Published in *Health* in 2011 by Future Leaders (www.futureleaders.com.au)

The Future of Global Health

Gustav Nossal

When I was a child, I was by no means alone in having Albert Schweitzer (1875–1965) as one of my great heroes. Organist, philosopher, physician and humanitarian, he inspired the world as a medical missionary in Africa. Early in life, he determined to pursue his interests in music, theology and ethics up to the age of 30. Thereafter, he would serve humanity directly and exclusively, with Jesus as his example. He started studying for a medical degree in Strasbourg in 1905, getting his MD after seven tough years, and then he set off for Lambaréné in what is now Gabon. He built a small hospital with money he had raised himself both by giving organ recitals and by a vigorous fund-raising effort in Germany and France. His wife acted as his anaesthetist. In the first nine months they treated 2,000 patients. With several years' interruption due to World War I and to poor health, Schweitzer continued to go back and forth to Gabon for the rest of his life, and died in his beloved hospital aged 90. All the while, he continued his search for a universal ethical philosophy with reverence for life as its centrepiece. In an essay written the week before his death, he revealed his two heroes as being Goethe and Gandhi. He stated: 'I live my life in God — the personality — I only experience in myself as a mysterious impulse'; and he gave the results of his struggle to find life's meaning: 'Invest your humanity in the direct service of humanity'.

Although Schweitzer won the Nobel Peace Prize in 1952, he was not without his critics. He wrote like a passionate opponent of colonialism, he stated we must atone for the crimes of oppression and the loss of personal dignity and human rights. However, his critics found him patronising: 'The African is indeed my brother but my junior brother'. He appeared to have little contact with the local people. After three decades he still depended on European nurses, while in contrast Sir Albert Cook in Uganda had been training local nurses and midwives since 1910 and had published a manual of midwifery in the indigenous language. His hospital eventually became squalid and lacking in modern amenities. He had failed to learn two vital lessons pertaining to foreign aid for global health: it will not work except as a true partnership with the affected country, and prevention is better than cure. This essay will examine what we have learnt in the century since Schweitzer left Alsace for Gabon.

The nature and scope of the global health problem

In any consideration of the development process, health cannot be taken in isolation. Poor health is significantly the result of poverty, but also a cause of poverty as premature death and chronic illness lower capacity for work. So does time spent caring for sick children and others. Similarly, poor health is partly due to poor education, and sickness reduces school attendance and thus educational attainment. As a reverse of this, we can construct a virtuous circle where aid targets health and/or education, improvements in either or both of which spur economic performance, and this speeds development. That being said, we should look at those efforts where the primary focus is health.

Several sets of raw statistics dramatise the health inequities of the globe. Overall, life expectancy is improving, but not everywhere. If we take four rich countries and compare life expectancy at birth (in years) between 1960 and 2009, we come up with the following figures: Sweden 73.0 to 80.9; Australia 70.8 to 81.6; United States 69.8 to 78.1; and Japan

67.7 to 82.5. In contrast, the situation in Zambia has gone backwards, 45.3 to 38.6, largely as a result of HIV/AIDS; and in the worst statistical country in 1960, Angola, the rise has been only from 33.2 to 38.2. In other words, life expectancy in the industrialised countries is now over twice that in the poorest developing countries.

A widely used health parameter in medical and scientific circles is the number of deaths in children under five per thousand live births. This is often taken as a surrogate for the efficacy of health services. Here, too, there has been improvement over the last 20 years. Taking the world as a whole, the figure in 1990 was 89, but in 2009 was 60. The rate of decline of mortality was 1.4% per annum between 1990 and 2000, but improved to 2.8% per annum in 2009. Contrast the industrialised countries as a group, which moved from 10 to 6; the best countries — for example, Sweden — moving from 7 to 3, Japan from 6 to 4 and Australia from 9 to 6; versus Sub-Saharan Africa as a whole from 180 to 129, South Asia from 125 to 71 and the worst country, again Angola, where the figures are 260 to 220. In other words, there are countries where 70 times more children die under the age of five than in Sweden! Two-thirds of the extra deaths are preventable.

One chilling statistic relates to deaths of women in childbirth. We have almost forgotten the dangers of childbirth in the richer countries; these are now so rare that they almost always occur when the mother has an underlying serious disease. This time we look at maternal deaths per 100,000 births, where the global improvement has been from 420 to 250 between 1980 and 2008. Contrast Sweden (6 to 5), Australia (11 to 5) and Japan (24 to 5) with India (680 to 280), Sierra Leone (1250 to 1050) and Bangladesh (1350 to 500) (some figures rounded because of reporting uncertainties). Contrasting best with worst, there is a 200-fold difference in the likelihood of a fatal outcome from pregnancy for mothers. There are in fact some villages where mothers have many babies and where their lifetime risk of dying in childbirth is one in seven! The three chief

causes of death are obstructed labour, haemorrhage and sepsis, thus again readily preventable with reasonable obstetric care.

There are also diseases which rarely kill but materially impact on quality of life. These include parasitic diseases caused by worms, and nutritional deficiencies causing stunting of growth and often impairment of intellectual development. Again, these are rife in the poorest countries.

We therefore reach the inevitable conclusion that these discrepancies constitute an intolerable global scandal. So what can be done about it?

The world can afford to help and also knows how to do it

Even if it were feasible, cloning Albert Schweitzer would not be the answer. We need properly targeted, well-planned global initiatives that link first-world expertise and funds with third-world local knowledge and priority-setting, the two constituting partnerships for development. Programs must, from the beginning, involve a real commitment and preferably some co-payment (rising with time) from the affected countries in order to promote sustainability. The focus should be on prevention or early diagnosis and treatment; and on primary health care at the local community level. Too often the developing country builds a shiny new hospital with intensive care wards and cardiac surgery rather than a rural village clinic concentrating on immunisation, malaria control, antibiotics for pneumonia and contraception. As with national jet airlines, the high-tech solution caters only for the few.

Foreign aid is widely criticised, and not without good reason. Often aid programs are used as tools of foreign policy or subsidies for donor country industries rather than concentrating on poverty relief. Not infrequently, aid dollars can be siphoned off by corrupt officials or leaders, and indeed 'corruption-proofing' programs is now a developed art form. It is claimed we need trade, not aid, but this is a sterile argument. We clearly need free trade, but some countries are so poor they have nothing to trade, and quite small amounts of aid can lift them from barest subsistence levels. A few critics trot out the

claim that, in the wake of the global financial crisis, aid cannot really be afforded. This is simply not true, it is a question of what the rich countries want to do. Global official development assistance is US$120 billion per annum. A distinguished American health economist, Jeffrey Sacchs, estimates that if this doubled, most of the Millennium Development Goals could be reached, and this total would still be less than the 0.7% of rich country gross national income that the United Nations itself set in 1970 as a reasonable goal for foreign aid. Contrast this sum of $240 billion with other global expenditures. The eventual cost of the wars in Iraq and Afghanistan is estimated at $3,000 billion. The defence budget of one nation alone, the United States, is $726 billion annually. OPEC oil revenue annually is $780 billion. The legal settlement that 'Big Tobacco' reached with claimants was $206 billion. Worldwide annual expenditure on pornography is $40 billion and on video games is $36 billion. One could go on. It is basically a question of priorities. In fact, only five countries meet or exceed the 0.7% target: Denmark, Luxembourg, The Netherlands, Norway and Sweden. Australia sits at 0.33% of GNI and is still planning to go to 0.5% by 2015.

Powerful forces are gradually shaping change. Over the last decade or so, health programs with global reach and budgets measured in billions have emerged and are making an impact. These are frequently partnerships between UN Special Agencies like the World Health Organization or UNICEF, private foundations such as the Bill and Melinda Gates Foundation or the Wellcome Trust, various non-government organisations and pharmaceutical industry. These have been very effective in particular disease areas and must now be examined in more detail.

The GAVI Alliance — immunising the world

Let us begin with the field I know best, that of vaccines and immunisation. I have had the good fortune of being associated with the World Health Organization (WHO) since 1964 via a variety of committees, and actually spent a full sabbatical year

(1976) working for WHO, mainly in Geneva, on tropical parasitic diseases. Like many large organisations, WHO has its strengths and weaknesses. It is at its best when exercising its normative role; that is, determining policy guidelines for global health problems and advising national agencies how to cope with health emergencies and 'big picture' issues. Here, it can use its great moral force to tap the very best brains in the world to produce authoritative reports and guidance. Few indeed are the medical scientists who refuse a call from WHO to help. It also has many 'on the ground' projects, of uneven quality, mainly because many are under-resourced. Its annual budget of about US$5 billion sounds large, but is spread rather thinly, and much of it is targeted by donors to specific, earmarked programs. The Director-General of WHO has a difficult job as the organisation is controlled by delegates from 193 member states, each with an equal vote in setting policy. Naturally global political issues often intrude.

One undoubted triumph of WHO was the global eradication of smallpox, a dreaded historic scourge which had a case fatality rate of 20–30% and left recovered victims dreadfully scarred. This was achieved by a coordinated vaccination campaign led by the American Dr DA Henderson, and the committee certifying that the last case had truly come and gone was headed by the recently deceased Australian virologist Professor Frank Fenner, his document being signed in 1980. Naturally, WHO wanted to follow up this success and it launched EPI, the Expanded Programme on Immunisation, under Dr Ralph Henderson (no relation). This was charged with delivering six vaccines to the infants of the world, namely those against diphtheria, whooping cough, tetanus, poliomyelitis, measles and tuberculosis. Much of the funding came from UNICEF and great progress was made, the coverage in developing countries moving progressively from about 5% to about 75%. Tetanus or 'lockjaw' is a terrifying infection, involving hydrophobia and spasms, usually resulting in a painful death. An unimmunised mother or her baby can contract it

during childbirth in unsanitary conditions. Poliomyelitis or infantile paralysis kills only when it affects the muscles of respiration, but it leaves its victims crippled. Tuberculosis in infancy can manifest itself as meningitis or as a widespread whole-body infection known as miliary tuberculosis. The BCG vaccine is effective for this age group but unfortunately does not prevent the much more common tuberculosis of adolescents and young adults, which infects the lungs and causes a chronic and frequently fatal disease. The search for a new and better TB vaccine is well and truly on. Many people regard measles as a trivial problem. It certainly is not, even in industrialised countries, as its (admittedly fairly rare) complications include meningitis, encephalitis and widespread bleeding. In developing countries, where there is often malnutrition, intercurrent other infection and a depressed immune system, it causes a case fatality rate of about 2%, devastating for a disease which practically every unimmunised person gets. So the six EPI vaccines achieved marvellous results when used. However, the EPI suffered from three limitations. With the resources available, it seemed unable to reach more children, 75% coverage was a plateau, and the rates in many Sub-Saharan countries were much lower than that. Further, it was not possible to include newer and more expensive vaccines coming through the research pipeline. Third, funding did not permit it to sponsor research and development of new vaccines needed solely in the developing countries. A new thrust was needed.

In 1997, I had been for some years the Chairman of the WHO committee felicitously known as SAGE (the Strategic Advisory Group of Experts) guiding all work on vaccines and biologicals. Apart from EPI, work on AIDS vaccines, the special effort in polio eradication shortly to be described and a host of other activities, a small and administratively separate program devoted to vaccine research came under SAGE's sway. We were always seeking extra funding for this. We became aware of the then small Bill and Melinda Gates Foundation, based in Seattle, Washington, and were able to secure an initial grant of $100

million (over five years) for global immunisation. Recognising that this might be a springboard for a major new global effort, a working group headed by WHO, UNICEF, the Gates Foundation, the Rockefeller Foundation and The World Bank set about a planning process involving all stakeholders over a two-year period. We were able to persuade the Gates Foundation to contribute a magnificent $750 million (which has since doubled) to what became known as GAVI, the Global Alliance for Vaccines and Immunization, launched in January 2000. Recently it has been restyled simply as the GAVI Alliance, and as many other partners have 'bought in' it now has a budget of about $1 billion per year.

What has the GAVI Alliance achieved in its first decade? Two hundred and fifty million extra children have received the standard vaccines in 72 GAVI-eligible countries, those with a GDP per head of population less than $1,000. Three new vaccines have been added to the schedule, namely those against hepatitis B, a potent cause of liver cancer; *Haemophilus influenzae b* or Hib, which causes meningitis, septicaemia and pneumonia; and (in some countries) yellow fever. Measles deaths have been reduced by 74% globally and 89% in Africa. In this first decade, it is estimated that 5.4 million deaths have been prevented. Bill Gates, the Chairman of Microsoft, made a fairly good investment when he founded that company. Instead, he is on record on more than one occasion stating that his $1.5 billion donation to the GAVI Alliance is 'my best investment ever'.

Nevertheless, the GAVI Alliance faces huge challenges. There are still 24 million children born each year not being immunised. There are annually still two million vaccine-preventable deaths. New vaccines currently being rolled out by GAVI are against the pneumococcus, the chief cause of pneumonia, and rotavirus, the main viral cause of severe diarrhoea. Still in the planning phase and so far unbudgeted are vaccines against the human papilloma virus (HPV) causing cervical cancer; Japanese B encephalitis; the meningococcus,

another devastating agent of meningitis; rubella or German measles, which causes birth defects if caught by the mother in early pregnancy; and typhoid fever. There is extensive research and much progress on new vaccines for 'the big three', namely HIV/AIDS, malaria and tuberculosis. Success here will mean a budgetary nightmare for GAVI, but one which must be faced.

Anti-vaccine activists

In contrast to most pharmaceutical products that seek to cure illness when it occurs, vaccines are given to healthy individuals, especially to infants and children deemed to be especially vulnerable. Therefore, it is entirely appropriate that vaccine safety is a prime concern. Fortunately, history has shown vaccines that have been through the appropriate clinical trial procedure to be extraordinarily safe. Minor adverse events such as local redness and swelling, mild fever, or local lymph node soreness are relatively common. More serious complications, such as febrile convulsions, are rare but not excessively so. Fatalities are genuinely vanishingly rare. Nevertheless, a minority of the public harbour the misconception that vaccines are dangerous, either somehow compromising the proper immune development of the child, or causing some serious problem such as encephalopathy or autism. Any such claim must be taken quite seriously and subjected to rigorous research; and, when the relevant evidence is in, must be politely but firmly refuted. Anti-vaccine activists tend to have forgotten what real epidemics are like. In a way, immunisation has become the victim of its own success. In industrialised countries, wards full of people in respirators with bulbar palsy from polio, or children rushed to emergency departments with bacterial meningitis, have become things of the past. It is only when complacency allows vaccine coverage to fall below a certain threshold that new disease outbreaks occur, and then mothers frequently change their minds! The author has found that sweet reason is the best weapon against anti-vaccine activists, simply presenting honest adverse event statistics over and over again and contrasting these with the frequency of malevolent

complications from diseases like measles and whooping cough. A few zealots will never be convinced but many others do come around.

A few years ago, Australia conducted a nationwide, school-based measles vaccine 'catch up' campaign. It provided a good opportunity to catalogue adverse events (serious ones extremely rare) and to gauge community attitudes. It turned out that only 8% of parents failed to avail themselves of the chance to immunise their child. Interestingly, of these only a quarter, or 2% of the global total, had an intellectual reason for declining. The other three-quarters were due to trivial reasons (losing the form, going on vacation, forgetting, and so on). As it happens, herd immunity could easily look after that residual two percentile. But well-targeted publicity campaigns on the benefits of vaccines and the overwhelmingly positive risk/benefit equation continue to be worthwhile.

Global Polio Eradication Initiative

For those infectious diseases where there is no animal reservoir and no environmental residual source (like, for example, the spores of the tetanus bacillus that can remain in the soil for years), total global eradication is possible. Once this is achieved, immunisation can stop. Apart from the great humanitarian benefit of eradication, there is therefore also a cost saving to health budgets. Smallpox is the only successful example, but an ongoing vigorous effort in poliomyelitis has brought us close to the goal. The Global Polio Eradication Initiative is a partnership chiefly between WHO, UNICEF and Rotary International. Apart from encouraging high immunisation rates through EPI, it employs two other strategic tools: very intense surveillance of all cases of acute paralysis, followed by culture of stool samples for presence of the virus; and national or subnational immunisation days where, through a huge mobilisation of community effort, all children under the age of five are assembled and given the drops of the polio vaccine, whether they have been previously immunised or not. These widely advertised NIDs reach children who have failed to show up for routine EPI visits. The

program has been going since 1988 and has reduced polio cases by over 99%. This does not come cheaply, expenditures between 1988 and 2010 totalling US$7.8 billion. A new strategic plan calls for the job to be completed by 2013. Up to 14 December 2010 there were only 874 confirmed cases globally, compared with 1503 at the same time in 2009. There are only four countries in which the virus remains endemic, namely Nigeria, India, Pakistan and Afghanistan, but unfortunately sporadic cases do occur in countries that had eliminated the virus because of importation. Such mini-epidemics must be quickly controlled by forceful immunisation around the index cases.

Some question the wisdom of spending $800 million a year on a disease that now affects so few. But being so close to the end goal, it seems unwise to stop now. A new study published in November 2010 estimates the economic benefits of global eradication at $40–50 billion by 2035. More than eight million cases of polio in children will have been prevented and, of course, reaching the final goal would have great consequences for the morale of health workers and the prestige of the field as well.

Response to the HIV/AIDS pandemic

HIV/AIDS represents one of the greatest world pandemics of all time. Since its first recognition in 1981, it has caused 25 million deaths and there are still 2.6 million new cases per year. The worst devastation is in Sub-Saharan Africa where about two-thirds of the cases occur. Deaths per year are around 1.8 million, and in Africa alone there are 15 million children who have lost one or both parents to the disease. The social effects of AIDS are incalculable, both with respect to the medicalisation of sexuality and the further stigmatisation of some minority groups. Yet, and somewhat surprisingly in the absence of a vaccine, there are some reasons for hope. The number of new cases annually is diminishing, and the number of patients receiving anti-retroviral therapy is increasing. This is a tribute to the massive effort mounted throughout the world, particularly in Africa.

The introduction of 'HAART', highly active anti-retroviral therapy, in 1996 dramatically improved the prognosis in AIDS. In recent years, the global community has committed unprecedented funding to give the benefit of HAART to patients in low- and middle-income countries. Under the coordinating umbrella of the United Nations program known as UNAIDS, two huge funding sources prime this initiative. The Global Fund to Fight AIDS, TB and Malaria was established in 2002, and though chiefly funded by aid agencies of governments, it receives and disburses funds from foundations and other private sources as well. Over $12 billion have been granted to 136 countries so far. The United States decided to go its own way. The President's Emergency Plan for AIDS Relief (PEPFAR) was established in 2003 and has so far contributed an amazing $25 billion. President Barack Obama has asked Congress for $10 billion per year to expand the initiative further. As a result, between 4 and 5 million people are now on chemotherapy funded by these programs.

Of course, prevention remains a high priority. Some countries have achieved much success through massive community education and the widespread use of condoms. Prevention of mother-to-child transmission through chemotherapy is highly effective where used. Male circumcision reduces the risk of heterosexually acquired HIV in men by 60%, both because the prepuce is especially delicate and vulnerable and because following circumcision the skin of the glans penis becomes thicker and stronger. Extensive research is being done on microbicides capable of killing the virus which could be used by women as pessaries prior to intercourse. All of that being said, a good vaccine remains the 'Holy Grail' of AIDS prevention.

Malaria

Another historic enemy of the human race is malaria. We can see how powerful a foe it is by noting the high incidence of certain otherwise deleterious genes that fortuitously provide some resistance to malaria in those parts of the world where it

is or has been prevalent. Globally, there are at least 300 million cases of malaria each year and about a million deaths. Children under five and pregnant women are particularly vulnerable. The *Plasmodium* malarial parasites are developing resistance to the widely-used drugs and the *Anopheles* mosquito vectors are beginning to be resistant to the commonly-used pyrethroid insecticides. Furthermore, malaria constitutes an economic burden, both because of decreased productivity and premature deaths, and because of the large portion of poor wages that may have to go to malaria treatment.

Despite these formidable considerations, there is reason for hope in this field as well. One surprising fact is that the use of insecticide-impregnated bed nets, which cost $5 each to make and another $5 to distribute effectively, can alone reduce malarial mortality in children by 50%. It is planned to distribute at least 700 million of these over the next few years. Indoor spraying of huts or other dwellings also helps. Advanced research using knowledge of the smell receptors in mosquitoes is providing new chemoattractants to tempt mosquitoes into traps and new chemorepellants for personal protection. One of the latter in late-stage trial is 1000 times stronger than the commonly-used DEET and appears to be completely safe. There is also much research on the biology of mosquitoes. Genetic variants are coming forward, such as sterile but sexually active males and females with a shortened lifespan incapable of supporting parasite maturation. One major Australian project headed by Dr Scott O'Neill from the Queensland Institute of Medical Research uses *Wolbachia* bacteria, harmless to humans, to weaken mosquitoes, though this work at present involves the Aedes carriers of dengue, not *Plasmodium*. Of course, large-scale release of GM mosquitoes would raise many ecological considerations, would have to be preceded by staged smaller trials, and would require extensive community consultation.

As regards anti-malarial drugs, there is a well-organised product development partnership known as the Medicines for Malaria Venture or MMV. This involves most of the large

pharmaceutical companies and many academic laboratories. The plan is to screen drug libraries for anti-malarial activity and/or to come up with new and improved anti-malarials. MMV has had great success in its decade of existence. It has two licensed drugs, nine others in clinical trial, and many more in advanced pre-clinical research. One product of special interest to Australia is OZ439, a drug in Phase II trial being developed by Dr Susan Charman of Monash University. It aims to beat resistance and to cure uncomplicated malaria with a single dose. Another important compound being developed by Professor Bill Charman is a synthetic analogue of artemisinine. The saga of this drug, now the single most important anti-malarial, is fascinating. Originally it was used as a herbal tea, which the Chinese have known about for 2000 years. The tea derives from the sweet wormwood tree. The Chinese themselves arduously purified the active ingredient, and quite a few chemical derivatives exist. But how many sweet wormwood trees can one plant in the world? A normal synthetic product would be a great advance.

In 2008, the UN launched a $3 billion plan to 'end all malaria deaths by 2015'. While this timeframe is clearly unrealistic, it is a sign of the optimism that the new discoveries have generated. To this must be added the fact that a first generation malaria vaccine has given 40–50% protection over a 15-month period in African infants. The Phase III trials will be completed this year or next. I believe malaria could be on its knees as a public health threat within quarter of a century.

Other tropical communicable diseases

To summarise the situation in some other major diseases, leprosy is on the way out, largely because of multidrug therapy, but tuberculosis is rampant and is a particular threat in combination with HIV, as this targets the very white blood cells (T lymphocytes) which are the chief defence against TB. Drug resistance is a deep worry in TB. The search for a good vaccine is intense.

Diarrhoeal diseases and acute respiratory diseases are under-represented in the global effort. Somehow HIV, malaria and tuberculosis seem more glamorous. Diseases caused by worms, on the other hand, are quite a success story. Hookworm is controlled in many communities, guinea worm has been nearly eradicated through water filtration, and the filarial worms that cause river blindness and elephantiasis are fast coming under control. The chief tool here is periodic (e.g., six-monthly) community-wide chemotherapy. The drug companies have been good here — for example, Merck has donated two billion doses of the drug ivermectin, which controls filariasis. Schistosomiasis, or snail fever, is still a major worry, though the drug praziquantel does a good job. Sadly, vaccine research in this area of parasites other than malaria is severely underfunded. This is a pity, because immunological and drug control could synergise in lowering parasite burdens.

Non-communicable diseases

In many low- and middle-income countries, obesity, diabetes and cardiovascular diseases are becoming major problems. The emerging middle class often imitates western urban lifestyles, so 'junk' food and over-eating generally represent dilemmas. Of course, urbanisation also causes less physical labour than agriculture, and usually the fitness craze of western upper middle classes has not yet manifested itself. Add to this the fact that the tobacco companies are directing their enormous promotional budgets more to developing countries and one soon reaches the conclusion that the preventive measures so relatively successful in the richer countries must now be exported. There is no doubt that organisations like the Victorian Health Promotion Foundation (VicHealth), the QUIT Campaign and Cancer Council Australia have learnt much down the decades. So have Diabetes Australia, the National Heart Foundation and other NGOs. Suitably modified, those lessons could help developing countries enormously. There are inspiring examples of Australians striving to do just that. Rhonda Galbally, the founding CEO of

VicHealth, has worked hard with health authorities in China, Indonesia and elsewhere. Robert Moodie, her successor, is now using his base at the Nossal Institute for Global Health to promote tobacco control and other health measures in developing countries. It will be a long and hard battle.

The looming problem of mental health

While I was at WHO in 1976, I spent some time with Norman Sartorius, who was in charge of a small unit devoted to mental health. He has since been multiply honoured for his work. His contention was that by 2050, depression would be the world's number one public health problem. Frequently unrecognised, swept under the carpet, mental health is the elephant in the room as regards global health. The problem is we do not know enough about how to prevent serious mental health illnesses. Professor Patrick McGorry, Australian of the Year for 2010, has argued that prompt, decisive and multi-disciplinary treatment of the first psychotic break, involving good psychiatric intervention but also physiotherapy, occupational therapy, group therapy and much tender loving care, can materially reduce the likelihood of recurrent attacks. But this requires resources not readily available in developing countries. In the meantime, recognition of the problem and availability of appropriate psychotherapeutic drugs constitute concrete approaches to a very difficult problem.

Nutrition and human development

Calorie malnutrition is now relatively rare in the world, and occurs predominantly in situations of warfare or major natural disasters. Not so with malnutrition involving insufficient protein or micronutrients like minerals and vitamins. Key elements are Vitamin A, iron, iodine, zinc and folic acid. Fortification of foods with these substances, or periodical administration as supplements, can have major health effects. I was not aware until about a decade ago that deficiencies in iron insufficient to cause significant anaemia can nevertheless lower the IQ by 15 points. Now there are technologies to obviate

these difficulties by producing genetically modified staple crops enhanced in these elements and thus much more nutritious. Work on such GM enhanced foods like wheat, maize, sorghum, rice and bananas has accelerated markedly since the Gates Foundation supported relevant research. There are hurdles to overcome: societal disquiet about GM foods; community acceptance of altered colour or taste; and inherent conservatism about what we eat. But the long-term potential is enormous. This is clearly a high priority area.

Health system strengthening

It is sometimes argued that developing countries simply do not have the resources to set up an effective health system. Again, this is a question of priorities. From the beginning of Castro's rule, Cuba gave high priority to public health and education. As a result, this poor country boasts outstanding health statistics and significant health attainments. Cuba has among the world's highest infant immunisation rates and an enviably long-life expectancy. As in the fields of health promotion and preventive medicine, there is much accumulated wisdom about what works in developing country health systems. The industrialised countries can help by educating developing country personnel, and particularly health leaders and decision-makers, about health systems both as regards prevention and cost-effectiveness in health care delivery. As the various large aid programs discussed above unfold, no opportunity should be lost to incorporate in-service training initiatives, recognising that sustainability can only come from building up indigenous capacity.

Conclusions

As a citizen of this crowded planet, I cannot tolerate the discrepancies in health outcomes that still persist. I rejoice in the fact that this issue is now centre stage. I am enormously heartened by the number of talented and idealistic young people who consult me every month, asking how they can contribute to global health. When I preach to them about the importance of partnering with experts from the affected

countries, I experience a real sense of privilege that my own life has exposed me to health leaders from India, China, Africa, Indonesia and Latin America, whose sheer brilliance and dedication put my own slender efforts to shame. In the last analysis, it is the linking of their destinies with those from the richer countries, with passion for a more just world that has the capacity to shape a healthier future for humankind. We have the technologies, even though more would be helpful. We have blueprints of programs that work. We have political commitments, although not always ironclad. We have over-arching global systems of proven merit. We have the beginnings of reportable successes to silence the sceptics. Global health is on the march. It is Generations X and Y who must determine where the march will end.

Gustav Nossal is an immunologist and physician who was a long-serving Director of The Walter and Eliza Hall Institute of Medical Research. He is now Professor Emeritus in the Department of Pathology, The University of Melbourne; a Principal of the consulting firm Foursight Associates Pty Ltd; and a senior consultant to the Bill and Melinda Gates Foundation. He has served as President of the Australian Academy of Science, President of the International Union of Immunological Societies, and he was appointed Australian of the Year in 2000.