C V I F O R U M

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In this Issue

Paying for the dream

"Let's get one thing clear: this is a practical dream, a do-able dream, a dream that's going to come true. That is the scientific consensus." The speaker is Dr Scott Halstead, Deputy Director of the Health Sciences Division at the Rockefeller Foundation in New York.

The dream? One vaccine given in a single oral dose shortly after birth to protect all the world's children against all the world's major infectious diseases. A true "children's vaccine". The CVI's original and ultimate objective, born out of the child survival goals to which 150 heads of state and other country leaders vowed their allegiance at the World Summit for Children in September 1990.

Four years on, an interview poll of some of the early "dreamers", including representatives of the five founding agencies – the United Nations Children's Fund (UNICEF), the United Nations Development Programme (UNDP), the Rockefeller Foundation, the World Bank and the World Health Organization (WHO) – and others actively pursuing the CVI's goals reveals a consensus that the dream is a worthwhile point on the horizon giving purpose and direction to the quest. But to some, the likely short-term fallout from the quest – new technology, new single-disease vaccines, new ways of administering them – is more important than the long-term vision. Views also differ about how long the quest is going to take – 10 to 25 years covers most estimates – how much it will cost and how easy it will be to find the money. Certainly, for many of those interviewed, the CVI's ability to harness to the cause the largely untapped energies and resources of the Third World will determine whether the dream is a truly global one.

"The CVI's strategic plan is an achievement of unprecedented importance and scope in the history of public health endeavours."

But, as a starting point, at whatever inclination one's eyes are pitched between sky and ground, the dream, as Dr Halstead says, is scientifically realistic. "It will be difficult, but it can be done." This, he notes, was the conclusion of a "bunch of hard-nosed scientists" convened in Washington, DC, by the United States National Institutes of Health shortly before the World Summit. "Science not only says it can be done," Dr Halstead adds. "It provides us with a range of options. The CVI's role is to do the nose-to-the ground planning, define the costs and select the best options."

For Mr Frank Hartvelt, Deputy Director of UNDP's Division for Science, Technology and the Private Sector, the CVI's strategic plan – which breaks the dream up into manageable steps – is in itself an achievement "of unprecedented importance and scope in the history of public health endeavours". It could, he believes, "have an enormous impact on human development generally and child development in particular". One facet of the plan he welcomes is its call for "a symbiotic relationship between the public and private sectors".

What interests UNICEF's Dr Terrel Hill more than a super multi-disease vaccine, though, "is getting the most useful vaccines on board as soon as possible against single diseases or groups of diseases, like malaria, acute respiratory diseases, diarrhoeal diseases. That would really revitalize our work." Dr Hill is UNICEF's Principal Adviser for Child Survival.

For Dr Phil Russell, of the Department of International Health at Johns Hopkins University in Baltimore, USA, and Special Adviser to the CVI, the technical feasibility of the dream is supported by early results of research on a single-dose tetanus toxoid vaccine, a heat-stable oral polio vaccine and use of the diphtheria-tetanus-pertussis (DTP) combination as a basis for new combination vaccines. He also cites work being done to

Cover photo: UNICEF/ Horst Cerni

UNICEF/Fran Antmann

Also participating in the CVI dream are these Peruvian children, "born to live" and claiming their right to immunization.

improve Third World vaccine manufacturing facilities and vaccine quality control systems. "The fundamental vision has not changed," says Dr Russell. "But we can't introduce a whole new generation of vaccines into the world without fixing those parts of the system that aren't working right, even if it distracts from the long-range concept." Indeed, according to a recent estimate, less than half of the 1.5 billion doses of vaccine being used in the world every year have been tested to see if they come up to WHO standards of quality.

Given, then, that it is technically feasible, what is the dream going to cost?

Dr Jong-Wook Lee, Director of WHO's Global Programme for Vaccines and Immunization (GPV) and CVI's Executive Secretary, says a total of US$1 billion over the next ten years "should bring us close to achieving the single-vaccine goal". Of this, about US$5 million a year should be enough, he says, for the CVI secretariat. "But those are just ballpark figures," he cautions.

For some, the ballpark covers a wider area. "For the CVI's long-term goals," says Dr Russell, "we're talking about developing a group of vaccines, however combined, against up to 20 different diseases." To take one vaccine from a twinkle in a vaccinologist's eye to a marketable product costs around US$200 million, according to private industry estimates. "The total cost of the CVI dream could therefore be anywhere between US$1 billion and US$10 billion," Dr Russell believes.

Where's the money going to come from? Already, the international donor community is contributing US$450 million of the US$1.5 billion a year being spent in developing countries on immunization – covering everything, from the vaccines themselves to spare tyres for vehicles. In its latest financial report, the CVI secretariat reckons a further US$120 million a year is needed to fulfil the CVI's strategic plan.

WHO Assistant Director-General Dr Ralph Henderson is concerned that "it won't be easy to get the international community to swallow the bitter pill of this new development expense". He urges that "we start sensitizing potential donors to the

"We can't introduce a whole new generation of vaccines into the world without fixing those parts of the system that aren't working right."

idea, so that they realize that the result will benefit not just developing countries but the whole world". The benefits to industrialized countries would include, he says, a more efficient vaccine purchasing system and a more dynamic R & D environment.

A report published last year by a United States Institute of Medicine Committee on the CVI is consistent with this view. Only very few of the vaccines on the CVI wish-list – against *Shigella*, malaria and dengue, for example – would be useful exclusively to developing countries, the report points out. Most of the others would benefit developed and developing countries. In the United States, for example, according to a recent survey by the Centers for Disease Control and Prevention (CDC) in Atlanta, a vaccine against many diseases that could be given in a single session could help raise immunization coverage levels. In many parts of the United States, the survey notes, these levels are below 50% in under-two-year-olds vs. a current 78% average for developing countries.

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Dr Lee is also concerned about finding funds. "I agonize over this every day. The scientists say we can make the dream come true. But how will we know, if we don't take the plunge and put our money where our hopes lie?" His plea, he says, is for a commitment of resources and energies to the CVI objectives by all the actors working under the CVI umbrella. But if the international community responds to his plea, the challenge will be to manage the resources effectively. With so many actors, he warns, there is a danger of succumbing to a least common denominator management approach. "That would kill the vision. It is a bold vision and it calls for bold decisions that may not please all the participants all of the time."

Some are less worried about finding the money to pay for the dream. Dr Ciro de Quadros, who is Special Adviser to the WHO's Director-General on the GPV and the CVI, is convinced that "there is so much excitement in the scientific community about what the CVI can achieve, that much of the enthusiasm will filter through to the donor community".

Dr Russell is also upbeat. "In the last few years," he says, "there's been a tremendous surge in public and private sector investment in new vaccines, boosted by the promise of modern biotechnology. Even developing countries are getting into the act, putting huge amounts of money into modernizing their vaccine manufacturing facilities."

Vaccine expert Dr Roy Widdus of the United States Public Health Service notes that "future scientific breakthroughs, such as so-called genetic immunization, could dramatically alter the total cost" (See *CVI FORUM* No. 7, pages 7-10). Savings, he adds, might also accrue from new heat-stable vaccines that don't require expensive refrigeration logistics, from combination vaccines that require fewer injection syringes and from oral vaccines that don't require any injection equipment at all.

Dr Widdus, who is assisting with the scientific coordination of CVI and GPV activities, believes an immediate effort should be made to "mobilize resources". "We need to use every means possible to let people know what we're doing. We need to convince national legislators, research agencies and development assistance bodies that reducing or eradicating diseases through immunization frees money being used for treatment." An oft-quoted example is smallpox, which was costing the world more than US$300 million a year in immunization, quarantine programmes and treatment – let alone a 1.5-2 million death toll – but was wiped off the surface of the globe by a 12-year vaccination programme costing a total of US$300 million for the whole period.

Ultimately, Dr Widdus believes, planning and good management are the two most important priorities. "You may have an exciting vaccine candidate. But if you don't lay out a good strategic development plan and go out and broker it, your potential backer will use his money for something else."

UNICEF/Sean Sprague

The "children's vaccine", when it appears, will spare children – and their mothers – the tribulations of multiple immunization shots.

The need for planning is also central to Dr Halstead's perspective. "Money is not a big problem," he says. "The problem is planning. Right now, we only need a catalytic US$5-10 million a year to keep the planning process running smoothly. For the rest, we could start building on the US$450 million being spent on immunization. But right now, it's too free a market. Undirected. Unplanned."

For several participants in the debate, some innovative management schemes may provide sources of – or reduce the need for – funding. Two aim to assist developing countries in fulfilling their own vaccine needs: one is UNICEF's Vaccine Independence Initiative, which focuses on financing; the other is the CVI's Vaccine Self-Sufficiency Initiative (VSSI), which focuses on vaccine production and quality control. Then there is UNDP's and UNICEF's proposed "20:20 compact", whereby both donor agencies and countries set aside 20% of their development budgets for basic services, including health. A global vaccine fund has also made its debut on the scene, supported by UNICEF and others, its purpose being to provide a central mechanism for managing funds received from external donors and earmarked for vaccine development projects.

Better collaboration among donors and countries could also "save huge amounts of money", says CVI administrative officer James Cheyne, who notes with satisfaction the sprouting of regional inter-agency coordinating committees. He is also pursuing a scheme for the creation of national CVI fund-raising committees, headed by "personalities in the public eye". Like others questioned by *CVI FORUM*, he also believes CVI fund-raisers could start knocking at the doors of developing, but economically emerging, countries like Brazil, Brunei, Malaysia, Singapore, South Korea, and the like.

There's also some recent good news for CVI supporters: UNICEF, the largest contributer to global immunization activities, is unlikely to reduce its annual support from the US$100 million level of recent years, according to Dr Hill. And at the World Bank in Washington, DC, Senior Public Health Specialist Dr Mary Young believes the Bank's early reservations "about committing itself financially to a vision that would produce results in the too distant future" may be changing to greater confidence – and possibly its first financial investment – in what the CVI can produce in the shorter term.

Such a change of heart may signal what Mr Cheyne calls, "the coming of age" of the CVI. The signs are, he says, that the international community "is more confident that the CVI is getting its act together and that it can produce concrete results".

Quite, says Dr Halstead, who, with a quick glance back at the dream, adds: "It's all a matter of finding the right words and the right products to fire people's imaginations."

"The signs are that the international community is more confident that the CVI is getting its act together and that it can produce concrete results."

Neonatal tetanus: the final countdown

The forgotten disease. The end-of-the-road disease. The hidden disease. Among the cluster of childhood diseases on the agendas of all the major health and development agencies, neonatal tetanus does seem to have been given a raw deal.

"Forgotten" – at least by the masterminds of the Universal Child Immunization (UCI) crusade, launched a decade ago, with WHO's Expanded Programme on Immunization (EPI) as its main weapon. An understandable oversight, perhaps: to protect newborn babies anti-tetanus shots must be given to their mothers – during or before their pregnancies – who can then pass on their anti-tetanus antibodies to their fetuses. Unchivalrous, the UCI knights were just not thinking of women at the time. An oversight that explains why only 45% of babies enter the world with these protective antibodies vs 80% who have been vaccinated against the other EPI target diseases – polio, measles, diphtheria, tetanus (the "non-neonatal" variety) and pertussis.

"End-of-the-road", because if ever there was a disease of poverty, poor hygiene and non-existent health services, neonatal tetanus is *it*.

And "hidden", because in 50 to 80% of cases, *Clostridium tetani*, the causative organism, kills its victims within a week or so of birth: a death too quick and too easily attributable to other causes to make it routinely into official records. Which explains why routine surveillance systems generally report fewer than 5% of cases and deaths, according to findings of district and community surveys.

Yet, neonatal tetanus is a scourge to be reckoned with. It still kills an estimated 500,000 newborn infants every year, not to speak of the 30,000 mothers who die from complications related to the infection. In some countries it accounts for half of all neonatal deaths and a quarter of infant deaths generally. Among the EPI diseases, its human and social toll – as measured in "disability-adjusted life years" – is second only to measles, according to the World Bank's 1993 World Development Report. Five years ago, in a denunciation of the disease's poor-relative status, WHO Assistant-Director Dr Ralph Henderson, then EPI Director, assailed the continuing existence of neonatal tetanus as "a major failure of public health practice...Not one case of neonatal tetanus should be allowed to occur".

The causative organism kills its victims within a week or so of birth: a death too quick and too easily attributable to other causes to make it routinely into official records.

Somebody was listening, because at around the same time, the WHO's governing body, the World Health Assembly, passed a resolution calling for the elimination of neonatal tetanus throughout the world by 1995. In WHO parlance elimination means doing away with the disease as a public health problem, as distinct from eradication which means literally wiping the causative organism off the face of the earth. Last October, EPI's policy-setting Global Advisory Group defined elimination of neonatal tetanus more precisely as bringing its incidence below 1 per 1,000 live births in all countries. The trouble is, neonatal tetanus does not cover vast swathes of a country: cases tend to cluster within relatively small areas. India is a good example: it accounts for a quarter of the world's deaths from neonatal tetanus, and three-quarters of India's deaths from the disease occur in one Indian state, Uttar Pradesh. This means that a country might have a national incidence rate below the target figure, while the disease rages on as a local menace. For this reason, last May, the World Health Assembly decreed that only countries that had reached the target in all their districts could say they had eliminated the disease.

UNICEF/Giacomo Pirozzi

One of the 700,000 children who avoided an early death last year, thanks to his mother's participation in a neonatal tetanus immunization programme

With 13 months to go to target day, EPI medical officer and tetanus strategist Dr François Gasse is optimistic. Data just in for 1993, analysed to allow for under-reporting, show that of the 158 developing countries known to have cases of neonatal tetanus, 81 or 51% have already brought their national incidence rates below the target figure. The data also suggest that 50 of these 81 countries may have reached the full district target. And by December 1995, Dr Gasse and his colleagues expect a total of 109 countries to have reached the "national" target and 81 the full target, with the remaining 77 countries "well on the way to doing so". Also on the books for the end of 1995 is a lowering of the worldwide incidence to under 1 per 1,000 live births. To reach this original target will involve lopping at least 350,000 cases from the current estimated total of 500,000 cases world-wide, leaving less than 150,000 cases annually.

"That would mean that in just over a decade we'd have made a nearly tenfold reduction in the world's case-load. And that we'd be saving from death from this disease over a million newborn babies a year plus 50,000 mothers. Surely that's cause enough for optimism."

These expectations, says Dr Gasse, are based on several facts: an excellent vaccine is available, vaccination is extremely effective in reducing cases and deaths from neonatal tetanus, the disease itself is conveniently distributed in limited areas and the percentage of women immunized over the years has been climbing steadily – from less than 25% five years ago to 45% today globally, which means nearly 60% for the tetanus-stricken areas of the world where vaccination is needed – while estimated annual deaths have been falling just as steadily over the same period, from nearly 800,000 to the current 500,000.

The current vaccine consists of an inactivated form (a *toxoid*) of the toxin that *Clostridium tetani* uses to snarl its victim's central nervous system. It is extremely effective and resistant to heat. It is also

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Vaccination is the most cost-effective, fastest means of bringing the disease to heel.

cheap – only 7 US cents per dose (for the vaccine itself). Provided it is of good enough quality and that women receive two or, in heavily infested areas, three shots, it will protect more than 95% of babies. Protection lasts at least five years after the third dose. Ideally, a fourth dose, giving protection for 10 years, and even a fifth, covering the duration of a woman's reproductive years, would be ideal, but not for the kind of crash programme required to meet the imminent deadline. But in developing countries it's hard enough to get women, particularly pregnant women faced with lack of transport and often difficult terrain, to return for even a second shot, never mind a third, fourth or fifth. The need for even two shots – the first only primes the recipient's immune system, the subsequent doses boost it cumulatively – is the biggest drawback of the current tetanus toxoid vaccine. That is why one of the first things the CVI did after its launch three years ago was to set up a special "product development group" to promote the development of a single-dose tetanus vaccine. The group is exploring several promising avenues towards that objective.

As for vaccination, EPI officials believe it is the most cost-effective, fastest means of bringing the disease to heel. One example: in the mid-1980s mass immunization campaigns covering 84% of women of childbearing age in an Indonesian province cut the death rate from neonatal tetanus by 84%, from 32 to 5 per 1,000 births, within two years. Another is Sri Lanka, where the steady fall in incidence of neonatal tetanus since 1974 shows a remarkable inverse correlation with the steady rise in immunization coverage of women (see graph). Overall, studies have shown that once 80% of women in an area have received two anti-tetanus doses the level of "seroprotection" – antibodies in the bloodstream of vaccinated people – in the area is high enough, coupled with promotion of clean delivery conditions, to bring incidence below 1 per 1,000 live births.

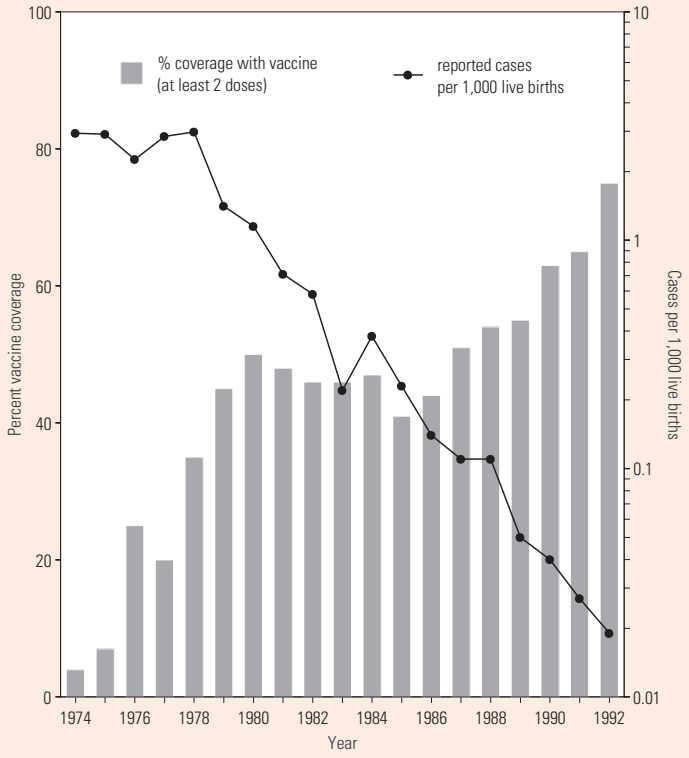
Some countries or territories have reached or even exceeded this level according to 1993 data. Examples: Sri Lanka (84%) and the Maldives (94%) with India coming close (at 78%) in WHO's South-East Asian Region (regional average 74%); Cape Verde (98%), the Central African Republic and Sierra Leone (81%), with Benin and Togo (77%), and Tanzania (72%) hot on their heels, in the African Region (average 39%); the Dominican Republic and Paraguay (87%) in the American Region (40%); and Morocco (87%) and Oman (85%), with Egypt (78%) coming close in the Eastern Mediterranean Region (50%).

True, many countries have rid themselves of neonatal tetanus without relying only on vaccination. In the pre-immunization era, North America and Europe, for example, brought the disease under control by improving hygienic conditions of childbirth, an approach facilitated by widely available hospital facilities. But a 100% level of vaccination coverage of the entire female population was needed to wipe out the disease. In developing countries, hospital facilities are few and far between and vaccination is the only radical, rapid way. But a bit of education can't do any harm. EPI's "elimination strategy" advocates clean delivery practices and warns of the risk of some traditional unsafe practices, such as dirty "helping" hands and the application of non-sterile substances – some communities use a butter preparation or even cattle dung – to a mother's perineum and her baby's umbilical stump or the use of non-sterile instruments to cut the cord.

But what really gives the EPI team cause for confidence that they will make short shrift of neonatal tetanus over the coming months is the focal distribution of the disease. They won't have to adopt a shotgun vaccination strategy that covers the whole world. Eighty percent of cases are believed to be clustered in just 12 countries and in just a few districts of these countries. A further 14 smaller countries have relatively few cases but a high incidence of disease – at least 5 per 1,000 live births. "All" you have to do is identify the high-risk districts in the high-risk countries and vaccinate all women of childbearing age in these districts.

Easier said than done, perhaps. But the EPI tetanus team is confident the strategy will work. "We're convinced," says Dr Gasse, "that most countries are committed to reaching the targets." In response to EPI requests for district data sent out only at the beginning of this year, officials in many countries – including all 47 countries of WHO's American region – are beginning to

Vaccination sends neonatal tetanus into tailspin in Sri Lanka



provide what figures are available for their districts. India, with a fifth of the world's cases, has launched a major elimination campaign that the government has agreed to pay for with limited outside help. Indonesia, another large and top priority country, has identified over 60 high-risk districts covering more than a third of the population, where they will vaccinate all women of childbearing age during two "immunization weeks" in the summer of 1995. China, another priority country, is about to take its first real plunge into mass anti-tetanus immunization, in Guizhou province, where tetanus is rampant (see page 11). Even in some war-racked countries – Afghanistan is an example – combatants have agreed to stop fighting to enable immunization campaigns to be conducted during "weeks of tranquility".

Countries are also showing their commitment by opening the doors of their vaccine manufacturing plants to CVI teams assessing vaccine quality throughout the world. By last September these teams had visited 13 of the 20 countries known to produce vaccine and to have a neonatal tetanus problem. They found substandard vaccine in six – Colombia, India, Iran, Pakistan, the Philippines and Viet Nam – and are working with the manufacturers to rectify the problem. Plans are also under way to complete assessments in the remaining countries.

A good vaccine and the political will in the affected countries – what more could you want? Money, US$83 million of it. That is what EPI calculates is needed to administer three doses of vaccine at a cost of US$0.50 per dose – including the vaccine itself, injection apparatus, transportation, cold chain and other logistical expenses – to the 55 million women of childbearing age estimated to live in the 26 countries with the highest incidence of neonatal tetanus. Countries themselves will bear about half the total cost, leaving a US$40 million tab that the EPI team hopes external donors will pick up.

And after elimination of neonatal tetanus? No, eradication is not on the cards. The causative organism of tetanus, although not ubiquitous, is extremely widespread in the environment, particularly in soil, dirt and fecal matter. Unlike *communicable* microorganisms such as the smallpox and polio viruses or the tuberculosis bacillus, *Clostridium tetani* doesn't need people to multiply or travel in. Preventing its transmission from dirt to newborn babies through clean delivery and blocking its disease-causing potential by vaccination are the only ways of holding neonatal tetanus in check as a world menace. And doing that, means maintaining immunization efforts and staying on the alert for new outbreaks. And, of course, making sure that neonatal tetanus is never again a "forgotten disease".

Holding neonatal tetanus in check as a world menace means maintaining immunization efforts and staying on the alert for new outbreaks.

Coping with size: China's efforts pay off

"If you were in China, you'd understand the problem." Prof Dai Zhicheng laughs and shakes his head at the same time. As Director of the Chinese health ministry's Department of Health and Epidemic Prevention, he is concerned with infectious diseases and his country's efforts to combat them.

The problem he refers to is the 1.2 billion people living in this, the world's most populous country. "With so many people and over 24 million births a year, we just can't be sure all our children have been immunized." The biggest difficulty, Prof Dai says, is keeping track of an increasingly mobile population. "Since our country began moving from a planned to a market economy, we have a large floating population that is not easy to reach." And indeed, the movement of millions of rural Chinese – as many as 100 million since 1990, according to one estimate – seeking to cash in on the newly freed entrepreneurial spirit of the cities is straining many aspects of China's bureaucratic control system, including its immunization programmes.

The problem is also the immensity of the country. "In many areas, you can drive for a whole day and you're lucky if you see more than one or two children," says Prof Dai. This is the case, he says, in regions like Inner Mongolia in the north and Xinjiang and Tibet in the east, which together make up nearly a half of China's land area but only 3% of its population. The good news, though, is that "people live so far apart from each other, that most infectious diseases in these areas are rare."

"With so many people and over 24 million births a year, we just can't be sure all our children have been immunized."

UNICEF/Sean Sprague

An immense country, a huge population – yet China's immunization programme is on target.

IN A NUTSHELL	
Population (estimate 1993):	**1.2 billion**
No. of births a year:	**24.5 million**
Infant mortality rate (<1 yr):	**35 per 1,000 live births**
Child mortality rate (<5 yr):	**43 per 1,000 live births**
% of 1-yr-olds fully immunized (1993):	**94**
% of national budget for health services:	**3**
Annual expenditure (in US$) on vaccines:	**10 million**
Human development rank:	**94**
Main immunization thrusts:	**polio, neonatal tetanus**
Priority vaccine needs unmet:	**hepatitis B**
Major health concerns:	**tuberculosis, schistosomiasis, goitre, hepatitis (A, B, C, non-A-non-B), occupational diseases, narcotic consumption**

Despite the problems – or because of them – Prof Dai points to achievements he and his colleagues are justifiably proud of.

• Two immunization targets, set by the Chinese government and supported by WHO and UNICEF, have been reached. By 1988, immunization programmes begun in the 1980s had vaccinated at least 85% of under one-year-olds in all provinces and regions against tuberculosis, diphtheria, pertussis, tetanus, polio and measles. And by 1990, they had attained the same coverage level for all of China's urban districts and rural counties. The third target – "our very own target", notes Prof Dai – is well on the way to being attained: 85% coverage in all townships by the end of 1995. China's coverage for the individual diseases is also impressive, exceeding the regional (East Asia and Pacific) average coverage rates for three vaccines: DTP (diphtheria-tetanus-pertussis), polio and measles. In an all-out drive to eradicate wild polio virus from the country by the end of 1995, China devoted two days, one in December 1993 and one in January 1994, to immunizing a total of 200 million children under four years of age with oral polio vaccine. A second two-day round is scheduled for this winter.

• Reflecting these attainments, China has witnessed a plummeting of polio cases, from around 25,000 a year in the 1970s to a record low of 653 in 1993, as well as a 90-95% fall over the same period in cases of measles, pertussis and acute tuberculosis. At the same time, "thanks largely to our immunization efforts", according to Prof Dai, life expectancy at birth has risen from around 64 years in the 1970s to 69 years in 1992 (for both sexes combined) and, since the 1960s, under one-year-old mortality has plunged from 140 to 35 per 1,000 live births and under-five-year-old mortality from 209 to 43.

The only blot on this picture of success is neonatal tetanus. Through vigorous application of the so-called "three cleans" strategy for delivery of newborn babies – clean hands, clean umbilical cord care and clean delivery surface – China has slashed its estimated neonatal tetanus death rate from around 55 to 4 per 1,000 births between 1954 and 1980. Nevertheless, there are still an estimated 98,000 deaths annually, a figure exceeded only by India's 101,000. However, in 300 districts, where 10% of the country's population is exposed to a high risk of this disease, 20% of women of childbearing age have had their first two shots of tetanus toxoid, a vaccination rate similar to that of several of China's southern neighbours. Part of the problem is that these districts are concentrated in the southern border areas, that lack health and education facilities. "In these areas," says Prof Dai, "about 20% of the women refuse tetanus immunization because of their beliefs." His services are planning education programmes aimed at these women, combined, this winter, with two one-day immunization campaigns in the southern province of Guizhou.

In an all-out drive to eradicate wild polio virus by the end of 1995, China devoted two days to immunizing a total of 200 million children under 4 years of age with oral polio vaccine.

MEETING CALENDAR

16-23 January 1995
Keystone, CO, USA

Muscoal immunity: new strategies for protection against viral and bacterial pathogens

Keystone Symposia, Drawer 1630, Silverthorne, CO 80498, USA. Tel: (1-303) 262-1230

16-23 January 1995
Keystone, CO, USA

Molecular aspects of viral immunity

Keystone Symposia, Drawer 1630, Silverthorne, CO 80498, USA. Tel: (1-303) 262-1230

19-23 February 1995
Nice, France

7th European congress on biotechnology

Mrs L Cohen, Société de Chimie Industrielle, 28, rue St Dominique, 75007 Paris, France

**3-5 March 1995*
San Francisco, CA, USA

2nd international conference on engineered vaccines for cancer and AIDS

Cass Jones, Professional Conference Management Inc., 7916 Convoy Court, San Diego, CA 92111, USA. Tel: (1-619) 565-9921; Fax: (1-619) 585-9954

16-22 March 1995
Taos, NM, USA

Control and manipulation of the immune response

Keystone Symposia, Drawer 1630, Silverthorne, CO 80498, USA. Tel: (1-303) 262-1230

**20-22 March 1995*
Washington, DC, USA

Vaccines: new technologies and applications

Cambridge Healthtech Institute, 1000 Winter Street, Suite 3700, Waltham, MA 02154, USA. Tel: (1-617) 487-7989; Fax: (1-617) 487-7937

**6-9 April 1995*
Virginia, CA, USA

DNA vaccines: a new era in vaccinology

Conference Dept, The New York Academy of Sciences, 2 East 63rd Street, New York, NY 10021, USA

**23-27 April 1995*
Ghent, Belgium

2nd international pharmaceutical biotechnology conference

Prof Dr E. Van den Eeckhout, University of Gent FFW, Harelbekestraat 72, 9000 Gent, Belgium. Tel: (32-9) 221-99-43; Fax: (32-9) 220-66-88

7-11 May 1995
Eilat, Israel

39th OHOLO conference on vaccines: novel strategies in design and production

The Secretariat, 39th OHOLO Conference, P.O. Box 19, 70450 Ness-Ziona, Israel. Tel.: (972-8) 381-656; Fax: (972-8) 401-404

**16-20 July 1995*
San Diego, CA, USA

8th international congress of mucosal immunology

Professional Conference Management Inc., 7916 Convoy Court, San Diego, CA 92111, USA. Tel: (1-619) 565-9921; Fax: (1-619) 585-9954

23-28 July 1995
San Francisco, CA, USA

9th international congress of immunology

Congress Secretariat, 9650 Rockville Pike, Bethesda, MD 20814, USA. Tel: (1-301) 530-7178; Fax: (1-301) 530-1816

**New entry*

PICTURE POSTSCRIPT

UNICEF/Lauren Goodsmith

A single drop, to save a life (see story, pages 2-5).

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