ontario, Canada K1A 0L2
tel: 1-613-946-8819; fax: 1-613-952-6668
email: shimian_zou@hc-sc.gc.ca

1. **Murray CJL, Salomon JA, Mathers C.** A critical examination of summary measures of population health. *Bulletin of the World Health Organization*, 2000, **78**: 981–994.
2. **Murray CJL, Lopez AD, eds.** *The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020.* Cambridge, MA, Harvard School of Public Health on behalf of the World Health Organization and the World Bank, 1996 (Global Burden of Disease and Injury Series, Vol. 1).
3. **Gross CP, Anderson GF, Powe NR.** The relation between funding by the National Institutes of Health and the burden of disease. *New England Journal of Medicine,* 1999, **340**: 1881–1887.
4. **Zou S, Tepper M, Giulivi A.** Current status of hepatitis C in Canada. *Canadian Journal of Public Health*, 2000, **91** (suppl 1): S10–S15.
5. **Zou S, Tepper M, El Saadany S.** Prediction of hepatitis C burden in Canada. *Canadian Journal of Gastroenterology* 2000, **14**: 575–580.

Editor – The above letter by Shimian Zou highlights one of the fundamental issues in the construction of health gaps such as disability-adjusted life years (DALYs), namely the problem of causal attribution. In arguing that DALYs underestimate the burden due to infectious diseases, however, Zou fails to appreciate the distinct merits of the two major approaches to causal attribution — categorical attribution and counterfactual analysis — which we have discussed elsewhere (*1*). In brief, categorical attribution assigns every event such as a death to a single cause according to a defined set of rules; this approach has the advantages of being simple and comprehensible, and provides the intuitively appealing property of additive decomposition (i.e., the total burden equals the sum of the burdens attributable to each cause). The other major tradition, counterfactual analysis, determines the contribution of a particular cause to the overall burden by comparing the current level of burden to the hypothetical level that would prevail if that cause were reduced or eliminated. While the counterfactual approach provides a conceptually clear solution to the problem of multi-causality, it is considerably more complicated to compute and less easily understood. In the example that Zou cites, relating to hepatitis C and chronic liver disease, the health outcomes are not "inaccurately attributed" but simply attributed categorically, according to the conventions of the International Classification of Diseases. The Global Burden of Disease Study (*2*) also used a simple form of counterfactual analysis (population attributable risk) to calculate the total burden attributable to various diseases and certain risk factors (such as unsafe sex) that cause other diseases after long latency periods.

Zou notes that DALYs do not capture the social and economic consequences involved in many conditions. As discussed in our paper (*1*), DALYs are a health gap measure that quantifies loss of health for a population against a normative standard, and are not intended to be a measure of total well-being. However, DALYs do capture discomfort, pain, suffering and stigma, as these aspects of health states are taken into consideration in measuring disability weights.

It is important to emphasize that measuring the burden of disease and assessing the potential benefits of interventions are distinct, albeit related, goals. The issue of averting future transmission is more relevant to intervention analyses than to describing a population's health during a defined period. An intervention analysis requires a dynamic application of burden assessment in which changes in an entire future stream of burden are computed in order to capture the anticipated benefits of an intervention (*3*). Clearly, however, even assessment of burden in the current period reflects the transmissibility of infectious diseases.

Finally, it is worth mentioning that, contrary to Zou's assertion that infectious diseases are "always ranked low or at the bottom of most disease burden analyses", a glance at the leading causes of DALYs globally in 1999 (*4*) shows that infectious diseases occupy four of the 10 highest ranks, including acute lower respiratory infections (1st), HIV/AIDS (2nd), diarrhoeal diseases (4th), and malaria (8th). Measles and tuberculosis are also in the top ten ranks for developing countries. ■

Joshua A. Salomon, Health Policy Analyst
email: salomonj@who.ch

Colin D. Mathers, Scientist

Christopher J.L. Murray, Director
Global Programme on Evidence for Health Policy
World Health Organization
1211 Geneva 27, Switzerland

1. **Murray CJL, Salomon JA, Mathers CD.** A critical examination of summary measures of population health. *Bulletin of the World Health Organization*, 2000, **78**: 981–994.
2. **Murray CJL, Lopez AD, eds.** *The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020.* Cambridge, MA, Harvard School of Public Health on behalf of the World Health Organization and the World Bank, 1996 (Global Burden of Disease and Injury Series, Vol. 1).
3. **Murray CJL, Lopez A.** On the comparable quantification of health risks: lessons from the Global Burden of Disease Study. *Epidemiology*, 1999, **10**: 594–605.
4. *The world health report 2000 – Health systems: improving performance.* Geneva, World Health Organization, 2000.

Even an HIV vaccine may not mean the end of AIDS

Editor – Data recently released by UNAIDS show the scope of the human immunodeficiency virus and acquired immunodeficiency syndrome (HIV/AIDS) pandemic, with a global total of 5.3 million new infections in 2000 (*1*). Every continent has been affected, though the developing countries are bearing the brunt. The most common mode of spread has been through heterosexual contact. Control and prevention of infection has generally been through information and education aimed at behavioural change: safer sex with the use of condoms has been promoted, injecting drug use discouraged, and needle exchange programmes introduced with varying success.

Some experts have suggested that the discovery of effective curative therapy and vaccine will be the "magic bullet" against HIV/AIDS, but I venture to dampen this optimism. Yes, an effective vaccine will be vital, so will effective, readily available and acceptable therapy. But availability is not enough, as experience has shown that other difficulties will stand in the way.

There have been vaccines against many communicable diseases for decades now, and the eradication of poliomyelitis from the western hemisphere is attributed to vaccination. But many other infections for which vaccines exist are still far from eradication. Of particular note are hepatitis B, tetanus and pertussis. In the case of hepatitis B, the vaccine is not generally available in many developing countries despite convincing evidence that it prevents infection and chronic forms of liver disease (e.g. cirrhosis and carcinoma). Other relatively new vaccines such as those against *Haemophilus influenzae* B and pneumococcal disease are still a rarity in the developing countries, where they are desperately needed.

The Expanded Programme on Immunization (EPI) has achieved remarkable progress in the prevention of childhood illness. But funding for EPI activities in many countries rests heavily with donor agencies. Malawi, one of the ten poorest countries, provides just 2% of its EPI budget. Will the goodwill that has sustained EPI activities continue and extend to HIV vaccines?

One feature unique to EPI vaccines is that they are given to children, not on the child's own volition but on that of the parents or guardian. If an eventual HIV vaccine is to be given to adults, different promotional skills will be required. Even the vaccines of childhood have been met with myths and misconceptions so that, in some cases, children fail to be immunized. A study in Zimbabwe published in 1999 (*2*) found that 55.6% of males and 64.6% of females felt they had no chance of being infected by HIV, yet the country seropositive level among adults aged 15 years and above is at least 15%, according to the National AIDS Control Programme.

The mode of delivery of an HIV vaccine would have to be considered carefully. If it were to be by injection, immunization against HIV could involve infection with hepatitis viruses in the process (*3*).

In case an effective therapy is discovered, who gets treated? For one thing, HIV testing is available in most industrialized countries (*4*) but not always in developing countries. There are areas of Malawi that are over 200 km away from the nearest testing centre, and the situation could be worse in other countries. Where antiretrovirals (ARVs) are available, at least in private practice, their use may be irresponsible (*5*). In a study in Zimbabwe the conclusion was that there was "therapeutic anarchy in the private sector in the way ARVs were being used" (*6*), thus creating a situation for the emergence of drug resistance and the consequent need to develop further generations of the drugs.

Perhaps it would be necessary to exercise surveillance of drug administration, in a way similar to the DOTS (directly observed therapy, short course) strategy that is being implemented for tuberculosis. But DOTS has not worked everywhere, and all the requirements for an effective DOTS programme — fully supervised therapy, laboratory diagnosis, reliable drug provision, effective monitoring and political commitment — are but a dream to most countries heavily affected by tuberculosis (and HIV/AIDS).

The issues I have raised, though depressing, are worth consideration, as it is not enough to manufacture vaccines or medications and think that patients will use them properly. That has not been the case with any other intervention in public health, because of the complexity of human behaviour. It is tempting to think that a cure will mean the end of HIV/AIDS, but we have cures for malaria, for example, and yet over 3 million deaths occur annually from the disease. ■

Adamson S. Muula
Assistant Lecturer and Registrar in Public Health
University of Malawi College of Medicine
Private Bag 360, Chichiri
Blantyre 3, Malawi
(email: a_muula@yahoo.com)

1. AIDS – dramatic surge in ex-Soviet Union, no respite worldwide, new data show. *Bulletin of the World Health Organization*, 2001, **79**: 78.
2. **Siziya S et al.** Risk awareness of HIV/AIDS among commercial farm workers in Zimbabwe. *Central African Journal of Medicine*, 1999, **45**: 316–320.
3. **Aamir JK et al.** Unsafe injections and the transmission of hepatitis B and C in a periurban community in Pakistan. *Bulletin of the World Health Organization*, 2000, **78**: 956–963.
4. **Mylonakis E et al.** Laboratory testing for infection with HIV: established and novel approaches. *American Journal of Medicine*, 2000, **109**: 568–567.
5. **Indalo A et al.** Antibiotic sale behaviour in Nairobi: a contributing factor to antimicrobial drug resistance. *East African Medical Journal*, 1997, **74**: 171–173.
6. **Nyazema NZ et al.** Antiretroviral (ARV) drug utilisation in Harare. *Central African Medical Journal*, 2000, **46**: 89–93.