Surveillance and monitoring do not evoke much enthusiasm among health professionals—nothing much seems to happen and if anything does happen, what can be done about it anyway? Perhaps we have forgotten what these terms mean and their true purpose. Surveillance is the continuous collection, analysis, interpretation, dissemination and feedback of health-related data and is essential for guiding disease prevention and control activities. Surveillance systems, owing to their continuous collection of data, are commonly limited to routine sources, for example: death certification by underlying cause of death, cancer registers, infectious diseases reports, hospital and primary care records and serological surveillance from laboratory reports. Monitoring systems, in contrast, aim to examine changes in health status or in the physical and social environment, and whereas they may use surveillance methods, may be episodic and often attempt to collect more accurate data for evaluating prevention and control activities. An ideal health information system should include both surveillance and monitoring.

Some countries have made substantial investments in repeated national surveys that can provide information on how health is progressing. In India, for example, the National Family Health Surveys (NFHSs), funded largely by the US Agency for International Development (1992–93; 1998–99; 2005–06) have provided major sources of nationally representative data. The prevalence of HIV infection is an important health indicator and global estimates of the burden require good data from large countries like India. India’s estimates of trends in HIV prevalence were estimated using antenatal clinic surveillance; but once the NFHS-3 included HIV screening as part of its monitoring, a prevalence of HIV of 0.28% was found, about half that of previous estimates, resulting in a downward reassessment of the numbers of people living with HIV in India and a re-interpretation of earlier trends. The NFHS has also collected data on tobacco use and obesity—two modifiable risk factors for non-communicable diseases (NCDs)—in its last two rounds which have provided a better understanding of prevalence and changes in these risk factors in India.

New evidence on global trends

Four recent papers reliant on monitoring data published in the *Lancet* focused on global trends in adults (aged 20 or >25 years) of modifiable cardiovascular risk factors—obesity, raised blood pressure, high blood cholesterol and blood glucose, and diabetes prevalence—over the last three decades. The investigators used the best available data and found marked variation in levels of these risk factors between countries, increasing rates globally of obesity and of high fasting blood glucose and diabetes but small declines in blood pressure and blood cholesterol. Commentators on these findings were struck by a ‘global tsunami of cardiovascular disease’ and an ‘epidemic of risk factors’. From the perspective of time trends, some of these data are encouraging—both blood pressure and blood cholesterol, which are major risk factors for heart attack and stroke, appear to be declining. From the perspective of places, North America leads on obesity with a prevalence of over 30% in 2008, whereas South Asia manages only 2–3% obesity prevalence. Systolic blood pressure for 2008 ranged from 117 mmHg (South Korea, women) to 140 mmHg (Niger, men) and blood cholesterol from 4.0 mmol/l (Niger, women) to 5.7 mmol/l (Iceland, men). Whereas the trends in body mass index (BMI) and in fasting blood glucose were closely correlated, there were interesting inconsistencies in South Asians. BMI trends in South Asians have been among the smallest but trends in fasting blood glucose have been among the highest. The prevalence of diabetes is fast approaching levels observed among the Nauru, a Pacific Island population with one of the highest prevalence rates in the world, and comparable with those seen in North America where obesity trends have risen dramatically (Figures 1 and 2).
Despite rising trends in obesity in many regions, blood pressure and blood cholesterol have generally shown downward trends. It is likely that these inconsistencies are explained by widespread use of medical treatments to control these two risk factors. In addition, differences in physical activity and dietary patterns, and fetal and early life determinants may all be playing roles in explaining the trends observed.

The methods used in these *Lancet* papers are not straightforward, as the investigators wanted to make use of as much of the available data as possible. For India this meant using studies as diverse as the NFHSs 2 and 3 (\(n=165\,289\)) and the Indian arm of the InterSalt study (\(n=190\)) for estimating BMI. Age-standardized means and prevalence rates from 1980 to 2008 were presented (Figures 1 and 2) but the earliest Indian data available were for 1986 (Table 1). So how does this magic trick work? The investigators grouped countries into regions (e.g. South Asia = Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan) and by per capita income. Differences in sample sizes of studies were accounted for by using inverse variance weighting. Further adjustments were made for income, urbanization and multiple food type availability as these affect levels of risk factors in countries. Finally, Bayesian hierarchical models were used to estimate risk factor changes over time by age, sex and country with the uncertainty in estimates incorporated. The modelling allowed estimates to be made for age-country-year groups (e.g. 1980, 20–49 years, India) where no real data exist by ‘borrowing’

**Figure 1** Secular trends in body mass index (kg/m\(^2\)) in men and women, 1980–2008. *Source:* abstracted from weatables\(^5\)

**Figure 2** Secular trends in diabetes prevalence (%) in men and women, 1980–2008. *Source:* abstracted from weatables\(^6\)
from age-country-year groups where data were available. This approach results in uncertainty limits that are about three times as wide for Indian BMI estimates in 1980 (no real data at all) compared with estimates after 1995 which are derived from considerably more real Indian data.

How credible are these new methods?

The Jaipur Heart Watch studies are small cross-sectional assessments of cardiovascular risk factors carried out in the same way by the same investigator between 1995 and 2005.12 In these studies obesity prevalence more than doubled in urban men and quadrupled in urban women, with prevalence, in 2005, of 51 and 58% for men and women, respectively. However, estimates from urban Jaipur should not be extrapolated to India as a whole. Among rural people drawn from 18 Indian states in 2005–07, the mean BMI in men and women was 21.7 and 22.8 kg/m², respectively.13 The NFHS-3 in 2005–06 estimated overweight/obesity prevalence for India as 12% (mean BMI 20.2 kg/m²) for men and 16% (mean BMI 20.5 kg/m²) for women with no increase in women (NFHS-2, mean BMI 20.3 kg/m², no data on men).14 These national data give some credibility to the methods used to derive estimates in the Lancet paper.

India vs China

It is always interesting to make comparisons between neighbours, particularly when they contribute such a large amount to the numerator and denominator of global disease burdens. So is India doing better than China? Both Chinese and Indians are clearly at the low end of the BMI distribution, although Chinese men are showing a trend towards increasing BMI (Figure 1), but both countries have a long way to go to reach North American or Pacific Island levels. For systolic blood pressure and blood cholesterol, there is no strong evidence of any time trend in levels of these risk factors (Table 2). China and India clearly differ in the resources given to monitoring activities. For each risk factor analysis, China has collected substantially more data than India: more than 3-fold for BMI (3 085 108 vs 932 632 individuals), almost 4-fold more for blood pressure, over 5-fold more for blood cholesterol and over 30-fold more for blood glucose (Table 1). Moreover, China has more nationally representative data covering a wider range of years.

Table 1 Data sources for Indian and Chinese estimates of modifiable risk factors

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Number of studies (total N)</th>
<th>Range of years</th>
<th>Number of nationally representative studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body mass index</td>
<td>32 (932 632)</td>
<td>1986–2008</td>
<td>3</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>22 (201 006)</td>
<td>1986–2007</td>
<td>2</td>
</tr>
<tr>
<td>Blood cholesterol</td>
<td>11 (19 625)</td>
<td>1994–2006</td>
<td>0</td>
</tr>
<tr>
<td>Blood glucose</td>
<td>14 (40 096)</td>
<td>1989–2007</td>
<td>0</td>
</tr>
<tr>
<td>China</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body mass index</td>
<td>64 (3 085 108)</td>
<td>1982–2008</td>
<td>8</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>44 (790 826)</td>
<td>1980–2009</td>
<td>4</td>
</tr>
<tr>
<td>Blood cholesterol</td>
<td>13 (102 857)</td>
<td>1985–2009</td>
<td>1</td>
</tr>
<tr>
<td>Blood glucose</td>
<td>18 (1 362 741)</td>
<td>1980–2008</td>
<td>3</td>
</tr>
</tbody>
</table>

Abstracted from webtables.5–8

Implications

Are these new Lancet papers important? These papers raise as many questions as answers. Why should blood pressure and blood cholesterol decline over time when BMI is going up? Why should hypertension affect almost half the population of some countries but not others? Why have large falls in blood pressure occurred in high-income countries? What is driving the apparent increase in blood pressure in low-income countries? Why do countries show rising trends in diabetes but no increase in obesity? These are averages, what is happening at the top and bottom of the risk factor distributions? Are the methods of analysis appropriate? What about other equally important modifiable risk factors—tobacco use and physical inactivity? The between-country comparisons show much greater differences in all the modifiable risk factors than the trends over time.

The investigators’ proposals for interventions to curb adverse trends in BMI, blood pressure, blood cholesterol and fasting blood glucose stress the need for financial and regulatory mechanisms and highlight the strong evidence for the health benefits of lowering blood pressure and blood cholesterol by lifestyle and pharmacological interventions. It is clear that the underlying causes of the complex patterns of the different risk factors observed globally, regionally and between and within countries are not fully understood. The underlying reasons for between-country differences in the levels of modifiable risk factors may provide potentially valuable ways of reducing the burden of NCDs. ‘Upstream’ determinants are likely to be important and include economic,15 educational,16 occupational,17 agricultural18 and trade19 policies which in turn affect opportunities for the population at large to lead healthy lives. Focusing only on health services without considering these upstream determinants would be missing an important—and modifiable—part of the causal chain.
So what is the take-home message from these new synthesized surveillance data for global and national health policy makers and practitioners? Major NCD risk factors are present in all populations but levels of obesity, blood pressure and cholesterol are still relatively low in poorer countries. However, the rising prevalence of diabetes in South Asia and Oceania is of great concern. There is no cause for complacency in low- and middle-income countries as public health approaches to controlling risk factors may be more effective in the early stages of the epidemiological transition but are difficult to design and will take a considerable time to implement. Combating the aggressive marketing of tobacco in low- and middle-income countries is essential through making tobacco control the highest priority for action. The Framework Convention provides a strategy that requires stronger implementation in all countries. But most countries desperately need better surveillance and monitoring systems that are relevant to the burden of communicable diseases and the newly recognized burdens of NCDs, mental illnesses and injuries—NCDs for short. Rather than establishing new surveillance and monitoring schemes for NCDs it would be preferable for them to be integrated into any existing communicable disease surveillance systems. For example, India has an Integrated Disease Surveillance Project and has intermittent NCD risk factor monitoring currently conducted in only seven states. One of India’s important monitoring systems—the Indian NFHSs—has already demonstrated its worth and expanding data collection to include modifiable risk factors—blood pressure, blood tests for diabetes and raised cholesterol levels and simple lung function tests—would provide more substantial coverage relevant to contemporary NCD burdens. Disappointingly, the Government of India is now planning to stop conducting any future NFHS.

Surveillance and monitoring of representative population samples will not solve the problems of the impending rise in NCDs but will make a major contribution to evaluating the impact of health-related policies and health interventions.

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