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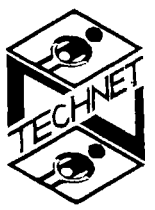
Washington D.C.
31 May to 4 June 1994



LOGISTICS FOR HEALTH INFORMATION SERIES

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ACRONYMS AND ABBREVIATIONS (OVERLEAF)

ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
AFR/AFRO	African Region or Regional Office
AIDAB	Australian International Development Assistance Bureau
AMR/AMRO	Region of the Americas/American Regional Office
BCG	Bacillus Calmette Guerin vaccine (for tuberculosis)
C5H10	Cyclopentane
CFC	Chlorofluorocarbon
CLM	Commodities and Logistics Management (software)
Dept.	Department
DPT	Diphtheria/Pertussis/Tetanus vaccine
DT	Diphtheria/Tetanus vaccine
EMR/O	Eastern Mediterranean Region/Regional Office
EPI	Expanded Programme on Immunization
GPV	Global Programme for Vaccines and Immunization
GWP	Global Warming Potential
HBeAg	Hepatitis B "e" antigen
HBsAg	Hepatitis B surface antigen
HBV	Hepatitis B virus
HCFC	Hydro-chlorofluorocarbons
HFC	Hydro-fluorocarbons
HIV	Human immunodeficiency virus
HRD	Human Resource Development
ICU	Instant cooling unit
IEC	Information, Education and Communication
MMR	Measles, Mumps and Rubella vaccine
MR	Mortality rate
NGO	Non Governmental Organization
NID	National Immunization Day
NIS	Newly Independent States
ODP	Ozone Depleting Potential
OPV	Oral Polio vaccine
PAHO	Pan American Health Organization
PNG	Papua New Guinea
QCI	Quality, Cost and Inventory survey
R11	CFC11 or $CFCl_3$
R12	CFC12 or CF_2Cl_2
R134a	$C_2H_2F_4$
R600	Isobutane
SEAR/O	South East Asia Region/Regional Office
Technet	Technical Network for Logistics in Health
TIP	Technology Introduction Panel
TRANSAID	Transportation Expertise for Save the Children Fund
TST	Time/Steam/Temperature
TT	Tetanus Toxoid
USAID	United States Agency for International Development
VVM	Vaccine Vial Monitor
WCBA	Women of Childbearing Age
WPR/O	Western Pacific Region/Regional Office
WR	WHO Representative

I. INTRODUCTION

The creation of the Global Programme on Vaccines and Immunization (GPV) comes at a time when immunization services face the greatest challenges since the inception of the Expanded Programme on Immunization in 1974. It is only effective leadership and co-ordinated teamwork that can meet such challenges.

A team of logistics experts from sixteen organizations (including two manufacturers) attended the 4th meeting of the Technical Network for Logistics in Health (TECHNET) held in Washington, 31 May to 4 June 1994. (See Annexes 1-3 for list of participants, agenda and list of documents.)

Discussions at the TECHNET meeting focused on practical issues of field operations associated primarily with the challenges to:

- **Accelerate** the global effort, through supplementary immunization activities, to meet the disease eradication, elimination and control objectives.
- **Develop and introduce** new vaccines, such as Hepatitis B and Yellow Fever, and incorporate other interventions, such as Vitamin A, into current immunization services.
- **Reverse** the trend of declining immunization coverage, mainly in countries in the African Region.
- **Assure** sufficient vaccine supplies at affordable prices and shift the vaccine financing progressively into the hands of governments.
- **Achieve** injection safety in immunization by eliminating incorrect sterilization and injection practices.
- **Attract** sufficient international and bilateral funding to sustain the acceleration of the programme.

In conclusion, participants voted on the **recommendations** adopted at the meeting to establish a priority list of TECHNET issues which they consider to be of greatest importance to immunization today. These are summarised below:

- **Safety of injections:** The risks posed to the future of immunization by current levels of injection safety are unacceptable. Countries urgently need national plans of action to achieve global elimination of incorrect EPI sterilization and injection practices by the year 2000.

- **Vaccine vial monitors (VVMs)** have the potential to make the cold chain more effective, to permit a more flexible use of vaccine in the field and to drastically reduce current levels of vaccine wastage. VVMs are clearly cost-effective and have been available for many years. They should be implemented without further delay.

- **Keeping opened vaccine vials more than one day:** With the rise in frequency of immunization sessions and the fall in number of children per session, vaccine wastage has become a threat to sustainability of immunization services. One WHO Region already recommends that opened vials of vaccines (excluding freeze dried vaccines) are kept for up to 5 days. This policy, with modifications, should be adopted globally.

- **National Immunization Days (NIDs)** are the single most complex event among all the immunization strategies and require meticulous planning. A guide on the specific practical details of the logistics of NIDs is urgently needed and should be prepared on the basis of the extensive experience gained in the Western Pacific and the Americas.

- **Low workload jet injectors,** designed for routine immunization and costing one tenth of the price of traditional injectors, are poised to compete with syringes and needles for use in the health centre and outreach activities. Injections with low workload jet injectors are expected to be safer, less expensive, more comfortable to the client and more convenient to the health worker. Field trials should be conducted without delay and, if successful, the low workload jet injectors should be made available for immunization.

Work in the above five areas, as well as in other areas covered by TECHNET recommendations, needs to be defined in terms of a Plan of Activities for each WHO Region and for each TECHNET member. See Annex 4 for Plans of Action so far drawn up.

II. CONCLUSIONS AND RECOMMENDATIONS

1.0 INJECTIONS

1.1 Unsafe injection, sterilization and disposal practices

Following the recommendation of the WHO/WPR Technical Advisory Group and the Yamoussoukro Declaration (March 1994) on the elimination of incorrect EPI sterilization and injection practices, the TECHNET strongly recommends that countries:

- Adopt the global target to achieve 100% safe and sterile injections by the year 2000, according to the indicators listed in Part III, para. 1.1.
- Prepare plans of action to reach these targets by the end of 1995; WHO Regional Offices to provide necessary support and compile Regional plans.
- WHO/Geneva to prepare a global statement, to be endorsed by UNICEF, on the risk of disease transmission due to incorrect injection practices. The statement will be used to:
    * inform all ministries of health via the official channels; and
    * obtain commitment to action from WHO, UNICEF and national programme managers at Regional meetings.

For discussion, see Part III, para. 1.1.

1.2 Injection and sterilization technologies

Low workload jet injectors are available and offer important advantages to both routine and special immunization operations.

- Assess the impact of the introduction of the low workload jet injector in the field, particularly its reliability in a variety of immunization settings. WHO and UNICEF to make a decision by the end of 1994 on whether to recommend widespread introduction.

For discussion, see Part III, para. 1.2.1.

A reusable syringe, graduated for both a 0.5 ml and a 0.05 ml dose is available and appears to simplify the provision of syringes for immunization.

- WHO/EPI to urgently evaluate the reusable syringe with graduations for both 0.5 ml and 0.05 ml doses in several different field settings. Make a decision by the end of 1994 on whether to introduce this syringe.

For discussion, see Part III, para. 1.2.3.

The number of sterilization cycles which reusable syringes can withstand is severely reduced in areas where there is hard water. The "McLoughlin steam vapour purifier" which has recently been laboratory tested by WHO ensures that syringes will reach their maximum potential working life.

- The McLoughlin purifier to be reviewed by the Technology Introduction Panel (TIP), field tested and made available for use.

For discussion, see Part III, para. 1.2.4.

2.0 PLANNING NATIONAL IMMUNIZATION DAYS

National Immunization Days (NIDs) require meticulous planning and considerable resource mobilization and management. A logistics guide is urgently needed for national and logistics managers in all countries working towards the disease elimination and eradication goals.

- By the end of 1994 prepare a logistics guide covering every aspect of the planning and implementation process of a NID.

For discussion, see Part III, para. 2.6.

- The preferred choice for large scale immunization activities such as NIDs is the high workload jet injector and disposable syringes (auto-destruct type if single use cannot be assured) with appropriate disposal equipment.

For discussion, see Part III, para. 2.4.

The planning of logistics, the cold chain and the deployment of injection equipment is crucial where NIDs are being implemented.

- Establish a Logistics Sub-Committee of the NID Steering Committee in each country to define resource needs, organize the best use of health and non-health personnel and establish a timetable for activities and transport.

For discussion, see Part III, para. 2.1.

The concentrated resource mobilization and the personnel management achieved by NIDs can contribute in a valuable way to the motivation and the material resources of the routine programme, particularly where NIDs become a regular event.

- Plan resources and personnel for immunization days in such a way as to maximize benefit to the routine programme, while also achieving the objectives of the NID.

- Countries which haven't previously conducted NIDs or exercises of this type should start by gaining experience with sub-national immunization days, preferably in areas where the management capacity and logistics infrastructure is relatively better developed.

For discussion, see Part III, para. 2.2.

3.0 VACCINE UTILIZATION

Vaccine vial monitors offer major benefits to improve the effectiveness and the operational efficiency of immunization services.

- Progressively attach vaccine vial monitors to all vials of vaccine, starting immediately with oral Polio vaccine. Provide all countries with the necessary instructional materials in advance.

- Continue to discard oral Polio vaccine at the end of the session until each vial is provided with a vaccine vial indicator. An opened vial of Polio vaccine may be kept up to 5 days if a vaccine vial monitor is attached.

For** discussion, see **Part III, para. 3.2.

In August 1992 WHO/PAHO recommended that opened vials of DPT, DT, TT and Hepatitis B may be kept in the cold chain and used over a period of up to 5 days . Considering the success of this recommendation in AMR and the potential improvement in vaccine utilization rates, TECHNET recommends the adoption of a global policy on opened vials of vaccine:

- DPT, DT, TT and Hepatitis B vials may be kept in the cold chain and used over a period of up to 5 days, from the time the vial is opened. Polio vaccine may also be used in this way *if a vaccine vial monitor is attached to the vial.*

- Continue to discard reconstituted Measles, Yellow Fever and BCG vaccine within 8 hours after reconstitution.

For discussion, see Part III, para. 3.1.2.

Vaccine requirements forecasting is becoming increasingly unsatisfactory, partly due to large scale disease elimination and eradication initiatives.

- Pursue the introduction of the WHO recommended CLM software for stock control and inventory management of equipment and transport in countries where computers are already available.

- Continue to develop forecasting tools and evaluate their use at national and international levels.

For discussion, see Part III, para. 3.3.

There is increasing concern that EPI strategies which result in high vaccine wastage may be unsustainable.

- Conduct further studies to get a clear understanding of the effect of frequency of immunization services on coverage and vaccine wastage.

For discussion, see Part III, para. 3.1.3.

4.0 MONITORING AND EVALUATING IMMUNIZATION LOGISTICS

- The methodology and software of QCI surveys should be made available for distribution in English, French and Spanish by the next TECHNET meeting.

For discussion, see Part III, Section 4.

5.0 LOGISTIC PRIORITIES IN EASTERN EUROPE

- Develop the necessary methods and equipment modifications to ensure that cold room, refrigerator and cold box temperatures do not fall below zero at the coldest ambient temperatures experienced in this Region.

- The TECHNET Secretariat to act as ombudsman in contacting the relevant donor agencies to prevent the frequent recurrence of problems encountered with the provision of vaccines and supplies by donors.

For discussion, see Part III, Section 5.

6.0 EQUIPMENT FOR IMMUNIZATION SERVICES

Concerning the use of domestic refrigerators for vaccine storage:

- Modify all domestic refrigerators used in immunization services to make them more suitable for vaccine storage. If modification is not cost effective, replace domestic refrigerators with approved vaccine storage models.

- Make data from laboratory tests and field trials on modified refrigerators available to all countries which use domestic refrigerators. Produce a manual with guidelines on modification options for distribution by the end of 1994.

- Prepare specifications for compression-type refrigerators for small health centres in tropical climates. Approach industry about manufacturing such refrigerators.

For discussion, see Part III, para. 6.1

Considering the current uncertainties among refrigerator manufacturers with the changeover to non-CFC gases:

- Start immediately with independent testing of all equipment produced with non-CFC foaming agents and refrigerants.

- Provide as much information as possible to countries and keep them informed of the situation.

- Delay the purchase of CFC-free equipment, where feasible, until the choice regarding replacement foaming and refrigerant agents is settled.

For discussion, see Part III, para. 6.2

- WHO/EPI to pursue the approach to an integrated use of solar energy in health and evaluate it in specific countries and areas.

For discussion, see Part III, para. 6.3

TECHNET commends progress in the development of the following refrigeration devices and recommends further testing and field trials:

- Battery-free solar refrigerator -- complete field trials by the end of 1995.

- Zeolite -- Form a TECHNET Sub-Committee to liaise with the manufacturer and assess the technical specifications of the new zeolite refrigerated plate system. Initiate laboratory tests by the end of 1994 and conduct field trials during 1995.

For discussion, see Part III, para. 8.2.5

7.0 TRANSPORT FOR HEALTH

- By the end of 1997, all countries to establish the necessary inventories of national transport resources. Each inventory to reflect standard minimum information, as included on sample form in Annex 5.

- TECHNET to prepare a guide on the development of a national transport policy for health by the end of 1994.

- Noting the important role played by motorcycles in outreach immunization and other field activities, TECHNET to support the training and follow-up which is necessary for successful implementation of a motorcycle fleet.

For discussion, see Part III, Section 7.0

III. SUMMARY OF PRESENTATIONS AND DISCUSSIONS

1.0 INJECTIONS

1.1 Elimination of unsafe injections

Injections are safe when they pose no risk to the client, the health worker or the general public. The injection technologies which are available today, as recommended in the WHO Policy, "Safety of injections in immunization services"[1], pose no such risk *when recommended procedures are followed.*

The main strategy to eliminate unsafe injections is to continue with the injection technologies which are already in use *if they are satisfactory, but to ensure that they* ***are used correctly***.

National surveys in the last two years have revealed widespread, unsafe injection practices in four out of the six WHO Regions. The three most prominent unsafe practices are the re-use of contaminated needles, accidental needlestick and the improper disposal of contaminated syringes and needles. A recent estimate of the disease transmission associated with these risks is reproduced below in Tables 1-2 and Figure 1[2]. The magnitude of the problem, however, has yet to be appreciated by many ministries of health, technical agencies and donor groups.

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1 Document WHO/EPI/LHIS/94.1 (August 1994).

2 Aylward B., Kane M., McNair Scott R., Hu D.: "Risk of human immunodeficiency virus and hepatitis B virus transmission through unsafe injections", Int. J. Epid. (in press).

Table 1: Model-based estimates of the number of cases of HIV/1000 fully immunized infants or women of childbearing age (WCBA), for specific seroprevalences and needle reuse rates ®

HIV Prevalence*	Infants cases/1000		WCBA cases/1000	
	if ® = 1	if ® = 4**	if ® = 1	if ® = 4
High (20%)	0.51	0.81 -- 1.9	1.4	2.3 -- 4.7
High (10%)	0.26	0.42 -- 1.0	0.81	1.3 -- 2.9
Intermediate (1%)	0.027	0.043 -- 0.11	0.12	0.14 -- 0.35
Low (0.1%)	0.0027	0.0043 -- 0.011	0.013	0.0014 -- 0.036

* Prevalence of HIV in the women of childbearing age population.

** Lower estimate assumes that the organism is transmissible to only the next susceptible, while the upper estimate assumes that all remaining susceptibles are exposed if the needle/syringe is reused.

Table 2: Model-based estimates of the number of cases of Hepatitis B/1000 fully immunized infants or women of childbearing age (WCBA), for specific seroprevalences and needle reuse rates ®

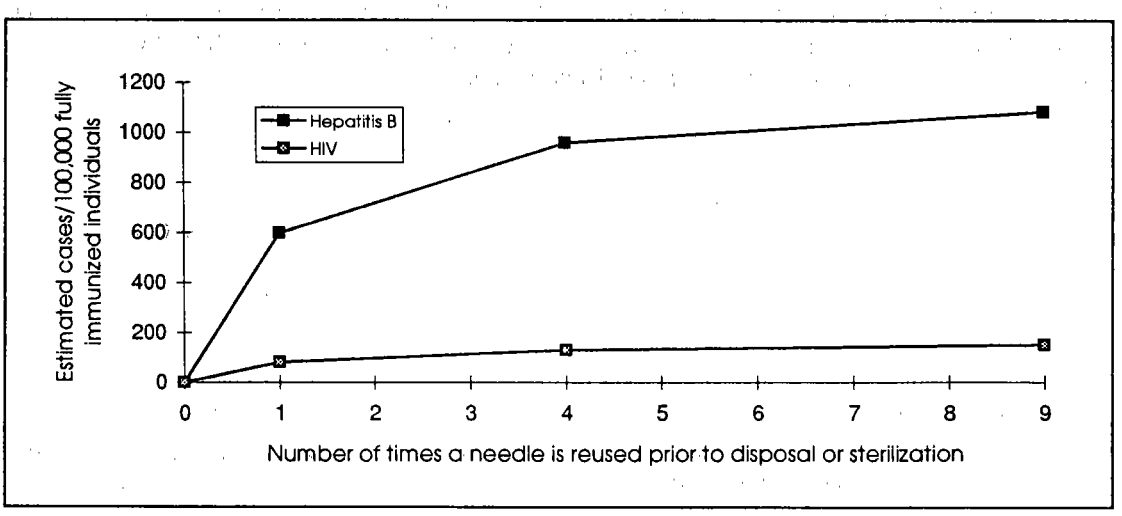
Hepatitis B Prevalence*	Infants cases/1000		WCBA cases/1000	
	if ® = 1	if ® = 4**	if ® = 1	if ® = 4
Very high***	9.8	15.6 -- 37.4	6.0	9.6 -- 22.8
High	2.6	4.1 -- 10.2	1.5	2.4 -- 5.9
Intermediate	1.8	2.9 -- 7.1	1.7	2.7 -- 6.7
Low	0.53	0.84 -- 2.1	0.63	1.0 -- 2.5

* Prevalence of HBsAg in the women of childbearing age population.

** Lower estimate assumes that the organism is transmissible to only the next susceptible, while the upper estimate assumes that all remaining susceptibles are exposed if the needle/syringe is reused.

*** High HBeAg resulting in substantial perinatal transmission.

Figure 1: Cases of injection-associated hepatitis B & HIV in a population of fully immunized women of childbearing age (HBsAg & HIV prevalence = 10%)



Unsafe injection practices are particularly prevalent in areas with frequent shortages of injection and sterilization equipment. Other logistic factors also play an important role. It is clear that the choice of injection equipment depends on the availability of a sustained budget and must relate to the logistics of each immunization strategy.

Injections for immunization typically comprise only 10-20% of all injections given in the health sector. They are often provided at a higher standard of safety than is observed with injections in curative services. *Immunization services, however, are at risk from the consequences of unsafe injections given throughout the health sector.* The strategy to eliminate unsafe injections cannot be targeted specifically at injections for immunization, without considering the other injections.

Taking into consideration the diversity of health services and the absence of a unified global policy, participants agreed that a practical entry point from which to initiate action on the safety of injections is the immunization services.

Such action should be well co-ordinated with authorities from the curative sector. In many countries the curative sector should focus on eliminating unnecessary injections which constitute a high proportion of their injections.

The immunization services should focus on the implementation of a strategy for safe injections with the objectives outlined below:

- **Stress global policy** on the safety of injections while sensitizing and informing ministries of health and international and non-governmental organizations on the risks of unsafe injections and the choice of injection technologies and associated costs.

- **Build national policies** on the safety of injections and translate them into district plans and budgets for injection materials and in-service training activities. Workshops for this purpose should be aimed at officials responsible for basic medical and nursing training curricula.

- **Prepare and disseminate a guide** for national managers on the selection of injection equipment according to immunization strategy, the calculation of needs for syringes and needles and the management of stocks. The guide should include a checklist for supervision and a protocol for rapid assessment of sterile practices.

- **Research** the international market and identify practical and affordable means to incinerate or otherwise destroy contaminated syringes and needles at the point of use.

- **Seek and actively promote ways** to link the donation of vaccines with the donation of sufficient syringes and needles. In countries where the funding of vaccines is being progressively shifted from donors to ministry budgets, extend this strategy to include funding of syringes and needles.

The third Technical Advisory Group meeting in 1992 adopted a conclusion/recommendation that:

> EPI sterilization practices are still not satisfactory, especially when considering the risk of HIV and HBV transmission through improperly sterilized needles and syringes and given the rapid spread of AIDS/HIV in Asia and the large number of infants expected to be affected. Steam sterilization has been shown to be a completely safe and cost effective way of sterilizing injection equipment. Each country must evaluate the injection practices of health workers and prepare a plan of action to eliminate incorrect practices by 1994.[3]

On the basis of this recommendation, the WHO Western Pacific Regional Office (WPRO) has developed a plan of action to eliminate incorrect EPI sterilization injection practices[4] by the year 2000. Progress towards this goal, as reported by WPRO staff, is already impressive.

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[3] Third Tag Meeting on EPI and poliomyelitis eradication in the Western Pacific Region, Beijing, China, 19-23 October 1992: para 3.7, page 6.

[4] WPRO: Elimination of incorrect EPI sterilization and injection practices in the Western Pacific Region, TECHNET/GPV/94.07.

TECHNET believes the WPRO goal may be suitably adopted as a global target for achieving safe and sterile injections, with the **indicators of progress** outlined below.

INDICATORS OF PROGRESS TOWARDS THE ACHIEVEMENT OF SAFE AND STERILE INJECTIONS

- **For sterilizable syringes,** TST sterilization indicators[5] are in use for all steam sterilizers at each health centre and evidence is available that they have changed colour. One self-adhesive indicator is attached to the underside of each rack-lid before sterilization. The indicator is inspected at the time of immunization, removed from the lid and attached to the immunization tally sheet as evidence of correct sterilization procedures.

- **For disposable and auto-destruct syringes,** each health centre either uses incinerator boxes[6] or has a systematic supervised system for the destruction of syringes.

- **A supervisory visit** is made to each health centre at least twice a year to inspect items on a checklist and all reports/check list indicators for such visits over the previous year are satisfactory.

An initial list of indicators for the checklist includes the following:

◊ No adverse reactions or other signs of unsafe injections at the site of the injection.
◊ Stocks of syringes and needles are sufficient.
◊ Used disposable syringes are burned or properly buried.
◊ Sterilizer and heater are in working order.

- **A rapid assessment survey** is conducted according to WHO minimum guidelines and practices are found to be satisfactory in 100% of the centres visited.

RECOMMENDATIONS

Countries to adopt the global target to achieve 100% safe and sterile injections by the year 2000, according to the indicators listed above.

- **Countries to prepare plans of action to reach these targets by the end of 1995; WHO Regional Offices to provide necessary support and compile Regional plans.**

- **WHO/Geneva to prepare a global statement, to be endorsed by UNICEF, on the risk of disease transmission due to incorrect injection practices. The statement will be used to:**

  * **inform all ministries of health via the official channels; and**

  * **obtain commitment to action from WHO, UNICEF and national programme managers at Regional meetings.**

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5 TST indicators (PIS E10/07) have been tested and are available at a cost of $223.88 per 50 packs of 300 indicators each (i.e. approximately $0.016 per indicator).

6 Incinerator boxes (PIS E10/08) have been tested and are available at $0.85 each. The incinerator box is used as a safe container for about 100 contaminated syringes and is designed to incinerate the syringes. Prototype boxes exist for capacities of up to 500 syringes, but are not yet on the market.

1.2 Injection and sterilization technologies

1.2.1. Low workload jet injectors

A low workload jet injector, still in development and undergoing field trial, was demonstrated and discussed. It appears to have many advantages over syringes and needles for use in fixed centre/clinic settings as well as in special immunization operations. It operates reliably with little or no maintenance under laboratory conditions and results from field trials will confirm its acceptability to health workers. One important advantage is the promise of a much lower cost in use.

It was agreed that field trials on the low-workload jet injector should be completed as soon as possible to permit it to become more generally available as an additional choice at health centre level.

Table 3: Cost of low workload jet injection compared to other injection technologies

	Clinic Workload of 5 injections/day		Clinic Workload of 50 injections/day	
Injection Equipment	**Total Costs**	**Cost per injection**	**Total Costs**	**Cost per injection**
Sterilizable	$75.12	$0.06	$108.28	$0.01
Disposable	$69.55	$0.05	$695.50	$0.05
Auto-destruct	$104.00	$0.08	$1,040.00	$0.08
*Jet Injector** *(low workload)*	*$121.55*	*$0.09*	*$380.00*	*$0.03*

* The manufacturers' price of US$ 250 per jet injector is used in these calculations. The addition of a sterile auto-destruct cap would increase the cost by approximately US$ 0.02 to 0.03 per injection.

RECOMMENDATION

- **Assess the impact of the introduction of the low workload jet injector in the field, particularly its reliability in a variety of immunization settings. WHO and UNICEF to make a decision by the end of 1994 on whether to recommend widespread introduction.**

1.2.2. Auto-destruct syringes

Auto-destruct syringes are now widely distributed by UNICEF although the quantities ordered by each country (with the exception of Iraq) have been limited. Participants agreed that auto-destruct syringes are the safest choice in situations where management and supervision of immunization services are weak, whether funds are limited or not.

The first problem encountered with the introduction of auto-destruct syringes is their high cost. This is a major stumbling block to implementation. UNICEF's recent price reduction from US 0.13 to US$ 0.08 is certainly welcome. It is not clear, however, how long UNICEF can continue to maintain the subsidy which makes this reduction possible.

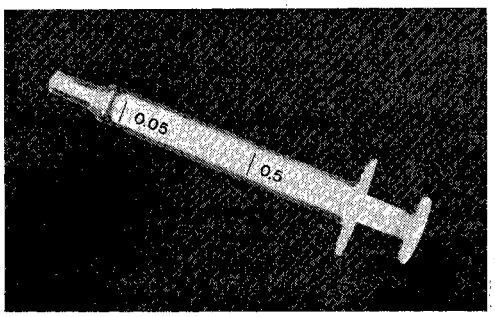
A new device which offers the potential for less costly auto-destruct syringes was demonstrated at the meeting. This device can be installed in most standard disposable syringe barrels, even the narrow barrels suitable for BCG injection. It has still to pass laboratory tests, however, and production will depend on its being adopted by a major manufacturer.

The second problem is the assumption, on the part of some users, that the auto-destruct syringe will not permit aspiration to check whether the needle has entered a vein. (The specifications for auto-destruct syringes do, in fact, exclude this requirement on the basis of a 1987 policy decision on

injections for immunization.) There *is*, however, sufficient movement in the plunger to allow for aspiration on both the currently available auto-destruct models.

1.2.3. A "universal" sterilizable plastic syringe for immunization

The "universal" immunization syringe



The sterilizable plastic syringe is currently supplied in two sizes: one for 0.5 ml and another 0.05 ml doses. At the meeting a proposal was put forward to re-graduate the current 0.5 ml syringe with markings for 0.5, 0.1 and 0.05 ml doses. This would simplify logistics and do away with the need for the 0.05 ml syringe which is more fragile and has a shorter working life than the 0.5 ml syringe.

The design of the 0.05 ml syringe, however, permits a longer plunger movement than is possible with the wider barrelled 0.5 ml syringe. The 0.05 ml plunger runs through to the hub of the needle, thus reducing dead-space and keeping vaccine wastage to a minimum.

It was agreed that the two syringes (0.05 and 0.5 ml) should be tested to quantify the difference in the wastage rates between them and check their respective accuracy in administering a 0.05 ml dose. If the difference is not significant, consideration will be given to changing to a single, universal syringe for immunization purposes, based on the 0.5 ml syringe.

RECOMMENDATION

- **WHO/EPI to urgently evaluate the reusable syringe with graduations for both 0.5 ml and 0.05 ml doses in several different field settings. Make a decision by the end of 1994 on whether to introduce this syringe.**

1.2.4. Counteracting the effects of hard water

The working life of all plastic, sterilizable syringes depends on the number of times they can be sterilized. This is maximized when they are sterilized in steam vapour from distilled water.

This steam vapour can now be generated, even in areas of hard water, by a device known as the "McLoughlin steam vapour purifier", currently undergoing laboratory and field tests. It was agreed that, once the tests are successful, racks should be made available to incorporate the purifier in areas of hard water. The consequent life of the syringes should then be monitored in as many areas as possible.

RECOMMENDATION

- **The "McLoughlin steam vapour purifier" to be reviewed by the Technology Introduction Panel (TIP), field tested and made available for use.**

1.2.5. Sterilizable needles

The life of sterilizable needles depends on the number of times they can be used before they become blunt or damaged. In the past, the life of a needle was extended by sharpening it on a stone. If this task is not conducted well, the risk of accidental needlestick is increased and subsequent injections can be very painful. *The practice of sharpening is, therefore, no longer recommended.*

Needle sharpening stones should be removed from kits for sterilization equipment. The life of needles, without sharpening, needs to be determined for the purpose of forecasting supplies.

2.0 PLANNING NATIONAL IMMUNIZATION DAYS

National Immunization Days (NIDs) are the most complex of the special immunization operations for the eradication of polio and the elimination of measles. NIDs may incorporate other special operations, such as immunization to eliminate Neonatal Tetanus in certain high risk areas.

NIDs require meticulous planning well in advance of their scheduled dates. Much of this planning activity is concerned with logistics, including the distribution of vaccine and injection equipment, setting up the necessary communications, obtaining sufficient transport and managing the movement of personnel.

2.1. Importance of a logistics sub-committee for NIDs

Experience has shown that the logistic aspects are best planned by a Logistics Sub-Committee of the National Steering Committee for the NID[7]. The main task of this Sub-Committee is to quantify the resource needs which must be met at each level of the system, according to the operational strategy and the target population. This information is most conveniently manipulated in computer spreadsheets.

The Sub-Committee must determine how and when the resources can be obtained, stored and distributed. It must also establish a detailed timetable of activities and responsibilities, beginning one year before the scheduled date/s for the immunization day/s.

If NIDs are carried out annually, as in many countries, the Sub-Committee becomes a permanent, routine resource to immunization services in the country. Again, experience suggests that NIDs are most supportive to the routine immunization services if they are supervised or executed by routine health staff and become an integral part of the routine services.

RECOMMENDATION

- **Establish a Logistics Sub-Committee of the NID Steering Committee in each country to define resource needs, organize the best use of health and non-health personnel and establish a timetable for activities and transport.**

2.2. NIDs in countries with a weak infrastructure

NIDs are an essential component of eradication and elimination of disease in all developing countries. The main organizational elements remain essentially the same, whether the managerial and logistic infrastructure is strong or weak. However, to ensure that the NID effectively reinforces routine immunization services, the way in which it is introduced varies.

Multi-antigen NIDs, which offer injectable vaccines in addition to oral Polio, are considerably more complex to organize than NIDs which offer only oral Polio. This suggests that a country with a weak managerial infrastructure may find that a single antigen NID is a practical way to build capabilities before it conducts a multi-antigen NID.

Supplementary sub-national NIDs to inject women in developing countries with Tetanus Toxoid are a valuable, even vital, way to boost routine services in areas of high risk for Neonatal Tetanus.

Countries with little or no previous experience of NIDs may phase in a sub-national immunization day to build the necessary managerial expertise. Countries with a poor transport or cold chain

[7] Maher C.: Logistics aspects of the poliomyelitis eradication initiative -- National Immunization Days, TECHNET/GPV/94.05.

infrastructure may, initially, require considerable external support. The need for such phasing and infrastructure building will be greatest in countries where routine immunization performance is weakest.

RECOMMENDATIONS

- **Plan resources and personnel for immunization days in such a way as to maximize benefit to the routine programme, while also achieving the objectives of the NID.**
- **Countries which haven't previously conducted NIDs should start by gaining experience with sub-national immunization days, preferably in areas where the management capacity and logistics infrastructure is relatively better developed.**

2.3. Manpower

The way in which the NID is organized at field level determines the amount of logistic support which is required from central level. The strategy of NIDs varies mainly between rural and urban areas and this has a marked impact on staffing and transport.

In an urban area, one immunization post is required to cover an area containing 200-250 children under 5 years of age. Each post is staffed by 1-2 vaccinators per antigen, 4 community volunteers for registration and 2 additional assistants for managing the flow of people.

In rural or sub-urban areas, the vaccinators move in teams of at least two persons. They start from higher ground and reach the lower areas later in the day. In sub-urban or high density hilly areas, teams can visit between 20 and 40 houses in a day; 50 to 80 in flat areas.

A single supervisor can manage a maximum of either 5 vaccination posts in an urban area or 2 to 4 immunization teams in a rural area. Scheduling their daily activities in relation to the target population enables the supervisor to quantify needs for vaccines, ice, cold chain equipment and transport.

2.4. Equipment and supplies

Sufficient lead time must be allowed for the provision of all equipment and supplies to each post. Particular attention should be given to the printing and timely distribution of simple tally sheets to record immunizations. The equipment needed each day for every health post or team includes:

- 12-18 vials (20 doses) of OPV—depending on the expected workload. Reserve stocks to be held at health centres.
- 1 vaccine carrier or flask (a second vaccine carrier may also be appropriate to carry ice so as to extend the range of the team).
- 1 kilogram of ice or 4 icepacks.
- Sufficient disposable needles and syringes:
  Requirement = Number of injections x wastage (usually 1:1).
- Sufficient syringe incinerators to destroy contaminated equipment on site.
- Immunization record sheets.

RECOMMENDATION

- **The preferred choice for large scale immunization activities such as NIDs is the high workload jet injector and disposable syringes (auto-destruct type if single-use cannot be assured) with appropriate disposal equipment.**

2.5. Transport

Transport needs vary widely according to topography and the road infrastructure. Non-governmental organizations and the private sector are the most frequent providers of additional transport for NIDs.

2.6. Global experience

There is already much useful experience, particularly in the Americas and the Western Pacific Region, on which to build rigorous planning for NIDs. Several countries of the Americas have already created their own NID field planning manuals.

Many countries in other Regions conducted mass immunization campaigns in the 1990-1991 era. These were principally multi-antigen initiatives which aimed to raise immunization coverage levels rather than interrupt virus transmission of Measles and Polio or eliminate Neonatal Tetanus.

RECOMMENDATION

- **By the end of 1994 prepare a logistics guide to cover every aspect of the planning and implementation process of a NID.**

2.7. NIDs in areas of conflict

Immunization campaigns organized in areas of conflict require an exceptional level of donor co-ordination and co-operation between leaders of all the conflicting factions[8]. Supplies and distribution systems are particularly vulnerable and difficult to organize under these circumstances. Equipping the cold chain must keep pace with constant looting and destruction. War tends to drain all skilled personnel from key managerial positions so training often has to start from scratch.

The presentation on Somalia, however, showed that highly successful immunization campaigns can be conducted, even under conditions of conflict. Up to May 1993, over 80% of the country's target population in areas of highest concentration received Vitamin A and was immunized against Measles. Social mobilization and the distribution of supplies were achieved through long and painstaking negotiations with all the factions involved.

Three important lessons were learned through the Somalia experience:

- Large scale immunization campaigns are feasible, even with no infrastructure and no functioning government.
- The key factor to success is sustained and timely support from the campaign's central organization to field level.
- The resources and organization which are generated by immunization campaigns in areas of conflict help to rebuild routine services, once order has been re-established.

[8] Ahmed N.: Immunization in Areas of Conflict, TECHNET/GPV/94.06.

3.0 VACCINE UTILIZATION

If vaccine is not utilized, it is either discarded at the end of a session or destroyed due to cold chain failure. High rates of vaccine utilization signal an efficient programme, but not necessarily a programme which effectively reaches children.

TECHNET discussions focused on ways to use vaccine more efficiently while also meeting programme targets.

3.1 Wastage of opened vials

Wastage of vaccine is of greatest concern in very small immunization sessions where less than ten children are immunized. The reason for this is the current global policy which advocates that opened vials of vaccine must be discarded at the end of the immunization session. The three potential solutions to this kind of vaccine wastage were thoroughly discussed at the meeting and are outlined below.

3.1.1. Reducing the number of doses per vial

This strategy has already received much interest in field programmes where vaccine wastage with 20 dose vials has been studied. One finding in the Western Pacific is that the number of doses which are actually obtainable per vial is less than the number claimed by the manufacturer[9]. This effectively lowers apparent wastage rates, often by as much as 20%.

Using 10-dose vials significantly reduces wastage for small immunization sessions. There are reports, however, that introducing 10-dose vials in parallel with other dosages per *vial for the same vaccine* causes confusion during the distribution process.

Vials containing smaller numbers of doses are costly and less easily available. The cost of the 10-dose vial is expected to rise as demand forces suppliers to switch from the 20-dose vial which is more economic to produce.

There was some degree of consensus that global policy should move towards a universal standard number of doses per vial, based on the minimum price per dose, rather than diversifying vial sizes to match the size of the immunization session. Vaccine wastage would then have to be controlled in another way.

3.1.2. Keeping opened vaccine vials more than one day

A laboratory test, conducted recently by the Public Health Laboratory Service (PHLS) in the United Kingdom, shows that the bactericide used in the formulation of DPT, TT and other liquid bacterial vaccines successfully resists a contamination challenge more severe than could be expected in the field over a period of a week. After thoroughly studying the scientific literature and polling Latin American countries, PAHO has adopted a Regional Policy to keep opened vials of liquid bacterial vaccines up to five days.

Debate during the meeting confirmed a 1992 TECHNET recommendation that oral Polio vaccine could safely be kept longer than one day *only when a vaccine vial monitor (VVM) to warn of excessive time and temperature exposure is attached.* Reconstituted Measles, BCG and Yellow Fever vaccine will continue to be discarded at the end of the session (6-8 hours).

There was strong support for the adoption of the PAHO recommendation as a global policy to keep DPT, DT and TT vaccines up to 5 days.

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[9] Manufacturers claim 10 doses from a 5 ml vial and 20 doses from a 10 ml vial. The WPRO study obtained 8 doses per 5.0 ml vial and 17 doses per 10.0 ml vial.

Table 4: Storage times for vaccine vials that have been opened and stored at a temperature between 0 and 8°C, as recommended by PAHO[10]

Vaccine	Time
Measles, MR, MMR, rubeola	8 hours
Polio	8 hours
BCG	8 hours
DPT, DT, TT	5 days
Hepatitis B	5 days
Heamophilus (HBCV)	8 hours
Yellow fever	8 hours

RECOMMENDATIONS

Adopt a global policy on opened vials of vaccine:

- **DPT, DT, TT and Hepatitis B vials may be kept in the cold chain and used over a period of up to 5 days, from the time the vial is opened. Polio vaccine may also be used in this way *if a vaccine vial monitor is attached to the vial.***
- **Continue to discard Measles, Yellow Fever and BCG vaccine within 8 hours after reconstitution.**

3.1.3. Concentrating immunizations within larger sessions

A study from Tanzania showed that improvements in vaccine utilization, without a corresponding drop in immunization coverage, can be obtained by a campaign to persuade people to accept less frequent but larger immunization sessions. This provoked a controversial discussion in which the reduction in cost and vaccine wastage inherent in large sessions was argued against the need to immunize at every opportunity.

It was agreed that large sessions enable management to monitor and manage the timing and frequency of immunization sessions according to attendance—factors which are important for the efficiency and sustainability of immunization services. Areas with high immunization coverage may be particularly good prospects for concentrating immunization services in less frequent sessions.

Studies, such as the Tanzania field study, are most valuable in demonstrating what can be achieved to raise the efficiency of the programme while improving—but not compromising—effectiveness.

RECOMMENDATION

- **Conduct further studies to get a clear understanding of the effect of frequency of immunization services on coverage and vaccine wastage.**

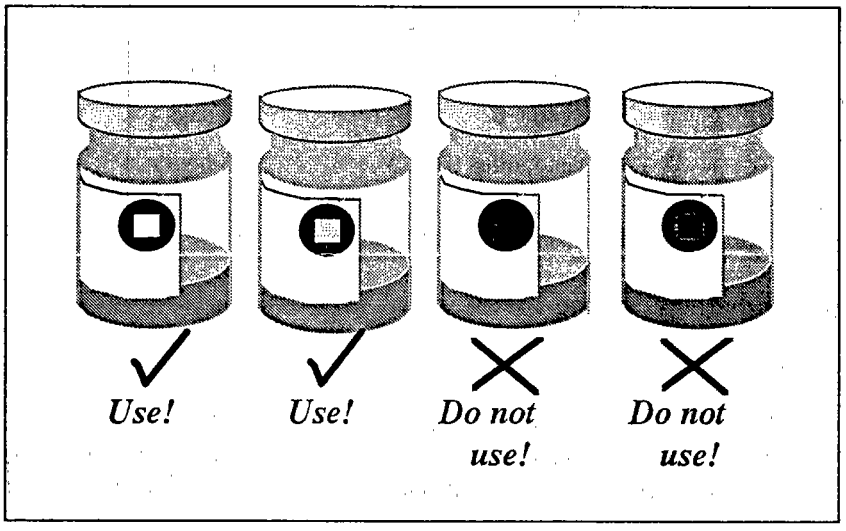
3.2 Using vaccine vial monitors (VVMs)

Even where a good cold chain exists, it is not perfect. If a cold chain failure takes place, health workers cannot know whether the vaccine is still effective. Where the cold chain does not exist, immunization is not able to take place at all. These factors are not only a major barrier to the global effort to reach high levels of coverage in routine services, they also constrain supplementary immunization activities which aim to eliminate and eradicate disease.

[10] PAHO/EPI Newsletter, Volume XIV, No. 4, August 1992.

The single, most powerful measure to remove this barrier, at minimum cost, is the implementation of vaccine vial monitors (VVMs). The VVM consists of a time and temperature indicator which is calibrated according to the heat stability characteristics of each vaccine. It is a disk of colour which can be attached or printed directly on the vial cap or label. When the potency of the vaccine is at risk, the VVM changes colour according to the history of accumulated time and temperature exposure.

Figure 2: Vaccine Vial Monitor (VVM)



The VVM technology has undergone laboratory tests and field trials in the EPI for over a decade. VVMs are affordable and, although they have been available since 1976, they have not yet been implemented in routine vaccine distribution.

The VVM enables health workers to:

- Keep oral Polio vaccine up to five days and, thereby, virtually eliminate vaccine wastage.
- Make an accurate assessment of the effect of cold chain failures and decide whether or not to use the vaccine involved.
- Recognize vaccine stock which has been partially exposed and select to use it before it has to be rejected.
- Take vaccine vials "beyond the reach of the cold chain" for limited periods where necessary in getting to difficult areas.

The *Institut Pasteur-Merieux* is the first major UNICEF supplier to offer to attach VVMs to its vaccine. They will supply 20,000 vials of oral Polio vaccine with VVMs this year (1994).

RECOMMENDATIONS

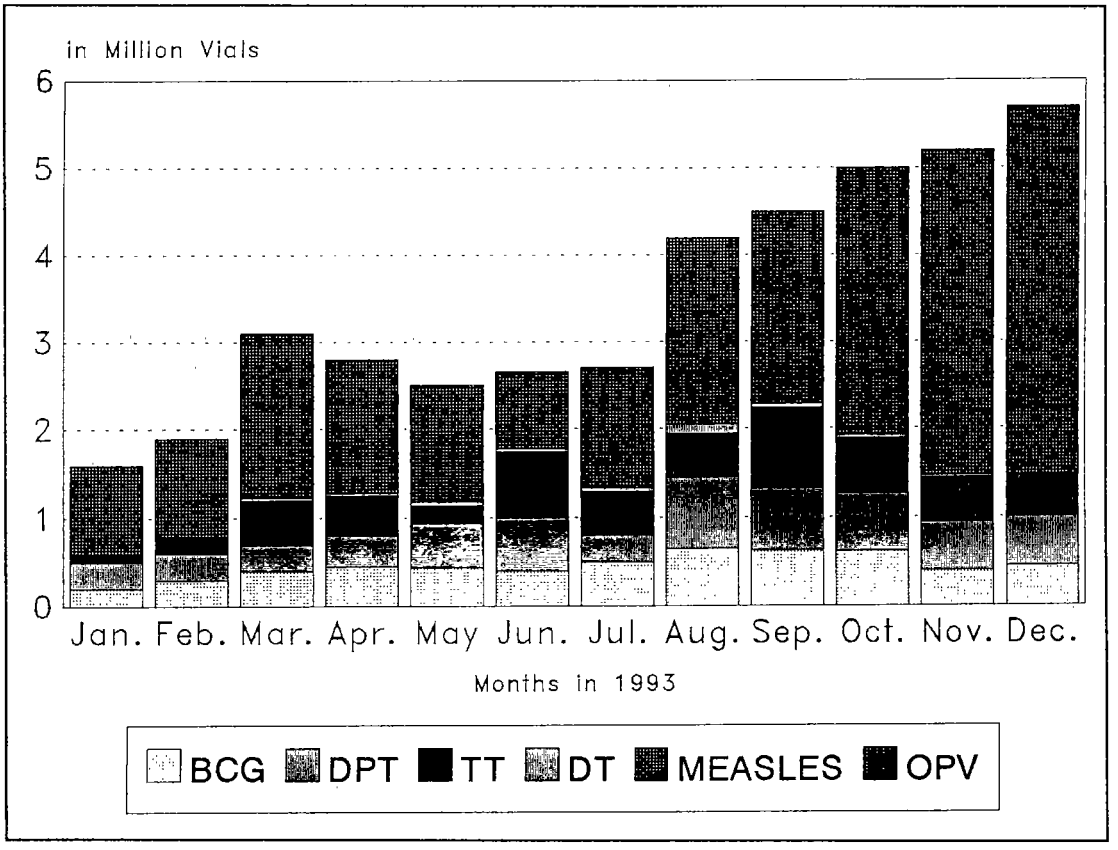
- **Progressively attach vaccine vial monitors to all vials of vaccine, starting immediately with oral Polio vaccine. Provide all countries with the necessary instructional materials in advance.**
- **Continue to discard oral Polio vaccine at the end of each session until every vial is provided with a VVM. An opened vial of Polio vaccine may be kept up to 5 days if a VVM is attached.**

3.3 Using computers to improve forecasting and stock control

The representative from UNICEF, New York made a presentation on vaccine supply which showed problems with vaccine forecasting and stock control. There are clearly increasing differences between forecasts for vaccine needs and actual quantities supplied. One reason for this appears to be the quantity of vaccines used during national immunization days. It is clear that, unless these large scale immunization operations can be systematically planned in advance, forecasting methods will remain highly inaccurate.

However, inaccuracies also occur in areas where NIDs have not been conducted so NIDs cannot be the sole cause. The forecasting method itself has flaws.

Figure 3: EPI vaccines shipped per month during 1993 (as of 31.12.93)[11]



[11] Cain, N.: Presentation, TECHNET meeting 1994 (UNIPAC 24.05.94).

There have been frequent reports of poor stock control at both national and sub-national levels. Stock control problems are not limited to vaccines. Disruptions in supplies of fuel, syringes and needles, caused by poor forecasting and stock control, have been found to provoke unsafe injection practices.

Two computer software tools to help improve forecasting and stock control were presented during the meeting:

National vaccine demand forecasting software

This software (Running under Foxpro v2.5) requires information on the size and frequency of immunization sessions and enables wastage rates to be estimated. The importance of session frequency in affecting vaccine wastage for a population of 15,000 is illustrated in the table below.

Table 5: Vaccine wastage

Frequency of sessions:	% Wastage
1 session per day	84%
3 session per week	64%
1 session per week	46%
1 session per month	7%

Commodities and Logistics Management (CLM) software

CLM is a Clipper 5.0 application written by MSH-MIS, Boston for USAID and WHO. It was demonstrated at the meeting and copies of the manual in English and French were made available to all participants. Copies of the software were sent out to members immediately after the meeting.

CLM is designed to be installed at both national and sub-national stores. It controls procedures for stock control of vaccines as well as for other supplies. It also facilitates routine maintenance of equipment and transport inventories at each individual store within the country or region where it is installed.

CLM is used in a number of countries for the EPI and is also being used to manage stocks of essential drugs and other primary health care supplies.

RECOMMENDATIONS

- **Pursue the introduction of the WHO recommended CLM software for stock control and inventory management of equipment and transport in countries where computers are already available.**
- **Continue to develop forecasting tools and evaluate their use at national and international levels.**

4.0 MONITORING AND EVALUATING IMMUNIZATION LOGISTICS

Maintaining and improving the efficiency of all aspects of immunization logistics depends on periodic monitoring and evaluation at all levels. The 1992 EPI Global Advisory Group recommendations stated that:

> "The quality of logistic support systems should be monitored by integrating the following reports into the routine EPI reporting at every level:
>
> - instances of failure in transport or major equipment, including breakdown or malfunction which have disrupted immunization services;
> - any shortages of vaccine, fuel or supplies which have disrupted immunization services.
>
> " All countries should prepare and periodically review, as part of their immunization plans of action, a long range plan for the replacement of major equipment, including refrigeration and sterilization appliances, according to their projected useful life. This plan should be based on an inventory system which records the model, age and location of each item. Changes in the status of this inventory should be reported through the routine EPI reporting system."[12]

There has been little progress towards implementing these recommendations since they were made. Plans have been developed, however, for a basic system on which this monitoring could be established and maintained. Key indicators of equipment maintenance systems and transport management will be identified and monitored on a periodic basis.

TECHNET members have participated in the preparation of the following manuals which were available at the meeting: *Manage the Transport System for Health*, plus *Facilitator's Guide* and *Monitoring Vehicle Use—A Guide for Transport Officers.*

New emphasis has been placed on monitoring recurrent costs of fuel and transport, simultaneously with other aspects of logistics. The rationale for this change is that inadequate recurrent budgets seriously constrain efforts to improve and maintain immunization coverage. This applies particularly to budgets for supervision, outreach operations and the collection of supplies and vaccines.

A Quality, Cost and Inventory survey (QCI) was recently conducted in Peru. The objective was to establish baseline information on which to build a periodic reporting system. This information would be passed each six months from health establishment to provincial level, and annually to national level.

Within a period of 6 months, the Peru survey reached 63% of the 4,819 health establishments in the country. Data from the questionnaires was entered using EPI-Info v5.1 and analysed with an application operating under Foxpro v2.0.

Based on the data collected during the survey, CLM software will be used at provincial and national levels to produce logistics reports and manage vaccine and syringe stocks. This information will enable mangers to:

[12] EPI Programme Report 1992, page 60.

- Identify establishments with inadequate or excessive recurrent budgets, relative to their level of activity.
- Identify equipment and transport which is due for replacement.
- Monitor delays in repairing equipment and vehicles.
- Monitor the flow of vaccines and syringes in relation to the number of children immunized.

More than 30 surveyors and supervisors were required during the six month period and the cost of the survey has so far exceeded US $ 100,000. A sound basis for a logistics information and management system can be laid in this way and TECHNET considered that it would be more appropriate to implement it in countries with a strong managerial infrastructure.

The concept of collecting and analysing recurrent cost "drivers" in order to build more satisfactory budgets was generally commended by participants. It was agreed that the survey questionnaires could be shortened so that the analysis method could be broadly applied in any country. Equipment and transport inventories could be built on a district basis, rather than institution by institution. This would reduce the complexity of maintenance and allow logistics quality to be assessed by a sample survey rather than by visiting 100% of the health institutions.

RECOMMENDATION

- **The methodology and software of QCI surveys should be made available for distribution in English, French and Spanish by the next TECHNET meeting.**

5.0 LOGISTIC PRIORITIES IN EASTERN EUROPE

5.1 Newly Independent States (NIS)

The soaring cost of vaccine which accompanied the break-up of the Soviet Union was the greatest shock to immunization services in the NIS. Vaccine prices rose by 570% in 1992 and a staggering 6250% in 1993. Cost increases and major reductions in the shipping of vaccine from Russia resulted in three out of the five Republics receiving less than 30% of their vaccine needs by June 1993. Obtaining vaccine supplies, therefore, heads the list of priority objectives in the NIS.

NIS PRIORITY OBJECTIVES[13]

Secure supplies of vaccine by:

- Providing donor support
- Improving or restarting local manufacture
- Setting up revolving funds
- Arranging credits and loans

Improve cold chain systems by:

- Providing new equipment
- Upgrading existing equipment
- Setting up maintenance systems
- Training health staff and technicians

Revise immunization policy and practice by:

- Providing immunization policy seminars
- Training health staff
- Shortening and simplifying the immunization schedule
- Giving priority to children of 0-1 years
- Reducing contraindications
- Reducing vaccine wastage

Improve operational management by:

- Joint ministry of health and donor planning
- Developing Programme components
- Training operational managers
- Rationalizing facility network
- Improving efficiency and reducing waste

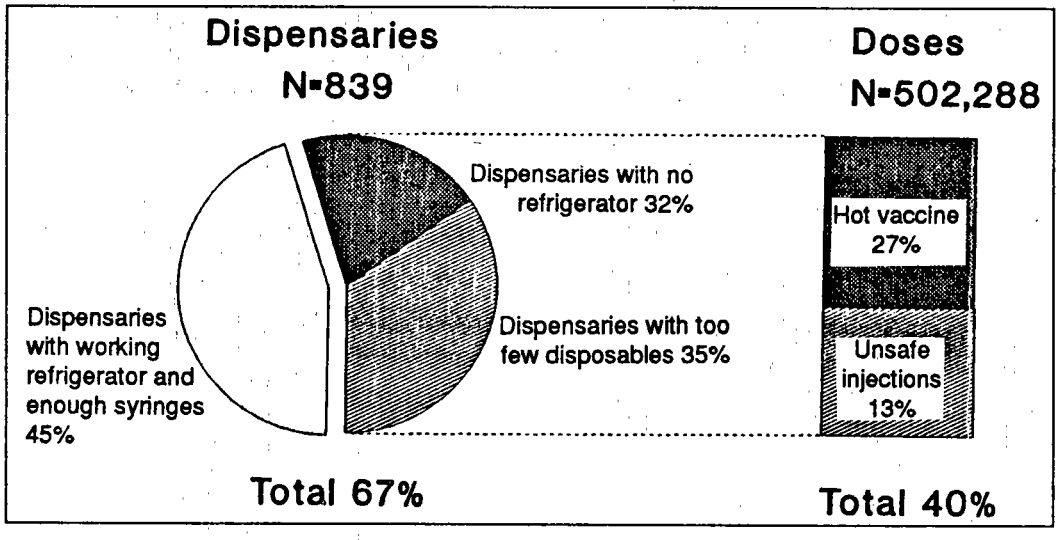
Major problems exist at several levels. First, the vaccine supply system collapsed then, with weak and poorly controlled cold chains, the national distribution systems also collapsed. Second, a remarkable lack of management and decision-making expertize within the public health system paralysed progress. Third, crippling debt coupled with heavy inflation de-stabilized the economy and brought services, including immunization, to a standstill.

[13] Gordon Larsen , Basics, USA: Presentation, TECHNET meeting 1994.

5.2 Eastern European countries

Eastern European countries share the weaknesses of health management which are evident in the NIS. They also have many of the same cold chain and vaccine distribution problems. The most striking issue raised during the presentation on Eastern Europe was, however, the danger posed by unsafe injection practices and inadequate disposal of contaminated injection equipment.

Figure 4: Useless vaccine or unsafe injection[14]



An excessive number of injections is given to children unnecessarily. Due to chronic shortages of injection and sterilization equipment, a great proportion of the injections are unsafe. These factors, combined with information on the standard of cold chain protection for vaccine, indicate that almost half the health establishments surveyed were giving unsafe injections and/or using vaccine with doubtful potency (due to heat exposure)[15].

The first priority for both the NIS and Eastern European countries has been to establish clear plans of action based on sound national immunization policies. However, it is evident that the current level of technical assistance which is available to these countries is insufficient to assure that plans are followed up and that the necessary external funds will continue to flow and be spent wisely.

The problem of vaccines freezing in the cold chain during cold times of the year in the NIS and Eastern Europe was discussed. Few options exist to protect vaccine in areas where the ambient temperatures drop to sub-zero levels. Research is needed on how best to use or modify existing refrigerators, cold rooms and cold boxes to protect vaccine as long as possible in very cold ambient temperatures.

RECOMMENDATIONS

- **Develop the necessary methods and equipment modifications to ensure that cold room, refrigerator and cold box temperatures do not fall below zero at the coldest ambient temperatures experienced in this Region.**
- **The TECHNET Secretariat to act as ombudsman in contacting the relevant donor agencies to prevent the frequent recurrence of problems encountered with the provision of vaccines and supplies by donors.**

[14] Battersby A: Overhead presentation (Figure 14), TECHNET meeting 1994.

[15] Ministry of Health, Romania/UNICEF Facilities Survey, conducted by Anthony Battersby, 1992-1993.

6.0 EQUIPMENT FOR IMMUNIZATION SERVICES

6.1 Domestic refrigerators

Domestic refrigerators are not suitable for the storage of vaccines. Their main weaknesses include the following:

- Insulation is thin so holdover time in case of power failure is short.
- Compartments for eggs, butter and bottles in the door cannot be used for vaccines as the door area often has higher temperatures (due to thin insulation and door opening).
- One-door refrigerators have a small freezer compartment which is not independent of the rest of the appliance; the temperature of the vaccine load consequently rises dramatically when icepacks are introduced for freezing.
- Thermal inertia is poor and temperatures vary considerably during day/night cycles.
- The vegetable compartment is not suitable for the storage of vaccines.

Many countries continue to purchase locally manufactured domestic refrigerators for their immunization programmes—China, for instance, uses over 50,000 domestic refrigerators, the Philippines 3,000 and Pakistan 5,000. They are either unwilling or unable to purchase large quantities of imported refrigerators specifically designed for vaccine storage. Research has, therefore, been conducted over the past few years to identify and test simple low cost ways to upgrade domestic refrigerators.

The *Universidad del Valle* in Colombia and the Murdoch University Energy Research Institute in Australia have developed and tested different types of upgrade kits which have also been field tested in Albania Colombia, Philippines and Thailand. The results of these tests are outlined below:

- **The simplest modification** consists in (i) placing loads of water (icepacks or water bottles) at the bottom and top of the refrigeration compartment and (ii) increasing the insulation of the door by filling all holes and compartments with styrofoam or any other type of insulating material. This improves the performance of the appliance by ensuring better thermal inertia and a longer holdover time. It is not, however, completely satisfactory. The vaccines cannot be maintained within a safe interval when the ambient temperature fluctuates rapidly as, for example, with day/night variations.
- **A more "sophisticated" modification** consists of a metal box fitted inside the refrigerator. This was found to be very successful during recent laboratory tests at Univalle and has been implemented on 300 domestic refrigerators in Albania. A conversion manual which describes the procedure is available from WHO/EPI, Geneva[16].

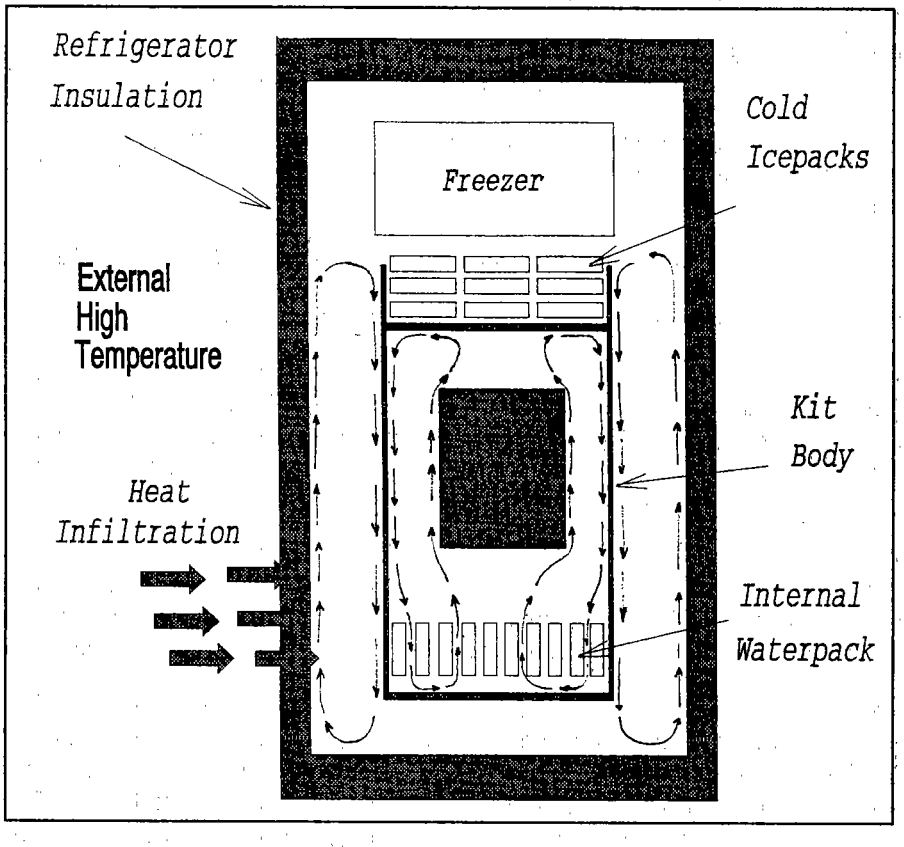
An efficiently managed programme with well trained personnel and a reliable electricity supply can, however, overcome the weaknesses of domestic refrigerators to a certain extent. In Morocco, where the rotation rate of vaccine is fast, the vaccines are not at risk in spite of minor breaks in the cold chain. This is because the vaccine is used rapidly and is seldom stored for more than a month. The refrigerator doors and vegetable compartments are loaded with bottles of water to increase the inertia and holdover time of the appliance and the staff know what to do in case of power failure.

[16] Herrera C, Rosillo M (Universidad del Valle, Cali, Colombia): Modification kit for the storage of vaccines in domestic refrigerators, TECHNET/GPV/94.14. (To be reproduced as document WHO/EPI/LHIS/94.4)

While no universal solution can be proposed, sufficient information is now available to encourage countries to:

- Assess the current risks of using domestic refrigerators (a field trial protocol for this purpose, based on the use of small data loggers, is available from WHO/EPI/Geneva).
- Select one of the above methods to upgrade existing domestic refrigerators.

Figure 5: Heat transfer patterns with metal box fitted in cabinet of domestic refrigerator



The current *Product Information Sheets* do not include any small compression refrigerators designed for use in urban areas.

RECOMMENDATIONS

- **Modify all domestic refrigerators used in immunization services to make them more suitable for vaccine storage. If modification is not cost effective, replace domestic refrigerators with approved vaccine storage models.**
- **Make data from laboratory tests and field trials on modified refrigerators available to all countries which use domestic refrigerators. Produce a manual with guidelines on modification options for distribution by the end of 1994.**
- **Prepare specifications for compression-type refrigerators for small health centres in tropical climates. Approach industry about manufacturing such refrigerators.**

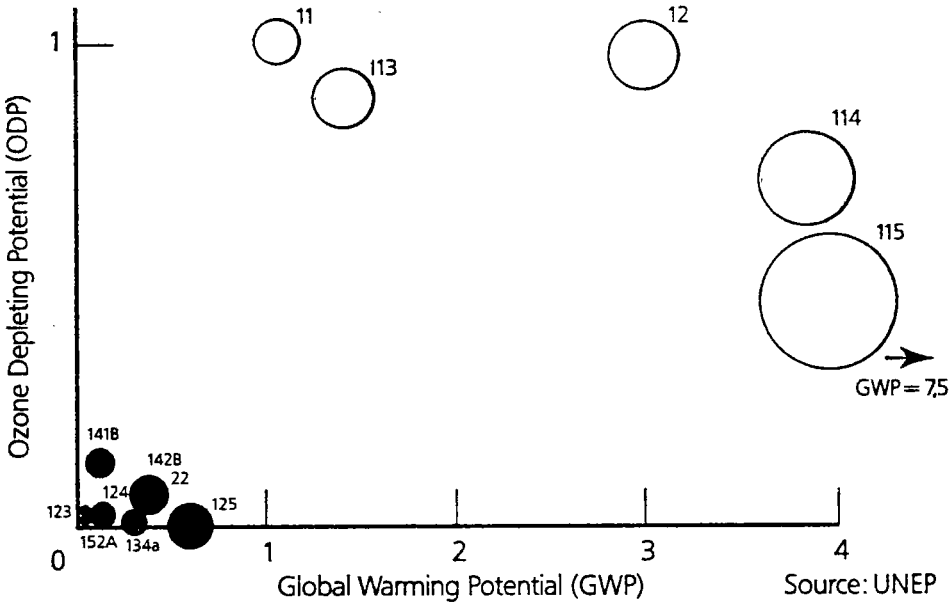
6.2 Choloroflurocarbons (CFCs)

6.2.1 Background

CFCs contribute to the depletion of the ozone layer of the atmosphere and global warming. They are, therefore, banned and the Montreal Protocol has established the following deadlines for implementation of the ban:

1 January 1995 : Ban of CFCs in all European Union Countries
1 January 1996 : Ban of CFCs in all industrialised countries
1 January 1999 : Ban in developing countries

Figure 6: HCFCs and HFCs address both ozone depletion and global warming concerns[17]



The large clear circles at the top right of the figure show the relatively large ozone depleting and global warming potentials of the CFCs. The small dark shaded circles at the bottom left show the significantly reduced potentials of HCFCs and HFCs. The area of each circle is proportional to the atmospheric lifetime of the compound. Note: CFC11 is the reference compound and hence has an ODP and GWP of 1.

6.2.2 Replacement of current products

The major CFCs currently used in cold chain equipment are R12 (in refrigeration circuits) and R11 (in insulation of refrigerators and cold boxes). Replacements for these products have been identified and tested by the refrigeration industry. No consensus has yet been reached on a standard replacement:

[17] Pamphlet: Vestfrost and the Environment -- CFC-free.

- **Insulation—Replacement for R11:** The current tendency in industry is to substitute cyclopentane (C5H10) as a foaming agent. Vestfrost and Electrolux have already introduced it in their production lines.

  Cyclopentane does not contribute at all to the depletion of the ozone layer and has a very low global warming potential (GWP). It is, however, highly flammable and requires strict safety procedures during production.

  Another product, HCFC 141b, is being used by manufacturers, including some Electrolux factories. It is, however, not considered as a long term solution and will be phased out by the year 2016 or, in some countries, earlier (by the year 2003 in the USA).

- **Refrigerant—Replacement for R12:** Until quite recently R134a (ODP:0 , GWP:0.24-0.29) was considered to be *the* perfect replacement for R12. However, under pressure from environmentalist groups, the German market is now lobbying for the use of R600 (isobutane). R600 is totally harmless to the environment, in spite of being highly flammable.

  Vestfrost has already invested large amounts of funds in the production of R600 refrigeration systems. Electrolux, which has already converted to R134a, does not envisage another change.

6.2.3 Impact on performance

- **Insulation**: Performance with cyclopentane and HCFC 141b has been measured theoretically (Lambda value) but the results do not reflect what would happen if these agents were used in a refrigerator cabinet. The tests were conducted on samples of naked foam which age differently from foam which is protected by a lining. It is only independent testing and monitoring of actual appliances that will provide an accurate indication of the change this insulation may have on performance. Preliminary data from manufacturers shows a 6.2% reduction in cold life with the new foam.

- **Refrigerant**: Initial test results showed a loss in efficiency when using R134a, but further improvements on the design of the evaporator seem to have overcome this problem. No independent test results are yet available.

  Performance of systems using R600 (isobutane) is not yet known.

6.2.4 Issues for concern

The introduction of new equipment in the field will generate a range of new technical and managerial problems, some of them general but others very specific to the respective country situation.

- The drop in performance of cold boxes, vaccine carriers and refrigerators through the use of less efficient foaming agents and refrigerants will have to be assessed independently. A programme of independent testing is being initiated by WHO/EPI/Geneva.
- The confusion over the choice of a replacement for R12 (R134a or R600 [isobutane]) makes it difficult to initiate activities at country level. Whereas R134a requires a new compressor and tools, isobutane may be interchangeable with R12.
- Countries receiving CFC-free equipment will need to keep a record of where the new equipment is located. This will avoid confusion when servicing is needed.
- Until the industry agrees on standard replacements and before the 1996 Montreal Protocol ban is enforced, it might be worthwhile to continue to supply R12-based equipment where feasible.
- The price of R12 will rise due to the ban and some countries may find it difficult to procure supplies for servicing purposes.

RECOMMENDATIONS

- **Start immediately with independent testing of all equipment produced with non-CFC foaming agents and refrigerants.**
- **Provide as much information as possible to countries and keep them informed of the situation.**
- **Delay the purchase of CFC-free equipment, where feasible, until the choice regarding replacement foaming and refrigerant agents is settled.**

6.3 Solar Energy and Health: Strategy for the Solar Decade

WHO/EPI presented a strategy for the use of solar energy in the rural health sector. This was previously presented at a high level experts meeting of the World Solar Summit at UNESCO in Paris in 1993[18].

Health and energy are critical and interdependent factors which determine the progress of rural development. Health interventions reach most communities in the world and have produced great improvements in child survival. Conventional energies, however, constitute a growing problem to the health infrastructure in terms of quality, availability, cost and affect on the environment. This problem affects not only the health sector but also agriculture and domestic life in rural areas—whether the country has a fast growing industry and an expanding urban population or whether it is extremely poor with a weak energy infrastructure and, coincidentally, the lowest child survival rates.

Renewable energies can meet rural health service and community needs with high quality energy at a low cost. They do not pollute the household environment and have been much studied in the last 20 years. Solar energy, in particular, has the flexibility to produce electricity, heat and cooling. The solar technology, furthermore, is backed by an established and experienced industry.

WHO's proposed strategy focuses on the health sector as an entry point for large scale introduction of solar energy technologies into the rural areas of developing countries.

- **In countries where insufficient rural cash economies curb the development of a commercial and domestic market**: international effort would be required to provide financial and technical support for the provision of solar energy to district level health and community services.
- **In countries with large rural populations and stronger rural economies**: promotion of local production and production-sharing should stimulate a commercial and domestic market.

The strategy includes co-ordination of international research to optimize the introduction, local production and market development of solar technologies and further improve their performance and reliability. The Netherlands has granted some funding to cover research but, as yet, no funds are available to establish a Task Force to implement the proposed global and Regional plans of action.

RECOMMENDATION

- **WHO/EPI to pursue the approach to an integrated use of solar energy in health and evaluate it in specific countries and areas.**

[18] The following documents concerning the Solar Summit presentation are available from WHO/EPI/Geneva: Report on Solar Energy and Health, WHO/EPI/LHIS/93.2; Working papers on Solar Energy and Health, WHO/EPI/LHIS/93.3; Conclusions and Recommendations on Solar Energy and Health from the World Solar Summit, UNESCO, Paris 1993, WHO/EPI/LHIS/93.4.

6.4 Equipment maintenance

Equipment maintenance systems set up in India and Ethiopia were described. One area of interest to TECHNET participants was the decision by the Ethiopian Ministry of Health to call on the private sector for some of its major equipment repairs, while continuing to rely on Ministry of Health cold chain technicians for simpler types of intervention.

It has been estimated that the amount of money required to train 14 regional technicians would cover the costs of repairing failed compression-type equipment in the private sector over a period of 8 years[19].

[19] Lainejoki M.: Cold Chain Maintenance and Repair Structure in Ethiopia, TECHNET/GPV/94.9

7.0 TRANSPORT FOR HEALTH

Africa, where most transport for health is provided by government ministries, was the main focus of presentations on transport management. In addition to a lack of sufficient resources, two major problems in the Region need to be tackled.

First, it is rare to find a country with a national transport policy which clearly covers standardization of vehicles, replacement, scrapping and allocation according to public health priorities. Where such policies *do* exist, they are rarely followed as donor preferences take precedence, resources are scarce and/or vehicle fleets are depleted.

Second, vehicles which are available at local level are often mis-managed, under-maintained and/or allocated without regard to public health priorities. Information which is generated at local level regarding cost, repair status and utilization is rarely analysed and/or used as a basis for making transport management decisions.

In spite of the size of the problems, however, the presentations were encouragingly optimistic about the future. At a national level, the main challenge is to obtain better collaboration between donors and governments in establishing and sustaining rational transport policies, particularly regarding the replacement of vehicles and their allocation according to public health priorities. At a local level, the main challenge is to provide the necessary skills and motivation for health managers to supervise the utilization and maintenance of vehicles, while also providing special training to vehicle drivers and motorcycle riders.

CRITICAL OBJECTIVES FOR BETTER TRANSPORT MANAGEMENT[20]

1. **Establish national policy**
   - Set criteria for vehicle replacement
   - Standardize models in fleet
     - Choose models according to performance record
     - Limit number of makes and models
2. **Decentralise transport management system**
   - Build a fleet inventory
   - Plan use of vehicles according to programme needs
   - Integrate activities
   - Monitor use and time off the road
   - Budget for transport needs

A national Transport for Health plan has been drawn up in Ghana. With the assistance of TRANSAID and Save the Children/UK, over US$ 200,000 has been spent on training regional/district managers and drivers, since January 1993.

Training alone, however, has not been enough. The driving force behind improvements to the system in Ghana has been a trial and error process of fact-finding, policy-setting, implementation of changes and meticulous monitoring of improvements in performance. Local solutions have been sought to local problems and care has been taken to incorporate the "ownership" incentive as a solution.

[20] Pierre L: Overhead presentation, TECHNET meeting 1994.

TRANSPORT IMPROVEMENT INITIATIVE -- MINISTRY OF HEALTH, GHANA[21]

Lessons learnt

- Support for change—"ownership"
- Local solutions for local problems
- Involvement of donors
- Management capacity
- Allocation of responsibility
- Integration with health care
- Need for total package

Project stages

- Fact finding
- Policy development
- Implementation of management system
- Improvement of performance

Principles

- Transport exists to support health care
- Transport allocation to be determined by health care priorities
- Effective management requires good data

RECOMMENDATIONS

- **By the end of 1997, all countries to establish the necessary inventories of national transport resources. Each inventory to reflect standard minimum information, as included on sample form in Annex 5.**
- **TECHNET to prepare a guide on the development of a national transport policy for health by the end of 1994.**
- **TECHNET to support the training and follow-up which is necessary for successful implementation of a motorcycle fleet.**

[21] Nancollas S, Overhead presentation, TECHNET meeting 1994.

8.0 RESEARCH AND DEVELOPMENT

8.1 TECHNOLOGY INTRODUCTION PANEL (TIP)

In 1988 UNICEF and USAID, with the participation of WHO, established the Technology Introduction Panel (TIP) to review the development and introduction of new technologies into UNICEF programmes. A WHO/UNICEF TIP Sub-Committee was established in 1994 to meet the need for more systematic co-ordination between the new EPI Unit of UNICEF, Copenhagen and the EPI Cold Chain group of WHO. This Sub-Committee will meet on a quarterly basis to plan and manage the introduction of new technologies into immunization programmes.

The success of major public health programmes is heavily dependent on the systematic introduction of new and modified technologies for different health interventions. The substance of the technology may vary, but the process by which it should be introduced is essentially the same.

The critical requirement at each stage is an objective evaluation of the technology, based on its impact on public health, the economics and the practicalities of its use. The process is thus endorsed or halted at each stage, according to the best currently available evidence.

PROCESS OF INTRODUCING A NEW TECHNOLOGY[22]

Stage 1 -- Recognition and definition of need:

Anyone can recognize the need for a technology or the opportunity to apply a new or improved technology for the benefit of a health programme. The initiative may come from an inventor, industry, field personnel or anyone in close contact with the programme. The critical success factor is that the need is defined with respect to:

- Impact on public health goals
- Expectation of a certain market
- Feasibility of production
- Financing
- Development of the technology
- Donor purchasing
- Sustained government purchasing
- Logistic burden in terms of maintenance, distribution and training
- Forecasting price and availability
- Projected lifetime and replacement
- Performance specification of the product

Research in each of these aspects is made available to a panel which makes the decision on whether to support further development of the technology in some way.

Stage 2 -- Product development:

The product development stage involves product engineers, testing agencies and experts in marketing and the economics of production. Each product requires:

- A product engineering specification, including definition of quality standards and, for international markets, packaging for shipping.
- Prototype testing: performance, safety and endurance both in the laboratory and the field.
- A marketing strategy developed on the basis of studies in key 'target' countries and defined in terms of the role of WHO, UNICEF, governments and the private sector.

[22] As defined during the TIP Sub-Committee's first meeting.

- A purchasing and production strategy oriented towards the maximum autonomy of local production, consistent with price and quality on the international market.
- A budget plan for the contracting, travel and other costs of marketing, implementation and evaluation of the product in use.
- Plans, budgets and the results of tests and trials are made available to a panel which makes the decision to support, in any way, the implementation of the technology into widespread use.

Stage 3 -- Implementation:

This is an execution phase, following closely the marketing and other plans made in the preceding phase. During this stage the logistics of reception in the receiving country, the distribution and the training are managed.

Any problems which are encountered are promptly fed back to WHO and UNICEF and the response is immediate. If implementation plans prove to be impossible to follow, they are either modified or the process of implementation is temporarily halted to enable a more general re-assessment to be made.

Stage 4 -- Evaluation:

The experience of WHO and UNICEF to date is that post-introduction evaluation of technologies must be pro-active and may be combined with managerial reviews of the public health programme. It requires a protocol for evaluation and involves visits to countries by an evaluator or an evaluation team. The manufacturer of the product must be given a role in this phase.

A valuable support to these activities is to network with field staff who keep maintenance or other records of the product in use in the countries. Field staff cannot, however, be relied upon as the sole means of evaluation of a product.

8.2. EQUIPMENT DEVELOPMENT

8.2.1. Battery-free solar refrigerator

For the past 4 years, research on battery-free refrigerators has continued with collaboration between manufacturers, UNICEF and WHO. Prototype Vestfrost refrigerators have been tested in India, Thailand and Colombia. Results so far are promising but have not yet met expectations.

It is felt that further research is required and that, eventually, standard performance specifications will have to be relaxed if battery-free appliances are to be included in the *Product Information Sheets*. Vaccine storage temperatures, in particular, are likely to exceed acceptable limits. The use of vaccine vial monitors (VVMs) should facilitate faster introduction of this type of refrigerator.

8.2.2. Instant cooling unit (ICU)

Electrolux has conducted some research on a new product based on the concept of an "instant cooling unit " in the form of a plate using zeolite.

The plate can be "charged" over a 3-hour period with a heat source which provides heat at 180°C. Once the plate is charged, a valve is closed and the plate keeps the charge indefinitely. When refrigeration is needed, the valve is opened and the plate starts refrigerating.

Initial tests conducted by the manufacturer on a plate designed to fit the RCW 25 cold box showed that temperatures between 0 and 8°C could be maintained for a week at an ambient temperature of 32°C.

This product generated a lot of enthusiasm among participants and several members offered to conduct field trials as soon as samples can be made available. It has tremendous potential for the cold chain in areas such as:

- **Passive refrigeration:** The ICU could replace kerosene refrigerators at health centre level, depending on its cost and the availability of an appropriate energy source for recharging. The lack of ice-making capacity would not be a problem if smaller plates were designed for vaccine carriers.
- **Cold boxes and vaccine carriers for transport:** The plates could be charged and stocked at ambient temperatures until they are needed.
- **In emergency situations**, such as refugee camps.

8.2.3. Micro hydro-electricity

In some areas, micro hydro-electricity offers the potential to supply low cost electricity to health centres. *Rainbow Power* in Australia has accumulated substantial experience in this area.

The installation of a micro hydro-electric generator, however, should not be conceived as a project for cold chain equipment only. It is, rather, a low recurrent cost infrastructure project. The power provided by a small turbine could meet the needs of a health centre and beyond, contributing thereby to the development of the rural community. It could provide electricity for cold chain equipment as well as for services such as lighting, communications, television, video and possibly small workshop tools.

The use of this technology would increase the range of alternative energy sources offered to countries and donors to meet the needs of primary health care in the rural areas of developing countries, complementing the use of solar electricity and/or replacing it in certain areas.

A hydro-electric system, however, cannot be installed anywhere. It needs a reliable stream with a minimum head of 15 m. Mountainous or hilly areas in many countries with good rivers, such as China, Indonesia, Nepal, Papua New Guinea and Southern African, could benefit from this technology.

Rainbow Power has produced an instruction manual which provides guidance on how to measure heads and water flow in simple ways[23]. These techniques can be used in the field with unsophisticated equipment to determine whether a site is suitable. Pilot projects may be conducted in Papua New Guinea in the near future.

8.2.4. Thermopak

A new opening procedure for the Thermopak container was demonstrated. Although progress has been made, the opening procedure is still difficult. The manufacturer's non-verbal instructions were found to be inadequate.

No progress has been made in defining where this super-insulated container would best fit into immunization activities. Vaccines for use in Somalia were purchased in Thermopak containers but it appears that they never reached the field.

8.2.5. Miscellaneous issues

- User and maintenance manuals for newly introduced equipment are often found to be inadequate and TECHNET recommends that WHO/EPI should systematically review manufacturers' manuals.
- The definition of the hold-over time for ice-lining refrigerators is inadequate as the data measured in the laboratory does not reflect field conditions. TECHNET recommends that the holdover time

[23] Energy from Nature, Renewable Energy Handbook, 7th edition, compiled by Peter Pedals.

be defined preferably as a range and measured in the poorest and best conditions, rather than given as an absolute value.

- The need to develop a small "refrigerator" for vaccine storage in cold climates was mentioned several times in relation to immunization programmes in Eastern European countries.

RECOMMENDATIONS

- **Battery-free solar refrigerator—complete trials by the end of 1995.**
- **Zeolite—form a TECHNET sub-committee to liaise with the manufacturer and assess the technical specifications of the new zeolite refrigerated plate system. Initiate laboratory tests by the end of 1994 and conduct field trials during 1995.**

ANNEX 1

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ANNEX 2

AGENDA

Chairman: Mr Allan Bass

TUESDAY, 31 MAY

08.30 Welcome and introductions
08.40 The structure of the Global Programme for Vaccines and Immunization -- Dr Ciro de Quadros, WHO/AMRO GPV Regional Advisor
08.50 Global overview of current priorities in GPV logistics -- John Lloyd
09.00 WHO and UNICEF Regional perspectives, objectives, strategies and concerns
09.30 Presentation of the agenda and objectives for the 1994 TECHNET meeting
09.45 Discussion
10.30 *Coffee*
11.00 **Session 1: Vaccine utilization & immunization strategy**
Plenary on Vaccines:
Vaccine forecasting, vial indicators and polio update -- Peter Evans
Vaccine utilization:
- Gambia -- Jobe Kebba
- Tanzania -- Claes Broms

TT freezing problems -- John Lloyd
11.45 Discussion
12.30 *Lunch*
14.00 **Session 2: Safety of injections -- the risks and the choices**
Regional plan of action -- Chris Maher
Report on injections in NIS -- Anthony Battersby
Eliminating unsafe injections: Yamoussoukro Declaration -- John Lloyd
14.45 Discussion

15.30 *Break*
16.00 **Session 3: Plenary on special immunization operations**
Planning logistics of national immunization days -- Chris Maher, Peter Carrasco,
Mojtaba Haghgou, Allan Bass
Immunization strategy in areas of armed conflict -- Nasim Ahmed
16.45 Discussion

WEDNESDAY, 1 JUNE

08.30 Introduction to Group Work -- Chairman
08.45 Technical Group Work: Sessions 1, 2 and 3:
Vaccines, Injections and Immunization Strategy
10.30 *Coffee*
11.00 Group work (continued)
12.30 *Lunch*
14.00 Group presentations and plenary discussion
15.30 *Break*
16.00 **Session 4: Monitoring and evaluating immunization logistics**
Quality, Cost and Inventory Survey; Peru -- Peter Carrasco and John Lloyd
Monitoring transport -- Lionel Pierre
Update on senior logistics planning workshop -- John Lloyd
CLM Software - Thom Graziano
16.45 Discussion

THURSDAY, 2 JUNE

08.30 **Session 5: Logistic Priorities in the NIS and Eastern Europe**
NIS --Gordon Larsen
Eastern Europe --Anthony Battersby
09.00 Discussion -- coordination of efforts
09.30 **Session 6: Refrigeration and icepack freezing equipment**
Domestic refrigerator update:
Laboratory report -- M. Rosillo
WPRO -- Chris Maher
Global overview -- Michel Zaffran
10.00 Discussion
10.30 *Coffee*
11.00 CFC-free refrigeration for the cold chain
Global policy -- Michel Zaffran
Cold chain maintenance and repair structure
Ethiopia -- Mikko Lainejoki
UNICEF experience in India -- A. L. Bhuyan
Other equipment issues
11.45 Discussion
12.30 *Lunch*
14.00 Solar energy -- Strategy for the Global Solar Decade -- Update by Michel Zaffran
14.30 Discussion
15.30 *Break*

16.00 **Session 7: Research and development**

WHO/UNICEF Technology Introduction Panel (TIP) -- John Lloyd
Battery-free solar refrigerator -- A. L. Bhuyan
Solar research issues -- Michel Zaffran
Mini-hydro electricity for health -- Allan Bass
Update on Thermopak research -- SIDA/Soren Spanner

16.45 Discussion

FRIDAY, 3 JUNE

8.30 Technical Group work -- Sessions 6 and 7: Refrigeration; Research and Development
10.30 *Coffee*
11.00 Group work (continued)
11.30 Group presentations and plenary discussion
12.30 *Lunch*
14.00 Internet and Technet communications:

Internet -- Allan Bass and Michel Zaffran
Technet conferencing -- John Lloyd

14.15 Discussion
15.30 *Break*
16.00 **Session 8: Regional working groups to develop plans of action**
Based on findings of technical working groups, plans of actions to be developed in the following Regional groups:

South East Asia and Eastern Mediterranean
The Americas, Europe and the NIS
Africa
Western Pacific

SATURDAY, 4 JUNE

08.30 Group presentations and discussion
09.30 **Session 9: Plan national, Regional and global monitoring of progress**
10.30 *Coffee*
11.00 Final reading of conclusions and recommendations
12.00 Closing

ANNEX 3

LIST OF DOCUMENTS

TITLE	AUTHOR	Code TECHNET /GPV
Child immunization before and after the collapse of the Soviet Union	Pott, J.	94.01
Tanzania cold chain monitoring	Broms, C.	94.02
Vaccine utilization: advice for EPI programme managers	Jobe, K.	94.03
The cold chain and medical logistics systems in Papua New Guinea	Bass, A.	94.04
Logistics aspects of the poliomyelitis eradication initiative -- National ImmunizationDays	Maher, C.	94.05
Immunization in areas of conflict	Ahmed, N.	94.06
Elimination of incorrect EPI sterilization and injection practices in the Western Pacific Region	WPRO	94.07
Riders for health, three successful projects in Southern Africa	Coleman, B. & A.	94.08
Cold chain maintenance and repair structure in Ethiopia	Lainejoki, M.	94.09
Indian cold chain topics	Bhuyan, A. L.	94.10
Solar refrigeration system - without battery	Bhuyan, A. L.	94.11
Technology Introduction Panel, UNICEF/WHO Sub-Committee -- Meeting Records	UNICEF/WHO	94.12

LIST OF DOCUMENTS *(continued)*

TITLE	AUTHOR	Code TECHNET /GPV
Hydro-power for health	Lambert, D.	94.13
Modification kit for the storage of vaccines in domestic refrigerators	Herrera, C. & Rosillo, M.	94.14

ANNEX 4

PLANS OF ACTIVITIES

PLANS FOR	SUBMITTED BY
• AFR	Musoni Mpayamaguru
Ethiopia	Mikko Lainejoki
Tanzania	C. Broms/K. Kagaruki
• AMR	Peter Carrasco
• WPR	Chris Maher
Papua New Guinea	Allan Bass
• WHO/EPI/Geneva	John Lloyd/Michel Zaffran

Note:

- Priority is rated on a scale from 1 for high priority to 3 for lower priority.
- All cost estimates are given in US dollars.

PLANS OF ACTION FOR AFR --- SUBMITTED BY MUSONI MPAYAMAGURU

OBJECTIVE: **1. Assure 100% safe injections during all immunization sessions, especially during mass immunization activities or during immunization days by the year 2000**

STRATEGY :
- Ensure the use of efficient sterilization equipment, namely: steam sterilizers together with, TST sterilization indicators, coupled with strict respect of recommended sterilization time.
- Ensure sufficient supplies of sterile syringes and needles at all immunization sessions.
- Use disposable (auto-destruct if possible) syringes and needles where sterilization is difficult or impossible.
- Ensure continuity of supplies of immunization equipment and materials.
- Ensure staff training in the importance of assuring safe injection at all times.

YEAR/S : 1994/1995

Activities related to Objective 1	Responsibility of	Time frame	Cost est./ Donors	Priority	Indicator
1.1 Through official channels use convincing facts to get political commitment where it has not yet been obtained.	AFRO/PM3 through WRs	By 01/95	--	1	% of countries having an injection policy by June 1995 % of countries assuring continuity of sufficient supplies of injection materials by June 1995
1.2 Through Regional Directors' meetings with WHO, UNICEF and NGOs, obtain donors' commitment to support the initiative and to give financial aid to countries,	AFRO/PM3	By 01/95	WHO, UNICEF and NGO's	1	The level of commitment obtained from each donor
1.3 Inform and mobilize National EPI Managers during annual Sub-Regional Managers' Meetings (2 meetings in 1994) 1.4 Inform all Ministries of Health via official channels	AFRO/PM3	By 01/95	-	1	By June 1995: % of countries having an injection policy % of countries assuring continuity of sufficient supplies of injection materials, including TSTs

PLANS OF ACTION FOR AFR (*continued*)

Activities related to Objective 1	Responsibility of	Time frame	Cost est./ Donors	Priority	Indicator
1.5 Organize country level EPI donors meetings with responsible nationals and WHO	AFRO/PM3 and CDI	05/94 to 06/95	-		% of countries having an immunization policy by June 1995. % of countries ensuring sufficient supplies of injection materials by June 1995.
1.6 Organize district and peripheral health staff workshops on sterilization/multi-use syringes/single-use disposable syringes (in 46 countries) **NOTE**: For purposes of economy, workshops on sterilization should: - be combined with disease surveillance workshops, where possible, and - include information on vaccine vial monitors, jet injectors and any other subjects relevant to the topic.	AFRO, WRs, countries and local EPI donors	04/94 to 12/95	$2,500,000 UNICEF, WHO & NGOs	1	% of immunization centres with staff trained in this area. TST sterilization indicators are in use for all steam sterilizers at each health centre by the year 2000. % of health centres reporting "0" abscesses and/or a decrease in post-injection abscesses by June 1995. Availability of incinerator-boxes for single-use syringes and needles are in use or there is supervised/systematic destruction of syringes and needles at all health centres by year 2000.
1.7 Through the annual EPI Managers' Sub-Regional Meetings, promote the use of new low workload jet injectors as soon as tests prove them to be cross-infection free.	AFRO/PM3 CDI and WRs	During 1995		1	% of countries interested in the use of the jet injectors.
1.8 Encourage technical assistance to countries of the Region -- at least one country per epidemiological block (3 countries)	AFRO/PM3/CDI	During 1994/95	$ 60,000 WHO	1	Enough countries willing to conduct field tests of new equipment when needed.
SUB-TOTAL FOR OBJECTIVE 1			**$2,560,000**		

PLANS OF ACTION FOR AFR (*continued*)

OBJECTIVE : **2. Encourage countries to implement immunization acceleration strategies which will increase immunization coverage and support the implementation of the initiatives for eradication of Polio and Yellow Fever by the year 2000.**
Ensure the availability of sufficient cold chain and logistics equipment and materials to support the acceleration activities.

STRATEGY:
- Mass immunization campaigns for the control of measles, NNT and the eradication of Polio and Yellow Fever
- National Immunization Days
- Supplementary immunization and mop-up activities for the eradication of the wild polio virus
- Ensure participation of the country donors in the planning meetings and obtain their commitment to support the acceleration activities.

YEAR/S: 1994/1995

Activities related to Objective 2	Responsibility of	Time frame	Cost est./ donors	Priority	Indicator
2.1 Provide technical assistance to countries for planning mass and/or supplementary immunization activities, if so requested by concerned governments (20 countries)	AFRO	1994/1995	$ 80,000 WHO		% of countries planning acceleration of immunization activities -- mass immunization campaigns or NIDs -- by June 1995.
SUB TOTAL FOR OBJECTIVE 2			**$ 80,000**		

PLANS OF ACTION FOR AFR (*continued*)

OBJECTIVE : **3. Promote the use of the vaccine vial monitor (VVM) to ensure that potent vaccines are administered and reduce wastage. Encourage countries to revise the open-vial policy for vaccine, in accordance with more stable vaccines. Promote the use of Commodity and Logistics Management software (CLM) for inventory control.**

STRATEGY :
- Through annual sub-regional EPI managers meetings.
- Writing to Ministries of Health through official channels to obtain their commitment.

YEAR/S : 1994/1995

Activities related to Objective 3	Responsibility of	Time frame	Cost est. /donors	Priority	Indicator
3.1 Motivate EPI national managers during their annual Sub-Regional Meeting. 3.2 Encourage countries to organize staff training on how to handle vials with VVMs and to increase their use in the programme. The training should be combined with sterilization workshop. (in 46 countries)	WHO/UNICEF	1994/1995	WHO/ UNICEF		% of countries using vaccine with VVMs by June 1995.
3.3 Encourage countries to organize refresher training for senior health staff, concerning the policy change (46 countries) *(The training should include the new policy on injection safety, injection materials, vaccines and vaccine vial monitors.)*	WHO/UNICEF	1994/1995	$ 230,000 WHO/ UNICEF		% of countries with revised policy on the use of opened vaccine vials by June 1995.

PLANS OF ACTION FOR AFR (*continued*)

Activities related to Objective 3	Responsibility of	Time frame	Cost est. /donors	Priority	Indicator
3.4 Inform national programme managers through WRs and the annual Sub-Regional Managers' Meeting about the use of CLM software. 3.5 Inform countries through WRs and Managers Meetings of available CLM training and assist them to identify suitable participants	WHO/WRs	1994/1995	AFRO/ WRs		% of countries with trained CLM users by December 1995. % of countries with inventory of various EPI commodities and equipment by December 1995.
3.6 Organize 4 workshops for 46 countries		During 1995	$ 230,000		
SUB-TOTAL FOR OBJECTIVE 3			**$ 460,000**		

OBJECTIVE: **4. Encourage countries to make a policy for EPI transport equipment.**

STRATEGY :
- Through annual sub-regional EPI Managers meetings and meetings with local EPI donors
- Conduct inter-country training for CLM users (3 week inter-country training course)

YEAR/S : 1994/1995

Activities related to Objective 4	Responsibility of	Time frame	Cost est. /donors	Priority	Indicator
4.1 Inform countries through WRs and National EPI Managers at their annual Sub-Regional meetings. 4.2 Provide technical assistance to countries at their request (20 countries)	AFRO/WRs	1994/1995	$ 100,000 WHO		% of countries with transport policy by June 1995.
SUB-TOTAL FOR OBJECTIVE 4			**$ 100,000**		

PLANS OF ACTION FOR AFR (*continued*)

OBJECTIVE : **5. Encourage countries to use WHO/UNICEF recommended cold chain equipment**
Discourage countries from using domestic refrigerators for the storage of EPI vaccines, unless the refrigerators are properly upgraded to meet performance specifications.

STRATEGY : • Through annual sub-regional EPI Managers' meetings and meetings with local EPI donors

YEAR/S : 1994/1995

Activities related to Objective 5	Responsibility of	Time frame	Cost est./ Donors	Priority	Indicator
5.1 Inform countries through WRs and National EPI Managers through their annual Sub-Regional Meetings.	AFRO/WRs	1994/1995		1	"O" countries using non-upgraded domestic refrigerators by the year 2000.
5.2 Liaise with local refrigerator manufacturers to advise them of the minimum recommended standards for a vaccine refrigerator (Consultants' cost)	WHO/HQ		$ 20,000 WHO/HQ	1	
SUB-TOTAL FOR OBJECTIVE 5			**$ 20,000**		
GRAND TOTAL FOR OBJECTIVES			**$3,220,000**		

PLANS OF ACTION FOR ETHIOPIA --- SUBMITTED BY MIKKO LAENIJOKI

OBJECTIVE: **1. Eliminate incorrect EPI sterilization and injection practices by the year 2000.**
STRATEGY : --
YEAR/S : 1994/1995

Activities related to Objective 1	Responsibility of	Time frame	Estimated cost	Priority	Indicator
1.1 Carry out rapid assessments in sterilization practices in at least two major regions of Ethiopia (minimum population covered, 10 million). Determine future requirements regarding injection equipment and plan training needs accordingly.		06/94 to 12/94			
1.2 Order TST (Time/Steam/Temperature) indicator spots for routine use in all steam sterilizers at every health facility.		Order 08/94 Introduce: 11/94 to 01/95.			
1.3 Order incinerator boxes to be used together with auto-destruct and other disposable syringes.		Order 08/94 Introduce 11/94 to 01.95.			

PLANS OF ACTION FOR ETHIOPIA (*continued*)

OBJECTIVE: **2. Reduce vaccine wastage by 50% from 1994 levels by the end of 1995.**
STRATEGY : --
YEAR/S : 1994/1995

Activities related to Objective 2	Responsibility of	Time frame	Estimated cost	Priority	Indicator
2.1 Specify future vaccine orders with vaccine vial indicators.		10/94			
2.2 In collaboration with Ministry of Health, revise and introduce a new policy for discarding opened vials of vaccines.		02/95			

OBJECTIVE: **3. Introduce national immunization days (NIDs) in all populous regions to eradicate polio & eliminate measles by year 2000.**
STRATEGY : --
YEAR/S : 1994/1995

Activities related to Objective 3	Responsibility of	Time frame	Estimated cost	Priority	Indicator
3.1 In collaboration with Ministry of Health and Regional Health Bureau prepare Plan of Actions for NIDs to be conducted in 1995 in Regions 1, 3, 4, SEPRG and 14.		12/94			
3.2 Order necessary supplies for NIDs.		12/94			
3.3 Establish a Logistics Committee to plan resources and personnel for the NIDs by nominating one Logistics Officer from each above-mentioned Region. Monitor progress by arranging regular monthly meetings.					

PLANS OF ACTION FOR TANZANIA --- SUBMITTED BY CLAES BROMS AND K. KAGARUKI

OBJECTIVE: **1. Ensure safe and sterile injections; field test low workload jet injectors**
STRATEGY : --
YEAR/S : 1994 -- 1995 / onward

	Activities related to Objective 1	Responsibility of	Time frame	Estimated cost	Priority	Indicator
1.1	Complete analysis of TST spot data received from field since its introduction in August '93.	K. Kagaruki	08/94	-	1	Final analysis.
1.2	Continue procurement, distribution, use and analysis of TST spot data from all health units which provide EPI services.	Claes Broms/ K. Kagaruki	08/94 onward	$ 10,000 per annum	1	Updated TST spot status report every 6 months.
1.3	Assist in planning and commission study on injection safety in curative services, i.e. current practice of boiling: - availability of syringes - sterility practices - costs, i.e. kerosene use - use of disposables	Claes Broms	03/95	$ 10,000	2	Final report.
1.4	Update/revise EPI/MCH supervisory checklist with regard to injection safety.	K. Kagaruki	12/95	-	1	Supervisory report format updated.
1.5	Ensure effective reporting system for adverse reactions in place.	Claes Broms/ K. Kagaruki	12/94	-	2	Functional reporting.
1.6	Ensure follow-up and corrective action taken by EPI Regional and district supervisors in areas with poor TST spot performance.	Claes Broms/ K. Kagaruki	10/94 onward	-	1	Increased percentage of correct sterilization.

PLANS OF ACTION FOR TANZANIA (*continued*)

	Activities related to Objective 1	Responsibility of	Time frame	Estimated cost	Priority	Indicator
1.7	Ensure regular updating of EPI/MCH equipment inventory to ensure availability of sterilization equipment at all health units.	K. Kagaruki	10/94 onward	0	1	Timely and complete update of inventory.
1.8	Procure sterilizer rack suitable for sterilization of curative service syringes in EPI steam sterilizer and conduct pilot field trials.	Claes Broms	04/95	$ 2,000	2	Final field test report.
1.9	Procure low workload jet injectors available on market and conduct field trial in pilot areas.	Claes Broms/ K. Kagaruki	04/95	$ 10,000	1	Final field test report.
1.10	Procure auto-destruct disposable syringes and conduct field trial in pilot areas.	Claes Broms/ K. Kagaruki	04/95	$ 10,000	2	Final field test report.
1.11	Change national policy with regard to sharpening of needles.	K. Kagaruki	09/94	0	2	Policy change.
1.12	Review/revise EPI training materials as needed with regard to injection-related practices.	K. Kagaruki	12/94	0	2	Revised training material.
1.13	Sensitize and inform national authorities on current injection status and actively participate in discussion towards formulation of national policy on safe injections.	Claes Broms/ K. Kagaruki	08/94 onward	0	1	Formulation of national policy.

PLANS OF ACTION FOR TANZANIA (*continued*)

OBJECTIVE: **2. Improve vaccine utilization through:**
- **use of vaccine vial monitor (VVM)**
- **keeping opened vaccine vials for more than one day**
- **study on vaccine wastage versus session size and coverage.**

STRATEGY : --

YEARS : 1994 -- 1995 / onward

	Activities related to Objective 2	Responsibility of	Time frame	Estimated cost	Priority	Indicator
2.1	Include a specific request for vaccine vial monitors in all future vaccine orders for Tanzania.	Claes Broms	08/94 onward	?	1	Vaccine vial indicators supplied with all antigens.
2.2	Plan and include training material on interpretation and correct use of vaccine vial monitors in existing training courses for health staff at all levels.	K. Kagaruki	09/94 onward	0	1	Vaccine vial indicator training included in all EPI courses.
2.3	Prepare for national policy change by sensitizing national authorities through Tanzania EPI Technical Committee on implications and potential benefits of changing national policy on keeping vaccine vials open for more than one day.	Claes Broms/ K. Kagaruki	12/94	0	2	Topic discussed in Technical Committee.
2.4	Assist in planning and commission follow-up study on correlation between accessibility/availability of services with coverage/vaccine wastage.	Claes Broms	04/95	$ 10,000	2	Final report completed.

PLANS OF ACTION FOR TANZANIA (*continued*)

OBJECTIVE: **3. Monitor and evaluate immunization logistics and financing**
STRATEGY : --
YEAR/S : 1995

Activities related to Objective 3		Responsibility of	Time frame	Estimated cost	Priority	Indicator
3.1	Identify key performance indicators/threshold values and finalize system design and establishment of integrated computerized monitoring system for finance, stores, equipment inventory, transport and cold chain functions (using Navision software)	Claes Broms	06/95	$ 10,000	1	System fully operational.

PLANS OF ACTION FOR AMR -- SUBMITTED BY PETER CARRASCO

OBJECTIVE: **1. Safe disposal of single-use syringes; safe sterilization.**
STRATEGY : Document methods of disposal of single-use syringes and routinely make available TST indicators
YEARS : 1994/95

Activities related to Objective 1	Responsibility of	Time frame	Estimated cost	Priority	Indicator
1.1 Introduce use of TST indicator in countries that sterilize their EPI syringes and needles	AMRO/HQ	07/94 -- 12/95	$ 3,000	1	Limited quantities of TST indicators procured, distributed and evaluated in selected countries.
1.2 Document precise methods of disposal of single-use syringes	AMRO/HQ	07/94 -- 07/95	$ 5,000	1	Questionnaire on disposal of syringes prepared, distributed, returned and analysed.
1.3 Field test low workload jet injector in Brazil	GPV/Geneva and PAHO/Brazil	08 - 09/94	$ 5,000	1	Field trial in Brazil conducted and report circulated.

OBJECTIVE: **2. Assure that opened vials of vaccines are discarded before the vaccine loses potency**
STRATEGY : Introduce vaccine vial indicators on TT, DPT and DT vaccine.
YEARS : 1994 - 1996

Activities related to Objective 2	Responsibility of	Time frame	Estimated cost	Priority	Indicator
2.1 Circulate samples of vaccine vial monitor with costs and instructions on use to AMRO countries.	AMRO/HQ	07/94 -- 07/96	$ 5,000	2	Instructions and other information circulated to countries and responses analysed.
2.2 Request that 1995 EPI Revolving Fund tenders include vial monitors for EPI vaccines.	AMRO/HQ	06/95 -- 09/95	--	2	1996 EPI vaccines supplied with vaccine vial monitor.
2.3 Survey all countries to determine quantities of vaccine/number of sites where EPI vaccines will be taken out of cold chain.	AMRO/HQ	07/94 -- 12/95	$ 5,000	2	Circulation and analysis of results of questionnaire to investigate where and how much vaccine is likely to be taken out of the cold chain.

PLANS OF ACTION FOR AMR *(continued)*

OBJECTIVE: **3. Improve performance of domestic refrigerators for vaccine storage.**
STRATEGY : Encourage countries to retro-fit domestic refrigerators by distributing manual.
YEARS : 1994-1996

Activities related to Objective 3	Responsibility of	Time frame	Estimated cost	Priority	Indicator
3.1 Distribute either manual on modification kit for domestic refrigerators or manual on retro-fitting refrigerators with water bottles and foam.	AMRO/ UNIVALLE	07/94 -- 12/94	$ 200	1	Manual printed and distributed.
3.2 Distribute questionnaire to follow-up implementation of recommendations to retro-fit domestic refrigerators.	AMRO/HQ	12/94 -- 08/95	$ 200	1	Evaluation questionnaire on retro-fits for refrigerators circulated and the results analysed.
3.3 Advise all donor agencies on requirements to provide retro-fit kit for each domestic refrigerator donated or procured.	AMRO/HQ	07/94 - 12/94	$ 200	1	-

PLANS OF ACTION FOR WPR --- SUBMITTED BY CHRIS MAHER

OBJECTIVES: **1. Ensure that correct EPI sterilization and injection practices are achieved and maintained in all countries.**
2. Improve monitoring and management of cold chain and logistics systems in countries.

STRATEGY : -

YEARS : 1994 - 1995

Activities related to Objectives 1 & 2	Responsibility of	Time frame	Estimated cost	Priority	Indicator
1. Work with national staff to develop national plans of action for the elimination of incorrect EPI sterilization and injection practices in all countries in the Region.	WPRO EPI National EPI staff	until 12/95	-	1	% of countries in the Region with a national plan of action.
2. Conduct field trials of low workload jet injectors.	WPRO EPI National EPI staff	before 07/95		1	Completion of trial.
3. Produce manual for the modification of domestic refrigerators and promote modification.	WPRO EPI	before 07/95		1	% of countries (using domestic refrigerators for vaccine storage) which are implementing the manual guidelines to modify refrigerators.
4. Work with national staff to develop national cold chain plans in the countries of the Region.	WPRO EPI National staff	until 12/95		2	% of countries with a national cold chain plan.

PLANS OF ACTION FOR PAPUA NEW GUINEA --- SUBMITTED BY ALLAN BASS

OBJECTIVE: **Ensure that safe injections are provided by all health workers in Papua New Guinea by the year 2000.**
STRATEGY : Rapid introduction of steam sterilization of injection equipment at all levels of the health delivery system, supported by the provision of equipment, supplies and district level training and supervision.
YEARS : 1994 through 1999

Activities related to Objective	Responsibility of	Time frame	Estimated cost	Priority	Indicator
1. Develop and establish injection equipment standards.	PNG Department of Health	02/94 to 12/94	-	1	Standards agreed.
2. Procure sufficient sterilizers, injection equipment and TST indicators to enable the implementation of the standards.	PNG Dept. of Health, ADB, AIDAB	06/94 to 12/95	-	1	Equipment, syringes and indicators procured.
3. Prepare training materials.	PNG Dept. of Health, USAID, Child Survival Support Project	08/94 to 12/94	-	2	Video, module, flip chart, poster prepared.
4. Train supervisors/trainers.	ditto	08/94 to 12/94	-	2	Supervisors trained.
5. Conduct district level training and distribute equipment and supplies at training sessions. (Training will cover sterilization, injection practices, supply management and supervision.)	PNG Dept. of Health, USAID Child Survival Support Project, ADB HRD Project	08/94 to 12/99	-	1	District level training completed.
6. Provide IEC materials, radio messages and health messages to reduce demand for injections.	ditto	08/94 to 12/99	-	3	IEC materials produced and broadcast.

PLANS OF ACTION FOR GPV/EPI, GENEVA --- SUBMITTED BY JOHN LLOYD AND MICHEL ZAFFRAN

OBJECTIVE/S : **1. Introduce vaccine vial monitors for all Oral Polio vaccine and then Measles freeze-dried vaccine**

STRATEGY :

- All suppliers of UNICEF oral polio vaccine should be routinely attaching vaccine vial monitors in accordance with the WHO specification by the start of 1996.
  - Ensure that vaccine vial indicators are demanded by UNICEF as part of the 1995 Tender
  - Work with one or more vaccine suppliers to conduct pilot implementations
- Information and sample training materials will reach all EPI programme managers and international staff by the middle of 1995.
  - Work with PATH/USA to develop necessary documentation and training materials

YEAR/S : 2

Activities related to Objective 1	Responsibility of	Time frame	Estimated cost	Priority	Indicator
1.1 Conduct the necessary supplier visits and WHO or UNICEF meetings required to remove barriers to implementation in the 1995 UNICEF tender.	Peter Evans	June 1995	$ 14,000	1	Vaccine suppliers provide quotations for Polio vaccine with vaccine vial monitors which are accepted by UNICEF.
1.2 Arrange for pilot implementation in at least 2 countries by the end of 1994.	John Lloyd	December 1994	$ 7,800	2	Oral polio vaccine reaches two countries which have already received training visits in advance.
1.3 Present model training materials and other information to all EPI programme managers, UNICEF & other NGO staff by mid-1995.	John Lloyd	August 1995	$ 13,000	1	Information package created in E,F & S and presented at PM meetings in AFR/SEAR/EMR/WPR.

PLANS OF ACTION FOR GPV/EPI, GENEVA (continued)

OBJECTIVE/S : **2. Evaluate low workload jet injectors for routine use in the EPI**
STRATEGY :
YEAR/S : 1

Activities related to Objective 2	Responsibility of	Time frame	Estimated cost	Priority	Indicator
2.1 Arrange for comparative risk assessment on injectors with disposable caps and those with reusable heads	John Lloyd	November 1994	0		
2.2 Arrange for durability and endurance testing to assess needs for routine maintenance and repair in the health centre	John Lloyd	January 1995	$ 22,000		
2.3 Conduct field trial in countries of at least two WHO Regions	Michel Zaffran	March 1995	$ 14,000		

OBJECTIVE/S : **3. Eliminate unsafe injections for immunization globally**
STRATEGY : To stimulate plans of action at national level which will ensure sufficient injection supplies, plus the necessary training and supervision to improve injection practices.
YEAR/S : 3

Activities related to Objective 3	Responsibility of	Time frame	Estimated cost	Priority	Indicator
3.1 Prepare an information package on safety of injections for presentation at all meetings of EPI Programme managers and UNICEF country staff.	John Lloyd /Michel Zaffran with Judy Polski (UNICEF)	December 1995	$ 38,000	1	Information package completed and presentations made.
3.2 Publish and disseminate a policy statement on injection and a paper on risks of unsafe injections, discussing alternative risk reduction strategies.	John Lloyd with Bruce Aylward	November 1994	$ 4,000	1	Papers published and disseminated.

PLANS OF ACTION FOR GPV/EPI, GENEVA (continued)

Activities related to Objective 3	Responsibility of	Time frame	Estimated cost	Priority	Indicator
3.3 Assist with the introduction of sterilization drums, starting with Australian drum in Bangladesh and Ethiopia.	Michel Zaffran	June 1995	$ 5,000	1	Drums stocked by Unicef Supply Division and used in Bangladesh and Ethiopia.
3.4 Identify low cost incinerators for urban and other heath centres and list in PIS.	Michel Zaffran	June 1995	$10,000	1	At least one low cost incinerator listed in 1995 issue of the Product Information Sheets.

OBJECTIVE/S: **4. Computerize stock control of vaccines and supplies at central store level of all countries and at all other major stores which already have access to a computer.**

STRATEGY: Make available, field test and support standardised Comodities and Logistics Management (CLM) for this purpose

YEAR/S : 2

Activities related to Objective 4	Responsibility of	Time frame	Estimated cost	Priority	Indicator
4.1 Work with MSH and USAID to finalise a standard software for both immunization and other PHC supplies in E,F and S.	John Lloyd	November 1994	$28,000	1	
4.2 Work with trial countries to evaluate the software in relation to country needs and develop improvements	John Lloyd	December 1994	$7,800	2	
4.3 Develop global training activities to enable each country to install, prime and start to use the software	John Lloyd	August 1995	$13,000	1	

PLANS OF ACTION FOR GPV/EPI, GENEVA (continued)

OBJECTIVE/S : **5. Planning of National Immunization Days**
STRATEGY : **Prepare logistics guide for NID's drawing on PAHO and WPRO expertise**
YEAR/S :

Activities related to Objective 5	Responsibility of	Time frame	Estimated cost	Priority	Indicator
5.1. Arrange for preparation of guide on the logistics of NIDs with input from PAHO and WPRO.	Michel Zaffran/John Lloyd	December 1994	$10,000	2	Guide finalised and field tested in one country.

OBJECTIVE/S : **6. Improve equipment for immunization services**
STRATEGY : Liaise with Industry, Unicef and laboratory ensure smooth transition to CFC free appliances, modification of domestic refrigerators and field trial of new technologies.

YEAR/S :

Activities related to Objective 6	Responsibility of	Time frame	Estimated cost	Priority	Indicator
6.1. Arrange for independent testing of CFC-free equipment.	Michel Zaffran	December 1995	$ 50,000	3	CFC-free equipment in 1995 edition of Product Information Sheets.
6.2. Compile data from laboratory tests and field trials on modified domestic refrigerators and make it available to all countries using domestic refrigerators.	Michel Zaffran	December 1995	$10,000	3	Programme on the modifications of domestic refrigerators initiated in at least 3 countries.
6.3. Field test zeolite Instant Cooling Unit and battery-free solar refrigerator.	Michel Zaffran	December 1995	$20,000	3	Results of field trials available and published.

ANNEX 5

FORM FOR INVENTORY OF NATIONAL TRANSPORT RESOURCES

VEHICLE INVENTORY

A REGISTRATION NUMBER :..... MAKE AND MODEL :..... YEAR : .....

CHASSIS NUMBER : ..... TYPE : ..... YEAR ACQUIRED : .....

B a. DOLLAR VALUE :..... c. FUEL CONSUMPTION :.....HIGH RATE :..... LOW RATE.....

b. DEPRECIATION RATE (%) :..... d. OPERATING BUDGET :.....HIGH RATE :..... LOW RATE.....

C

	199....		199....		199...		199....		199....	
	Months 1-6	Months 7-12	Months 1-6	Months 7-12	Months 1-6	Months 7-12	Months 1-6	Months 7-12	Months 1-6	Months 7-12
1. Location										
2. Last odometer reading										
3. Efficiency %										
4. Number of days in shop										
5. Fuel Cost										
6. Cost of oil, preventive maintenance and repairs										

	199....		199....		199...		199....		199....	
	Months 1-6	Months 7-12	Months 1-6	Months 7-12	Months 1-6	Months 7-12	Months 1-6	Months 7-12	Months 1-6	Months 7-12
1. Location										
2. Last odometer reading										
3. Efficiency %										
4. Number of days in shop										
5. Fuel Cost										
6. Cost of oil, preventive maintenance and repairs										