DIPHTHERIA, WHOOPING COUGH AND TETANUS IMMUNIZATION COMBINED WITH SMALLPOX VACCINATION

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A consensus of opinion has indicated the inadvisability of combining *primary* smallpox vaccination with the administration of other antigens. Parish and Cannon[1] stated: 'When infants under 9 months old have to be vaccinated against both yellow fever and smallpox there should be an interval of 21 days between the vaccinations no matter which is done first. If possible, all other preventive inoculations for infants should be avoided within 3 weeks (a working compromise) of a *primary* vaccination, in order to reduce the likelihood of untoward effects that might be aggravated by, or ascribed to, the administration of several antigens at the same time. In older subjects, too, it is preferable that inoculations against typhoid, typhus, etc., should not be done at the same time as a *primary* vaccination'.

Routine immunization against diphtheria, whooping cough, tetanus, poliomyelitis and smallpox is conducted at the 8 polyclinics operated by the Johannesburg City Council in the Bantu residential areas of the city. Nevertheless, in the last decade 3,081 Bantu cases of diphtheria were notified, with 343 deaths, in the age group neonate - 10 years. Over the age of 10 years the incidence was insignificant.

THE IMMUNIZATION CAMPAIGN

As a result of the satisfactory response of the Bantu to the feed of Sabin type I oral poliomyelitis vaccine administered in 1960, and to the 3 feeds of trivalent Sabin vaccine in 1961 (84%, 81%, 90% and 86% of the estimated target being achieved in each feed), and the introduction of maintenance oral vaccination of the newborn, the probability of provocative poliomyelitis[2,3] arising from the injection of other antigens became minimal. Therefore, to meet the incidence of diphtheria an extensive campaign was organized to bring immunization to the 70,000 homes in the area. The estimated target was approximately 100,000 children in the age group 3 months - 9 years. The diphtheria antigen used was purified toxoid alum precipitated (PTAP) combined as a triple antigen with pertussis and tetanus antigens.

Children in the age group 3 months - 2 years received the triple antigen and those in the age group 3 years - 9 years received only diphtheria and tetanus antigens in view of a possible untoward reaction to pertussis vaccine[4] in the older age group. Six mobile and 2 school and crèche immunizing teams were placed in operation and the schedule provided for inoculations on 3 occasions, to be followed by a booster dose 1 year later. The first phase of the campaign was conducted between 27 November and 15 December 1961, the second between 29 January and 16 February 1962, and the third, scheduled for the period 2 April - 19 April 1962, is being carried out at the time of writing.

First Phase

In the first phase 80,657 children (81% of the estimated possible target) were inoculated in the selected age group of 3 months - 9 years, of whom 22,282 in the age group 3 months - 2 years received triple antigen and 58,375 in the age group 3 years - 9 years received diphtheria and tetanus antigens only. Apart from 1 urticarial response, no abnormal reactions to the injected antigens were reported.

Smallpox Outbreak

Ten days before the beginning of the second phase a case of smallpox was diagnosed in the area with extensive contact. A directive from the State Health Department required the initiation of large-scale smallpox vaccination in the Bantu residential complex. The smallpox vaccination and the scheduled second phase of the diphtheria, whooping-cough and tetanus immunization campaign were thus found to coincide, and the problem arose whether the second phase should be cancelled or should be carried out in combination with simultaneous smallpox vaccination, disregarding frequent opinion that the combined procedures were inadvisable. After consideration of the incidence of diphtheria, the fact that the first phase of the campaign was concluded, that the propaganda, organization and preparation for the second phase was complete, and the lack of evidence of unsatisfactory reaction to the combined procedures based on large numbers of instances, it was decided that diphtheria, whooping-cough and tetanus

TABLE I. IMMUNIZATION CAMPAIGN, SECOND PHASE

	Antigens			*Smallpox vaccinations*				*Estimated primary smallpox vaccinations*			
	D.W.T. 3 months to 2 years	*D.T. 3 years to 9 years*	*Total*	*3 months to 2 years*	*3 years to 9 years*	*10 years and over*	*Total*	*3 months to 2 years*	*3 years to 9 years*	*10 years and over*	*Total*
Week before beginning of second phase	—	—	—				52,185				13,045
1st week	10,363	23,424	33,787				34,425				8,606
2nd week	8,712	21,381	30,093				38,328				9,583
3rd week	6,107	15,488	21,595	6,107	15,488	12,431	34,026	1,527	3,872	3,108	8,507
Total	25,182	60,293	85,475				158,964				39,741

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

immunization and smallpox vaccination would be carried out concurrently.

Second Phase

In this second phase 85,475 children (85% of the estimated possible target) were inoculated in the selected age group 3 months - 9 years, of whom 25,182 in the age group 3 months - 2 years were injected with triple antigen and 60,293 in the age group 3 years - 9 years received diphtheria and tetanus antigens. In addition 158,964 persons of all age groups were vaccinated against smallpox in the week preceding and during this period.

DISCUSSION

Neither during the conduct of the first or second phases of the campaign, nor up to the time of writing, has a case of poliomyelitis been notified in the area. No instance was reported of abnormal reaction to the injection of the antigens and concurrent smallpox vaccination. However, it was in a proportion of cases only that an individual was inoculated with injected antigens and vaccinated against smallpox at the same time, and for a realistic assessment this and other factors required review.

Primarily, the organization conducting the diphtheria, whooping-cough and tetanus immunization had thrust upon it the additional task of concurrent mass vaccination, not only of the age group 3 months - 9 years, but also of all age groups. It was essential to bring rapid protection to the community and, in accordance with previous experience, incumbent to avoid slowing and confinement of the scope of the undertaking by collecting and recording of non-essential data in the field. Though a record for every individual was kept of diphtheria, whooping-cough and tetanus inoculations administered in each phase, it was not possible to record vaccination procedure in any form other than a total of vaccinations performed.

Sudden demand on lymph supplies and a panic reaction by sections of the population not resident in the Bantu areas, created a limited vaccine supply during the first 2 weeks of the combined operation. Vaccine, however, became freely available in the final third week of the phase. Accordingly, during the first 2 weeks doctors and nurses were directed to select subjects for vaccination on a broad basis of not having been vaccinated previously or the passing of a long interval since the last vaccination, both considered in relation to the lymph supply. In the final week there was no selective restriction. The discretion of the individual vaccinator therefore introduced an uncontrollable variable in statistical evaluation.

In view of these factors the problem was to determine a reasonably accurate and conservative figure of subjects where antigens and vaccination were administered together.

Estimated Primary Vaccination

Since no record was available of *primary* vaccinations, recourse was had to a survey conducted by one of us in 1960 in these areas, which showed that, of a random and geographically widespread total of 99,045 persons, 26,164 were previously unvaccinated, representing 26·42% of the sample drawn from the 500,000 residents. Recent reassessment of related factors indicates that no material change is likely to have occurred in this situation. Assuming that approximately 25% of all age groups in the Bantu residential areas of Johannesburg were unvaccinated, it is considered reasonable to estimate that 25% of the smallpox vaccinations in the immunization campaign under discussion were in fact *primary* vaccinations.

Though it is evident from Table I that several thousands of children received concurrent *primary* vaccination and injection of antigens in the first 2 weeks of the phase, it was only in the third week that free supply of lymph resulted in every child who received injected antigens being vaccinated at the same time, regardless of previous vaccinational history. Accordingly the undefined numbers of concurrent administrations in the first 2 weeks were excluded from the observation.

CONCLUSION

This study was therefore based on the data of the third week of the phase only, and it was estimated with reasonable accuracy that, with no reported or otherwise detected evidence of untoward reaction, 5,399 children received injected antigens with concurrent *primary* vaccination against smallpox. Of this total, 3,872 received diphtheria and tetanus and 1,527 diphtheria, tetanus and whooping-cough antigens.

SUMMARY

A study is described of *primary* vaccination against smallpox and concurrent administration of other antigens without untoward reaction.

We thank Dr. J. W. Scott Millar, Medical Officer of Health, Johannesburg, for permission to publish this paper.

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