

MASS VACCINATION IN RURAL AREA OF IRAN: A SERO - EVALUATION*

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ABSTRACT

In an attempt to convert mass vaccination practices to the Extended Programme on Immunization, a sero-evaluation study was carried out in rural Iran in 1976. A total of 22 246 rural children of 2-12 years of age were sampled. Blood samples taken on filter paper were tested by indirect hemagglutination technique to determine the level of circulating antibodies against tetanus toxoid. Tetanus was selected as an index not only because natural antibody against it is practically non existent, but also because protective levels of this antibody can reveal vaccination status of the individuals. Results show that except for few districts where complete protection reaches over 70%, the immunization status is not commendable. Moreover, no specific pattern for immunization could be detected. These and other results are discussed.

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INTRODUCTION

Organized mass vaccination against major diseases of childhood in Iran includes the target diseases in the Expanded Programme on Immunization (EPI) too, namely: tuberculosis, diphtheria, pertussis, tetanus, measles, and poliomyelitis. However, one of the major differences between current mass vaccination practices and the EPI, among others, is the evaluation process which is an integral and important part of the latter.

As a preliminary step towards the conversion of the current mass vaccination programmes to the EPI, an evaluation was planned and carried out in 1976 as a joint effort between the Department of Communicable Disease Control and Malaria Eradication of the Ministry of Health, Government of Iran, and the School of Public Health and Institute of Public Health Research, University of Teheran.

To measure the extent and quality of mass vaccination, circulating levels of tetanus antitoxin, which had previously been used by others (Levine and Wyman 1964, Finger et al 1975) was selected as an index, mainly because natural immunity to this toxin is practically non-existent in children and any detectable level of this antibody can safely be accepted to reflect previous vaccination. Moreover, since tetanus vaccine is administered jointly with pertussis and diphtheria vaccines (DPT), the level of circulating tetanus antibody reveals the extent of immunity against these diseases too. Study was planned to cover rural children of 2-12 years of age. Rural areas were selected because they are the most underprivileged parts of the country and thus, the results was expected to show the worst conditions prevailing in the country.

MATERIALS AND METHODS

Population sample. Based on the confidence limit of 95%, precision of 7%, and probability of 30%, a sample size of 200 children of 2-12 years of age was decided upon for each of the 162 districts in the country. This sample size corresponded to about 3 per thousand of the 7 million rural children of the same age group. Since these children

comprize about 40% of the total rural population, a total of 500 rural inhabitants of all ages had to be selected in each district to yield the needed 200 children. The rural population of each district was divided into clusters of 100 each, and 5 cluster in each district were randomly selected.

Blood samples. Blood samples were collected by finger prick method on a No. 3 filter paper, enough to cover a circle of 22 mm in diameter. These samples were collected in the field by the personnel of the Ministry of Health, and shipped to the School of Public Health for immunological studies. Each blood sample was accompanied by a demographic information form covering the name, sex, age, and address of each child sampled.

Immunological tests. Upon arrival of the blood samples at the School, the serum was diluted out and titrated by an indirect hemagglutination test as described by Boyden 1951, and slightly modified to use horse red blood cells instead of sheep red blood cells (Ansari 1977). The hemagglutinating titres (HA) thus obtained had to be converted to neutralizing titres to reveal the protection status of the children. Of the various formulas proposed for such conversions, those proposed by Chatterjee 1964 ($Y=0.229+0.91X$) and by Galazka and Abgarowicz 1967 ($Y= 1.05X - .29$) were used. In both cases, the protective level of neutralizing antibody, 0.01 mg/ml (McComb 1964), was calculated to roughly correspond with the HA titres of 1/40. Thus the hemagglutination results were classified as follows: titres of 1/40 and more as complete protection (+), titres of 1/20 and 1/10 as partial protection (+,-), and titres of less than 1/10 and negatives as no protection (-). We further assumed that these protections reveal vaccination status as complete, i.e. three sequential injections of potent vaccine, partial vaccination, and no vaccination respectively.

RESULTS AND DISCUSSION

At the time of this study, mass vaccination in Iarn was carried out on a voluntary basis, i.e. in both urban and rural areas only those children who were brought to be vaccinated on their own initiatives were covered. Howe-

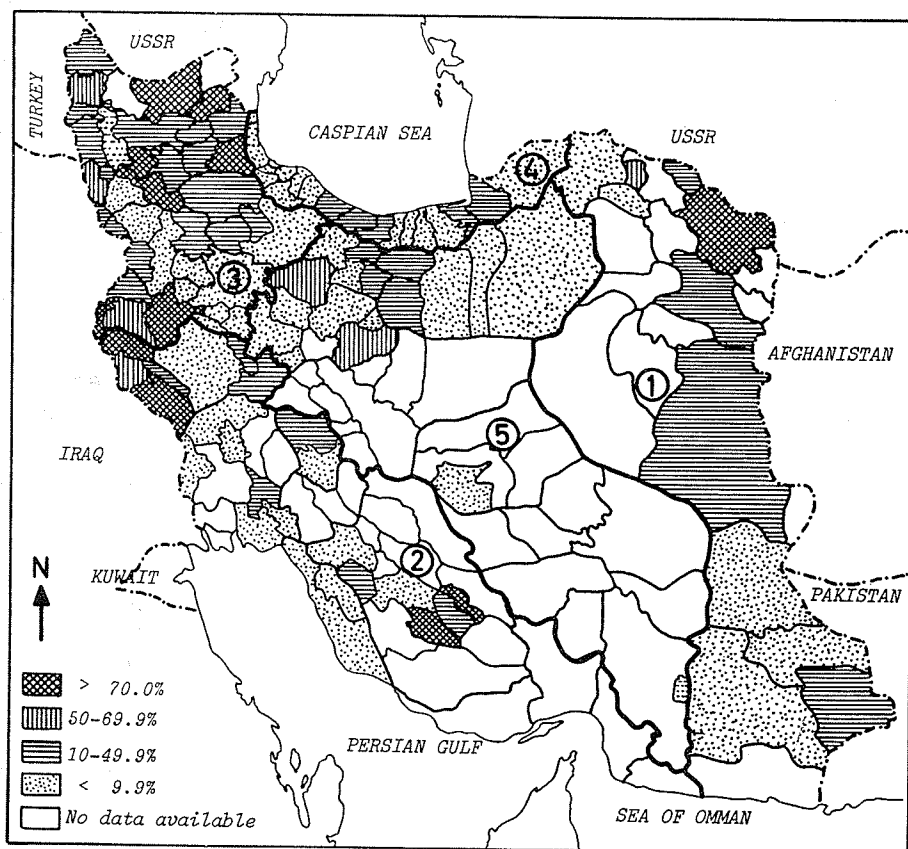


Figure 1. Mass vaccination coverage as detected by antitetanus antibody determination in children of 2-12 years of age, rural Iran, 1976.

1- Eastern Region, 2- Southern Region, 3- Northwestern Region, 4- Northern Region, 5- Central Region.

ver, the situation in the rural areas is a bit different because in the rural areas the arrival of vaccination team is a sort of social event and may attract more people and thus result in more coverage. The main purpose of the present study was not to correlate the protection level with the vaccination history, but to measure the extent of coverage under voluntary participation in the field with mobile teams. It was also expected to produce a base line data for implementation of the EPI in Iran.

A total of 22 246 blood samples from 106 districts in 19 of the 24 provinces of the country were collected and tested. The results, grouped into 5 geographical regions are presented in table 1. The overall figure of 50.9% vaccinated (23.9% complete and 27.0% partial) on country wide basis is misleading since this attribute is not homogeneously distributed and not only reaches a maximum of 68.6% in the north-western region, it shows even more heterogeneity at the district level (Fig.1). As can be seen, no specific pattern is detectable and closely related and adjacent districts show significant variation in their vaccination coverage as detected by our method.

Table 1. Vaccination status* of children of 2-12 years of age by region, rural Iran, 1976.

Region	Total Sampled	(+)**		(+, -)**		(-)**	
		#	%	#	%	#	%
Northwestern	7139	2678	37.5	2223	31.1	2238	31.4
Southern	5084	1536	30.2	1260	24.8	2288	45.0
Eastern	2339	423	18.1	679	29.0	1237	52.9
Central	3669	468	12.8	695	18.9	2506	68.3
Northern	4015	217	5.4	1144	28.5	2654	66.1
Total	22 246	5322	23.9	6001	27.0	10 923	49.1

* determined by antitetanus antibody measurement.

** (+) Complete vaccination ($HA \geq 1/40$), (+, -) Partial vaccination ($HA 1/20$ and $1/10$), (-) No vaccination ($HA < 1/10$).

The age, sex, and vaccination status of the sample is presented in table 2. No significant sex difference is seen. However, children of 2-5 years of age are shown to have appreciably higher percentage of no vaccination, specially in the mediocre coverage areas, i.e. 10-69.9%. This observation may hint to a cohort effect due to the relaxation of mass vaccination campaigns during the 3 -5 years preceeding the study.

These results suggest that no general pattern for mass vaccination could be detected in Iran, meaning that the so called organized mass vaccination has been heavily dependent on individuals responsible for vaccination in each district rather than a coherent system. To us, the lack of a coherent system is the very nature of the concept of "developing countries" and Iran, which is technically so developed to prepare all her needed vaccines for such programmes locally and according to the highest international standards, is no exception. Thus, unless a sound system, tailored to the needs of a developing country is established and maintained, no amount of technical, financial, and advisory support can help achieve the stated objectives of the EPI in any developing country of the world.

Since 1976, when this study was planned, simpler, cheaper, and quicker methods for serological surveys have been developed which can be used for future studies.

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Table 2. Age, sex, and vaccination status* of children of 2-12 years of age, rural Iran, 1976.

Age	FEMALES			MALES			BOTH SEXES						
	(+)	(+,-)	(-)	Total	(+)	(+,-)	(-)	Total	(+)	(+,-)	(-)	Total	
2-5	#	838	992	1856	3686	948	1167	2118	4233	1786	2159	3974	7919
	%	22.7	26.9	50.4	100	22.4	27.6	50.0	100	22.5	27.3	50.2	100
6-8	#	823	893	1486	3202	1126	1140	1717	3983	1949	2033	3203	7185
	%	25.7	27.9	46.4	100	28.3	28.6	43.1	100	27.1	28.3	44.6	100
9-12	#	578	731	1130	2439	973	1027	1746	3746	1551	1758	2876	6185
	%	23.7	30.0	46.3	100	26.0	27.4	46.6	100	25.1	28.4	46.5	100
Unknown	#	19	25	443	487	17	26	427	740	36	51	870	957
	%	3.9	5.1	91.0	100	3.4	5.5	91.1	100	3.8	5.3	90.9	100
All ages	#	2258	2641	4915	9814	3064	3360	6008	12432	5322	6001	10923	22246
	%	23.0	26.9	50.1	100	24.7	27.0	48.3	100	23.9	27.0	49.1	100

* As determined by antitetanus antibody measurement: (+) complete vaccination (HA > 1/40), (+,-) Partial vaccination (HA 1/20 and 1/10), (-) no vaccination (HA < 1/10)

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