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Stimulation in early childhood

A DOCUMENT FOR ACADEMIC LEVEL WORKERS AND PROFESSIONALS.

Over the past two decades, the social and political issues of poverty have fostered a major theme in child development research. The philosophy that problems created by man can be corrected by man has been reflected in attempts to rescue young children from the ravages of poverty by providing them with early stimulation. Much of what has been learned about the early stimulation of all children has been motivated by the concern for those who face a high risk of being adversely affected because of their social environment.

The issues of early stimulation can be reviewed along the lines of several major questions: 1) What factors are linked to patterns of impaired development? 2) Can we intervene effectively in the child's life to stimulate his or her development? 3) Must such intervention begin early in the child's life? 4) Do the effects of intervention stay with the child as he or she grows older? 5) Does social change affect child development? 6) What is the impact of early stimulation relative to other interacting variables in the child's situation?

The references that are noted in this literature review are illustrative rather than exhaustive, since the bibliography for any one of the questions would exceed the space allotted for this report.

FACTORS LINKED TO IMPAIRED DEVELOPMENT

Poverty is linked clearly to problems in child development. Almost no children born outside poverty and free of neurological damage score below 80 IQ (Kushlick and Blunden, 1974). The true incidence of subnormal IQ among the poor is debated - the majority of poor children still perform above the mental retardation level - but its higher prevalence is generally accepted. A minority of social scientists have advanced a genetic explanation for these differences (Jensen, 1977), but the majority of investigators emphasize socio-cultural factors in the early upbringing of the child. Language development has been investigated as one of the key dimensions related to emergence of other skills. Comparisons of language performance by race and social class invariably find a more elaborated linguistic system coming from white middle-class families (Bernstein, 1976). Bernstein suggests that different social roles are being acted out in lower class families, as opposed to middle-class families whose heterogeneous communities require an elaborate communication code. A more restricted communication code is sufficient for a more homogeneous culture where many feelings and attitudes are already understood by the members. This explanation has been attacked as an unwarranted negative comment on various minority groups (Labov, 1970).

This publication has been made possible thanks to a grant of the US Department of Health, Education and Welfare, at the occasion of the International Year of the Child.
The overriding question that must be answered before any others make sense is: Can the developmental status of children be changed through deliberate programming? The answer to that from available research is «yes». It is possible to move groups of children from one-half to one standard deviation higher on measures of intellectual ability (p. 238).

More specific questions are answered less definitively. There has been some support in the literature for parent involvement as a key element in successful intervention programs, for the importance of a systematic and organized curriculum emphasizing language, and for beginning the intervention as early as possible (Heber et Garber, 1975).

Should Earlier Stimulation Be Better?

Rutter (1979) has reviewed the information on critical periods of development, addressing primarily the question as to whether it is more important to intervene at a young age than later. The weight of the evidence currently suggests that psychosocial development can be influenced by environmental changes at any stage in the child's life. Clearly, environmental improvement in middle or later childhood can lead to identifiable social and behavioral improvement. However, Rutter concludes that there is still uncertainty as to whether intervention in the early years has a greater effect than in the later years. Any difference would be only relative, at best.

Rutter suggested that the more serious variable to be concerned about in early intervention may well be emotional bonding rather than cognitive ability, since children even in good foster home settings seem to carry negative effects of early emotional distance of training.

Is Intervention Effective?

A number of research reviews have been published on a variety of projects that have documented the effects of early intervention (Bronfenbrenner, 1975). Karnes and Teska (1975) provided a specific summary statement that would be accepted by most reviewers:

In the search for factors related to low mental development, the socialization practices of low-income mothers have yielded consistent findings. Since mothers are widely viewed as the primary agents of socialization, significant attention has been paid to any differences in treatment visible in the mother/child interaction. An extensive collection of literature (Streissguth et Bee, 1972; Feshbach, 1973) supports the following conclusions. Mothers of low-income children generally:

a) Allow their children to play alone more often.

b) Decrease their level of interaction as the child grows older.

c) Use more physical intrusion and provide little positive reinforcement when teaching their child.

d) Issue more commands and ask fewer questions, generally using authoritarian speech.

The total pattern of discovered factors suggests that low-income mothers are providing a less stimulating and supportive linguistic environment for the child than do middle-income mothers.

There is also a strong sentiment for identifying cultural factors in the larger society that may be linked to delayed development in young children. Ogbu (1978) maintains that poor school performance among minority children results from discouragement that was instilled by a society that tolerates seemingly hopeless conditions among the poor. He believes that blaming the child for poor performance instead of society is a classic case of «blaming the victim».

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Do Intervention Effects Last?

One serious question is whether results obtained in early intervention programs maintain themselves over time. Some of the short-range follow-up
studies have, in fact, indicated that some of the initial gains in IQ scores seem to be lost a year or two after the intervention has been completed and the youngsters placed in a regular educational setting.

A major consortium review of developmental continuity was established as a collaborative effort among twelve research groups to answer the question on the later outcomes of early education programs (Lazar et al., 1977). In each of the studies involved, the youngsters were of low-income families and had taken part in a home-based, center-based, or combined center-home visit program. The youngsters were from nine to eighteen years of age at the time of the follow-up study, which measured their cognitive ability, achievement, and attitudes.

The combined results from the twelve groups suggested that the differences on measures of cognitive abilities lasted through the primary grades, but disappeared after that. However, significantly fewer of those children who had been in early stimulation programs were later assigned to special education classes or required to repeat a grade in the public schools. There was continued high parent satisfaction with the effects of the stimulation program, and the children rated themselves higher on self-concept than did the control children. One general conclusion of the consortium was that a well-planned curriculum for young children in a preschool setting was likely to reduce later costly special education or remedial programs.

**SOCIAL INTERVENTION EFFECTS**

Although the majority of intervention efforts have focused on a direct attempt to improve the conditions for the child or the family, some evidence has become available on the implications of larger ecological interventions. For example, Maynard and Crawford (1975) studied the effects of income supplements to poor families on their children’s school absenteeism, academic grades, and behavior. In a sample from the Southeastern United States, black children from homes where income supplements were provided had lower rates of absenteeism, better comportment grades, and higher academic performance than did a control sample. Such findings were not obtained in the Midwestern U.S. with a sample of white families.

In a similar but larger ecological change, Ratcliffe (1978) reported the results of societal intervention in Kerala, a small, densely crowded state in South India, where the per capita income is $20 per year and the caloric intake is lowest in the country. Despite these disadvantages, Kerala shows low infant mortality and high levels of literacy and female education. Ratcliffe credited these conditions to agrarian reform that effectively increased levels of social justice and economic equity throughout the society.

**THE INTERACTION OF FACTORS**

One of the newer concepts in the past decade has been the synergistic impact of several factors affecting child development. In their review of the literature on reproductive risks and caretaking casualty Sameroff and Chandler (1975) found that birth complications among low-income families produced retarded development, but that a similar set of complications did not produce retarded development in middle-class infants. Werner, Bierman and French (1971), in a study of all live births on the Island of Kauai, found that birth complications did not seem to affect IQ scores of children at age 2 years, if the home environment was favorable. On the other hand, children reared in unfavorable environments demonstrated a direct relation between the severity of birth complication and IQ score at 2 years.

A similar finding was discovered by Zeskind and Ramey (1978) in which fetal malnutrition, when counteracted by a stimulating educational environment, did not seem to have negative impact on the child. When malnutrition was combined
with a generally unstimulating home environment, negative developmental consequences were identified.

Because it seems clear that there are many complex sets of variable interactions that can produce significant positive or negative sequences, future evaluations of the effects of environmental variables on the youngster must be done with a clear sense of the combination of variables present, rather than a mere examination of each variable independently.

One can say with confidence generated from available research that early stimulation organized by competent professionals can have a limited, but still significant, impact on children from low-income homes. Specifying the nature and extent of the impact, however, has become more complex than previously assumed. One is presented with an image of a child resting within the envelope of the family which, in turn, rests within an envelope of the larger society. Questions as to which layer of the environment is most responsive to intervention, or which intervention has the greatest long-term effect, remain intriguing and unanswered.

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* Interested readers may apply to the ICC Documentation Centre to obtain additional references.
International Children's Centre

INFANT

STIMULATION

A DOCUMENT FOR MASS MEDIA SPECIALISTS

DEDICATED TO THE INTERNATIONAL YEAR OF THE CHILD.

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INTERNATIONAL CHILDREN'S CENTRE
Programme on the Development of Information on Early Childhood

Château de Longchamp
Carrefour de Longchamp
Bois de Boulogne

75016 PARIS
France
ALL BABIES NEED:

• TO BE WANTED
• TO BE LOVED
• TO BE TALKED TO
• TO BE PLAYED WITH

FACTS AND FASHION

Fashions and theories of child care vary from one generation to another and from one part of the world to the next. In different societies babies' needs are met in different ways.

FOR A CHILD TO FULFIL ITS POTENTIAL ALL THESE BASIC NEEDS MUST BE MET.

WHY IS IT IMPORTANT TO BE WANTED?

Every child is born with a certain potential.

This may already be affected before the child is born if the pregnancy is not a good one.

Being wanted is the first step in helping a child fulfil its potential.
RESEARCH SHOWS that a child is affected by its mother's emotional state even before birth. Babies of anxious mothers have different patterns of movement in the wards. This "nervousness" can persist.

A good pregnancy means:
- A relaxed mother
- A well nourished mother
- A well prepared mother

All these mean good care during pregnancy.

RESEARCH SHOWS that the living conditions of the future mother - physical, emotional and economic - are of the utmost importance if the child is to be born at term at the correct weight (3,000-3,500 grams) and with its full potential for development.

Visits during pregnancy are an opportunity for advising the future mother and reassuring her. It is particularly important when she has little support from family and/or community.
THE QUALITY OF CARE IS REFLECTED IN STATISTICS FOR INFANT MORTALITY

Annual number of deaths to infants under one year of age per 1000 live births

AFRICA
NORTHERN AFRICA
WESTERN AFRICA
EASTERN AFRICA
MIDDLE AFRICA
SOUTHERN AFRICA
ASIA
SOUTHWEST ASIA
MIDDLE SOUTH ASIA
SOUTHEAST ASIA
EAST ASIA
NORTHERN AMERICA
LATIN AMERICA
MIDDLE AMERICA
CARIBBEAN
TROPICAL SOUTH AMERICA
TEMPERATE SOUTH AMERICA
EUROPE
NORTHERN EUROPE
WESTERN EUROPE
EASTERN EUROPE
SOUTHERN EUROPE
U.S.S.R.
OCEANIA

SOURCE: Population Reference Bureau, 1978 World Population Data Sheet

Infant mortality rates, world regions, about 1975

WHERE IS YOUR COUNTRY PLACED?
ARE YOU SATISFIED WITH IT? ARE THERE QUESTIONS TO BE ASKED?
BIRTH

Always a dramatic moment, be it in a village hut or city hospital. Dramatic for the baby as it changes from fetus to newborn. Dramatic for all who are present at the outward beginning of a new life.

NEWBORN BABIES CAN SEE, HEAR, TASTE, SMELL, FEEL.

THEY ARE LEARNING FROM THE BEGINNING

For the parents and baby, it is not always "love at first sight". The conditions of the birth can affect this. Even in hospital the parents need to feel "at home". Many modern techniques are developing to improve the wellbeing of mother, father, and baby at the time of birth.

IS YOUR COUNTRY AWARE OF THEIR NEEDS? IS ANYTHING BEING DONE TO MEET THESE NEEDS?
THE FIRST YEAR

Perhaps the most important year of life. A baby develops from a cuddled helpless bundle to a crawling walking toddler with a personality of its own.

There is a harmony in the development of a normal baby. The different areas of development - physical, emotional, and intellectual - are usually separated for the convenience of description, but in any child they develop as one whole.

Different upbringing practices influence the age at which the different stages are passed through. The table below shows how the progress of an infant brought up in a traditional African environment and carried everywhere on its mother's back compares with a baby in a Westernized environment with less permanent and close physical contact with its mother.

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<th>Traditionally reared African baby</th>
<th>Westernized baby</th>
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<tr>
<td>4-6 weeks</td>
<td>Holds up head</td>
</tr>
<tr>
<td>4 months</td>
<td>3 months</td>
</tr>
<tr>
<td>8 months</td>
<td>Sits without support</td>
</tr>
<tr>
<td>12-14 months</td>
<td>7-8 months</td>
</tr>
<tr>
<td></td>
<td>Stands up and walks</td>
</tr>
<tr>
<td></td>
<td>12-14 months</td>
</tr>
<tr>
<td></td>
<td>Runs</td>
</tr>
<tr>
<td></td>
<td>24 months</td>
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EACH CHILD IS DIFFERENT. THESE ARE ONLY AVERAGES

The above table is important only as a reminder that different fashions of mothering affect the rate of development of a skill. This applies in all areas of learning.
Investigation should always be viewed in the context in which it is carried out. It is not always transferable from one culture to another. But it is generally true that babies need close, constant interaction with an adult, usually, but not necessarily the mother.

**CHILDREN NEED TO HEAR THE SPEECH OF ADULTS TO LEARN TO SPEAK THEMSELVES.**

A traditionally reared African child will hear the language of its mother and the adults surrounding her as she works and moves around.

The Westernized child will hear the language of adults face to face in the everyday private events of feeding and diaper changing.

**CHILDREN NEED THE EXPERIENCE OF FEELING AND EXPLORING TO DEVELOP UNDERSTANDING OF THEIR WORLD.**

Some babies are never short of things to touch. A mother's skin, hair, clothes are always there for some. Others need "extras". Toys to explore and feel, because there is less permanent physical contact with a mother.

**WHAT RETARDS DEVELOPMENT?**

POVERTY is an important factor because it usually means that not all the babies' basic needs can be met.
CAN ANYTHING BE DONE TO HELP?

Social intervention.

Improving the living conditions is always the first priority. In any society a child lives in a circle of family which in turn lives in a circle of community and society generally.

The layers interact with one another and to change the one you have to change the other.

Educational intervention

When educational intervention programmes have been tried, it has been possible to improve the child's ability to develop and use language. The programmes which involved the parents too worked best.

Does the improvement last?

Even when the improvement in performance falls off after primary school age, significantly fewer of the children involved in early stimulation programmes were later in need of special education classes.

Substitute care

Every society should examine carefully the needs of the child as well of those of the adults when setting up systems of substitute care.
REMEMBER

• TO LEARN TO LOVE  
  A child needs to be loved

• TO LEARN TO SPEAK  
  A child needs to be talked to

• TO LEARN TO UNDERSTAND ITS WORLD  
  A child needs the experience and guidance of an adult to explore it
ARE THE PROVISIONS MADE FOR SUBSTITUTE CARE OF CHILDREN IN YOUR COUNTRY BASED ON THESE NEEDS OF A CHILD OR DO OTHER CONSIDERATIONS DETERMINE THEM?
BREAST-FEEDING BIOLOGICAL VALUE

For thousands of years, mother's milk was the only resource for infant feeding, and those who were deprived of it had no hope of surviving for very long. Progress in both techniques and hygiene, however, enabled artificial milk to be made available for infants; its continuous use became widespread that by the early 1970's breast-feeding had practically fallen out of disuse. The only arguments put forward to try and stop this trend were psychological ones, and they were rarely based on scientific methods.

Apart from its different proportions in human milk and in cow's milk, the casein found in the two types of milk has different characteristics. The composition of its soluble fractions is nevertheless still more dissimilar, since β-lactoglobulin, which is the dominant protein in bovine lactocereum, is completely non-existent in human milk in which α-lactalbumin, immunoglobulins and lactoferrin are the three main fractions, whereas they are only present in very small quantities in cow's milk. Non-protein N also represents a much larger fraction in breast milk than in artificial milk.
Unlike those in cow's milk, human milk is capable of inhibiting the growth of bifidobacteria by the action of several bifidobacteria-specific factors which are also present in human milk. These factors include lacto-N-trigalactoside, the latter having the strongest action with regard to the growth inhibiting the growth of bifidobacteria. The factors encountered in the growth of bifidobacteria, some of which have the property of oligosaccharides, are not yet well characterized in human milk, but have a remarkably high content.

**Factories and glycerol structure**

*Oligosaccharides and growth factors of Bifido-*

This composition could be reproduced by the addition of oligosaccharides. It would therefore be a condition to determine that the bifidobacteria and bifidobacteria-specific factors do not have any harmful effect on the bifidobacteria or the bifidobacteria-specific factors have no harmful effect on the bifidobacteria. The bifidobacteria-specific factors need to be reproduced in order to determine the bifidobacteria-specific factors of the bifidobacteria. Furthermore, even if no-growth factors are found in the bifidobacteria-specific factors, this leads to enrichment of these products in the bifidobacteria-specific factors.

The bifidobacteria-specific factors are not yet identified. This is not firmly understood.

Calcium, iron, and a large number of other factors are found in the bifidobacteria-specific factors, such as galactose, lactose, and lactose. A bifidobacteria-specific factor, present in human milk, cannot be reproduced either, except by using the bifidobacteria-specific factors. The bifidobacteria-specific factors of the bifidobacteria cannot be given and only the major bifidobacteria-specific factors can be given.

The composition of bifidobacteria-specific factors of the bifidobacteria cannot be given and only the major bifidobacteria-specific factors can be given.
Immunoglobulins

The immunoglobulins in human milk are different both quantitatively and qualitatively from those in cow's milk. Cow's milk contains chiefly IgG and IgM, and the concentration of IgA in bovine colostrum is lower than that of serum IgA. Human milk, on the other hand, contains mainly IgA-5 which represent more than half the milk protein in the original colostrum and have antibody activities directed against most bacteria and viruses, and particularly against enterobacteriaceae. They do not prevent invasion of the digestive tract by these species, but, like IgA produced locally, they can prevent these bacteria from binding to the glycoproteins in the intestinal mucosa and thus protect the host from their pathogenic effects. It has also been demonstrated that they can inactivate the enterotoxin produced by certain enterobacteriaceae and thus stave off its effects without eliminating the pathogenic bacteria of the host. Finally, it is possible that they enhance the proliferation of less virulent strains. The IgA-5 in mother's milk thus constitute a kind of natural immunity transmitted passively to the infant, and capable of protecting it against present or past germs against which the mother has become immunized. The close antigenic relationship between different enterotoxins may even explain that a protective effect may be observed in connexion with germs to which the mother had never been exposed. In cooperation with other immune factors, IgAs are also capable of inhibiting the absorption of various food antigens, and this may have implications for the prevention of allergic manifestations. It may even be that these antibodies prevent absorption of the antigens in cow's milk in infants who are only partially breast-fed.

Lactoferrin and folic acid and vitamin B₁₂ ligands

The antimicrobial action of human milk is not dependent only on antibodies. Unlike cow's milk which only contains traces of lactoferrin, human milk has a high content of it, since its concentration may be as high as 3.5 or 4 mg/ml in colostrum and close to 1.7 mg/ml in mature milk. Although it differs in many ways from serum transferrin, human lactoferrin (or lactotransferrin) has also the property of reversibly binding iron on specific sites and this explains its bacteriostatic effect.

For bacteria to grow the presence of iron is required, but the coefficient of association between transferrins and iron is such (about 10^10) that the amount of free iron in balance with a complex saturated at 25% is approximately 10^8 times less than the requirement for bacterial growth. The pathogenicity of bacteria and yeasts is thus to a certain extent dependent on their ability to compete with the transferrins for iron, and in any case, the host's sensitivity to these pathogenic agents is enhanced with increased transferrin saturation. Consequently, iron supplementation of infant diets theoretically has the potentiality, by exceeding the capacity of lactoferrin saturation, which is already very low in cow's milk, of promoting the growth of enterobacteriaceae and thus of increasing the infants' sensitivity to infection.

The presence of folic acid and vitamin B₁₂ is also required for bacterial growth. Here again, however, human milk has a particularly high content of ligands which may act in competition with the microorganisms and play a bacteriostatic rôle comparable with that of lactoferrin. All these substances, which are
not found in artificial infant foods, may therefore be considered to be important regulators in host-parasite interactions.

**lysozyme, cellular components, and other defence factors against infection**

The concentration of lysozyme in mother's milk averages 0.3 to 0.5 mg/ml, or about 3000 times more than in cow's milk. Its possible effect on faecal flora is suggested by the fact that it is found in significant amounts in the stools of breast-fed infants. The lysozyme in egg-white, which is sometimes added to artificial infant foods, is also capable of passing unchanged through the gastro-intestinal tract, but has not so far been possible to demonstrate any advantage in this practice. Mother's milk also contains a lactoperoxidase which is active against streptococci, an antistaphylococcal factor, the complement components C3 and C4 (particularly C3), as well as non-specific antiviral factors which are also present in fresh or pasteurized cow's milk but not in powdered milk or in artificial infant foods.

Finally, human milk contains a large number of leukocytes. These are particularly numerous in colostrum (0.5 to 10 x 10^6/ml). About 90% of them are macrophages whose mobility is inhibited by MIF (macrophage inhibiting factor); they are capable of phagocytizing yeasts and bacteria, and can kill the latter. Colostrum also contains a large number of lymphocytes, of which about half are T lymphocytes and are capable of producing IgA-S, MIF, and of undergoing blastic transformation in the presence of non-specific mitogens or foreign lymphocytes; it has also been demonstrated that after stimulation by viruses they can produce interferon, and it has been said that they can play a rôle in the transfer of delayed hypersensitivity from mother to infant.

**THE PROTECTIVE ROLE OF MOTHER'S MILK AND THE EFFECT OF CONSERVATION PROCESSES**

A breast-fed infant is thus protected from infection and from the excessive absorption of food antigens by a whole series of mechanisms at a time when its defence systems are not yet developed and there is the highest risk of sudden death. In fact, although it is sometimes difficult to decide how much is due to the protective rôle of mother's milk and how much to greater contamination with artificial feeding, more especially in developing countries, there is no doubt that the frequency of enteric infections is lower in breast-fed infants than in those fed on cow's milk, and this effect extends well beyond the neonatal period.

The protective effect of a number of these factors, however, only holds good with fresh milk. To prevent the contamination of human milk intended for premature or sick babies, it is usually sterilized by heating to 100°C, and several recent studies show that although this practice is quite effective from this point of view, it is no longer possible to detect IgA or lactoferrin, the greater part of the lysozyme or the ability to bind folic acid and vitamin B_12; the ability to inhibit the growth of E. coli in vitro is also lost, and the addition of iron for this purpose is of no avail; finally, the
non-specific action against viruses is also destroyed. Pasteurization at 62.5° C for 30 minutes is also effective against bacterial contamination, at least as long as the original bacterial count is below 10^6/ml; in spite of conflicting results, it would seem that it reduces the IgA level by about 20%, and a considerable part of the lactoferrin; lysozyme, however, is more stable at this temperature. Finally, even though most of the factors of resistance to infection are preserved by pasteurization, or preferably by rapid freezing at -20° C, leukocytes are completely destroyed by these procedures; in any case, their count would be greatly reduced if the milk were stored or collected in glass containers because of the strong tendency of macrophages to bind to the walls.

The chemical composition of the milk also plays a definite rôle in maintaining an acid pH and establishing a gram positive flora with lactobacilli predominance in breast-fed infants. This is indeed evidenced by the fact that certain characteristics of the stools of breast-fed infants can be reproduced in newborns artificially fed with "adapted" preparations which are as similar as possible to human milk in their lactose, proteins and phosphates rates and in their ability to act as buffers. This gives hope that some protection against the pullulation of gram negative pathogens may be achieved by adopting the formulas. Studies are also underway to try and include in the milk immunoglobulins extracted from colostrum of cows sensitized with different strains of E. coli. The addition of RNase in artificial infant foods might also provide protection against certain virus infections, but there is no means of confirming this for the time being.
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Interested readers may apply to the ICC Documentation Centre to obtain additional references.
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BREAST - FEEDING

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Château de Longchamp
Carrefour de Longchamp
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75016 PARIS
France
BREAST FEEDING IS DECLINING RAPIDLY!

WHY SHOULD YOU BE CONCERNED?

THE FACTS ARE HERE
BREAST MILK

WHAT IS IT MADE OF?

PROTEINS
FATS
SUGARS
SOME VITAMINS
PROTECTIVE SUBSTANCES

AFTER A FEW WEEKS
VITAMIN C
VITAMIN D
NEED TO BE GIVEN

PERFECTLY SUITED TO
THE DEVELOPING NEEDS
OF AN INFANT

THE MILK STARTS AS
COLOSTRUM AND
BECOMES "PROPER" MILK
AT 4 - 5 WEEKS
BOTTLE MILK

PROTEINS
FATS
SUGARS
SOME VITAMINS
NO PROTECTIVE SUBSTANCES

SOME MILKS NEED
VITAMIN C

MOST HAVE
VITAMIN D ADDED

MILK IS
ALWAYS THE SAME,
ONLY GIVEN IN LESSER
QUANTITIES AT FIRST.
**BREAST MILK**

Contains anti-infective agents which protect baby from disease, especially diarrhoea.

Seems to lessen the risk of allergies, obesity and atherosclerosis in later life.

Good value. It is cost-effective for the mother to transform inexpensive foodstuffs providing chiefly calories and protein into a nutritive food.

NOT FREE but cheaper. Cost corresponds to price of foodstuffs needed to feed a nursing mother adequately.

In a developing country with a population of 10 million and a birthrate of 45%, the loss of breast milk in a drop from 100% to 50% breast feeding would be 40,000,000 litres.

Full breast feeding is accompanied by a delay in the return of menstruation and prolongs infertility; it is not safe enough to be risked as a means of birth control.

**BOTTLE MILK**

NO anti-infective agents.

When given in insufficiently hygienic conditions leads to serious gastrointestinal disorders.

Has to be imported in countries with low milk production. Costs are high for extra medical care associated with breast-fed babies.

Costs

- 33% of daily wage of agricultural worker in Uganda
- 20% in Chile
- 50% in Tanzania

Add to this the cost of bottles and sterilising equipment.

40,000,000 litres of processed milk must be imported or taken from the rest of the community.

Mothers become fertile more quickly after birth.
EXTENT OF BREAST FEEDING IN SELECTED COUNTRIES AND YEARS, 1946-71

WHAT ARE THE MAIN CAUSES OF THE DECLINE?

Mothers going back to work early.
Changes associated with moving from a rural to an industrial society
(Isolation of young couples. No older family around).
Imitation of reference groups – the well-to-do; health personnel.

Psychological effects - embarrassment; disgust.
Wrongly interpreted feminism.
Advertising impact of bottle milk manufacturers.
The improvement in the manufacture of bottle milks.
Hospital organization where routines is more important than babies.

INDIFFERENCE 1
WHAT CAN BE DONE TO IMPROVE THE SITUATION?

Extension of the length of maternity leave, especially the post-natal part of it. A minimum of 6-8 weeks post-natal is desirable plus the possibility for nursing mothers to extend this further.

Breast feeding rooms and breaks at places of work.

Flexible working hours.

Breast feeding bonuses have been adopted in theory, at least, by many countries. Now they need to be put into practice.

WHAT EXTRA CONTROLS ARE NEEDED?

Protection of mother’s milk against its possible pollution (legislation on the use of insecticides and drugs).

Control of milk and infant foods.

Stricter regulations on composition and labelling.

Stricter control on advertising, distribution and sale.

IMPROVE THE CRITICAL POINTS OF INFLUENCE?

The maternity hospital is a key period. The positive attitude of staff is crucial.

Babies should be put to the breast as soon as possible.

Hospitalised babies need mothers with them, not weaning.

Health centres should promote breast feeding, not cover their walls with bottle milk adverts.

Family planning personnel should take breast feeding into account when advising on contraception.

Programmes to distribute milk should aim at pregnant nursing mothers and older children who are weaned. Milk supplements should go to the mother in cases of insufficient lactation (thus leading to a rapid increase in milk secretion) and not be given directly to babies.

Schools should run courses on parenthood and make the facts known in simplified but accurate form.
THERE IS HOPE!

The rate of decline of breast feeding is not an irreversible phenomenon.

It is on the increase again in the United States, Finland, France, Great Britain, Norway and Sweden.

In France, the average rate of breast feeding on the 5th day rose from 30% in 1972 to 48% in 1976.

Find out what is happening in your country!

BUT the situation is still deteriorating rapidly in most developing countries.

It is urgent to prevent this from getting worse!

Treat breast feeding from a worldwide as well as a nationwide perspective when you publicise the facts.

MAKE THE FACTS KNOWN NOW!
DEFINITION AND LIMITS

A number of definitions have been put forward to cover the concept of an accident, but none of them are entirely satisfactory. The involuntary and fortuitous aspect of accidents is often advanced, although the events may be directed by a deep-seated, unconscious intention which it is thus difficult to discover. It is however important to rule out brutality towards children, accidental traumatisms, and suicide.

A definition often used is that of WHO:

"By accident is meant an event which is independent of human willpower, caused by an external force, acts rapidly, and results in bodily or mental damage".

A fatal accident" is characterized by the fact that death occurs at once or within a week after the accident.

"Death due to an accident" occurs more than a week and less than a month after the accident.

"Death due to the sequelae of an accident" occurs one year or more after the accident, although it is considered to be a consequence of the accident.

This definition is incomplete, since it eliminates accidents which do not cause lesions, whereas these are just as important as the others.

The review could be prepared thanks to a grant of the US Department of Health, Education and Welfare, at the occasion of the International Year of the Child.
Prevention of Accidents in Childhood

EPIDEMIOLOGY

Mortality

Accidents are the chief cause of death in children between the ages of 1 and 15 in all industrialized countries (Table I). In many countries their frequency is increasing.

In developing countries, where communicable diseases and malnutrition are the prime causes of death, the number of fatal accidents is still high although deaths from accidents are lost among other causes which are statistically more numerous (Table II). If the number of accidental deaths is calculated per 100,000 children, the true importance of accidents becomes clear (Graph I).

Mortality statistics are not in fact a satisfactory indicator of the extent of this phenomenon, and of its social and economic consequences. The use of a different parameter - in this case the number of years of life lost, calculated on the basis of life expectancy - brings out more clearly the gravity of accidents which occur primarily in children, adolescents and young adults and take a high toll of young and potentially productive lives.

This increase, which is in opposition to the decrease in the overall number of deaths, raises from year to year the percentage of accidental deaths in mortality from all causes. Except for the age-group 0-1 year, accidental death now heads the list of causes of death. Mortality in males is already noticeably higher than in females in the first year of life, and this trend becomes more marked in higher age-groups.

The following figures are striking: in the United States, in 1971 and 1972, accidents from all causes led to the equivalent of 2,240,000 years of incapacity; in Mexico, in 1972, occupational accidents cost the country on an average $4,500 for each casualty; in France, in 1977, the total cost of road accidents was approximately 38 billion French Francs.
Prevention of Accidents in Childhood

Morbidity

This is much less well known, even in countries which possess reliable statistics.

On the basis of a number of epidemiological studies, it can be stated that for every child who dies accidentally there are between 200 and 900 non-fatal accidents. Other studies have shown that every year between 6% and 10% of all children consult a doctor as a result of an accident.

In all age-groups and in all countries, boys run roughly twice as much risk as girls of meeting with an accident.

Beyond morbidity statistics - chiefly hospital statistics, therefore too much reliance should not be placed on them - residual handicaps must also be taken into account. In industrialized countries, accidents are responsible for an increasing number of handicaps in children, since perinatal pathology and poliomyelitis have decreased considerably in importance as a result of preventive measures. In developing countries, this aspect of the pathology of accidents is still more disquieting: the socio-economic cost of serious sequelae is quite intolerable, and facilities for rehabilitation are quite inadequate.

AETIOLOGY

In industrialized countries, the accidents which predominate are traffic accidents, drowning, falls and poisoning. In developing countries, a large proportion are due to burns and poisoning. Although traffic is comparatively less heavy, road accidents are also very frequent in these countries.

A survey of this type made in Belgium by the Oeuvre nationale de l'Enfance and covering 4300 subjects aged between 0 and 6 years followed up regularly over a one-year period, showed that 44% of them had an accident during the year, the maximum frequency being during the 4th year. According to this survey, for one fatal case there were 890 non-fatal accidents and one case of permanent invalidity. This ratio, which is in fact accident lethality, varies greatly according to the statistics, but it can be said that for one accidental death there are several hundred less serious accidents.

A survey made in Benin by the Ministry of Primary Education and the International Children's Centre covered 282 accidents, of which 41% were road accidents. These were followed in order of frequency by accidents due to sharp or...
Prevention of accidents in childhood

In reality, accident etiology varies according to age.

Between 0 and 1 year, it is usual to incriminate:
- one main cause, mechanical suffocation;
- and three accessory causes: falls, poisoning, and traffic accidents in which the baby is killed as a passenger.

From 1 to 4 years, there are five main causes responsible for the majority of cases:
- traffic accidents, in which the child is involved as a pedestrian, a passenger, or else when learning to ride a bicycle;
- burns, from hot liquid which a child pours over himself or into which he falls, or from flames (danger of matches);
- drowning in rivers and especially in unprotected water points;
- accidental falls;
- poisoning, for which medicinal drugs and household products are equally responsible: here mortality is low, but hospitalization is frequently requested since the exact chemical nature of the poison and the quantity actually absorbed are often not known.

From 5 to 14 years, there are three main causes:
- traffic accidents in which children, as they grow older, are more and more often involved personally, as riders of bicycles or mopeds;
- traumas from falls or rural accidents;
- drowning in rivers or in the sea.

Pointed objects, and burns.
Accidental poisoning was mainly due to the absorption of kerosene or medicinal products.

A distinction must be made between mechanical suffocation and sudden unexpected death in young infants, which is not strictly an accident but appears to be due to a poorly understood breathing disorder.

Great progress has been achieved in this field through the establishment in many large towns in industrialized countries of Anti-poison Centres which are easily accessible to the public.
Prevention of accidents in childhood

From 15 to 24 years, traffic accidents take by far the highest place. They represent approximately 2/3 of the pathology due to injuries, at least for boys.

PSYCHOPHYSIOLOGICAL ELEMENTS

An understanding of the normal development of children is an important basis for the prevention of accidents in childhood.

Studies carried out for many years in Sweden by S. Sandels & coll. have provided extremely valuable information in this connexion.

In addition, parents often overestimate their children's abilities. It is a well-known fact that children have unforeseeable reactions when faced with a traffic problem right up to adolescence; on this point, parents have a wrong and often too optimistic idea of their children's abilities. Children have a very imperfect understanding of the signs and symbols which are increasingly used in the control of road traffic as well as in preventive demonstrations.

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Prevention of accidents in childhood

It is often found that an accident originates from faulty supervision of a child. This is a difficult problem, because children must be protected from the most dangerous risks, but at the same time it is important to avoid over-protection which may hamper their normal development. Decisions as to which risks are permissible and which must be forbidden have to be made all the time in everyday life.

As for the technical environment which, especially in industrialized countries, surrounds a child with risks of accidents, its role may be summed up in the words of Berfenstam: "There is actual incompatibility between the customary basis for the behaviour of a child and the environment in which he lives, which has been created by adults for adults and is full of dangerous traps".

Prevention

Preventive action must be multidisciplinary if it is to be effective. What is needed, indeed, is to achieve nothing less than a fundamental change of attitude towards the phenomenon of accidents throughout the whole population.

First of all, precise data on accidents and their sequelae must be collected, correctly interpreted, and made known to families, different social groups, and the body of decision-makers.

Secondly, legislative measures must be used, not only in connexion with the global conception of the urban and rural environment, but also with regard to housing. Any new product should be checked for its potential risks before being put on the market.

Thirdly, a health education campaign for the general public must be undertaken, directed more especially at parents, schoolteachers, driving-school instructors, and medical and para-medical personnel.

A diagram from WHO (Graph 2) outlines an approach which has already been applied to a great extent in Sweden, where it has also been

Being taught what to do, particularly with regard to changing direction, does not alter the fact that a large number of serious mistakes are still made.

In some countries, the examination to obtain a driving licence includes questions on the behaviour of children.
Prevention of accidents in childhood

possible to achieve a considerable decrease in mortality from accidents in children (Graph 3).

THE ROLE OF PHYSICIANS AND THE HEALTH TEAM

The days are past when a physician had no more than a purely technical role of repairing injuries. He is also responsible for preventive activities.

All medical practitioners with experience and proper training introduce elements of health education into their daily work. Thus, being aware of the most common home accidents, they will very quickly identify the main risks of accidents in a child's immediate surroundings when they make home visits, and can easily and naturally introduce the concept of accident prevention into the family.

All medical practitioners give thought to the side-effects of their prescriptions. One such effect, which is often forgotten, is the impact of the drug on the patient's alertness and behaviour, which may diminish his or her capacities as a pedestrian or a driver. There is also the risk of children consuming drugs which frequently look like sweets. The physician must therefore stress the importance of never leaving drugs within the reach of children.

A physician working in an MCH centre must give instructions on accident prevention to the staff working with him or her. Home visits by a paediatric nurse on the arrival of a new baby in the family are an excellent opportunity for giving information on the risk of accidents. This part of health education addressed to the parents is just as important as instructions on nutrition or hygiene.

School medical officers can encourage groups of schoolteachers to spread health education messages among the children and young people. They must also watch over the school environment and make suggestions for changes in it for the purpose of preventing accidents.

Finally the physician should - as indeed should all adults - give an example to children. Wearing a safety belt in a car, respecting traffic regulations, and showing responsible behaviour on all occasions are the best way of passing on health education.
Prevention of accidents in childhood

Medical staff, however, are not alone in this complex task. All health personnel are right at the centre of preventive activities through their many-sided work - informative, educational, preventive, and sometimes curative - among children, parents, and the various professions and organizations involved.

RESEARCH ON ACCIDENTS

Medical staff must contribute to research on the aetiology of the various pathological states that they encounter in their work. This is also true for accidents.

A medical officer in an emergency unit has an important role in this regard. From a complete file describing the accident, the statements of the various witnesses, and the observations of the patient as well as of the people who accompany him, the medical officer can put together valuable pieces of information to help in understanding the mechanism of the accident. These pieces of information are often hidden from the police, or are forgotten through a mechanism of repression. The medical officer, on the basis of these facts and his own observation, must decide, for instance, if he has to deal with a child who has met with an accident or a child who has been ill-treated.

It is important that all this information should be carefully entered in the greatest possible detail in the patient's file. A complete examination of the patient, with a detailed description of the injuries, will make these files a valuable working tool on which epidemiological studies can be based.

To clarify the mechanism of accidents, a multidisciplinary approach is needed covering all the factors involved. Town planners, technicians, psychiatrists, and physicians all have specific knowledge which can contribute to a solution of the problem. In this connexion, it is worth mentioning the very complete multidisciplinary investigations which are made when there is an airplane accident.

Information from different sources should always be collated in this way. For traffic accidents, the road-builders, the traffic police, the hospitals,
Prevention of accidents in childhood

and the insurance companies each hold a fragment of the truth about the accident.

Furthermore, studies also need to be made on the consequences of the accident, and the means available to the family to meet the needs of a child who has been injured accidentally.

Such insistence on the prevention of accidents and on the research needed in this field may seem exaggerated at first sight. Medical staff might easily plead lack of time for such an ambitious programme. This is because accidents have long been considered as something outside medical pathology proper; for proof of this, one only has to look at the short time devoted to them in the medical curriculum.

However, for many other scourges which ravage the population, medical practitioners have been able to adapt their methods of investigation, treatment and prevention. Why should this not also be possible for this scourge of our time, which entails such heavy consequences for the individual, the family, and society?


**TABLE 1 — Place of accidents among the 10 leading causes of death in Europe (1971).**

Percentage of cause to all causes (p. 100) and place (P).

<table>
<thead>
<tr>
<th>Place of Accident</th>
<th>Accidents p. 100</th>
<th>Congenital anomalies p. 100</th>
<th>Malignant neoplasms p. 100</th>
<th>Influenza and pneumonia p. 100</th>
<th>Enteritis and other diarrhoeal diseases p. 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>German Federal Republic</td>
<td>33.0</td>
<td>13.6</td>
<td>10.1</td>
<td>5.6</td>
<td>1.5</td>
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<td>Austria</td>
<td>35.4</td>
<td>8.5</td>
<td>10.3</td>
<td>6.3</td>
<td>-</td>
</tr>
<tr>
<td>Belgium (*)</td>
<td>30.7</td>
<td>11.1</td>
<td>9.5</td>
<td>5.9</td>
<td>-</td>
</tr>
<tr>
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<td>29.1</td>
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<td>8.8</td>
<td>11.5</td>
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<td>15.0</td>
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<td>7.5</td>
<td>4.4</td>
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<td>14.0</td>
<td>9.3</td>
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<td>10.2</td>
<td>11.1</td>
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<td>9.5</td>
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<td>10.6</td>
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</table>

(*) The data from Belgium are for 1970

TABLE II. — Place of accidents among the 10 leading causes of death for selected countries in Latin America, Asia and Africa (1971).
Percentage of cause to all causes (p. 100) and place (P)

<table>
<thead>
<tr>
<th>Country</th>
<th>Enteritis and other diarrheal diseases</th>
<th>Influenza and pneumonia</th>
<th>Bronchitis, emphysema and asthma</th>
<th>Measles</th>
<th>Accidents</th>
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<td>2.2 7</td>
<td>4.6 5</td>
<td>4.9 4</td>
</tr>
<tr>
<td>Mexico</td>
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<td>19.7 2</td>
<td>5.3 5</td>
<td>7.1 3</td>
<td>2.4 6</td>
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<tr>
<td>Panama</td>
<td>15.3 2</td>
<td>16.2 1</td>
<td>12.0 3</td>
<td>2.3 7</td>
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<td>27.0 1</td>
<td>13.4 2</td>
<td>11.9 3</td>
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<td>14.8 1</td>
<td>12.7 2</td>
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<td>— 2</td>
<td>32.5 2</td>
<td>0.6 10</td>
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<td>Singapore</td>
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</table>

(*) The data from Chile are for 1970

Graph 1: Accident death rates in the age-group 1-4 years in different countries.

(Source: Symposium Uppsala Univ., 1977: Prevention of accidents in childhood)
ACCIDENT PREVENTION AND INTERVENTION AS A CONCERN OF SOCIETY AS A WHOLE


ACCIDENT PREVENTION AND INTERVENTION AS A CONCERN OF SOCIETY AS A WHOLE

Measures of accident prevention in various spheres of social life
- Arranging facilities for children, flats, residential areas, playgrounds, sports and recreational facilities in such a way as to exclude sources of accidents (e.g., engineering, employment and means of production, means of transport, town and road construction)
- Education, imparting of information, propaganda (e.g., educational, psychological) in such facilities as creches, kindergartens, schools; instruction of the public by the mass media; direct influence by individuals and groups
- Organizational measures (e.g., organization of the care in creches and kindergartens; increased road safety; observance of safety rules)

Measures of medical treatment of accidents and of influencing the sequelae of accidents
- Task of the Red Cross (aid in the case of accidents and work of first-aid posts)
- First-aid training, ambulance service, special life-saving services and training of their staff
- Effective and disposable medical emergency services. Special centres for the care of special groups of accident victims: intensive care wards; (round-the-clock service), expansion of the toxicological advisory services etc.
- Therapeutical, medical, medico-technical and medicamentous care and treatment
- Rehabilitation, medical educational economic social

Acquisition, analysis and comparison of information, and creation of effective comparable and realistic information material for various fields and for the central level designed for assessing morbidity and mortality as well as main causes of accidents, elaboration of accident prevention, programmes, and cost-benefit success failure analysis

Orders: summarized information: condensed information (feedback information)


Graph 2
Graph 3. Accident deaths per 100,000 mean population in the age group 0-14 years, 1951-1974. Total and distribution by accident type.
International Children's Centre

PREVENTION
OF CHILD ACCIDENTS
AT HOME

A DOCUMENT FOR MASS MEDIA SPECIALISTS

DEDICATED TO THE INTERNATIONAL YEAR OF THE CHILD.
THIS PUBLICATION HAS BEEN MADE POSSIBLE BY A GRANT FROM THE
U.S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE.
FACTS

1. ACCIDENTS ARE FAST BECOMING THE GREATEST SINGLE CAUSE OF CHILD DEATHS.

2. FOR EVERY 1 FATAL ACCIDENT BETWEEN 200-900 CHILDREN ARE ADMITTED TO HOSPITAL.

3. FOR EVERY FATAL ACCIDENT, BETWEEN 1-4 HANDICAPS RESULT.

4. OVER HALF THE ACCIDENTS OCCUR WITH AN ADULT PRESENT.
CHILD ACCIDENTS ARE A MAJOR PUBLIC HEALTH PROBLEM IN INDUSTRIALISED COUNTRIES

WHICH COUNTRY HAS THE BEST CHILD ACCIDENT RECORD?

SWEDEN FOR BOYS
— 37% of child deaths from all causes.

U.K. FOR GIRLS
— 25% of child deaths from all causes.

Even so these figures are extremely high.

WHICH COUNTRY HAS THE WORST CHILD ACCIDENT RECORD?

ICELAND FOR BOYS
— 68% of child deaths due to all causes.

CANADA FOR GIRLS
— 43% of child deaths due to all causes.

Table I. — SHOWS THE ACCIDENT RECORD OF THE INDUSTRIALISED COUNTRIES.

Where is your country in this table? Are there questions to be asked?
### BOYS

<table>
<thead>
<tr>
<th>Country or area</th>
<th>Percent</th>
<th>Death rate</th>
<th>Accidents</th>
<th>All causes</th>
</tr>
</thead>
<tbody>
<tr>
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<td>37.0</td>
<td>15.1</td>
<td>40.8</td>
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<tr>
<td>U.K.: England &amp; Wales</td>
<td>38.4</td>
<td>19.6</td>
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<td>German Dem. Rep.</td>
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<td>56.3</td>
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</table>

Table I. — Percentage of accidents to all causes of death, according to rank, deaths from accidents and all causes per 100,000 children aged 1-14; 1971.
### GIRLS

<table>
<thead>
<tr>
<th>Country or area</th>
<th>Percent</th>
<th>Death rate</th>
<th></th>
<th></th>
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<tr>
<td></td>
<td></td>
<td>Accidents</td>
<td>All causes</td>
<td></td>
</tr>
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<td>Norway</td>
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<tr>
<td>Canada</td>
<td>43.6</td>
<td>19.3</td>
<td>44.3</td>
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</tr>
</tbody>
</table>
Who are the most vulnerable?

The toddler and the teenager.

The young child is by nature an explorer and discoverer. A child pokes and prods, tastes and eats, climbs and pulls things down, just to find out. Accidents are often the result.

The adolescent is at a stage of proving himself, rebelling against the advice of adults—and their rules. This leads to risk taking and accidents.

Table 2. — Shows the main causes of accidents and how they change with age (U.S.A., 1975)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>0-1 years</th>
<th>1-4 years</th>
<th>5-14 years</th>
<th>15-24 years</th>
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<tr>
<td>Motor vehicle accidents</td>
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<td>10.3</td>
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<td>Accidental drowning and submersion</td>
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<td>11.9</td>
<td>11.2</td>
<td>61.0 M</td>
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<td>Other transport accidents</td>
<td>0.1</td>
<td>0.4</td>
<td>0.8</td>
<td>2.1 T</td>
</tr>
<tr>
<td>Accidental poisoning</td>
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<td>0.5</td>
<td>1.1</td>
<td>3.6 M</td>
</tr>
<tr>
<td>Accidental falls</td>
<td>1.0</td>
<td>0.9</td>
<td>0.3</td>
<td>4.2 T</td>
</tr>
<tr>
<td>Accidents caused by fires</td>
<td>1.0</td>
<td>1.1</td>
<td>0.5</td>
<td>6.5 M</td>
</tr>
<tr>
<td>Accidents caused by firearms</td>
<td>2.2</td>
<td>0.9</td>
<td>0.2</td>
<td>0.3 F</td>
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<td>Accidents of industrial type</td>
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<td>4.8</td>
<td>1.5</td>
<td>1.3 T</td>
</tr>
<tr>
<td>All other accidents</td>
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<td>4.9</td>
<td>1.8</td>
<td>1.7 M</td>
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<tr>
<td>U.S.A., 1975</td>
<td>4.6</td>
<td>4.7</td>
<td>1.3</td>
<td>0.8 F</td>
</tr>
</tbody>
</table>

Table II. — Death rates specific for sex and age, per 100,000 population (infant mortality per 100,000 live-born)
PREVENTING ACCIDENTS

THERE ARE FOUR MAIN ELEMENTS IN EVERY ACCIDENT.
EACH ONE NEEDS LOOKING AT.

HUMAN ENVIRONMENT

CHILD

AGENT OF
ACCIDENT

PHYSICAL ENVIRONMENT

1. CHILD

In the first two years of life, the child is totally dependent on the protection of the adults around. Later, from about 3 onwards, the protective attitude must be combined with education.

The child must be taught the risks of his actions. Total shielding from all potentially dangerous situations is not the answer. A child has to learn gradually to cope with the environment he lives in.

2. THE HUMAN ENVIRONMENT

More than half the accidents to children happen with an adult present. The adult has often not realised the situation is dangerous to a child.

Remember. A child of two has his eyes 75 cms from the ground when he is standing, even lower when sitting and crawling. What he sees is not familiar territory to adults—tempting holes of electric sockets, detergents and bleaches—all lie “down there”. It requires imagination to enter into the child’s world.
PARENTS NEED HELP

Advice on accident prevention should be given as much emphasis as feeding and immunisation.

Schools need to develop an understanding of the problem and attach importance to the teaching of safety. Both Sweden and the U.K. have extensive safety club activities in and out of school. Look at their position in the accident TABLE 1. Do you think this is due to chance? What provision is made in your country?

MEDICAL, HEALTH AND SOCIAL PERSONNEL have an important role with families. More emphasis must be given to accident prevention. At the moment the emphasis in medical and nursing studies is on treatment and not prevention.

3. THE PHYSICAL ENVIRONMENT

A child is often in danger in the world planned for adults by adults. Whilst industrial progress has removed the causes of some accidents (e.g. central heating has reduced the number of burns by fire and washing machines have reduced scalding), it has introduced many more. Drugs, electricity, mechanisation in agriculture and household equipment are all newer and important causes. Even more recently plastic wrappings and bags, man-made materials in clothing, "technical" toys, medicines purchased like sweets, have all added to the risks.

The widespread fashion for "fondues" and "barbecues" is ironically, now increasing again the accidents due to "naked flame" which were previously reduced by other forms of heating being developed.
4. THE AGENT OF THE ACCIDENT

In the case of a child this can be absolutely anything, an aerosol spray, a small part of a toy broken and swallowed, even a tin of talcum powder which tips over a child’s face so that the contents are inhaled. It is therefore best to bear in mind not the list of agents which have been involved in accidents, but the context in which they were involved.

ACCIDENT PREVENTION REQUIRES IMAGINATION AND ACTION

MEDICINAL TABLETS CAN BE PACKAGED IN CHILD-RESISTANT BOTTLES AND PACKAGES.

GAS APPLIANCES SHOULD HAVE THE KNOBS WHICH REQUIRE PRESSING DOWN AS WELL AS TURNING.

ELECTRIC POINTS NEED TO BE AUTOMATICALLY COVERED UP WHEN NOT IN USE.

ALL DANGEROUS HOUSEHOLD MATERIALS NEED A MORE COMPLICATED OPENING AND CLOSING SYSTEM, BEYOND A CHILD’S SKILLS.

HIGHER COSTS? Yes, a slightly higher cost of production, BUT ACCIDENTS ARE COSTING US MORE.

ACCIDENTS CAN BE AVOIDED. THEY ARE OPEN to scientific study and, where recommendations are implemented, accidents have been reduced (see Graph).
DEATHS THROUGH ACCIDENTS per 100,000 in the age group 0-14 years. Sweden.
1951-1973 inclusive.

Death / 100,000


All causes
Traffic
Drowning
Other causes
ACCIDENTS ARE A MAJOR PUBLIC HEALTH PROBLEM.

THERE IS SOMETHING YOU CAN DO ABOUT IT.
October 1979

IMMUNIZATION: ITS IMMUNOLOGICAL BASIS

Document for university personnel

IMMUNOLOGICAL STUDY

In the past few years, immunization has benefited from recent fundamental progress in immunology. The mechanisms of immunity acquired after immunization against virus diseases are similar to those used by the organism against the same diseases.

The introduction of an antigen into the organism releases an immune response which may be humoral or cellular in nature, or both at once. An immune response implies recognition by the immune system of the antigenic substance and the selection of a certain number of immunologically suitable cells capable of organizing this response.

Briefly, two types of cells are involved in the immune response: macrophages and lymphocytes.

1. Macrophages

Macrophages derived from a monocyte clone play an important part in the release as well as in the expression of immune responses, quite apart from any antigenic specificity. However, they play a very important part in digestion of the antigen (phagocytosis) and its presentation to the lymphocytes, as well as in certain cytotoxic reactions.

Macrophages enter in at almost all levels of the immune response.

a) They are capable of transforming certain antigens to make them recognizable by B lymphocytes.

b) They play an important rôle in the cooperation between T and B lymphocytes; they intervene as moderators of this cooperation.

c) They may also be cytotoxic and inhibit the proliferation of K cells (K: killer).

The antigenic message liberated by the macrophages is picked up at once by the lymphocytes whose stem cells are located in the bone marrow.

2. Lymphocytes

These are responsible for specific cellular or humoral immunity. There are two categories: B and T lymphocytes, each broken down into numerous sub-categories.

T lymphocytes, whose differentiation is dependent on the thymus, either by actually passing into the thymus or through the action of a humoral factor working by remote control, are responsible for cell-mediated immunity which is at the origin of the processes of delayed hypersensitivity of which the classic example is tuberculin allergy.
Contrary to the T-helper action, T lymphocytes possess depressive properties on certain clones of B lymphocytes and even on the T-helpers, which in some cases lead to a specific immune paralysis.

IMMUNOGLOBULIN SYNTHESIS IN THE FOETUS AND THE NEWBORN

Contrary to a long-held belief, the foetus is capable of synthesizing certain categories of antibodies. Traces of IgM have been found as early as the 10th week of foetal life, and very small quantities of IgG from the 12th week onwards. On the other hand, the foetus is incapable itself of synthesizing IgA, IgD and IgE.

It is now known that only the maternal IgG, because of the properties of their Fc fraction, are capable of getting actively through the placenta. However, during the first six months of foetal life they only do so in small amount, and only from the 6th month of pregnancy onwards do they become sizeable; this is attributed to a sudden increase in placental permeability to immunoglobulin G. Humoral immunity in the newborn is thus essentially an adopted immunity which requires the transmission of passive immunity from the mother to the infant as a result of an active transfer through the membranes of the placenta.

The immunoglobulins present in the blood-stream at birth are thus chiefly IgG of maternal origin. Their level in a newborn at term is usually the same as, or slightly higher than, that of the mother, and is made up mainly of antibacterial and antiviral antibodies which have a major protective rôle in the first two trimesters of life; in certain cases, they may even, on the contrary, inhibit immune processes resulting from immunization. Thus, immunization against measles before the 12th month is only partially effective, and in certain cases it is necessary to use a strongly antigenic vaccine to overcome the effect of the maternal antibodies, as has been shown recently with injectable poliomyelitis immunization.

T cells have characteristic surface antigens. They neither carry nor secrete large quantities of immunoglobulin, and from an immunological point of view they act by direct cell contact.

On contact with the antigen, an activation of the T lymphocytes takes place; they undergo a blastic transformation and split up to produce daughter cells, which are responsible for what are known as cellular immunological reactions.

T lymphocytes, stimulated by the antigen, secrete a certain number of mediators, or lymphokines. Among the biological activities of these lymphokines may be mentioned macrophage migration inhibition (M.I.F.), non-specific macrophage activation, and anti-viral action (interferon).

B lymphocytes (B for Bone Marrow) are solely medullary in man. They proliferate under the influence of antigenic stimulations which lead to the formation of specific antibodies. They are differentiated into plasma cells which are highly specialized in the synthesis and excretion of immunoglobulines or antibodies. Their specific membrane receptors are immunoglobulins. The plasma cells secrete and liberate, as the case may be, different types of immunoglobulins: IgG, IgM, IgA, and, more rarely, IgD and IgE.

The duality of the lymphoid system and the immune responses does not exclude close interrelationships:

1) Direct interaction between T and B lymphocytes, the antigen constituting a bridge between these cells by combining with a soluble factor produced by the T lymphocyte and facilitating its binding to the surface of the macrophages which then present it to the lymphocytes.

2) The intervention of soluble mediators, specific or otherwise of the antigen, transformed by the T-helper.
Furthermore, it is known that cell immunity can perfectly well develop in the newborn, and that in particular BCG and smallpox vaccinations can be given at birth with a maximum likelihood of success.

The elements of the response of the immune system to immunization with an inactivated or live vaccine are also well known. When a primary immunization is given, the IgMs are the first to appear; they can be detected by the 3rd day, with a maximum level around the 2nd or 3rd week, then they decrease very quickly and disappear within one or two months.

IgGs appear after a few days, reaching their maximum by about the 5th week, when the IgMs have more or less disappeared, and remaining at a constant level for several weeks, then declining very slowly over the years; this is why booster injections are extremely important.

Serum IgAs, whose role is not yet clear, never reach a very high level. On the other hand, local IgAs, which are secreted by the various mucous membranes, play an essential role in protection against viral infections; this is the case with Sabin oral poliomyelitis vaccine, and vaccines administered intranasally.

**Dynamics of the Formation of Antibodies**

Injection of a vaccine leads to the production of antibodies after a latency period of varying duration. The response is especially rapid and intense after a booster injection.

**1. Primary response:**

Primary reactions are those observed after the first injection of a vaccine, as opposed to secondary reactions which are observed when injections are repeated.

In brief, after the first injection of a vaccine, there are three distinct periods:

1) the latency period, between injection of the vaccine and the appearance of serum antibodies. This period varies according to the development of the subject's immune system, and the kind and form of antigen used.

2) the growth period. As soon as the latency period is over, the antibody level increases exponentially: it reaches its maximum in a period varying between 4 days and 4 weeks. This period is approximately 3 weeks for tetanus or diphtheria toxoid, and 2 weeks for microbial vaccines. Usually the production of IgM antibodies precedes that of IgGs.

3) the period of decline. After reaching a maximum concentration, the level of antibodies declines, at first rapidly, then slowly. The period of decline varies: it depends both on the rate of synthesis of the antibodies and their degradation, and on their quality and quantity. IgAs and IgMs decline more quickly than IgGs.

**2. Secondary response:**

Reintroduction of the antigen after a suitable period releases a response of a secondary type, characterized both by the rapid appearance of specific antibodies and the large number of antibodies secreted. The maximum antibody level is reached in a few days. The growth phase remains exponential, but its development is more rapid, whereas the period of decline is longer. Furthermore, a temporary decrease in the antibody level is observed, followed by a further rise if the second injection is given before the antibodies induced by the first injection have disappeared. If the antibodies present in the serum are still at a high level, they will obscure the antigens administered.

The importance of the secondary response is due to the presence of a population of lymphocytes endowed with a 'memory', which are stimulated by the immunogenic molecule and are differentiated into antibodies secreting cells. The phenomena of immunological memory exist for both types of lymphocytes, T and B. The secondary response is observed with a maximum of intensity if the doses of antigen are increased at later stimulations.

Immunological memory persists for a long time in man. It depends on the quality and quantity of the antigen, and on the periodicity of the stimulations.
both in Europe and in Africa (DPT+ injectable or oral Polio; Yellow Fever + Cholera; DPT+ Yellow Fever + Measles; Smallpox + BCG + Measles; etc.).

Also, association of viral vaccines is possible; the association of measles and rubella vaccines is compatible and effective, as well as that of measles, rubella, and mumps vaccines.

On the other hand, in some cases, there may be antigenic competition; inhibition or lessening of the antibody response is then observed. It should be noted that association of more than five vaccines produces a kind of immunological saturation; antigenic competition usually takes place at the expense of a viral immunization (yellow fever or measles, for example).

Studies carried out in Africa have shown that there is competition between TAB and poliomyelitis vaccines, to the detriment of the latter. In the same way, association of yellow fever and cholera vaccine has revealed very doubtful immunization against yellow fever.

Furthermore, the problems raised by the relationships between the dose of antigen and the immune reactions are complex. According to the dose, the same antigen may produce either immunity or tolerance. A good example of antigenic competition is given by oral poliomyelitis vaccine.

In order to avoid competition among the three types of vaccine, some authors consider that monovalent vaccines containing only one type of virus should be used; it has indeed been noticed that when the three attenuated viruses are administered simultaneously in equal doses, type II is usually the one that wins. It is the only one that multiplies and produces antibodies, hence the precaution taken in the preparation of French live vaccine to include a much smaller proportion of type II virus than of types I and III.

This concept of antigenic competition thus explains the absolute necessity for controlled studies to be made in advance of any recommendation for new associations of vaccines.

**MODE OF ACTION OF VACCINES**

The advantage of immunization over serotherapy is the duration of its protection, by setting in motion an active process comprising, on the one hand,
the presence of circulating antibodies and, in certain cases, reactive lymphocytes which are immediately available when contamination occurs later, and, on the other hand, the building up of a sensitized immune system capable of responding immediately in case of attack by a wild germ; this is the anamnestic reaction.

In simplified terms, 4 types of vaccines may be distinguished:

- toxoids: diphtheria, tetanus
- killed bacterial vaccines: pertussis, typhoid, cholera, and attenuated live bacterial vaccines: BCG
- inactivated and attenuated live viral vaccines: oral and injectable poliomyelitis, influenza, rubella, measles, mumps
- polysaccharide vaccines: meningococcal and pneumococcal vaccines

Toxoids immunize only against exotoxin; they are of excellent quality because of their antigenic purity and the soluble nature of this antigen; they produce a humoral reaction which is easy to assess.

Bacterial vaccines cause a large number of antibodies to appear, among which there are most probably opsonins. These vaccines have an adjuvant action and increase the immune response obtained when there is an association of vaccines.

Among the viral vaccines, smallpox vaccine has been known the longest. Inoculation of the vaccine virus in man produces immunity against smallpox as a result of cross antigenicity between the two viruses. Vaccinia mainly produces cellular immunity; antibody response is usually very weak.

With regard to the other viral vaccines, whether attenuated or live, they bring about humoral immunity with production of circulating antibodies which are easy to assess by sero-neutralization or haemagglutination inhibition test.

Some live vaccines - for example, oral poliomyelitis vaccine or vaccines administered nasally - produce, in addition to humoral immunity, local immunity of the tissues with production of type A immunoglobulins (IgA), and ensure very great local surface immunity, thus preventing implantation of the virus through the entry route.

Finally, the meningococcal A and C and polyvalent pneumococcal polysaccharide vaccines produce in man the formation of antibodies homologous to the capsular types contained in the vaccine.

**SUITABILITY OF IMMUNIZATION FOR INFANTS**

Recent immunological data show that infants can be immunized earlier than was thought for a long time; there is thus no reason to postpone immunizations until after the first year - as was the habit when diphtheria immunization was first introduced - or until the second half of the first year, as is quite often thought in some countries.

Furthermore, it is important to determine the best age for each immunization, taking into account, on the one hand, the epidemiology of the diseases and the time in life when a child is most exposed to them, and, on the other hand, the varying ability of children to react to vaccine stimulation.

There is constant progress in new possibilities of immunization, but there is certainly no question of immunizing children or adults against all the infectious diseases. Before establishing an immunization schedule, the epidemiological data of the country in which the child lives must be taken into account.

To ensure that a child is properly protected, it is thus necessary to determine the order, the timing, and the possible vaccine associations; the point is to find the simplest and most effective method of protecting the child as early as possible.

For immunization to be effective, it is essential that the basic immunization be correct and complete: the doses, the number of injections, the interval between them, the booster injection one year after primary immunization, and the later boosters.
It should be remembered that the desirable interval between injections is theoretically one month. In fact, although this interval of one month ensures a satisfactory acquisition of antibodies, it should not be taken for granted that any change in the timing of injections will lead to failure of the immunization and oblige the physician to start immunization all over again from the beginning.

Nowadays, through titration of antibodies after immunization, it is possible to space the intervals between injections of vaccines without in any way changing the number of injections or the immunization schedule.

Controlled studies have indeed shown that there can be a three-month interval between the first and second injection, and a six-month interval between the second and third injection. The same is true for the booster injection which is given 12 to 18 months after the third injection, while further boosters are given every 5 to 7 years. Between 7 and 10 years, it is enough to give two consecutive boosters at intervals of 6 weeks; after 10 years, it is necessary to start immunization again from the beginning.

**IMMUNIZATION, GAMMAGLOBULINS, AND IMMUNE DEFICIENCY SYNDROME**

Gammaglobulins are now widely used in preventive or curative therapy. In certain cases, they may inhibit the establishment of active immunity if a vaccine is injected within a few days of their administration.

The appearance of immunity after immunization with attenuated live viral vaccine is conditioned particularly by a considerable increase of vaccine viruses in the organism which is stopped by the presence of gammaglobulins. To immunize satisfactorily, therefore, it is best to wait at least 6 weeks after the last injection.

On the other hand, gammaglobulins do not seem to check the response of the vaccine after immunization with vaccines prepared with killed microorganisms. Some authors believe, however, that the quality of the immunization is not so good.

It should be noted that the administration of gammaglobulins does not cause any change in the level of antibodies discernable in the serum, and does not affect serological tests which remain valid to prove an intercurrent infection (SEVER).

Can vaccines be administered to a child suffering from hypogammaglobulinaemia? The most currently widespread opinion is that a child suffering from hypogammaglobulinaemia cannot respond to immunization by synthesizing antibodies, and the fear of reactions to vaccines often leads to an attitude of abstinence with such children.

Until recently, immune deficiencies were described on the basis of their clinical characteristics. A better understanding of T and B lymphocytes has made it possible to classify congenital immune deficiencies as combined deficiencies with impairment of the T and B function, T deficiencies alone, or B deficiencies alone, global or dissociated, typified by X-linked hypogammaglobulinaemia.

In no case should live vaccines be used, as they may be dangerous in case of cellular immunity deficiency; cases of hypogammaglobulinaemia of the Swiss type are known, which have been revealed by the extremely serious disorders following immunization with a live vaccine (fatal generalized complications following BCG vaccination, gangrenous vaccinia, or paralysis following absorption of Sabin polio vaccine).

On the other hand, the use of inactivated or killed vaccines is recommended, since some ability to synthesize antibodies subsists; in this case, it is best to immunize more frequently, to enable the sensitized lymphocytes required for protection to come into play.
FOR FURTHER INFORMATION

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Mécanisme de l'immunité provoquée par les vaccinations antivirales.  

Allergy and clinical immunology.  

Fetal defense mechanisms  

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For additional information,
Please contact the:

INTERNATIONAL CHILDREN'S CENTRE

Programme on the Development of Information on Early Childhood,

Château de Longchamp
Carrefour de Longchamp
Bois de Boulogne

75016 PARIS
France
FACTS:

Five million children die every year from diseases which immunization can prevent. Thousands more are unnecessarily handicapped for life. It costs more to treat disease than to prevent it.

The World Health Organization campaign has already eradicated smallpox. It can do the same for other diseases.

It is the W. H. O.’s objective to immunize every child in the world against preventable diseases by 1990.

All children must be immunized to be individually protected. At least 80% of the population must be immunized to eliminate the risk of an epidemic breaking out.
QUESTIONS TO ASK:

• WHY ARE CHILDREN STILL DYING FROM PREVENTABLE DISEASES?

Major reasons are:

- Lack of public motivation and interest.
- Insufficient enthusiasm on the part of health authorities.
- Inadequate financing of programmes which would permit widespread use of vaccines.
- Insufficient or poorly trained health and paramedical personnel.
- Difficulty of establishing proper storage or handling in remote or rural areas.

• WHICH OF THESE APPLIES IN YOUR COUNTRY?
CAN YOU DO ANYTHING TO HELP?

• WHY IMMUNIZE?

The aim of immunization is the prevention of disease.

In any immunization programme:

- protection must be as strong as possible,
- the number of injections as few as possible,
- the risk of reaction as slight as possible.
INFORMATION ON DISEASES IMMUNIZATION CAN PREVENT

POLIOMYELITIS  attacks children under 5 and leaves them paralysed for life; 1.5 % die of it.

TUBERCULOSIS  There are 3.5 million new cases every year. Half a million die. Its more serious forms, including tuberculous meningitis, occur in children under 5.

DIPHTHERIA  Incidence is not well known but hundreds of thousands of children under six are attacked by it every year. Its effects are serious and can be fatal.

TETANUS  An infant is exposed as soon as it is born. The umbilical wound is vulnerable (due to poor sanitation, covering the umbilicus with animal dung and other ancestral traditions). In some developing countries 2 % of newborns have tetanus. 80 % of these newborns die of it.

MEASLES  Almost all children contract it sometime. Between 1 and 10. % die of it in developing countries, 1 in 10,000 die of it in industrial countries.

In 1 - 3 % there are often serious nervous system complications involving hearing and sight.

WHOOPING COUGH  Can be fatal if contracted in the first few months. It is a disease which may persist for 10 or 12 weeks. The toxin produced by the organism responsible causes paroxysms of coughing which exhaust both patients and parents and can permanently damage lungs.
Schedules differ from one country to another but the guiding principles are the same. What is the recommended schedule in your country? Do you know the thinking behind it? Do you help to publicise it?

Here are the schedules of three different parts of the world for comparison:

<table>
<thead>
<tr>
<th>AGE</th>
<th>IMMUNIZATION</th>
<th>FRANCE</th>
<th>CAMEROON</th>
<th>UNITED STATES OF AMERICA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 months</td>
<td>D.P.T. - Polio + Oral Polio No. 1 + B.C.G.</td>
<td>D.P.T. + Oral Polio No. 1 + B.C.G</td>
<td>D.P.T. + Oral Polio No. 1 + B.C.G</td>
<td>D.P.T. - Polio + B.C.G</td>
</tr>
<tr>
<td>4 months</td>
<td>D.P.T. - Polio + Oral Polio No. 1 + B.C.G.</td>
<td>D.P.T. + Oral Polio No. 1 + B.C.G</td>
<td>D.P.T. + Oral Polio No. 1 + B.C.G</td>
<td>D.P.T. - Polio + B.C.G</td>
</tr>
<tr>
<td>6 months</td>
<td>D.P.T. - Polio + Oral Polio No. 1 + B.C.G.</td>
<td>D.P.T. + Oral Polio No. 1 + B.C.G</td>
<td>D.P.T. + Oral Polio No. 1 + B.C.G</td>
<td>D.P.T. - Polio + B.C.G</td>
</tr>
<tr>
<td>8 months</td>
<td>D.P.T. - Polio + Oral Polio No. 1 + B.C.G.</td>
<td>D.P.T. + Oral Polio No. 1 + B.C.G</td>
<td>D.P.T. + Oral Polio No. 1 + B.C.G</td>
<td>D.P.T. - Polio + B.C.G</td>
</tr>
<tr>
<td>10 months</td>
<td>D.P.T. - Polio + Oral Polio No. 1 + B.C.G.</td>
<td>D.P.T. + Oral Polio No. 1 + B.C.G</td>
<td>D.P.T. + Oral Polio No. 1 + B.C.G</td>
<td>D.P.T. - Polio + B.C.G</td>
</tr>
<tr>
<td>12 months</td>
<td>D.P.T. - Polio + Oral Polio No. 1 + B.C.G.</td>
<td>D.P.T. + Oral Polio No. 1 + B.C.G</td>
<td>D.P.T. + Oral Polio No. 1 + B.C.G</td>
<td>D.P.T. - Polio + B.C.G</td>
</tr>
<tr>
<td>14 months</td>
<td>D.P.T. - Polio + Oral Polio No. 1 + B.C.G.</td>
<td>D.P.T. + Oral Polio No. 1 + B.C.G</td>
<td>D.P.T. + Oral Polio No. 1 + B.C.G</td>
<td>D.P.T. - Polio + B.C.G</td>
</tr>
<tr>
<td>16 months</td>
<td>D.P.T. - Polio + Oral Polio No. 1 + B.C.G.</td>
<td>D.P.T. + Oral Polio No. 1 + B.C.G</td>
<td>D.P.T. + Oral Polio No. 1 + B.C.G</td>
<td>D.P.T. - Polio + B.C.G</td>
</tr>
</tbody>
</table>

In areas with limited resources, it is most effective to reduce the number of visits to health centers to a minimum and to combine the program as much as possible with other material and child health services.

* D.P.T.: diphtheria, whooping cough, tetanus

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THE ROLE OF THE MEDIA IS:

- TO KEEP PEOPLE INFORMED

Information to parents is essential for the success of any immunization programme.

Remind them of the nature of the disease the programme is designed to prevent.

Tell them where and when their child can be immunized.

Tell them what effect the immunization can have.
• ALSO TO ASK QUESTIONS ON THE PARENTS' BEHALF

The questions should be asked in an unsensational calm way which elicits the facts but does not result in sensational overheated arguments between medical personnel.

Parents do not have the information to decide who is right in such an encounter.

A CAUTIONARY TALE!

The media in Great Britain was blamed for the recent whooping cough epidemic.

Media coverage of the risk of brain damage associated with the whooping cough vaccine began in late 1974 with the publication of a medical report.

The wide publicity given to this report caused a drop of vaccination for whooping cough from 80% to 35%.
What was even more important was that the incidence of vaccination against tetanus and diphtheria dropped too.

At its peak, there were still over 1,000 cases of whooping cough per week.

In 1979 with the epidemic past its peak, there are still over 400 cases per week.

The horror of the whooping cough epidemic has pushed vaccinations back up to 50%, but this is still well below the 1974 level.
ARE THERE LESSONS TO BE LEARNED FROM THIS?

THE MEDIA MUST VERIFY FACTS
AND PROVIDE CAREFULLY PREPARED
AND PRESENTED INFORMATION.
THE POPULATION NEEDS TO KNOW
THE FACTS CLEARLY AND SIMPLY.
YOU CAN HELP HEALTH PERSONNEL ACHIEVE THE W. H. O. OBJECTIVE OF SAFELY REDUCING DEATH AND HANDICAP DUE TO DIPHTHERIA, WHOOPING COUGH, TETANUS, MEASLES, POLIOMYELITIS AND TUBERCULOSIS BY IMMUNIZING EVERY CHILD IN THE WORLD BY 1990.