PERSPECTIVE AND PRACTICES OF APPROPRIATE TECHNOLOGY IN MATERNAL AND CHILD HEALTH

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An important factor for the success of primary health care (Maternal and Child Health, Immunization, Diarrhoeal Disease and Nutrition) is the use of appropriate health technology. Examples of technologies include midwifery kits in delivery, vaccines and cold chain equipment used in immunization programmes and the use of oral rehydration salts in diarrhoeal diseases control programmes. These technologies are generally taken from developed countries and are used with minimum adaptations in developing countries with differing general situations. The technologies used may consequently be inappropriate. What then is appropriate technology (AT) related to Health?

The development of any technology involves basically three stages: research and development, field trials of prototypes and large-scale introduction. The new technologies under development must be relevant in order to make a significant impact in solving a health problem. The technologies must be suitable for the physical environment in developing countries in which they are used and easy to operate by primary care health workers with a low level of literacy and training. It would be easier to devise a technology to match the users' cultural beliefs and social setting than to modify their practices.

The field trial of prototypes is a critical step to ensure the appropriateness and acceptance of the technology to the end-users. No matter how much the designer anticipates the field conditions, including the physical and human environment, the field trials always provide additional input to improve the technology. The experience accumulated by the primary health workers would be invaluable in the final design. The field trial is also useful in testing materials for training the users. Information, education and communication (IE&C) material form an integral part of the technology. Very often the support materials have to be developed for persons of low literacy and without technical training since the success of a particular technology could depend on its proper use.

The large-scale introduction would be predicated by the successful completion of the field trials and the final product design. It is also essential to assure continuous supply and maintenance of products relating to the technologies. Technologies from developed countries could be produced locally where it could be economically justified. A system must also be devised to service the product no matter how simple it may be. These are essential criteria in the development process of new appropriate technologies.

Technologies which have been in existence in the Western world but are simplified to use local materials and labor for manufacturing, such as latrines, simplified dental chairs, etc., fit into the common perception of appropriate technology.

Advanced technologies from developed countries often are not amenable to local manufacture. In those circumstances where such a technology could make a significant impact in the delivery of health care in a developing country, it may be justified to develop and manufacture them in the developed countries. An example is the measles vaccine time-temperature indicator which changes color abruptly when exposed to excessive heat indicating that the vaccine has lost the prescribed potency. The indicator is based on a highly specialized chemical which was developed in the U.S. The development of the indicator involves the intimate participation of health workers from developing countries to assure that the design of the product is appropriate and inexpensive. This category of appropriate technology has a significant potential because of the vast but yet untapped resources of private industries in developed countries.

How would appropriate technology be applied in MCH programmes? There are many technologies suitable for MCH programmes. It is useful to provide a framework in which the development, adaptation and introduction of technologies for MCH can systematically be evolved. In MCH, the "Risk Approach" has been promoted as a managerial tool for organizing health services. Individuals and groups with a high expectation of complications or disease are defined as "at risk" and early identification and intervention would be the primary aim of the "risk approach" in MCH. Risk factors in MCH would include: high blood pressure during pregnancy, low birth weight, and low haemoglobin level. The detection of these and other risk factors requires the use of specific technologies.

Within the framework of the risk approach, the delivery of care in MCH programmes can often be divided into three categories:

1. Antenatal

2. Intrapartum

3. Neonatal

Within each category there are specific activities performed by different levels of health workers. The primary health care workers with limited training, can usefully avail themselves of more limited technologies than others.

A suggested list of technologies and related products for an MCH programme would be as follows:

1. Prenatal period: measurement of blood pressure, glucose and protein in urine; fundal height as indication of fetal growth, and diagnosis of anaemia.

2. Labour and early puerperium: monitor progress of labor, fetal stress and delivery kits.

3. The neonatal period and puerperium: thermal control of newborns, weight at birth, determine jaundice, transportable incubators for newborns at risk, and clamping of the umbilical cord.

4. Post neonatal period: nutritional status evaluation and breast-feeding.

During the prenatal period, trained TBAs can be taught to measure the blood pressure, proteinuria and urine glucose. These are indicators to detect toxaemia. The traditional mercury column sphygmomanometer is not suitable for rural areas where TBAs have to travel from house to house. The electronic syphgmomanometer is more transportable than the mercury column type, but the supply of batteries for the electronic unit can be a problem. There is also a fully automatic electronic syphgmomanometer which does not require the detection of the onset of the first pulse to determine the blood pressure. Because of the more sophisticated design, durability and service of the units can be a problem.

There are test strips available which indicate the presence of glucose and protein in urine by a simple colour change. These strips are very simple to use and have a long product life. However, the relative high cost per test (8-15 US cents) may make it difficult for programmes to provide sufficient quantities for all TBAs. The manufacturing process of the indicator strips is relatively simple and they can be produced locally for 4-5 cents each.

There is, at present, no reliable noninvasive method to detect anaemia. A blood sample is required to determine the level of haemoglobin. The test requires the use of a colorimeter and/or a centrifuge which makes it impractical to carry out such a test in the field. WHO/MCH has sponsored the development of a battery-operated device for haemoglobin determination. However, the system requires the use of reagents which may present a supply problem. An approach which does not require a blood sample is to use the redness of the conjunctival arterial blood. An "anemiometer", a strip of paper with three bands of different shades of red is used to measure mild, moderate and severe anaemia. This system is being evaluated for its accuracy and sensitivity. It is hopeful that this system can be used by TBAs in the field.

From the onset of labour to the time of delivery, the key function of the TBAs is to monitor the progress of labour and to make referrals, when complications arise, to the next level of care. TBAs can be trained to perform clinical examinations including elapsed time between contractions, maternal blood pressure, and palpation of femoral pulses and determination of hemorrhage. Technology to make these examinations are available, though it may require further adaptation to match the level of TBAs' training. However, the critical need is to develop a system to use the clinical information for decision-making by the TBAs. The system can be a simple chart incorporating the clinical data with decision points clearly indicated.

For normal delivery, a delivery kit containing the essential items such as a bar of soap, a razor blade, a towel and cotton string should be provided to the TBAs. The items in the kit are consumed over time, and a supply system must be set up to restock the kits. Midwifery kits have been available from UNICEF. However, there was general debate that for use in home delivery, this kit is too large, heavy and contains several items seldom used. PATH has proposed to evaluate the UNICEF midwifery kits to:

1. Provide qualitative and quantitative information on use/effectiveness of the kit;

2. Assess user perception and acceptance of the kit;

3. Develop training materials to improve proper and effective use of the kit;

4. Modify kit content to respond to needs in home delivery.

There are several activities carried out by the TBAs on the neonate. The umbilical cord has to be tied within a short time after birth. A cotton string is recommended because it can be sterilized. However, it takes practice to make a secure tie with the string. A disposable inexpensive plastic cord clamp is being evaluated by PATH as a substitute for the string. The clamp design will ensure a tight closure at a specific distance from the stump of the umbilical cord, without danger of slipping. The weight at birth is a useful indicator to assess the survival of the infant. The normal distribution of birth weights ranges from about 2900g to 3200g. Therefore, weighing scales of at least 100g accuracy is required. Because the scale is to be transported to the house where the delivery takes place, it must be lightweight, durable and easy to operate. The spring-balance scale is widely in use; however, there are questions regarding its accurate recording of birth weights. A new, low-cost weighing scale is under development at PATH and may meet the requirements for accurate determination of birth weight.

Keeping the neonate warm is important in avoiding cold stress and injury leading possibly to metabolic disturbance and to pulmonary hemorrhage. Wrapping the newborn with a double towel provides adequate prevention of heat loss. However, there are now inexpensive materials available that provide better thermal insulation than the traditional towels. A special laminated Mylar® (plastic material) can be made into sheets which offer 2-3 times better thermal insulation than cotton sheets. The mylar sheets can be made available at about 50 US cents each and can be reused many times. In situations where ambient temperature is sufficiently low, the extra protection is important, especially in a house with poor insulation even in tropical climates.

It is not uncommon for a newborn to develop jaundice. Early diagnosis of jaundice makes it possible to refer the infant for timely treatment at a higher level health care facility. TBAs can be taught to use a simple icterometer. A device is used to blanch the skin and the colour of the skin is compared to a reference on the device. The degree of yellowness of the skin can be used to detect jaundice, and the production and development of a simple icterometer kit would be appropriate.

In situations where a newborn requires special care, the infant will have to be transported to a facility at the next level of health care. Thermal control during transport is critical to the survival of the infant. Incubators used in hospitals and clinics are often cumbersome, heavy and require a continuous supply of electricity. A portable, battery-operated incubator using light bulbs as heating elements is under development and the design is simple with t he construction materials readily available in most developing countries. Data obtained so far indicates that by using a motorcyle battery, the unit can maintain 37 ± 1°C for a period of 12 hours.

During the postneonatal period, the nutritional status of the infants has to be closely monitored. There are basically four anthropometric indicators for nutritional status:

1. Weight for age measuring wasting* and stunting** combined.
2. Height for age measuring stunting.
3. Weight for height measuring, wasting
4. Arm circumference measuring wasting

A bracelet of flexible material can be made to measure arm circumference. Weight for height and weight for age charts are available from UNICEF. In the neonate, body length can be measured with a measuring tape. A baby-length measure can also be constructed using plywood to give a more accurate reading. The plan for constructing such a device is available from WHO.

The technology used generates a large quantity of data. These data must be collected and analyzed to monitor and evaluate the technology and its appropriateness in the health care delivery system. TBAs would need special, simple data collecting forms appropriate to the literacy level, and items to be recorded should be kept to a minimum. A system for the flow of essential data within the health network should also be devised. The flow of information will help improve the health care infrastructure and may ensure interventions and proper referral of the patients.

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* Wasting, which is extreme thinness, reflects acute, current malnutrition.

** Stunting, which is retarded skeletal growth, reflects chronic, long-term malnutrition.

In summary, a large number of technologies are available to facilitate the delivery of MCH care. The technologies have to be evaluated carefully as to their appropriateness before introducing them into MCH programmes. To successfully introduce a technology at the primary level, the health workers should be properly trained to use the technologies, with a good supply system, and the impact of the technology on the programme properly evaluated.