The 20th century revolution in health – and the consequent demographic transition – lead inexorably to major changes in the pattern of disease. This epidemiological transition results in a major shift in causes of death and disability from infectious diseases to noncommunicable diseases (1).

As a result of the epidemiological transition, to continue the example of Chile presented in Chapter 1, the distribution of causes of death in 1999 differs markedly from the distribution of causes of death in 1909, as shown in Figure 2.1 (2). Not only have the major causes of death changed, but the average age of death has been steadily rising. The resulting new epidemics of noncommunicable disease and injuries challenge the finances and capacities of health systems.

Despite the long list of successes in health achieved globally during the 20th century, the balance sheet is indelibly stained by the avoidable burden of disease and malnutrition that the world’s disadvantaged populations continue to bear. Some analysts have characterized a world of incomplete epidemiological transition, in which epidemiologically polarized sub-populations have been left behind (3). Reducing the burden of that inequality is a priority in international health. Furthermore, it can be done – the means already exist.

Figure 2.1 Distribution of deaths by cause for two cohorts from Chile, 1909 and 1999

1999 data: Estimates based on data from the WHO Mortality Database.
Health policy-makers in the early decades of the 21st century will thus need to address a double burden of disease: first, the emerging epidemics of noncommunicable diseases and injuries, which are becoming more prevalent in industrialized and developing countries alike, and second, some major infectious diseases which survived the 20th century – part of the unfinished health agenda. This chapter describes this double burden of disease. It points to the availability of cost-effective interventions that make it possible to complete substantially the unfinished agenda in the first decade of the 21st century. Health systems development – discussed in the next chapter – must focus on delivering these interventions for the poor.

**EMERGING EPIDEMICS OF NONCOMMUNICABLE DISEASES AND INJURIES**

The next two decades will see dramatic changes in the health needs of the world’s populations. In the developing regions, noncommunicable diseases such as depression and heart disease are fast replacing the traditional enemies, in particular infectious diseases and malnutrition, as the leading causes of disability and premature death. Injuries, both intentional and unintentional, are also growing in importance and by 2020 could rival infectious diseases worldwide as a source of ill-health (1). The rapidity of change will pose serious challenges to health care systems and force difficult decisions about the allocation of scarce resources.

To provide a valid basis for such difficult health policy decisions, there is a great need for the development of reliable and consistent data on the health status of populations worldwide. Further, as *The world health report* has argued before (4,5), a new approach to measuring health status needs to be implemented, one that quantifies not merely the number of

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**Figure 2.2 The emerging challenges: DALYs attributable to noncommunicable diseases in low and middle income countries, estimates for 1998**

Source: Annex Table 3.
The Double Burden: Emerging Epidemics and Persistent Problems

... deaths but also the impact of premature death and disability on populations, and which combines them into a single unit of measurement. Several such measures have been developed in different countries, many of them being variants of the so-called Quality-Adjusted Life Year (QALY), which is principally used to measure gains from interventions. In contrast, the Disability-Adjusted Life Year (DALY) is a measure of the burden of disease.

DALYs express years of life lost to premature death and years lived with a disability, adjusted for the severity of the disability. One DALY is one lost year of healthy life. A “premature” death is defined as one that occurs before the age to which the dying person could have expected to survive if he or she was a member of a standardized model population with a life expectancy at birth equal to that of the world’s longest-surviving population, Japan. Disease burden is, in effect, the gap between a population’s actual health status and some reference status.

The initial assessment of global disease burden using DALYs was prepared in 1993 for the World Bank (6) in collaboration with WHO. Subsequently revisions and extensive documentation of disease burden for the year 1990 have been published (1). In this report, disease burden has been quantified using “standard DALYs”, calculated according to the methods described in earlier work on the burden of disease (1). This report provides new estimates of disease burden for the year 1998.

Noncommunicable Diseases

In 1998, an estimated 43% of all DALYs globally were attributable to noncommunicable diseases. In low and middle income countries the figure was 39%, while in high income countries it was 81%. Among these diseases, the following took a particularly heavy toll (see Figure 2.2):

- neuropsychiatric conditions, accounting for 10% of the burden of disease measured in DALYs in low and middle income countries and 23% of DALYs in high income countries;
- cardiovascular diseases, responsible for 10% of DALYs in low and middle income countries and 18% of DALYs in high income countries;
- malignant neoplasms (cancers), which caused 5% of DALYs in low and middle income countries and 15% in high income countries.

One of the most surprising results of using a measure of disease burden which incorporates time lived with disability is the magnitude it ascribes to the burden of neuropsychiatric conditions. Because of the limited mortality consequences, this burden was previously underestimated. As shown in Box 2.1, a large proportion of the burden of disease resulting from neuropsychiatric conditions is attributable to unipolar major depression, which was the leading cause of disability globally in 1990. The disease burden resulting from depression is estimated to be increasing both in developing and developed regions. Alcohol use is also quantified as a major cause of disease burden, particularly for adult men. It is the leading cause of disability for men in the developed regions and the fourth leading cause in developing regions.

These findings also highlight the “hidden epidemic of cardiovascular disease” (7). Within cardiovascular diseases (CVD), which collectively are responsible for about one in eight DALYs globally, ischaemic heart disease and cerebrovascular disease (stroke) are the most significant conditions. It has been estimated that ischaemic heart disease will be the largest single cause of disease burden globally by the year 2020 (1). Box 2.2 discusses in more detail the nature of cardiovascular diseases in the Eastern Mediterranean Region. Substantive
The World Health Report 1999

Evidence suggests that current programmes for CVD risk factor prevention and low-cost case management offer feasible, cost-effective ways to reduce CVD mortality and disability in populations both in developed and developing countries (8). Implementation of such programmes should be a priority for health policy-makers as the burden of CVD rises in all socioeconomic groups and inflicts major human and economic costs on societies.

The third largest cause of disease burden within noncommunicable conditions is cancer. Cancers are responsible for a large proportion of years of life lost and years lived with disability. Among cancers, the most significant cause of disease burden is lung cancer, which is projected to become ever more prevalent over the next few decades, if current smoking trends continue. Tobacco is a major risk factor for several other noncommunicable diseases as well. As discussed in detail in Chapter 5, tobacco control is one of the major public health priorities for the 21st century.

Noncommunicable diseases are expected to account for an increasing share of disease burden, rising from 43% in 1998 to 73% by 2020, assuming a continuation of recent downward trends in overall mortality (which have yet to be realized in China and elsewhere) (9). The expected increase is likely to be particularly rapid in developing countries. In India, deaths from noncommunicable causes are projected to almost double from about 4.5 million in 1998 to about 8 million a year in 2020.

The steep projected increase in the burden of noncommunicable diseases worldwide – the epidemiological transition – is largely driven by population ageing, augmented by the rapidly increasing numbers of people who are at present exposed to tobacco and other risk factors, such as obesity, physical inactivity and heavy alcohol consumption. This increase in noncommunicable diseases induced by changes in age distribution poses significant problems. Health systems must adjust to deal effectively and efficiently with the globally chang-

Box 2.1 The rising burden of neuropsychiatric disorders

Disease priorities change dramatically as measurement of disease burden shifts from simple mortality indicators to indicators that incorporate disability. Neuropsychiatric conditions have been ignored for a long time as they are absent from cause of death lists. However, when disease burden measurement includes time lived with a disability, several of the neuropsychiatric disorders become leading causes of disease burden worldwide.

Annex Table 3 reports that 11% of the global burden of disease in 1998 was attributable to neuropsychiatric conditions; in high income countries, one out of every four DALYs was lost to a neuropsychiatric condition, while in low and middle income countries this group of conditions was responsible for one out of ten DALYs.

Of the ten leading causes of disease burden in young adults (in the 15–44 year age group) four were neuropsychiatric conditions. More specifically, unipolar major depression was the fourth leading cause of overall disease burden in 1990, while in adults aged 15–44 years it was the leading cause of DALYs, both in high income and low and middle income countries. Alcohol dependence, bipolar disorder, and schizophrenia were among the leading causes of disease burden in this age group in 1998.

Great attention needs to be paid to the growing needs of populations in the area of mental health. As shown in the table, neuropsychiatric conditions are among the leading causes of disability and burden. Psychiatric disorders are frequently a considerable drain on health resources as a consequence of being misunderstood, misdiagnosed or improperly treated. With proper budgetary planning and allocation of resources, introducing an effective mental health programme into primary health care can reduce overall health costs. Mental health care, unlike many other areas of health, does not generally demand costly technology; rather, it requires the sensitive deployment of personnel who have been properly trained in the use of relatively inexpensive drugs and psychological support skills on an outpatient basis.

<table>
<thead>
<tr>
<th>Disease or injury</th>
<th>Rank in cause-list</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>World</td>
</tr>
<tr>
<td>Unipolar major depression</td>
<td>4</td>
</tr>
<tr>
<td>Alcohol dependence</td>
<td>17</td>
</tr>
<tr>
<td>Bipolar disorder</td>
<td>18</td>
</tr>
<tr>
<td>Psychoses</td>
<td>22</td>
</tr>
<tr>
<td>Obsessive-compulsive disorder</td>
<td>28</td>
</tr>
<tr>
<td>Dementia</td>
<td>33</td>
</tr>
<tr>
<td>Drug dependence</td>
<td>41</td>
</tr>
<tr>
<td>Panic disorder</td>
<td>44</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>47</td>
</tr>
</tbody>
</table>

Source: Annex Table 3.
The Double Burden: Emerging Epidemics and Persistent Problems

...ing nature of illness, and health policy-makers will be challenged to find the most cost-effective uses of their limited resources to control the rising epidemics of noncommunicable diseases. In contrast to the limited number of conditions responsible for most of the excess disease burden among the poor, policy-makers will need to develop systems capable of responding to an enormous variety of conditions as the epidemiological transition matures.

At the same time, health policy-makers will need to respond to the unexpectedly persistent inequalities in health status within countries. This is a problem that affects disadvantaged populations in developed and developing countries alike. Traditionally, the focus of global health policy has been on the less developed nations. Recent studies have revealed surprisingly large inequalities within developed nations, and they highlight the need for policies that focus on disadvantaged populations throughout the world. Box 2.3 summarizes some of the findings of national studies on inequalities in the USA and the UK.

Injuries

Injuries, intentional and unintentional, are a large and neglected health problem in all regions, accounting for 16% of the global burden of disease in 1998. Figure 2.3 shows the major categories of injuries responsible for most of the burden. Road traffic accidents were the ninth leading cause of disease burden globally in 1998, fifth in the high income countries and tenth in the low and middle income countries. For adult men aged 15–44, road traffic accidents are the biggest cause of ill-health and premature death worldwide, and the second biggest in developing countries. The burden from road traffic accidents is projected to increase globally, and particularly in developing countries. In sub-Saharan Africa, partly because of the projected reduction of the burden from infectious diseases, injuries (primarily road traffic accidents, war and violence) are expected to account for a large proportion of ill-health.

Recent figures for homicides, suicides and traffic accident deaths for countries in the Americas show that these rank as the main causes of death and disability. Every year, close to 120 000 people are killed, 55 000 commit suicide, and 126 000 die in traffic accidents in the Americas (10). At least 12 countries have homicide rates above 10 per 100 000 inhabitants.

**Box 2.2 Cardiovascular diseases in the Eastern Mediterranean**

The countries of the Eastern Mediterranean are going through an epidemiological transition, leaving many of them with the double burden of infectious and noncommunicable diseases. The ageing of the population, progressive urbanization, and changes in nutritional habits and lifestyles all contribute to the occurrence of cardiovascular diseases.

Although age-specific mortality rates are declining, the risk factors for cardiovascular diseases are more prevalent than before. Diets have a higher fat content; there are over 17 million people with diabetes and a further 17 million with impaired glucose tolerance; smoking is widespread especially among younger people; and physical activity is insufficient. Prevention has the potential to reduce mortality further.

Mortality data are inadequate in many countries of the Eastern Mediterranean, but available information shows that coronary heart disease is increasing as a cause of hospital admission and is being seen at younger ages than before. Hypertension has been reported to affect more than 20% of adults, but it is estimated that more than half of the cases are not diagnosed.

Community-based intervention programmes have been shown to be effective in promoting healthy lifestyles and reducing the incidence of cardiovascular diseases. WHO is therefore working with countries to establish pilot projects to provide information on risk factors and to promote healthy lifestyles with regard to tobacco use, diet and physical activity. Special emphasis is placed on inculcating good habits in children and adolescents. Efforts are made to involve local groups and community decision-makers, so as to mobilize the community and ensure that people are able to follow healthier lifestyles.

Contributed by the WHO Regional Office for the Eastern Mediterranean.
Violence and self-inflicted injuries (including suicide) are a major public health concern because of their increasing significance within the global disease burden. Injuries primarily affect the younger age groups and often result in disabling conditions. In higher income countries, road traffic accidents and self-inflicted injuries were among the ten leading causes of disease burden in 1998 as measured in DALYs. In less developed countries, road traffic accidents were the most significant cause of injuries, ranking eleventh among the most important causes of lost years of healthy life. Intentional injuries primarily affect young adults, with males in the age group of 15–34 years bearing a particularly large proportion of the burden.

Domestic violence, especially against women, is not always reflected in physical injury but may be apparent in psychological sequelae. Traditionally, violence has been classified as intentional injury. While it is clearly important to recognize violence as a cause of injury,

**Figure 2.3 The emerging challenges: DALYs attributable to injuries in low and middle income countries, estimates for 1998**

![Diagram showing DALYs attributable to injuries](image)

**Box 2.3 Health inequalities in the USA and the UK**

The use of national life expectancy at birth as a measure of health and well-being of a population places the United States among the better-off countries. National life expectancy has been rising steadily for both men and women in the last half of the century. National life expectancy is an aggregate measure and masks the remarkable variation that is observed within the nation. The results from the on-going study on the burden of disease and injury in the USA have shown that at the county level, the range in life expectancy is similar to the range observed across all countries. The range in life expectancy between females in Stearns, Minnesota and males in Bennett, Jackson, Mellette, Shannon, Todd and Washabaugh counties, South Dakota, is 22.48 years. This range becomes even wider – 41.3 years – when race-specific life expectancy across counties is calculated. This difference of 41.3 years corresponds to 90% of the global range from the population with the lowest life expectancy (males in Sierra Leone) to the population with the highest (females in Japan).

The USA has been reasonably successful at reducing the inequalities in absolute terms (not relative terms) in child and adolescent mortality as compared to the range in mortality observed between the established market economies and sub-Saharan Africa. On the other hand, the USA has been much less successful in reducing inequalities in adult male and to a lesser but substantial extent adult female mortality. While the focus of most public health analysis remains health conditions in children and the elderly, the largest inequalities in the USA relative to the rest of the world are found in adult male and adult female health conditions.

Large health inequalities have also been reported in the UK. Last year an independent inquiry set up by the British government reviewed the evidence on inequalities in health in England. The report published in November 1998 states that although average mortality rates have fallen in the last 50 years, unacceptable inequalities in health have persisted. The report identified three crucial approaches: all policies likely to have an impact on health should be evaluated in terms of their impact on health inequalities; a high priority should be given to the health of families with children; and further steps should be taken to reduce income inequalities and improve the living standards of poor households.

particularly among women where the connection may not always be evident, the health consequences also need to be understood. So too does the different nature of the violence experienced by men, women and children.

Globally, injuries are responsible for one in six years lived with disability. Injuries have, nevertheless, often been a neglected area of public health policy. More attention therefore needs to be focused on dealing with the growing problem of injuries – through more comprehensive prevention, improved emergency and treatment services, and better rehabilitation.

**Persistent Problems of Infectious Diseases and Maternal and Child Disability and Mortality**

Despite the extraordinary advances of the 20th century, a significant component of the burden of illness globally still remains attributable to infectious diseases, undernutrition and complications of childbirth. These conditions are primarily concentrated in the poorest countries, and within those countries they disproportionately afflict populations that are living in poverty. The residual concentration of infectious diseases afflicting the poor is truly an avoidable burden, because inexpensive and effective tools exist to deal with much of it. In fact, it mostly results from relatively few conditions.

The disproportionate share of the burden of disease on the poor is demonstrated in Table 2.1 and Figure 2.4, based on analyses reported in Annex Table 7. Within countries, the disadvantaged fare much worse as measured by several health indicators than the better-off. Those living in absolute poverty, compared with those who are not poor, are estimated to have a five times higher probability of death between birth and the age of 5 years, and a 2.5 times higher probability of death between the ages of 15 and 59 years. Overall, the poor fare worse than the better-off in society on all health indicators studied. Figure 2.4 demonstrates the distinctly different distributions across countries of health indicators for the poor and the non-poor. It clearly shows that the non-poor have a much higher overall health level than the poor.

These data illustrate another critical point. Some countries attain far better health conditions for their poor people than others. Poor children in China have less than a third of the risk of dying before their fifth birthday than comparably poor children in the United

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage of population in absolute poverty</th>
<th>Probability of dying per 1000</th>
<th>Prevalence of tuberculosis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>between birth and age 5, females</td>
<td>Non-poor</td>
<td>Poor:non-poor ratio</td>
</tr>
<tr>
<td>Aggregate</td>
<td>38</td>
<td>4.8</td>
<td>92</td>
</tr>
<tr>
<td>Chile</td>
<td>15</td>
<td>7</td>
<td>8.3</td>
</tr>
<tr>
<td>China</td>
<td>22</td>
<td>28</td>
<td>6.6</td>
</tr>
<tr>
<td>Ecuador</td>
<td>8</td>
<td>45</td>
<td>8.4</td>
</tr>
<tr>
<td>India</td>
<td>53</td>
<td>40</td>
<td>4.3</td>
</tr>
<tr>
<td>Kenya</td>
<td>50</td>
<td>41</td>
<td>3.8</td>
</tr>
<tr>
<td>Malaysia</td>
<td>6</td>
<td>10</td>
<td>15.0</td>
</tr>
</tbody>
</table>

a Poverty is defined as income per capita of less than or equal to $1 per day, expressed in dollars adjusted for purchasing power.
b The aggregate estimate refers to all countries listed in Annex Table 7.
See Explanatory Notes to the Statistical Annex for an explanation of the methods used to derive the estimates.
Source: Annex Table 7.
Republic of Tanzania. Poverty is not an insurmountable barrier to better health when policies are right. This further illustrates that much of the burden on the poor is unnecessary.

The unfinished agenda

The populations of developing countries and particularly the disadvantaged groups within those countries remain in the early stages of the epidemiological transition, where infectious diseases are still the major cause of death. Figure 2.5 depicts the distribution of deaths in low and middle income countries in 1998. It illustrates the five major childhood conditions which are responsible for 21% of all deaths in low and middle income countries: diarrhoea, acute respiratory infections, malaria, measles and perinatal conditions. Almost all DALYs from these five conditions occur in developing countries. Less than 1% are registered in high income countries. It is noteworthy that most of the DALYs among infants and young children are attributable to a limited number of conditions for which either preventive or curative interventions exist. This report will argue, in Chapter 3, that a priority for health systems development is to achieve effective delivery of these interventions, which are delineated below.

Immunization programmes have yielded the most significant changes in child health in the last few decades. Although some vaccines represent the most cost-effective public health intervention of all, the world does not use them enough. At least 2 million children still die each year from diseases for which vaccines are available at low cost. Similarly, for diarrhoeal disease, there exists a simple, inexpensive and effective intervention: oral rehydration therapy. Diarrhoeal diseases and pneumonia together account for a high proportion of deaths of children in developing countries. In several developing countries, therefore, diarrhoeal disease control programmes have been merged with a simplified approach, promoted by WHO, to detecting acute respiratory infections (primarily pneumonia).

In adults, maternal conditions, HIV/AIDS and tuberculosis are the three major causes of disease burden in developing regions, as depicted in Figure 2.5. Together, they accounted for 7% of all DALYs in 1998. Among maternal conditions, obstructed labour, sepsis and unsafe abortion were among the ten leading causes of death and disability among women aged 15–44 years in developing countries in 1998. The burden of maternal conditions has been hard to quantify because of the lack of reliable data. But it is a major public health problem and represents a major and unnecessary burden for which policy-makers should increasingly be held accountable.
THE PERSISTING AND EVOLVING CHALLENGES

Despite the successful eradication of smallpox and the control of several infectious diseases in the 20th century, there remain some significant threats that are particularly challenging because of the changing nature of the disease pattern and the ways it manifests itself in populations. A clear example is malaria. Public health efforts in the last four decades have been remarkably effective in reducing the burden of malaria in South-East Asia and Latin America. Despite this achievement, malaria remains a major public health problem, particularly in Africa (see Annex Table 8). Malaria has been named as one of WHO’s top priorities. Chapter 4 provides a detailed overview of the problem and the WHO approach to it.

Malaria, along with HIV/AIDS and tuberculosis, can be classified among a group of diseases for which control efforts are being jeopardized by microbial evolution. This problem is described in Box 2.4. Figure 2.5 demonstrates that a large proportion of the deaths occurring between the ages of 15 and 59 years in low and middle income countries can be attributed to HIV and tuberculosis. Effective and cost-effective strategies for controlling tuberculosis exist; but standard treatment regimens require six or more months of chemotherapy and rely on well-organized services to achieve high rates of adherence. The interaction of HIV and tuberculosis is also an important public health matter, as individuals who are infected with both are more likely to die from tuberculosis than from other infections. During the period of active tuberculosis infection, they may transmit the infection to previously uninfected contacts. Because HIV infection is projected to increase over the coming decade, the burden from tuberculosis may also increase unless there are energetic efforts to extend the reach of existing control measures with proven effectiveness and cost-effective-

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**Figure 2.5** DALYs attributable to conditions in the unfinished agenda in low and middle income countries, estimates for 1998

- Tuberculosis: 22%
- Maternal conditions: 25%
- Acute respiratory infections: 27%
- Perinatal conditions: 26%
- Malaria: 13%
- Diarrhoea: 24%
- Measles: 10%
- Major adult conditions: 10%
- Major childhood conditions: 23%
- All other conditions: 66%

Source: Annex Table 3.
ness, as well as to invest in the development of new tools for tuberculosis control. The tuberculosis situation in the Western Pacific Region is described in Box 2.5.

The challenge posed by these persisting and evolving conditions is that tools to control them have either not been developed or, if available, are not used effectively or, in some cases, are becoming increasingly ineffective. As examined in more detail in Box 2.4, antimicrobial resistance is a worrying phenomenon since it could have great adverse effects on the control and treatment of diseases such as pneumonia, tuberculosis and malaria. These conditions emphasize the need, as discussed further in Chapter 3, for health systems to invest in research and development strategies to come up with cost-effective tools to control the remaining threats from infectious diseases.

Increases in international air travel, trade – particularly the food trade – and tourism mean that disease-producing organisms, the deadly as well as the commonplace, can be transported rapidly from one continent to another. This trend may threaten international public health security, although so far the consequences have remained quantitatively unimportant. To counter any such threat, the global surveillance of infectious diseases is being improved through an international information network. This should make it possible to recognize outbreaks faster.

### The Avoidable Burden of Disease

The most significant fact about the unnecessary burden is that it is concentrated on a few conditions, most of which are avoidable. There are many vaccines, drugs and clinical algorithms that if employed globally would lead to a dramatic reduction in the burden of infectious diseases. Figure 2.6 illustrates the links between infant mortality rates and per capita income in some of the most populous low and middle income countries. The countries that are above the curve in 1990 are low and middle income countries which had a higher infant mortality rate than expected, given their average income per capita. Their distance above the curve indicates potential reductions in mortality, i.e. the gains that would

---

**Box 2.4 Microbial evolution – the continually changing threat of infectious disease**

Resistance of disease-causing organisms to antimicrobial drugs and other agents has become a great public health concern worldwide. It is having a deadly impact on the control of diseases such as tuberculosis, malaria, cholera, dysentery and pneumonia.

Antimicrobial resistance is not a new nor a surprising problem, but it has worsened in the last decade. All bacteria possess an inherent flexibility that enables them, sooner or later, to evolve genes that render them resistant to any antimicrobial. By killing susceptible bacteria, an antimicrobial provides selective pressures that favour overgrowth of bacteria carrying a gene that confers resistance. The continuous use of antimicrobial agents encourages the multiplication and spread of resistant strains.

The result is that drugs which cost tens of millions of dollars to produce, and take perhaps 10 years to reach the market, are only effective for a limited time period. Examples of diseases whose agents have demonstrated drug resistance include tuberculosis, malaria, gonorrhoea and typhoid fever.

In the case of tuberculosis, poor prescribing practices or poor patient compliance with treatment have led to the development of strains of *Mycobacterium tuberculosis* which are resistant to the available drugs. Malaria presents a double resistance problem: resistance of the *Plasmodium* parasites, which cause the disease, to antimalarial drugs; and resistance of the *Anopheles* mosquitoes, the vectors of the disease, to insecticides. Pneumococci and *Haemophilus influenzae*, the most common bacteria causing acute respiratory infections in children, are becoming more resistant to drugs. More than 90% of *Staphylococcus aureus* strains and about 40% of pneumococci strains are resistant to penicillin.

In the USA, antibiotic-resistant bacteria generate costs of a minimum of $4 billion to $5 billion yearly; these costs are likely to be much higher in developing countries.

Answering questions concerning the use of antibiotics in food production, emphasizing ways to prolong the effectiveness of existing antibiotics, pursuing key areas of basic research and seeking incentives for developing new antibiotics, and exploring legal and regulatory mechanisms in key areas of need are priorities that need to be addressed by policy-makers.

result from their joining the curve. That the infant mortality rate in low and middle income countries is higher in the most populous countries suggests the importance of focused international assistance. Health systems need to provide the existing, cost-effective interventions to these populations so that the countries that are currently lagging behind can join the curve.

Immunization is the greatest public health success story in history (12). The basic vaccines are available to combat the six major diseases in children (measles, tetanus, pertussis, tuberculosis, poliomyelitis and diphtheria). Immunization coverage falls far short of 100%, and it is the world’s poorest and most vulnerable children who remain unreached.

Poliomyelitis is an example of a disease for which eradication is possible. The only reason for the existence of remaining cases is insufficient coverage. WHO is committed to

**Figure 2.6 Infant mortality rate related to income**

![Infant mortality rate related to income](image)

*Note: For explanation of the curve relating IMR to income, see note to Figure 1.4.*

**Box 2.5 Tuberculosis in the Western Pacific**

The notified cases of tuberculosis in the Western Pacific Region in 1996 represented 25% of the global total, mainly because expansion of the WHO tuberculosis control strategy, particularly in China, improved case management and brought many more cases under treatment. There were 2.16 million estimated new cases in 1997, and the average case fatality rate was 20%. Coinfection with HIV is still low in the Region as a whole, but those who are coinfected with tuberculosis and HIV may reach 26 per 100,000 population by 2000. WHO has been collaborating closely in the establishment of surveillance of HIV infection among tuberculosis patients in Cambodia, Malaysia, and Viet Nam.

Data from 21 countries and areas in the Region show that the majority of cases occurred during the productive years of life. Delayed diagnosis or partial treatment often lead to longstanding lung disability and job loss, causing socioeconomic hardship. Untreated or inadequately treated tuberculosis patients spread the infection to others, especially in crowded and poor communities. Children aged 5–9 years living in urban slums in the Philippines showed more than twice the prevalence rate of infection for the general urban population: 39% of them were infected with the disease.

Tuberculosis ignores national boundaries. In Australia, Hong Kong (China), Malaysia and Singapore, the numbers of tuberculosis cases have not decreased for several years because of the increased or continued detection of new tuberculosis patients among immigrants.

The directly observed treatment, short course (DOTS) strategy was introduced in the Western Pacific in the early 1990s and is now used in 28 countries and areas; 35% of tuberculosis cases are treated with DOTS, and 55% of the total population have access to the strategy. In China, a DOTS programme supported by the World Bank is being implemented with WHO collaboration in 13 provinces. The programme has so far achieved a cure rate of over 90% and is accessible to 560 million people. In Cambodia, more than 90% of district health facilities are using DOTS as a routine strategy. In the Philippines, a new approach using DOTS began in three provinces in 1996, in collaboration with WHO, raising the cure rate from 60% to 80%. DOTS will be accessible to more than half of the total population in the country by the end of 1999.

Contributed by the WHO Regional Office for the Western Pacific.
The World Health Report 1999

eliminating poliomyelitis cases by the year 2000. As is shown in Figure 2.7, there have been remarkable reductions in the geographical spread of the disease since 1988. The last case caused by wild poliovirus in the Western hemisphere occurred in Junin, Peru, on 23 August 1991. The last case in WHO’s Western Pacific Region was recorded in March 1997 near Phnom Penh in Cambodia. WHO has just initiated a “final stretch” effort with the goal of stopping transmission globally by December 2000, of certifying this achievement by 2005 and of stopping immunization by 2010. The eradication effort illustrates two important points. First, partnerships with nongovernmental organizations can be very productive: Rotary International has made major commitments to polio eradication and its influence with local leaders plus financial contributions (about US$ 500 million) have been critical to success. Second, properly designed, highly goal-oriented programmes can contribute importantly to health systems development.

WHO is also involved with the provision of interventions against several other infectious diseases. The Integrated Management of Childhood Illness is a group of preventive and curative interventions. The strategy focuses on pneumonia, diarrhoea, measles, malaria and malnutrition, as these account for 70% of all childhood deaths globally, but it also addresses other serious infections (for example, meningitis), other causes of febrile disease (for example, dengue) and other associated problems (such as eye problems associated with measles or vitamin A deficiency, and ear infections). Preventive interventions including immunization, support for breastfeeding and other nutrition counselling are also emphasized.

Other similar initiatives are in different stages of development and implementation. For tuberculosis, the “directly observed treatment, short course” (DOTS) intervention has been

Figure 2.7 Reductions in wild poliovirus transmission between 1988 and 1998

![Map showing reductions in wild poliovirus transmission between 1988 and 1998]
shown to be highly cost-effective (see Box 2.6). Tuberculosis is highly concentrated in poor subgroups of populations, as indicated in Table 2.1. Prevalence of tuberculosis is estimated to be almost four times higher in populations living below the poverty line than in the better-off. The adult lung health initiative has grown out of the tuberculosis control activities of WHO, recognizing that only a small proportion of adults presenting with a cough have tuberculosis and that adequate treatment or advice should be provided to individuals with other lung diseases. The initiative offers an integrated approach to detecting and treating tuberculosis, asthma and chronic obstructive lung disease.

Maternal mortality risks, which are highly concentrated in developing countries, are also to a large extent preventable and avoidable. The mother–baby package aims to reduce mortality and disability associated with maternal reproductive health, the risks of delivery for both mother and child, and the first weeks of life.

At the end of the 20th century, it is unacceptable that women continue to suffer and die as a result of complications related to pregnancy and childbirth. The enormous disparities in levels of maternal mortality and morbidity between rich and poor are a continuing afront. The evidence of what works to reduce maternal mortality already exists. The interventions needed are cost-effective. Expanding health system coverage is required: women must have access to skilled assistance during pregnancy and childbirth, and they must be able to reach a functioning health care facility when complications arise.

### Box 2.6 Tuberculosis and the “Stop TB” Initiative

Tuberculosis was one of the chief causes of death in northern Europe and the Americas until about 1900. Mortality rates gradually fell because of improved living conditions and the advent of effective chemotherapy, but the disease persisted in developing countries, where it causes some 25% of preventable mortality among young people. It is still a leading killer of young women worldwide. About 1.8 billion people are infected with the tuberculosis bacillus, and the tuberculosis burden will grow with an expanding global population. Inappropriate or inadequate tuberculosis treatment further increases transmission. So do such assaults on the health of the poor as hunger, civil disturbances and, most importantly, HIV which alone will account for some 14% of global cases by the year 2000.

Because tuberculosis predominantly hits young adults, its social and economic consequences are among the greatest of any infectious disease. Almost all cases are in countries least able financially to mount an effective response. In countries where resources are generally sufficient, their poor allocation and ineffective use often result in treatment which fails to cure almost all patients. These conditions explain the evolution of multidrug-resistant strains of tuberculosis.

Since 1989, WHO has encapsulated current best practice for tuberculosis case-finding and treatment into the DOTS (directly observed treatment, short course) strategy and, together with the World Bank and Harvard University, has shown it to be one of the most cost-effective health interventions available. Over 100 countries now accept DOTS as a standard approach, and over 1 million patients have been treated with it since 1990. Global surveillance systems have been established and the spread of drug resistance is being charted.

But progress is too slow, mainly because of the lack of political will and commitment within a number of high prevalence countries to broaden the deployment of the strategy to all who need it. The “Stop TB” initiative arose from discussion of these constraints between representatives of several of the high burden countries which account for 80% of the global epidemic, the International Union against Tuberculosis and Lung Disease, the Royal Netherlands Tuberculosis Association, the American Lung Association, the American Thoracic Society, the US Centers for Disease Control and Prevention, the World Bank and WHO. WHO aims to expand significantly this global coalition and to increase investment in tuberculosis control, in order to attain the Stop TB goal of reducing the tuberculosis disease burden.

The Stop TB initiative will focus on four products to accomplish its objectives.

- A global action plan to guide and accelerate coordinated responses to tuberculosis control internationally, regionally and nationally. It will offer an analytical framework and recommendations for immediate action in high burden countries and particular settings, such as areas significantly affected by multidrug-resistant strains of tuberculosis.
- A global tuberculosis drug facility to provide universal access to high quality Fixed Dose Combination preparations of anti-tuberculosis drugs and to ensure coordinated international arrangements for their financing, procurement and supply, quality control and distribution.
- A global research agenda to address short-term operational constraints and the development of new diagnostic agents, drugs and vaccines. It will facilitate collaboration on research capacity strengthening in low income, high prevalence countries; expansion of appropriate policy-relevant health systems research; control and treatment of multidrug-resistant tuberculosis; and the development of new tools.
- A global charter for advocacy and commitment to enable endemic countries and their partners to declare renewed commitment and agreement on specific steps to be taken. It will generate increased international attention to tuberculosis. Specific performance targets will enable the monitoring and reporting of progress.
Syndromic treatment of sexually transmitted infections is another example of defining best practices in the face of resource constraints. Box 2.7 describes successful interventions to stop HIV transmission in Thailand and elsewhere in South-East Asia.

Rationalization of drug use and development of drug supply systems can similarly be aided by clearly defined standard guidelines where first and second line drugs for each level are specified. Revision of the regulations on who can use which drugs is often needed. For example, an injection of quinine for severe malaria or chloramphenicol for severe pneumonia, prior to referral to a higher level in the health system, may be life saving. But health staff at first-level facilities may not be authorized to use injectable drugs or the drugs may be supplied regularly only to hospitals. Policies may need to be changed to accommodate broader use of certain drugs for defined purposes.

In addition to the disease-specific interventions and control programmes which are available, there is also need to deal with a significant risk factor for disease, malnutrition, which is primarily concentrated in the world’s poorest and most disadvantaged populations. Malnutrition is estimated to be the single most important risk factor for disease, being responsible for 16% of the global burden in 1995, measured in DALYs (1). Malnutrition, either in the form of protein-energy malnutrition or micronutrient malnutrition, primarily of iron, vitamin A and iodine, often contributes to premature death, poor health, blindness, growth stunting, mental retardation, learning disabilities and low work capacity (13,14). Protein-energy malnutrition, as indicated by slow or incomplete physical growth is, however, as much a consequence of disease as a cause. Infection may, in many environments, contribute more to malnutrition than dietary inadequacy. Hence disease control is important for reducing the malnutrition burden.

Box 2.7 HIV/AIDS control in South-East Asia: the challenge of expanding successful programmes

The human immunodeficiency virus (HIV) was slower to emerge in South-East Asia than in other parts of the world, but it is now a serious public health problem and a threat to development. The first patient with AIDS was reported in 1984 from Thailand, since when a total of 92,391 cases of the disease have been reported up to 1 July 1997, mostly from Thailand, India and Myanmar. However, because of under-reporting and under-diagnosis the reported cases only reflect a proportion of the true problem. UNAIDS and WHO estimate that there are currently more than 5.5 million people in WHO’s South-East Asia Region (which includes India) who are infected with HIV – 18% of the global total. In 1998 alone there were estimated to be 1.2 million new infections in the Region. Heterosexual transmission may spread the virus from high-risk groups to the general population. National authorities in the Region are responding to the pandemic with urgency. They have developed strategic plans and are implementing a variety of control measures, as the following examples show.

- Thailand’s 100% condom use programme has received worldwide attention. Its effectiveness can be assessed by the declining HIV incidence among military recruits: from 3.6% in 1993 to 2.1% in 1995. At the same time, sexually transmitted diseases are at a lower rate than ever before.
- In Calcutta, India, the Sonagachi health care and education project among sex workers has become a model for successful peer education; HIV prevalence remains low and sexually transmitted diseases are declining.
- Needle exchange programmes and community-based treatment approaches for injecting drug users in Myanmar and Nepal have been effective in bringing about behavioural change and reducing HIV infection rates.

WHO continues to provide technical, material and logistical support to national programmes for AIDS prevention and the control of sexually transmitted diseases, through the Regional Office in New Delhi and in selected countries. WHO collaborates with the World Bank and with UNAIDS – of which it is a cosponsor – in assisting national programmes and in carrying out intercountry and regional activities.

The integration of care of sexually transmitted diseases into the general health services is considered a priority in the region, necessitating the training of primary care workers, managers and private practitioners. WHO and UNAIDS provide support to governments in order to monitor the trends of the HIV/AIDS pandemic through surveillance, to promote research, to ensure safe blood transfusions, and to strengthen laboratory diagnostic services. Other priority interventions include case management capacity building, health promotion and education, and the planning of comprehensive care and counselling for people with AIDS or infected with HIV.

Evidence shows that intervention can succeed. Augmented political, financial and technical support is required to make sure that interventions are delivered where they are needed.
Interventions to reduce micronutrient malnutrition are likely to prove particularly cost-effective. Programmes can include four strategies – supplementation, fortification, food-based approaches leading to dietary diversification, and complementary public health control measures – to the degree appropriate and feasible (13). The long-term goal of intervention should be to shift emphasis away from supplementation towards a combination of food fortification – universal salt iodization or iron-fortified flour, for example – and dietary diversification.

In conclusion, the double burden of disease defines the complexity of the problems health systems must address. The two elements of the double burden differ markedly in their implications for policy. The unfinished agenda deals with a limited number of conditions, highly concentrated on the poor and for most of which extremely cost-effective interventions are available. This burden on the poor is, indeed, an unnecessary one that targeted programmes can alleviate. Epidemiological transition, on the other hand, generates epidemiological diversity. This aspect of the double burden involves large numbers of conditions potentially affecting everyone, although here again the poor suffer more. Interventions – whether preventive or curative – are less likely to be decisive, although there are important exceptions, such as tobacco control discussed in Chapter 5. Health systems must be able to respond flexibly to this diversity.

References