No. Downes's

C 26

A FIELD EXPERIENCE OF

COMBINED MEASLES, DIPHTHERIA, WHOOPING COUGH

AND TETANUS IMMUNISATION.

I.W.F. SPENCER, M.B., B.CH., D.P.H., D.T.M. & H.,

M.E.E. COSTER, M.B., B.CH., M. RICHTER, M.B., B.CH.,

and M. MAHER, M.B., B.S., L.R.C.P., M.R.C.S.

City Health Department, Johannesburg.

The safety and efficacy of Enders' attenuated live measles-virus vaccine was accepted [1, 2]. The objective was a trial of mass field application of the vaccine and its combined administration with other antigens in a selected community.

The Bantu residential complex of Johannesburg covers an area of 26 square miles and houses approximately half a million persons. The population structure varies from recently detribalized Bantu to professional levels with academic qualification. In varying degree there is retention of Bantu tradition and concept which is greatest in the recently detribalized and least in the higher socio-intellectual strata where adoption of the European way of life is paramount. The socio-economic advancement of this community has been relatively rapid and is generally superior to that in the Bantu homelands. The complex has a network of polyclinics acting

:- as ..... /

as an integrated system with a base hospital (Baragwanath Hospital). The polyclinics operated by the Johannesburg City Council are staffed by 520 Bantu and European medical officers, health visitors, nurses and others, and of the total, 458 are Bantu and 62 are European. The clinics provide curative, midwifery, dental, child welfare and health visitor, tuberculosis and immunization services; are linked with each other, their midwives operating in the district, ambulance services and the base hospital by radio communication; and conduct an extensive home visiting service by doctors, nurses, health visitors and midwives. There were 935,052 patient attendances, 12,135 district confinements and 72,299 ambulance removals during 1961. In addition private practitioners have established practices in the area.

Certain advantages were inherent in the selection of this population group. It represented a large static community resident in an area sufficiently small for reasonable practical control, and served by an adequate medical service which formed a part of the daily life of the people to which they could report any markedly untoward reaction to immunisation and obtain medical advice and care where necessary.

There were further specific indications for undertaking an extensive application of measles immunisation in combination with other antigens. Primarily, as in other parts of Africa, measles is a greater problem amongst

:- Bantu ..... /

Bantu than Europeans, though in the community selected it is very much less of a hazard than for example in Nigeria[3] or in the upper Volta[4]. Nevertheless epidemics of measles are frequent in South Africa and mortality statistics fail to reflect morbidity, and frequently mortality, resulting from complications. Further, varying degrees of malnutrition in a considerable proportion of children contribute to the severity of the illness and to a higher rate of complication. Katz[3] considers that in Nigeria measles is the acute infection most likely to precipitate acute kwashiorkor.

In Table I comparative mortality rates for Europeans, Coloureds, Asiatics and Bantu in Johannesburg are shown. In Table II comparison is made between deaths from diphtheria and measles in the Bantu. As a result of 3 basal phases of mass immunisation the number of deaths from diphtheria in 1962 was reduced to 8 amongst the Bantu living in Johannesburg, though none of these occurred amongst children living in the complex under discussion and in which the immunisation campaigns were carried out.

TABLE I

TABLE II

Based on clinical experience and preliminary serological studies by other workers, it was estimated that by the age of 5 years the majority of Bantu children in the selected community had contracted measles. On these

:- grounds ..... /

grounds and for technical reasons, it was thought practicable to combine measles vaccination with diphtheria whooping cough and tetanus immunisation in the age group 3 months to 2 years, in a scheduled fourth booster phase of a diphtheria whooping cough and tetanus immunisation campaign, in which 3 basal phases had already been completed. In selecting this age group consideration was given to the effect of persistent maternal antibody in the younger infants. Reilly et al.[5] showed that infants with detectable measles antibody of maternal origin failed to respond clinically and serologically to live attenuated measles-virus vaccine, and that later when maternal antibody was lost, they became susceptible to infection with the virus given parenterally. They also showed a failure of antibody response among infants under 5 months of age who exhibited maternal antibody. In the mass field experience of our study wastage of vaccine would inevitably occur when administered to children with protective antibody levels of maternal origin or from previous infection, as medical histories are notoriously unreliable in Bantu practice. Further, the vaccine would tend to be brought into disrepute if children vaccinated against measles whilst they still had protective maternal antibody titres subsequently contracted the disease on exposure to natural infection. However it was felt that maternal antibody would be lost at 6 months of age, that infants of younger age who possessed it would

:- do ..... /

do so in varying degree, and that in those with lower levels the result would be similar to the modifying effect of gamma-globulin when co-administered with measles vaccine. In a mass campaign involving thousands of inoculations of measles vaccine, antibody estimations were impracticable. Apart from impracticability, a most important feature in our experience in dealing with rural or urban Bantu communities is that venepuncture is acceptable in small clinical trials, but, in pilot probes immediately preceding a mass campaign, or during a mass campaign, the practice should be rigorously avoided. This opinion was supported by Katz et al.[3] in their Nigerian experience where they found that customs and beliefs made parents quite unwilling to have blood taken from their children and no further serologic assays were performed in their later studies because of their unwillingness to urge bleedings on an unwilling population. It was thus essential in our undertaking to give measles vaccine to all in the age group in which the most susceptibles were to be found.

The development of multiple immunisation techniques is of especial significance in Africa where communities are frequently in need of mass immunisation for the control of disease, and where environmental conditions and attitudes often preclude a satisfactory return on numerous occasions for different inoculations. In South Africa Spencer and Coster[6] showed that smallpox vaccination could safely be combined with triple vaccine in mass immunisation procedure, whilst Winter and his co-workers[7] subsequently demonstrated the safe

:- and ..... /

and satisfactory combination of immunisation against poliomyelitis, diphtheria, whooping cough, tetanus and smallpox. The combination of measles vaccine with triple antigen was therefore a further step in a necessary direction. That only one inoculation of live attenuated measles-virus vaccine is necessary for protection is significant.

According to Taneja[8] mass trials in several areas of the world with different population groups, environmental and socio-economic conditions, would be of the utmost importance. Weibel[2] describes that amongst susceptible children given Enders' attenuated live measles-virus vaccine without gamma-globulin, 80% may be expected to develop a temperature greater than 100°F(R), 20% a temperature of 103°F(R) or higher, and an exanthem in 45%. Similarly a report[1] based on current available information states that when administered without gamma-globulin, although in the majority symptoms are minimal, pyrexia of 103°F(R) or greater may be experienced in 30% to 40%, beginning on the sixth day and lasting 2 to 5 days and a rash beginning with or after the subsidence of fever in 30% to 60%. Observers comment on the striking lack of disability in children with reactions. If gamma-globulin in recommended dose is given at the same time as the vaccine, reactions are greatly reduced in intensity and incidence. The combination of live measles-virus vaccination in a fourth booster triple vaccine

:- immunisation ..... /

immunisation campaign for which planning, organization and propaganda were already complete, rendered the administration of gamma-globulin impracticable.

Consideration was given to the contraindications to measles vaccine. Though no reports were found in the literature describing concurrent immunisation with live measles-virus vaccine and diphtheria whooping cough and tetanus antigens, there appeared no valid reason precluding the safety and efficacy of the combination. Though difficult under the pressure of field conditions, every effort was made in mass campaigns to exclude any child who was febrile, appeared ill to the medical officer, or where any such history was obtainable. Specific contraindications to measles immunisation in the selected age group 3 months to 2 years were considered to be marked egg sensitivity, neomycin sensitivity, depression of resistance by steroid therapy and leukaemia or other malignancies. The hazard of egg sensitivity was slight. Children presenting antibiotic sensitivity or undergoing steroid therapy by the hospital and clinic services are issued with bracelets on which data are recorded, though it could not be anticipated that they would necessarily always be worn. In view of the medical services available the possibility of known leukaemias or malignancies presenting for immunisation seemed minimal.

Broadly the procedure adopted was modified to the circumstance.

:- A PRELIMINARY ..... /

A PRELIMINARY EXPERIENCE OF MASS IMMUNISATION

Routine diphtheria immunisation services at clinics in 1960 resulted in a total of 5,537 completed courses in the Bantu residential complex. This and other unsatisfactory features necessitated a reassessment of established practice. The reassessment modified subsequent development.

There were 2 primary observations: a) However diligently routine immunisation at clinics was pursued it remained fractional in relation to the population target at risk. b) The response to and conduct of large-scale immunisation in the face of panic situations caused by an outbreak of epidemic disease was delusive. Large near uncontrollable numbers presented at clinics and other specified points for immunisation. As the impetus of fear subsided numbers rapidly dwindled. Analysis showed that the seemingly impressive total of inoculations tended to originate from localized areas near to clinics and other immunisation centres and was inadequate in comparison with the population group at risk.

Possible causes were considered. Distances, straitened family circumstances and transport problems rendered it difficult for mothers resident far from immunisation centres to abandon their homes, cover the distances involved with their children, stand in queues of hundreds in panic situations and return late in the day or evening to their homes and domestic chores.

:- Similar ..... /

Similar factors undoubtedly occurred, but with no impact of urgency, at clinics under non-panic conditions of routine immunisation. These factors also affected adults, though to a lesser extent, who desired immunisation in panic conditions. It was evident that willingness of the populace to co-operate would permit more effective organization provided these factors were overcome and that there was reasonable assurance that immunisation would be available to all within a specified minimal period.

We concluded that routine clinic immunisation services would continue to form the foundation of immunisation procedure and that a new health visitor service would expand clinic immunisation on a domiciliary basis. However, in times of epidemic, threatened epidemic, or when there was need to boost clinic immunisation, mass immunisation had to be brought to the people by teams operating on a street to street basis with an assurance that immunisation would be available within a specified period to all who needed protection. Panic reaction and huge queues at isolated points had to be replaced by a calm community to whom immunisation would be brought as near as possible to their domicile, and to schools and creches in the case of children attending these institutions.

These principles were adopted in the administration of 3 feeds of trivalent oral poliomyelitis vaccine in this complex in 1961. The target age group was 3 months to 9 years. Nineteen mobile teams, 5 teams stationed at various centres and 8 teams at clinics were used. The totals of feeds given in

:- the ..... /

the 3 phases were 83,958, 91,035 and 88,847 being 81%, 90% and 86% of the estimated target. (Oral poliomyelitis immunisation of the newborn has been maintained in this area since completion of the mass campaign). Results proved encouraging. A frustrating feature was the overlapping of areas in practice, however carefully they were allocated to teams, and the flux of persons passing from one area to another in their desire to be immunised. It was obvious that to overcome these difficulties the allocation of areas to teams would, in addition, need the plotting of times and places of stops on individual team field maps, together with the homes to be immunised at each stop during the whole operative period of a phase, and the people informed in advance of the scheduled date of arrival of a team in their environs. The areas and movement so defined would have to provide a single, uniform, advancing level of progression of teams through the entire area. People had to be persuaded to wait at their houses for teams to come to them. Apart from the method of record keeping determining the rate of operation of a team, the card record system used proved particularly valueless as it was almost impossible to relate any individual to a card for long periods after the campaign. Clearly therefore, a system of simple record books for each team had to be devised whereby every individual inoculated could be easily related subsequently in each

:- phase ..... /

phase to his or her recorded entry. It required an address for each of the 70,000 houses in the area opposite which details of immunisation and consent for each child and phase could be tabulated. These books could then later be issued to clinics serving the areas recorded in a specific set of books, and be retained for reference purposes. There was need for fewer but more effective teams. Six mobile teams operating from vans equipped with public address systems and 2 school and creche teams were considered sufficient. In instances when children were not at home when teams called at their houses referral slips would be left with which they could report at clinics for inoculation. There was increasing evidence that propaganda methods suitable for Europeans were not optimal for Bantu communities of the pattern in our study, and that posters and radio press and magazine announcements were not necessarily interpreted by all the people in the manner intended. Word of mouth by those who knew, notably Bantu medical, nursing and clinic personnel, and families of those safely inoculated, remained the most powerful channel for the majority, coupled with a forthright, simple, factual presentation of essential data, in a manner understood, in brief circulars in Bantu languages to every householder, parents of school and creche children, and in letters to school principals and creche supervisors. Private practitioners and hospitals were to be kept informed.

These conclusions were precisely incorporated in the organization of a

:- diphtheria ..... /

diphtheria, whooping cough and tetanus immunisation campaign in the area and proved completely satisfactory, especially as this undertaking was more complex than the oral poliomyelitis immunisation campaign and required administration of antigens by hypodermic injection. The 3 basal phases were completed in 15 working days each, in December 1961, February 1962 and April 1962, when 80,657, 85,475 and 74,945 children, being 81%, 85% and 75% of the estimated possible target, were inoculated in the selected age group 3 months to 9 years. In addition 158,964 persons of all ages were vaccinated against smallpox in the second phase. Children aged 3 months to 2 years received triple antigen and those in the age group 3 years to 9 years received only diphtheria and tetanus prophylactic. No untoward reactions were reported except 1 urticarial response and 3 abscesses at the site of injection. Observation during the ensuing year showed no detectable increase of serum hepatitis following the large number of subcutaneous injections given. Syringes were boiled at regular intervals only, but a sterile needle was used for each individual and operators were directed to avoid drawback into syringes after insertion of the needle. The obtaining and recording of consent in every case introduced an essential element of trust in the minds of an urbanized Bantu population. The fourth booster phase of the campaign was scheduled for a year later, and combination of measles vaccination in this phase would therefore meet a population conditioned to mass immunisation

procedure.

Thus the method evolved was an adaption to meet the particular circumstances and epidemiological needs of a specific community which was similar to many others in Africa.

THE PILOT PROBE

Our custom has been to submit pertinent data to regularly held discussion groups attended by less senior medical field workers prior to the introduction of any new undertaking. Bantu participants have usually given a mirror pattern of views or reaction to be expected from the community, thus stimulating confidence, or producing modification or retraction of intention. They thought that measles vaccination would be acceptable, notwithstanding moderately severe clinical reactions in a proportion of cases, but they emphasized that the critical factor determining whether measles vaccination should be undertaken was not clinical reactions, but parental and community reaction to these manifestations. They recommended that a pilot survey of these attitudes be completed, and that if opinion was adverse, administration of the vaccine should be withheld.

The purpose of the pilot project was therefore a preliminary assessment of

a) Concurrent administration of measles vaccine, given without gamma-globulin, and diphtheria whooping

:- cough ..... /

cough and tetanus antigens.

b) Parental reaction to the procedure.

The measles vaccine was Enders' attenuated dried live virus (Edmonston strain), and the triple antigen, purified diphtheria and tetanus toxoids absorbed on aluminium phosphate with killed Bordetella pertussis organisms.

The random sample chosen consisted of 100 children in the age group 3 months to 2 years 11 months. It represented a sample of subjects expected in the mass phase, and included various nutritional states, social economic and intellectual strata, and deliberately excluded any enquiry as to whether the subjects had suffered from measles or not. The undertaking was clearly explained to the mothers in their own language, and they were told that reactions of variable severity to the measles vaccine would occur in some children. Consent was requested in all cases and refused in none.

Clinical Reactions

Inevitably the clinical reaction survey was of limited accuracy owing to factors such as intercurrent infection, even if the excess were to be calculated above a "norm". Further, the incidence of intercurrent infection of a respiratory nature was high in the colder early months of winter, in which the pilot probe and mass phase took place. In addition there was the inclusion

:- of ..... /

of non-susceptibles with residual maternal or naturally acquired measles antibody. However it indicated what could be expected in the mass field experience to follow.

The measles vaccine was stored at -20°C. and reconstituted with sterile water immediately before use. Syringes and needles free of detergent and antiseptic were provided throughout, with complete separation in sterilization and use of equipment for measles vaccine and triple antigen, thus avoiding contamination of the virus with the formalin content of the latter.

Each child received subcutaneously 0.25 c.c. of measles vaccine in the left arm and 0.5 c.c. of triple antigen in the right. Every mother was requested to advise the clinic of any untoward reaction in the ensuing week, as reaction to the triple antigen was likely to occur 48 hours after inoculation, and to bring their children to the clinic on the seventh post-vaccinational day for assessment of clinical reaction to the measles vaccine. In those cases where mothers could not, or failed to present with their children on the seventh day, the children were visited in their homes by two of us. All children in the sample who showed any clinical reaction were observed by the same two medical officers, assisted by the health visitor service, during the seventh to fourteenth post-vaccinational days at the clinic and in their homes. Clinical reactions in this period are summarized in Fig. 1. The pattern of reaction

:- to ..... /

to the measles vaccine appeared to fall within the range reported by other workers, and no indication was noted of adjuvant or adverse effect on reaction severity to measles vaccine or triple antigen caused by combination of the two.

The percentile occurrence of a rash in the 3 age groups in Fig. 1. suggested that residual maternal antibody could be evaluated in terms suggested in the introductory paragraphs of this communication.

FIG 1.

Parental Reactions

The survey commenced after all clinical reaction had subsided and was limited by the few days available before the beginning of the mass phase.

The samples consisted of parents of 25 children who had shown reactions in the pilot probe, and 25 who had not. As reactions had varied from mild coryza and minimal indisposition to pyrexia greater than 104°F (R), it was not possible to choose a random sample of parents of reactors, and selection was based on a median representation of reaction from the mildest to the most severe. The selection of parents of non-reactors was truly random.

Two health visitors, a European and a Bantu, carried out the assignment. The former was responsible for organization, whilst the latter, with avoidance of leading question, obtained and recorded virtually verbatim statements from

:- parents ..... /

parents. The European health visitor did not enter homes to assist in interviewing parents in order to obviate the naturally courteous desire of Bantu to give answers to non-Bantu persons most calculated to please the interrogator.

Critical analysis of replies showed uniformity of opinion in the 4 main groups of Zulu, Shangaan, Xhosa and Sesutho speaking people. There was remarkable confidence in any injection or measure for protection, and recurrent comment that children were well and free from the diseases against which they had been immunised. In our opinion, the skein of protection against adverse influence woven into the fabric of African tribal medicine has facilitated acceptance of immunoprophylactic technique.

In both samples parents made it clear that a degree of indisposition after inoculation was to be anticipated, the view being held that immunisation kills disease and "nothing can die without a little struggle". They thought that measles killed many children, and dreaded it and its complications more than they did diphtheria. There was an almost constant opinion that "if the rash does not appear well on the body it remains inside, damages the lungs, and the child dies". In some homes they still had the shrub used in their treatment of measles and believed to bring out the rash. They held it necessary that measles be driven out. Following this concept the whole propaganda approach to measles vaccination for the mass phase was based on the

:- injection ..... /

injection driving out the disease.

There was some confusion amongst mothers of reactors who did not develop a rash. Mothers whose babies had no reaction at all, in the main, considered that the dose of vaccine was so accurately measured for their particular children that it caused no reaction, that as their children did not become ill second doses may be necessary to make the vaccine effective, or that their babies were so strong that they did not seem ill after the vaccination.

In both groups of the total sample, even in cases of relatively severe clinical reaction, there was unshaken trust in straightforward immunisation, and complete acceptance of the introduction of measles vaccination.

THE FIELD EXPERIENCE

Propaganda and organization were as indicated in the final development outlined. Routine immunisation with diphtheria whooping cough and tetanus antigens, and smallpox and B.C.G. vaccination, was discontinued 1 month before the phase to eliminate field problems related to multiple use of upper arms. All teams carried resuscitatory and antihistaminic drugs and equipment. Measles vaccine was given on the left arm and triple or diphtheria and tetanus antigens on the right. Measles vaccine was administered entirely by medical officers,

:- and ..... /

and diphtheria whooping cough and tetanus antigens by nursing staff under their surveillance. The precautions taken in the pilot probe were maintained in the mass phase. Dried measles vaccine supplies were refrigerated at -20°C., and teams carried their issues for estimated 6 hourly periods of requirement in fibreglass bags packed with dry ice. As the vaccine contained no preservative other than residual neomycin, special caution was taken with multiple puncture arrangement of the multi-dose vials, which required reconstitution of the vaccine by the addition of 8 c.c. of sterile water. In general, vaccine in a vial was not reconstituted until sufficient vaccinees had collected, and when impracticable, the reconstituted vaccine was stored at approximately 4°C in the fibreglass containers and discarded if not used within 8 hours. A record relating vaccine batch numbers to vaccinees was kept. Detailed reaction survey forms to be completed by examining medical officers were issued to the clinic and hospital services of the area.

Each child in the age group 3 months to 2 years 11 months received 0.25 c.c. measles vaccine and 0.5 c.c. triple antigen, and in the age group 3 years to 9 years 11 months 0.5 c.c. diphtheria and tetanus antigens.

The functioning of the organization, consisting of 80 personnel and 16 transport vehicles, was uneventful. It completed its assignment in 14 working days between the scheduled dates 6 - 24 May 1963.

:- Statistical ..... /

Statistical Results

A total of 105,636 inoculations was given. Details are tabulated in Table III. The 21,947 children inoculated with triple antigen received measles vaccine at the same time. However an additional 342 children received measles vaccine alone as they had inadvertently been given a booster injection of triple antigen at a clinic shortly before commencement of the phase.

TABLE III

It was found usual in all phases of the campaign to achieve a higher percentage of the estimated target in the age group 3 years to 9 years than in the age group 3 months to 2 years. Children of the older group were more easily reached in creches and schools than were children of the younger group, where mothers were often unwilling to bring their children to teams in inclement weather, and where the occupants were frequently found to be away from their homes and failed to report to clinics for subsequent inoculation.

Reported Reactions

A fundamental difference in assessing clinical reaction encountered in the pilot probe and in the mass phase, was that in the former all the children were examined, whereas in the latter, cases were brought for examination only when parents thought that the severity of reaction rendered it advisable

:- to ..... /

to seek medical aid. Parental opinion in the pilot probe clearly indicated that a considerable degree of incapacitation would be accepted as a normal sequel to immunisation. Thus the study of reactions reported in the reaction survey sheets of the mass phase merely indicated the degree of clinical reaction found in those who were brought for examination.

An analysis of symptoms in the 333 children where parents considered this necessary is represented in Figure II. Forty three were aged 3 months to 6 months, 38 were aged 7 months to 9 months and 252 were 10 months to 2 years 11 months old.

FIGURE II.

Generalized reaction attributable to triple antigen was insignificant, but locally, however, 9 abscesses were reported. All were on right arms and related to triple antigen. The incidence of local infective reaction was thus higher than in the combined 3 basal phases of the campaign, but was. nevertheless, thought to be low in view of the conditions of high wind and incessant dust which, with later cold and rain, dogged the fourth phase.

The reactions in Figure II are broadly related to measles vaccine, within the limits of unassessable intercurrent infection and insignificant reaction to triple antigen, and the extent of occurrence in three age groups

:- of ..... /

of symptoms is shown.

Of the 333 children brought for medical advice, 37 were found on examination to have rectal temperatures over 102°F., 23 over 103°F., 13 over 104°F. and 3 over 105°F. Further, 4% were reported to have had convulsions, apparently pyrexial in origin. No convulsions were reported in the pilot probe. Reference to pyrexial convulsion in measles vaccination was made by Goffe[9] and Markham[10]. Tympanitis featured prominently in reaction survey reports by medical officers, amongst whom were several who considered reactions rather severe and approximating natural measles. It was not thought possible to attempt an analysis on the basis of reaction severity, owing to the difficulty of determining suitable criteria, and eliminating the variable of observations by multiple examiners. However, in general, the degree of incapacitation was little in relation to the degree of clinical reaction and only in 333 out of 22,289 vaccinees (i.e. 1.5%) did parents think symptoms sufficiently marked to seek medical advice. None of the classical complications of measles were reported after vaccination and there was no evidence of secondary cases. Combination of triple antigen and measles vaccine appeared to have no adverse effect on reaction.

In one instance an 11 month old infant inoculated with triple antigen and measles vaccine the preceding afternoon, died on the following morning. The

:- mother ..... /

The mother stated the child was well when she took it for immunisation. At autopsy the cause of death was lobar pneumonia in grey hepatization and gastro-enteritis. Termination was apparently not related to immunisation. The result of virology studies was not available at the time of writing. The case emphasized the possibility, in mass immunisation procedure, that children may be brought for immunisation with previously established acute respiratory pathology, where, though the morbid process continues, symptomatology is so masked by chemotherapy that the parent considers an infant sufficiently well for immunisation and the history insufficiently significant to report at that time. One other case which received triple antigen and measles vaccine terminated in hospital of unrelated pathology. Permission for an autopsy was refused.

Only 3 European children received measles vaccine in this study. The 15 month old son of one of us received measles vaccine without gamma-globulin, and was a healthy, well nourished infant, immunised against diphtheria, whooping cough, tetanus, smallpox and poliomyelitis, and without any history of previous illness whatsoever. A maximum rectal temperature of 106.4^{o}F. was recorded on the eighth post-vaccinational day during 4 days of pyrexia, which was followed by a generalized morbilliform rash between the tenth and twelfth post-vaccinational days. Aspirin and sponging was necessary for pyrexial control on the eighth post-vaccinational day, but no other therapy was required. Except

:- at ..... /

at the time of maximum pyrexia, when the child was obviously incapacitated, the disability was relatively slight. Two female children aged 1 year 9 months and 3 years 4 months of one of the team medical officers were also given measles vaccine without gamma-globulin. One developed a maximum rectal temperature of 104.8°F. on the eighth post-vaccinational day during 4 days of pyrexia, and the other 102.6°F., with a generalized morbilliform rash.

Community Reaction

Immunisation against measles in the mass phase appeared acceptable to the Bantu community and parental reaction paralleled that obtained in the pilot probe.

CONCLUSIONS

The concurrent administration of live attenuated measles-virus vaccine with triple antigen proved safe in the study described.

Under the presenting conditions of mass inoculation the use of gamma-globulin was impracticable. In these circumstances, and in a proportion of cases, clinical reactions to the measles vaccine tended to be rather severe for a routine immunization procedure.

The incidence of intercurrent infection in winter months suggested the advisability of conducting mass measles immunisation in months when these conditions

are less prevalent.

The relatively slight incapacitation associated with high pyrexial levels found in instances after live measles-virus immunisation may have produced insufficient maternal care of some poorly nourished and ill-clad children, with risk of exacerbation of existing pathology or lowered resistance to other infection.

Maintenance measles immunisation of the newborn, on their reaching the selected age group, will become necessary if immunological advantage gained by mass immunisation is to be retained.

Whilst mass campaigns of live attenuated measles virus vaccination without gamma-globulin appear justified where measles is a critical problem, in communities at intermediate risk, consideration should be given to combination schedules[1] of an inoculation of inactivated vaccine followed 2 months later by an injection of live attenuated measles-virus vaccine. Reactions would be minimal, and though the duration of antibody persistance is not yet definitely determined, protection would seem very satisfactory. In addition it would permit combined administration in diphtheria whooping cough and tetanus immunisation programmes. In other circumstances where measles is a lesser health problem, there would appear to be no indication for mass immunisation, and live attenuated measles-virus vaccination should be administered with gamma-globulin and possibly

:- reserved ..... /

reserved, at this stage, for cases at high medical risk should they contract natural measles infection.

SUMMARY

1. Immunization with combined live attenuated measles-virus vaccine and diphtheria whooping cough and tetanus antigens in an urban Bantu community is described.

2. The development of immunization procedure to meet the epidemiological needs of the community is outlined.

3. A pilot survey and field campaign of combined immunization is discussed.

We are indebted to the World Health Organization for their interest in this project and for arranging to supply the measles vaccine, the Secretary for Health for approval of the undertaking, Dr. J.H.S. Gear for advice and encouragement and Dr. J.W. Scott Millar, Medical Officer of Health, Johannesburg, for permission to publish this paper.

REFERENCES

1. Advisory Committee on Measles Control. (1963) : J. Amer. Med. Ass., 183, 120.

:- 2. Weibel ..... /

2. Weibel, R., Halenda, R., Stokes, J., Hilleman, R. and Buynak, E.B. (1962) : J. Amer. Med. Ass., 180, 1086.

3. Katz, S.L., Morley, D.C. and Krugman, S. (1962) : Amer. J. Dis. Child., 103, 402.

4. Medical News. (1963) : J. Amer. Med. Ass., 184, 44.

5. Reilly, C.M., Stokes, J., Buynak, E.B., Goldner, H. and Hilleman, M.R. (1961) : New Eng. J. Med., 265, 165.

6. Spencer, I.W.F. and Coster, M.E.E. (1962) : S. Afr. Med. J., 36, 881.

7. Winter, P.A.D., Mason, J.H., Kuhr, E., Schaafsma, A.W., Robinson, M., Saayman, L.R. and Spence, R.G. (1963) : S. Afr. Med. J. 37, 513.

8. International Conference on Measles Immunisation. (1962): Amer. J. Dis. Child., 103, 431.

9. Goffe, A.P., Woodall, J.T., Tuckman, E., Paulett, J.D., Manser, I.N., Franklin, L.M. and Chapple, P.A.L. (1963) : Brit. Med. J., No. 5322, 26.

10. Markham, F.S., Cox, H.R. and Reugsegger, J.M. (1962) : Supplement, Part II, Amer. J. Pub. Health, 52, 57.

TABLE I.

DEATHS FROM MEASLES FOR 5 YEAR PERIOD

MORTALITY RATES

YEAR	Europeans		Coloureds		Asiatics		Bantu		Total	
	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
1957	1	0.003	2	0.06	1	0.04	33	0.07	37	0.04
1958	2	0.005	1	0.03	1	0.04	52	0.10	56	0.06
1959	Nil	Nil	2	0.05	Nil	Nil	15	0.03	17	0.02
1960	2	0.005	7	0.16	Nil	Nil	29	0.06	38	0.04
1961	Nil	Nil	3	0.07	Nil	Nil	42	0.08	45	0.05

TABLE II.

NUMBER OF DEATHS FROM DIPHTHERIA AND MEASLES IN THE BANTU

1957 - 1961.

YEAR	DIPHTHERIA	MEASLES
1957	20	33
1958	22	52
1959	14	15
1960	24	29
1961	23	42

TABLE III.

IMMUNISATION CAMPAIGN, FOURTH PHASE

	ANTIGENS			MEASLES VACCINATION	TOTAL INOCULATIONS
	D.W.T.	D.T.	TOTAL		
	3 months to 2 years	3 years to 9 years		3 months to 2 years	
Inoculations	21,947	61,400	83,347	22,289	105,636
Percentage of Estimated Target	73.2%	87.7%	83%	74.3%	

D.W.T. = diphtheria, whooping cough and tetanus immunization;

D.T. = diphtheria and tetanus immunization.

FIG. I. PILOT SURVEY.

ANALYSIS OF REACTIONS TO COMBINED IMMUNIZATION.

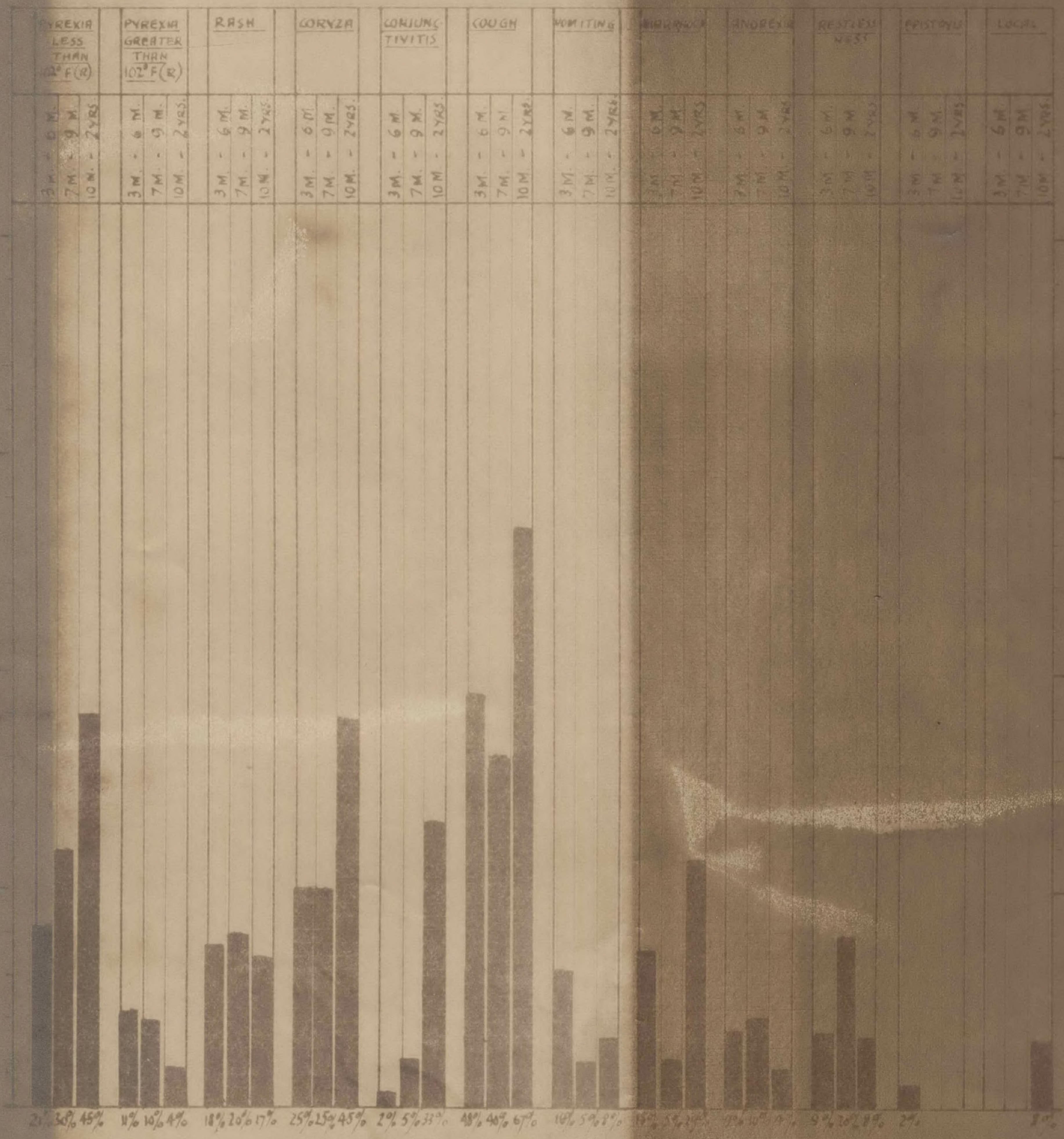

FIG. II FIELD EXPERIENCE

ANALYSIS OF REACTIONS TO COMBINED IMMU

PERCENTAGE IN AGE GROUP

PYREXIA LESS THAN 102°F (R)
- 3 M. - 6 M.
- 7 M. - 9 M.
- 10 M. - 2 YRS

PYREXIA GREATER THAN 102°F (R)
- 3 M. - 6 M.
- 7 M. - 9 M.
- 10 M - 2 YRS.

RASH
- 3 M. - 6 M.
- 7 M. - 9 M.
- 10 M. - 2 YRS.

CORYZA
- 3 M. - 6 M.
- 7 M. - 9 M.
- 10 M - 2 YRS.

CONJUNCTIVITIS
- 3 M. - 6 M.
- 7 M. - 9 M.
- 10 M - 2 YRS.

COUGH
- 3 M. - 6 M.
- 7 M. - 9 M.
- 10 M. - 2 YRS.

VOMITING
- 3 M. - 6 M.
- 7 M. - 9 M.
- 10 M - 2 YRS.

[illegible] PYREXIA
- 3 M - 6 M.
- 7 M - 9 M.
- 10 M. - 2 YRS.

RESTLESSNESS.
- 3 M - 6 M.
- 7 M. 9 M.
- 10 M. - 2 YRS.

CONVULSIONS.
- 3 M - 6 M.
- 7 M - 9 M.
- 10 M - 2 YRS

LOCAL.
- 3 M. - 6 M
- 7 M - 9 M.
- 10 M - 2 YRS

Collection Number: A1132

Collection Name: Patrick LEWIS Papers, 1949-1987

PUBLISHER:

Publisher: **Historical Papers Research Archive, University of the Witwatersrand, Johannesburg, South Africa**
Location: **Johannesburg**

LEGAL NOTICES: