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Commentary: Shifting burden of disease—epidemiological transition in India

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Non-communicable diseases are rapidly increasing in many developing countries, largely due to demographic and lifestyle changes. It is estimated that nearly half the disease burden in low- and middle-income countries is from non-communicable diseases, and more than 21% of deaths in such countries are due to cardiovascular diseases.[1] Cancer is not yet among the top ten leading causes of death in developing countries,[1] but the incidence of cancer in such countries is increasing. In the year 2000, 80% of new cases of cervical cancer occurred in the developing world[2] and it is estimated that 56% of all cancer deaths occur in developing countries.[3]

Many parts of India are experiencing an epidemiological transition and this is reflected in a growing burden of non-communicable diseases. In this issue of the *International Journal of Epidemiology*, Joshi *et al.*[4] show that non-communicable and chronic diseases are the leading causes of death in rural India. The study was conducted in 45 villages in East and West Godavari in Andhra Pradesh and has an estimated population size of 180 162. Mortality data were recorded through an ongoing surveillance system and information on causes of death was ascertained using the verbal autopsy for 98% of deaths. A specific underlying cause of death was assigned for 82% of all verbal autopsies. The leading causes of death were diseases of the circulatory system (32%), injury and external causes (13%), infectious and parasitic causes (12%), neoplasms (7%) and respiratory diseases (5%).

The implications of these findings are far reaching, and have been clearly described by Joshi *et al.*[4] First, the peak prevalence of many non-communicable diseases occurs at a younger age than in developed countries. The socio-economic impact of premature death due to non-communicable diseases is enormous since these deaths often affect the main income earner in the household and those who rear children. Second, the health delivery system must be reorganised in order to fight the growing burden of non-communicable diseases. Patients with non-communicable diseases typically require care over a long period of time, sometimes decades, and this may require technologically advanced equipment which may not be available in developing countries. It has been recommended that the management and control of non-communicable diseases requires clinical management in a primary care setting, population-based interventions on health promotion, and macro-economic policy.[5] The task of implementing effective programs to control non-communicable diseases in rural India and other developing country settings should not be underestimated.

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The interpretation of disease burden data is not without its difficulties and there are some important methodological issues that merit consideration. First, all studies that aim to assess disease burden using mortality patterns rely on accurate data on cause of death. In many developing countries, the majority of deaths occur at home, and consequently, accurate information on cause-specific mortality is scarce. The verbal autopsy has been used extensively to obtain cause-specific mortality data, but it cannot be presumed to be completely reliable. The verbal autopsy has been shown to vary across settings and, therefore, it should be validated before use in each setting.[6] For diseases which have long-term and relatively easy to measure risk factors, data on risk factors may be useful for predicting the current and future burden of disease.[1,7] For example, the burden of cardiovascular disease in the Seychelles—a middle-income country—was measured using data on risk factors such as smoking, blood pressure, body mass index and cholesterol level.[8] Indeed, when information is available on risk factors, this could be used as part of the verbal autopsy in order to improve its accuracy in assigning a cause of death.

Second, the interpretation of mortality patterns, particularly measures of the relative burden of non-communicable and infectious diseases, depends on how the causes of death have been grouped. For example, in the Joshi paper,[4] using the broad groupings derived from the International Classification of Disease (ICD), pneumonia is presumably grouped under the category of 'diseases of the respiratory system' rather than under 'infectious and parasitic diseases'. Therefore, the 22% of deaths in the under fives due to pneumonia are not classified as infectious diseases (Table 2).[4] While classification of pneumonia makes little difference to the overall conclusions in this study, it could change the overall pattern of infectious vs non-communicable diseases in other settings, or when focusing on causes of childhood mortality. Further limitations of the ICD rules have been noted elsewhere[1] for diseases such as HIV/AIDS, diabetes and hepatitis B and C, which are direct causes of death, and also increase the risk of other diseases such as tuberculosis, cirrhosis, renal failure and cardiovascular disease. In addition, under most groupings, cancer is classified as a non-communicable disease which is appropriate when considering treatment. For those cancers with an infectious aetiology, this may not be appropriate, particularly when considering disease prevention. Infection is responsible for nearly 25% of cancers in developing countries compared with $<10\%$ in developed countries.[9]

Finally, it should not be forgotten that many developing countries are combating the double burden of infectious and non-communicable diseases.[10] In many of the countries which are seeing a rise in non-communicable diseases, infectious diseases such as HIV, tuberculosis and malaria are not under

control. In recent decades, child survival has improved in many parts of the world due to the success of immunisation programmes and other interventions in maternal and child health. In India, for example, the under-five mortality rate has reduced considerably from 123 per 1000 in 1990 to 85 per 1000 in 2004,[11] but it still remains unacceptably high; India is one of 53 countries highlighted recently as not being on track to reach the Millennium Development Goal of a two-thirds reduction in under-fives mortality by 2015.[11] For many countries, the challenge is to implement appropriate prevention strategies in order to halt the growing trend in non-communicable diseases against a background of infectious diseases which remain out of control.

References

[1] Lopez AD, Mathers CD, Ezzatti M, Jamison DT, Murray CJL. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. *Lancet* 2006;**367:**1747–57.

[2] Denny L. The prevention of cervical cancer in developing countries. *BJOG* 2005;**112:**1204–12.

[3] Shibuya K, Mathers CD, Boschi-Pinto C *et al*. Global and regional estimates of cancer mortality and incidence by site. *BMC Cancer* 2002;**2:**37.

[4] Joshi R, Cardona M, Iyengar S *et al*. Chronic diseases now a leading cause of death in rural India—mortality data from the Andhra Pradesh Rural Health Initiative. *Int J Epidemiol* 2006;**35**:1522–29.

[5] Greenberg H, Raymond SU, Leeder SR. Cardiovascular disease and global health: threat and opportunity. *Heart Aff (Millwood)* 2005; W-5-31–W-5-41.

[6] Anker M, Black RE, Coldham C *et al*. A standard verbal autopsy method for investigating causes of death in infants and children. Geneva: World Health Organisation, 1999. WHO/CDS/CSR/ISR/99.4.

[7] Ezzati M, Lopez AD, Rodgers A, Vander Hoorn S, Murray CJL and the Comparative Risk Assessment Collaborating Group. Selected major risk factors and global and regional burden of disease. *Lancet* 2002;**360:**1347–60.

[8] Bovet P, Shamlaye C, Gabriel A, Riesen W, Paccaud F. Prevalence of cardiovascular risk factors in a middle-income country and estimated cost of a treatment strategy. *BMC Public Health* 2006;**6:**9.

[9] Kanavos P. The rising burden of cancer in the developing world. *Ann Oncol* 2006;**17:**viii 15–viii 23.

[10] Boutayeb A. The double burden of communicable and non-communicable diseases in developing countries. *Trans R Soc Trop Med Hyg* 2006;**100:**191–99.

[11] Bryce J, Terreri N, Victora CG *et al*. Countdown to 2015: tracking intervention coverage for child survival. *Lancet* 2006;**368:** 1067–76.