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ASSESSMENT OF BCG VACCINATION IN THE LIBYAN ARAB REPUBLIC

by

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I INTRODUCTION

Before describing the methods of assessment of the BCG campaign in Libya and presenting an appraisal of the results, it might be useful to review briefly the history of tuberculosis in that country, and to specify the measures that have been adopted to make BCG vaccination an effective agent in the prevention of the disease.

1. Tuberculosis in the Libyan Arab Republic

Tuberculosis in Libya was recognized many years ago. Numerous cases were recorded in the coastal belt in the nineteenth century (Kanter, 1967), and there was a serious outbreak of the disease in 1887. In 1912 eighty-eight new cases were reported in the densely populated cities of Tripoli, Garian and Tarhuna. On the other hand, very few cases were found in a survey of the Southern Desert in the 1930's

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As happened elsewhere, the prevalence of tuberculosis increased sharply after the Second World War, it spread to districts where it had been previously unknown and it was characterized by being acute and rapidly progressive.

The prevalence of naturally acquired tuberculin sensitivity was estimated in 1954 in Ben Walid, a remote, isolated and settled community. It was 2% in those aged 0 to 4 years; 40% in those aged 10 to 19 years; and 90% in those aged 30 years or more.

A World Health Organization survey in 1959 in the Eastern Region showed tuberculin sensitivity ranging from 6% in children under 5 years to 79% in people of 40 years or more. The average for all ages was 49%.

The prevalence of tuberculin sensitivity among school-children in Benghazi in 1969 ranged from 7% among primary pupils (6 - 9) to 39% among senior pupils (15 - 16). In a similar survey in Tripoli in 1971 the corresponding figures were 8% and 30%.

From 1953 to 1955 135 401 people were vaccinated with BCG.

The first survey for active pulmonary tuberculosis, limited to the Eastern Region and carried out in 1959 (Neuman, 1961), showed that the prevalence of active disease was 1.83%. In urban areas - Benghazi, Ajdabia, El Marj, Beida - the prevalence was 2.7%, whereas in rural areas it was 0.8%.

In 1963 a pilot project in the control of tuberculosis was started in Benghazi by the World Health Organization and the Government. The technical and operational experience gained from this study proved invaluable in the subsequent planning of the Tuberculosis Control Programme.

In the light of the WHO tuberculosis control policy and recent advances in the control and management of this disease, the Libyan programme is based on the following concepts:

a) Bacteriological confirmation of the disease. Tuberculosis is diagnosed only if tubercle bacilli are found in the smears of sputum or are isolated in culture.

b) Domiciliary treatment except in certain conditions and under certain circumstances requiring hospitalization.

c) Direct, mass BCG vaccination, that is, vaccination without prior tuberculin test.

The Tuberculosis Control Programme is now conducted from two Regional Tuberculosis and Chest Centres, sixteen Tuberculosis Control Centres, nine MMR Mobile Units and three chest hospitals with a total of 567 beds. In addition, another chest hospital of 200 beds is being developed after the necessary alterations, from a former general hospital 200 kilometers east of Tripoli.

The diagnosis of pulmonary tuberculosis depended mainly on clinical and radiological evidence until 1971 when bacteriological diagnosis became available as the laboratory facilities developed. The incidence of newly discovered cases diagnosed bacteriologically in the last four years is as follows:

	1971	1972	1973	1974
Libyans	1 178	1 165	1 124	914
per 1 000	0.6	0.6	0.6	0.55
Expatriates		81.	251	385
Totals	1 178	1 246	1 375	1 299

The population given by the census of 31 July 1973 was 2 257 037. The estimated mid-year population for 1974 was 2 348 358. In spite of the greatly increased efforts at case finding in recent years, the yield has not increased commensurately. The incidence among expatriates was not recorded separately for 1971. The expatriates contribute a considerable and increasing number of cases to the total. This matter is receiving close attention. The incidence per 1 000 includes Libyans and expatriates.

2. The vaccination law

The vaccination law promulgated in November 1969 and enlarged in scope in April 1972, makes BCG vaccination obligatory during the first month of life of the child. The municipal authorities do not issue a birth registration certificate unless the parents produce the BCG vaccination card. If delivery has taken place in a maternity hospital where BCG vaccination is available, the child is vaccinated in the hospital. If BCG vaccination is not available in the hospital, or if the child is delivered at home, then the parents must have the child vaccinated at the nearest maternity and child health centre.

3. The policy of BCG vaccination

The policy of BCG vaccination is designed to achieve maximum coverage of the population, particularly of the younger age groups, and so direct BCG vaccination is offered in the following centres to the groups named:

i) Maternity hospitals and maternity sections: of the major hospitals, for the newly born, forty-eight hours after birth.

ii) Maternity and child health (MCH) centres: of which there are ninety-four throughout the country.

iii) School health centres: for school entrants and, subsequently, during school medical inspection, to all children without a BCG scar.

iv) MMR surveys: to children up to the age of 15 years.

v) Special mass vaccination campaigns: carried out by the Tuberculosis Control Programme to cover children in remote districts.

vi) Contacts of known tuberculosis patients: to protect them against the development of infection.

vii) Persons attending tuberculosis control centres: with symptoms but without radiological evidence of disease are given BCG irrespective of age. The reasons for this procedure are that patients may come to the centre from

remote districts and therefore cannot be expected to attend again for check-up. They may also be tuberculin-negative. Further, since the facilities exist, they should be used to the full.

viii) Contacts of known cases of leprosy: because some of the trials show that BCG confers a degree of protection against leprosy (Brown and others, 1968; Russell and others, 1968).

ix) Staff working in tuberculosis control institutions: who are tuberculin negative are given BCG vaccination.

4. BCG vaccine

The BCG vaccine was obtained from Yugoslavia until 1970. In 1971 and 1972 it was obtained from Japan. Since 1973 it has been obtained from the Glaxo Laboratories.

When the Yugoslav vaccine was being used there was a lower conversion rate and more complications than would have been expected. Subsequently, three reports from workers in the programme were submitted to the Ministry of Health, the results of which have been put together in the following table:

	Vaccines	
	Yugoslav	Japanese
Mean induration size	5.2mm	9.9mm
Conversion rate	28%	67%
Complications	4.8%	0.4%

The reasons for these differences were not immediately clear. One fact which pointed to faulty technique was the increased incidence of complications which occurred when the Yugoslav vaccine was in use. Further, the Yugoslav vaccine was being used at the beginning of the BCG campaign when much had to be done and there were few to do it; and these few, although trained as well as might be, were relatively inexperienced and unskilled. In the pressure of work injections could, no doubt, be given deeply which would account for the

increased incidence of complications. Moreover, inadequate dosage, that is to say less than 0.1 ml, is easily given when the nurse watches the bleb rising in the skin rather than checking the dose from the graduations on the syringe; and this would account for the low mean induration size. In short, the failure seemed to point to vaccination rather than to vaccine; to faulty technique rather than to poor quality of the product. That there was a failure of technique rather than of the vaccine was implied and supported by certain comments and recommendations in the Report of Dr. D. Savic, the Regional Adviser in Tuberculosis of the WHO Eastern Mediterranean Regional Office, who visited Libya from 12 to 24 June 1972. These were that:

a) Proper techniques and dose will prevent an undue incidence of enlarged lymph glands.

b) The vaccinator should be trained to look at the scale on the syringe, as only in that way can an adequate dose be given.

c) Constant training, refresher courses and operational and technical supervision remain indispensable activities.

d) Expired BCG vaccine should not be used, and it should be ordered more frequently and in smaller quantities.

e) The temperature of refrigerators where BCG vaccine is stored should be checked during field visits.

The change from the Japanese to the Glaxo vaccine was dictated by administrative reasons; the impossibility of sending the vaccine directly and rapidly from Japan to Tripoli without exposure to high temperatures, and the approval of the Glaxo vaccine by WHO (UNICEF, SUNO - 27, Rev.1, 5 December 1969) which could, moreover, be sent directly from London to Tripoli in a few hours without undue or prolonged exposure to heat. It was also decided to order supplies frequently - every four months - and in smaller bulk.

5. The technique of vaccination and dosage

The intradermal route of vaccination is used because it is uniform and accurate. By using a leak-proof syringe the dose of vaccine can be measured precisely, and the risk of complications due to an overdose is reduced. Further, the administration of a reduced dose for the new-born is simple. The WHO Expert Committee on tuberculosis (9th report) "emphasized that intradermal vaccination by syringe and needle remains the most precise way of administering the precise dose."

Using an Omega leak-proof syringe, 0.1ml of the reconstituted vaccine is injected intradermally into the left arm at a site just above the insertion of the deltoid muscle. This is the internationally accepted site for BCG vaccination. Infants are given half the adult dose.

Intradermal injection by a jet injector was at one time considered. It can be useful and rapid when large numbers of persons can be lined up and inoculated one after the other. However, such a situation seldom arises. Further, when adults and infants have to be inoculated at the same session, it is technically not feasible to adjust the jet injector to give the smaller dose to the infant. Moreover, jet injectors require skilled maintenance and repairs. They do not administer the full dose for which they are calibrated, and the size of the lesion varies more than that after vaccination by syringe. There is also an increased risk of unpleasant reactions (ten Dam and others, 1970). The technique has, therefore, not been adopted.

6. Training

The Regional Tuberculosis and Chest Centres at Tripoli and Benghazi are responsible for training nurses in administering BCG. The training which lasts for two weeks, is given to groups of nurses from the Schools for Assistant Nurses and Health Assistants, and also, when required, to individual nurses. Tuberculosis Control Centres may also train nurses to give BCG, in which case their training is supervised by the Regional Tuberculosis and Chest Centres. The latter examine the nurses at the end of the two-week course for their efficiency. A training manual and instructions in Arabic have been prepared for the nurses.

During 1972 and 1973, 467 nurses, assistant nurses and student nurses were trained as follows:

Regional Centre	Number trained		Total
	Females	Males	
Tripoli	273	40	313
Benghazi	136	18	154
TOTAL	409	58	467

7. The BCG centres

As mentioned earlier under the policy of BCG vaccination, there are 192 vaccination centres in the Libyan Arab Republic. These are located in the Tuberculosis Control Centres, MCH centres, maternity hospitals, school health centres and certain selected health centres. The Tuberculosis Control Centre of an area is responsible for the technical supervision of the BCG vaccination centres of the area, supplies the BCG vaccine and equipment and collects reports. These centres are appropriately sited throughout the country and are easily accessible to the majority of patients. Remote places are served by a mobile vaccination team from the Tuberculosis Control Centre of the particular area.

II ASSESSMENT OF BCG VACCINATION

Continuous assessment of the activity of the BCG vaccination campaign, and comprehensive and unceasing supervision are essential and indispensable elements in its success. The various operational and technical components which can be used as indicators of efficiency and progress may be tabulated as follows:

i) Is the service adequate in space and time? Are the vaccination centres conveniently sited and accessible, and are they open all the year round?

ii) Health education. Are the people aware of the value of the service in protecting their health and the health of their children; and are they prepared to co-operate, and to urge their neighbours to cooperate? This aspect may be brought home by publicity campaigns - for instance, posters, notices in the newspapers, radio and television programmes.

iii) Quality of the service. Are the appropriate numbers of skilled, experienced and enthusiastic men and women available, who believe firmly in the value of the service they provide and who establish good relations with the public? Is the equipment sufficient and are supplies replenished when needed?

iv) Vaccine storage. Is the vaccine fresh and not time-expired? Is it properly stored in a refrigerator and protected from light during use?

v) Technique. Are injections precisely measured and really intradermal, and are the tuberculin reactions when tested adequate? Is the incidence of complications low?

vi) Recording and reporting. Are records maintained, and are reports submitted to the supervising centre correctly and at the proper time? Is there a feed-back when appropriate, from the central authority to the periphery?

vii) Vaccination of school children. Are the number of pupils and the number of vaccinations similar?

viii) Vaccination of the newborn. Are the numbers of births and of vaccinations of the newborn equal or nearly so?

ix) Vaccination coverage. What is the vaccination coverage in a specific population group?

x) BCG scar surveys. Do the great majority - 70% or more - of young people bear the scar of BCG vaccination? BCG scar counts are the best index of the effectiveness of the programme.

xi) Tuberculin testing. With the increasing coverage by vaccination, tuberculin testing has diminished in value except for special investigations.

xii) The BCG vaccine. Viable counts of random samples of the vaccine from the stores and of the residues after use are a check on the protection from light and heat.

xiii) The incidence of tuberculous meningitis and of miliary tuberculosis, indicates the absence of protection with BCG. There were seven cases of tuberculous meningitis in 1973, three in children and four in adults. In 1974 ..... cases were recorded.

xiv) The ultimate success of a BCG programme depends on the number of cases prevented. This, however, requires follow up studies over a long period of both vaccinated and unvaccinated groups.

The following methods of assessment have been used in the Libyan Arab Republic.

1. The vaccination coverage

BCG vaccination had been used on a limited scale before 1970, but no detailed records have been preserved.

Records of BCG vaccination were kept from 1970 onwards and the consolidated Table 1 shows the coverage achieved in each muhafida. For this table the population has been taken from the 1973 Census Preliminary Report, and figures for the population below the age of fifteen years have been calculated from the age structure of the 1964 population. The table shows that the vaccination coverage in that age group was 80%, ranging from 44.3% in Khalij to 94.9% in Jabal Akhdar. There was less than 70% coverage in the thinly populated and vast muhafidat of Khalij, Ghrian and Sebha.

Table 2 gives the consolidated BCG vaccination for each muhafida from 1970 to 1973 by age and sex. The vaccination coverage for males and females up to the age of ten is the same, but during adolescence it is greater in males than in females, as is to be expected. Of the total vaccinations from 1970 to 1973, about 60% were in males and 40% in females.

The numbers of BCG vaccinations for males and females in each age group for 1973 and 1974 are given below. The total numbers for each year respectively are 293 665 and 212 422. The vaccination coverage for both sexes is almost equal up to the age of fourteen years, but thereafter the coverage for females is much lower.

BCG Vaccination in 1973 and 1974 in the Libyan Arab Republic

Year	Sex	Age group					
		0 - 1	1 - 4	5 - 9	10 - 14	15+	Total
1973	Male	46 584	19 802	40 562	9 695	48 530	165 173
	Female	43 196	19 516	41 155	8 771	15 854	128 492
	Total	89 780	39 318	81 717	18 466	64 384	293 665
	percentage of total	30.6	13.4	27.8	6.3	21.9	100
1974	Male	54 232	6 674	20 529	4 389	43 464	129 288
	Female	51 544	5 589	18 766	2 736	4 499	83 134
	Total	105 776	12 263	39 295	7 125	47 963	212 422
	Percentage of total	49.8	5.8	18.5	3.3	22.6	100

Vaccinations in the age group up to fourteen years constituted 78% of the total in 1973 and 77.4% in 1974. The maximum number of vaccinations was carried out in both years in the age group 0 to 1. The percentages were 30.6% in 1973 and 49.8% in 1974. The number of vaccinations in the newborn is not known. A new proforma has, therefore, been introduced with a separate column for the age group 0 to one month.

2. Tuberculin testing

After the mass BCG vaccination campaign tuberculin testing is no longer a sensitive index of the prevalence of naturally acquired infection. It is, further, not particularly useful to test the effectiveness of BCG vaccination by tuberculin testing because an intradermal vaccination with a potent vaccine should result in a positive tuberculin test in nearly all subjects. To carry out these tuberculin

tests routinely taxes the staff who have already more than enough to do and who would be better employed in extending the range of BCG vaccination. In fact, some isolated tuberculin surveys have been carried out in recent years but they do not give much useful information. Indeed, sensitivity to tuberculin does not run strictly parallel to resistance to infection. Tuberculin sensitivity may wane while resistance to infection remains.

A national tuberculosis prevalence survey is to be carried out in 1976 in the Libyan Arab Republic. The sample size will be approximately 50 000. The subjects will be tuberculin tested. The reactions among individuals with BCG scars will be an indicator of the success of the vaccination campaign. Of course, the period of time between the vaccination and the tuberculin testing will have to be taken into account.

3. BCG scar survey

And now remains the principal method of assessment of the success of the BCG vaccination campaign, namely, the BCG scar survey or count (WHO:EM/TB/128). This is an absolute indicator of the effectiveness of the coverage. It consists of the inspection and counting of the BCG scars in randomly selected samples of the appropriate population. Following intradermal vaccination with a potent vaccine a clear lesion or scar is visible in almost all those who are vaccinated (Mokhtari and others, 1970).

With such surveys in view, a card and directions for completing it were designed (Annexes I and II), and the method was applied in a scar count carried out in April and May 1974. The Statistical Section of the Ministry of Health selected a random sample from all classes of the primary schools in the Libyan Arab Republic. The following table shows the size of the sample.

Sample size

Name of Mohafida	No. of schools in sample	No. of pupils		Total
		Males	Females	
Tripoli	30	1 500	1 511	3 011
Benghazi	20	951	1 023	1 974
Zawia	21	954	917	1 871
Khoms	17	808	761	1 569
Misurata	20	614	720	1 334
Gharyan	17	842	767	1 609
Sebha	13	549	426	975
Al Khalij	14	684	725	1 409
Jebal Akhdar	17	775	756	1 531
Derna	16	771	567	1 338
Total	185	8 448	8 173	16 621

The results are given in tables 3 to 10.

There were 4.1% of absentees among males and 4.8% among females (table 3). Absenteeism ranged in males from 1.4% in Zawia to 10.5% in Al Khalij; and in females from 0.7% in Sebha to 22.3% in Al Khalij. The absenteeism was generally higher among adolescent females than among adolescent males. Scars were recorded in 91.2% of males and 90.2% of females, the average being 90.8%, and the range from 79.2% to 97.7% (table 4). The percentage of scars increased with increasing age (table 5) and in the higher classes (table 6). This suggests that children who were not covered at the time of admission to school were vaccinated later at the school inspections. All scars were in the left arm and almost all were just above the insertion of the deltoid muscle, and normal in shape (table 7). 8.6% of males and 9.8% of females were without scars (table 8). The scar diameter was between 5mm and 8mm in 60% of the cases. The mean size of the scars was 6.5mm (table 9); in males, 6.48mm and in females. 6.52mm. 90.7% of children between five and fourteen years had scars (table 10).

Since BCG vaccination in the Libyan Arab Republic began only five years ago, the question of revaccination will not normally arise until the 1980's. At that time the justification for revaccination will have to be considered in the light of the status of the programme. It may well be that new cases of infection in young men and women will be few, and that the tuberculosis patients in the last decades of the twentieth century will come only from among the old people who have been infected in the past.

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TABLE 1

Governorate-wise Percentage of BCG Vaccination carried out in the Libyan Arab Republic during the years 1970-73

Name of the Governorate	Total Population-1973	Total Vaccination 1970-73	%	Population below 15 years	Vaccinations in 1970-73	%
Tripoli	709,100	376,355	53.1	309,200	282,912	91.5
Benghazi	331,200	130,204	39.3	144,400	113,413	78.5
Zavia	244,300	87,392	35.8	106,500	81,148	76.2
Misurata	179,300	89,586	50.0	78,200	73,148	93.5
Khoms	162,700	91,621	56.3	70,900	55,016	77.6
Garian	155,200	59,036	38.0	67,700	36,804	54.4
Jabal Akhdar	131,100	81,597	62.2	57,100	54,188	94.9
Derna	123,400	47,606	38.6	53,800	45,034	83.7
Sebha	112,300	39,910	35.5	49,000	24,624	50.2
Al-Khalij	108,400	30,170	27.8	47,200	20,904	44.3
T o t a l	2,257,000	1,033,477	45.8	984,000	787,191	80.0

- Population of 1973 is according to the 1973 census (Preliminary Report)
- Percentage of Population below 15 years of age is 43.6 out of the total population of 1964 census.
- Number of vaccinations, in the age group below 15 years, is according to their ages in 1973 and not as in the year of vaccination.

Libyan Arab Republic,
Ministry of Health,
Community Health Department/Statistical Section,
Tuberculosis Control Programme.

TABLE 2

BCG VACCINATION (BY AGE AND SEX) DONE IN EACH GOVERNORATE OF THE LIBYAN ARAB REPUBLIC DURING THE YEARS FROM 1970 TO 1973.

Age	Sex	Names of the Governorates. Tripoli	Misurata	Khoms	Zavia	Garyan	Sebha	Benghazi	Jabal Akhdar	Derna	Khalij	Total
0 - 1	F	50556	5053	3656	10680	2963	3390	18304	4416	4139	2419	105572
	M	57193	5586	4204	10737	3243	3618	18237	4538	4261	2684	110301
1 - 4	F	8942	8438	5388	9557	2978	483	5518	2666	859	1985	46814
	M	9465	8960	5480	9847	4146	755	11196	2648	976	2029	55684
5 - 9	F	62105	12580	10489	15073	7186	5213	16923	4577	4074	3665	141885
	M	69626	21185	14334	17969	10000	5100	22723	5439	5026	4752	176154
10 - 14	F	17990	3390	5229	3686	3471	2409	4438	755	450	1274	43092
	M	24129	10756	10920	7018	5499	4879	4901	1130	478	3336	73046
15 - +	F	16892	4472	8730	793	4941	3574	3257	2764	186	1740	47329
	M	59457	9166	23211	2032	14609	10489	10386	5531	298	6290	141469
Total both Sex.	F	156485	33933	33492	39852	21539	15069	47440	15178	9708	11079	383775
	M	219270	55653	58129	47540	37497	24841	67445	19486	11039	19091	559991
Total Both Sexes		376355	89586	91621	87392	59036	39910	* 131204	* 81597	** 47606	30170	*** 1033477

* = includes total of B.C.G. done in 1970.

** = includes total of B.C.G. done in Tubruk Region (without distinction of age and sex).

*** = Grand Total of B.C.G. done in Libyan Arab Republic from 1970 to 1973.

TABLE 3

AGE AND SEX-WISE PERCENTAGES OF ABSENTEES.

Governorate.	Item.	Age in years. 5 - 9 Male.	5 - 9 Female	10 - 14 Male.	10 - 14 Female	15 - 19 Male	15 - 19 Female	Male.	Female
Tripoli	Sample.	803	629	584	766	55	59	1442	1454
	Absent.	33	29	25	22	-	6	58	57
	%	4.1	4.6	4.3	2.9	-	10.2	4.0	3.9
Benghazi	Sample.	428	473	479	506	10	27	917	1006
	Absent.	28	7	6	9	-	1	34	17
	%	6.5	1.5	1.3	1.8	-	3.7	3.7	1.7
Zavia.	Sample.	470	406	422	461	49	32	941	899
	Absent.	9	10	4	8	-	-	13	18
	%	1.9	2.5	0.9	1.7	-	-	1.4	2.0
Khoms.	Sample.	358	307	364	395	64	22	786	724
	Absent.	8	7	10	26	4	4	22	37
	%	2.2	2.3	2.7	6.6	6.3	18.2	2.8	5.1
Misurata	Sample.	299	354	291	342	7	12	597	708
	Absent.	9	4	8	8	-	-	17	12
	%	3.0	1.1	2.7	2.3	-	-	2.8	1.7
Gharyan	Sample.	383	338	375	393	58	13	816	744
	Absent.	9	12	15	11	2	-	26	23
	%	2.3	3.6	4.0	2.8	3.4	-	3.2	3.1
Sebha.	Sample.	174	156	308	247	51	20	533	423
	Absent.	3	3	10	-	3	-	16	3
	%	1.7	1.9	3.2	-	5.9	-	3.0	0.7
Al Khali.	Sample.	272	212	293	320	54	61	619	593
	Absent.	44	68	16	50	5	14	65	132
	%	16.2	32.1	5.5	15.6	9.3	22.9	10.5	22.3
Jabal Akhdar.	Sample.	320	289	354	409	58	16	732	714
	Absent.	23	21	16	20	4	1	43	42
	%	7.2	7.3	4.5	4.9	6.9	6.2	5.9	5.9
Derna.	Sample.	362	271	326	230	45	35	733	536
	Absent.	20	20	17	8	1	3	38	31
	%	5.5	7.4	5.2	3.5	2.2	8.6	5.2	5.8
Total.	Sample.	3869	3435	3796	4069	451	297	8116	7801
	Absent.	186	181	127	162	17	29	332	372
	%	4.8	5.3	3.3	4.0	3.8	9.8	4.1	4.8

TABLE 4

SEX-WISE PERCENTAGES OF SCARS.

Governorate	No: of Examinations		Scars.		%		Total %
	Male.	Female.	Male.	Female.	Male.	Female.	
Tripoli.	1384	1397	1285	1301	92.8	93.1	93.0
Benghazi.	883	989	754	729	85.4	73.7	79.2
Zavia.	928	881	867	836	93.4	94.9	94.1
Khoms.	764	687	643	591	84.1	86.0	85.0
Misurata.	580	696	537	655	92.6	94.1	93.4
Gharyan.	790	721	733	658	92.8	91.3	92.0
Sebha.	517	420	512	404	99.0	96.2	97.7
Alkhalij.	554	461	491	413	88.6	89.6	89.0
Jabal Akhdar.	689	672	656	642	95.2	95.5	95.4
Derna.	695	505	634	474	91.2	93.8	92.3
Total.	7784	7429	7112	6703	91.2	90.2	90.8

TABLE 5

AGE AND SEX-WISE PERCENTAGES OF SCARS.

Governorate.	Item.	Age in years. 5 - 9 Male.	5 - 9 Female	10 - 14 Male	10 - 14 Female	15 - 19 Male	15 - 19 Female.	Total. Male.	Total. Female.
Tripoli.	Examined.	770	600	559	744	55	53	1384	1397
	Scar.	717	570	518	683	50	28	1285	1301
	%	93.1	95.0	92.7	91.8	91.0	90.6	92.8	93.1
Benghazi.	Examined.	400	466	473	497	10	26	883	989
	Scar.	341	323	404	384	9	22	754	729
	%	85.3	69.3	85.4	77.3	90.0	84.6	85.4	73.7
Zavia.	Examined.	461	396	418	453	49	32	928	881
	Scar.	422	381	397	429	48	26	867	836
	%	91.5	96.2	95.0	94.7	98.0	81.3	93.4	94.9
Khoms.	Examined.	350	300	354	369	60	18	764	687
	Scar.	266	243	321	330	56	18	643	594
	%	76.0	81.0	90.7	89.4	93.3	100	84.2	86.5
Misurata.	Examined.	290	350	283	334	7	12	580	696
	Scar.	263	319	267	324	7	12	537	655
	%	90.7	91.1	94.3	97.0	100	100	92.6	94.1
Gharyan.	Examined.	374	326	360	382	56	13	790	721
	Scar.	350	285	336	361	47	12	733	658
	%	93.6	87.4	93.3	94.5	84.0	92.3	92.8	91.3
Sebha.	Examined.	171	153	298	247	48	20	517	420
	Scar.	170	150	296	234	46	20	512	404
	%	99.4	98.0	99.3	94.7	95.8	100	99.0	96.2
Akhalij.	Examined.	227	143	278	271	49	47	554	461
	Scar.	184	128	260	245	47	40	491	413
	%	81.1	89.5	93.5	90.4	96.0	85.1	91.8	89.6
Jabal Akhdar.	Examined.	296	265	339	392	54	15	689	672
	Scar.	275	244	327	383	54	15	656	642
	%	92.9	92.1	96.4	97.7	100	100	95.0	95.5
Derna.	Examined.	342	250	309	223	44	32	695	505
	Scar.	319	237	273	207	42	30	634	474
	%	93.3	94.8	88.3	92.8	95.4	93.7	92.8	93.9
Total.	Examined.	3681	3249	3671	3912	432	268	7784	7429
	Scar.	3307	2880	3399	3580	406	243	7112	6703
	%	89.8	88.6	92.6	91.5	94.0	90.7	91.4	90.2

TABLE 6

CLASS-WISE PERCENTAGES OF SCARS.

Governorate	Classes. I Exmn	I Scar	I %	II Exmn	II Scar	II %	III Exmn	III Scar	III %	IV Exmn	IV Scar	IV %	V Exmn	V Scar	V %	VI Exmn	VI Scar	VI %	Total. Exmn	Total. Scar	Total. %
Tripoli.	463	418	90.3	554	525	94.8	438	415	94.7	433	392	90.5	466	427	91.6	427	409	95.8	2781	2586	93.0
Benghazi.	334	229	68.6	346	273	78.9	272	224	82.4	312	275	88.1	335	262	78.2	273	220	80.6	1872	1483	79.2
Zavia.	281	254	90.4	279	261	93.5	344	331	96.2	321	305	95.0	306	293	95.8	278	259	93.2	1809	1703	94.1
Khoms.	304	224	73.7	249	193	77.5	251	231	92.0	213	187	87.8	220	201	91.4	214	198	92.5	1451	1234	85.0
Misurata.	222	196	88.3	214	196	91.6	260	249	95.8	226	221	97.8	189	176	93.1	165	154	93.3	1276	1192	93.4
Gharyan.	279	263	94.3	242	217	89.7	239	220	92.0	281	250	89.0	236	229	97.0	234	212	90.6	1511	1391	92.0
Sebha.	101	99	98.0	145	144	99.3	164	157	95.7	171	167	97.7	207	205	99.0	149	144	96.6	937	916	97.7
Alkhalij.	155	126	81.3	150	124	82.7	155	143	92.3	146	140	95.9	223	205	92.0	186	166	89.2	1015	904	89.0
Jabal Akhdar	239	203	84.9	204	189	92.6	224	220	98.2	237	237	100	227	222	97.8	230	227	98.7	1361	1298	95.4
Derna.	256	251	98.0	173	148	85.5	206	195	94.7	181	163	90.0	188	168	89.4	196	183	93.4	1200	1108	92.3
Total.	2634	2263	85.9	2556	2270	88.8	2553	2385	93.4	2521	2337	92.7	2597	2388	91.9	2352	2172	92.3	15213	13815	90.8

Exmn = No: examined.

EM/SEM.TB/6
Table 6

TABLE 7

CHRACTERISTICS OF SCARS.

Governorate.	Scar.		Left Arm.		Suitable Location.		Natural Shape.	
	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
Tripoli.	1285	1301	1285	1301	1278	1288	1278	1288
	100	100	100	100	99.4	99	99.4	99
Benghazi.	754	729	754	729	721	716	734	698
	100	100	100	100	95.6	98.2	97.3	95.7
Zavia.	867	836	867	836	865	833	864	832
	100	100	100	100	99.8	99.6	99.7	99.5
Khoms.	643	591	643	591	638	584	637	586
	100	100	100	100	99.2	98.8	99.1	99.1
Misurata.	537	655	537	655	537	655	537	654
	100	100	100	100	100	100	100	99.8
Gharyan.	733	658	733	658	709	647	727	655
	100	100	100	100	96.7	98.3	99.2	99.5
Sebha.	512	404	512	404	443	387	479	384
	100	100	100	100	86.5	95.8	93.6	95
Alkhalij.	491	413	491	413	406	382	461	388
	100	100	100	100	82.7	92.5	93.9	93.9
Jabal Akhdar.	656	642	656	642	603	594	628	592
	100	100	100	100	91.9	92.5	95.7	92.2
Derna.	634	474	634	474	550	353	492	456
	100	100	100	100	85.5	74.5	77.6	96.2
Total.	7112	6703	7112	6703	6750	6439	6837	6533
	100	100	100	100	95.0	96.0	96.1	97.5

TABLE 8

SEX-WISE PERCENTAGES OF SCARS DIAMETER.

Governorate.	Examined.		Scar Diameter (mm)															
			0		1 - 2		3 - 4		5 - 6		7 - 8		9 - 10		11 - 12		13 - +	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Tripoli.	1384	1397	99	96	75	103	573	551	396	385	189	217	35	31	11	10	6	4
	100	100	6.9	7.2	5.4	7.4	41.4	39.4	28.7	27.5	13.4	15.5	2.5	2.2	0.8	0.7	0.5	0.3
Benghazi.	883	989	129	260	-	4	17	37	61	66	569	528	89	68	12	21	6	5
	100	100	14.6	26.3	-	0.4	1.9	3.7	6.9	6.7	64.5	53.4	10.0	6.9	1.3	2.1	0.7	0.5
Zavia.	928	881	61	45	4	2	43	25	177	77	594	683	37	36	10	12	2	1
	100	100	6.6	5.1	0.4	0.2	4.6	2.8	19.1	8.7	64.0	77.5	4.0	4.1	1.1	1.4	0.2	0.1
Khoms.	764	687	121	96	18	14	40	36	142	154	198	179	135	135	78	49	35	24
	100	100	15.8	14.1	2.3	2.0	5.2	5.2	18.6	22.4	25.9	26.0	17.3	19.6	10.2	7.1	4.6	3.5
Misurata.	580	696	43	41	24	28	197	192	227	249	66	117	19	58	4	5	-	6
	100	100	7.4	5.9	4.1	4.0	34.0	27.6	39.1	35.7	11.4	16.8	3.3	8.3	0.7	0.7	-	0.9
Gharyan.	790	721	57	63	6	10	39	40	161	159	298	219	160	157	42	40	27	33
	100	100	7.3	8.7	0.7	1.4	4.9	5.5	20.4	22.0	37.7	30.4	20.2	21.8	5.3	5.5	3.4	4.6
Sebha.	517	420	5	16	3	2	25	23	166	129	208	175	89	65	12	4	9	6
	100	100	1.0	3.8	0.6	0.5	4.8	5.5	32.1	30.7	40.2	41.7	17.2	15.5	2.3	0.9	1.7	1.4
Alkhalij.	554	461	63	48	6	7	46	51	281	173	101	117	41	40	14	17	2	8
	100	100	11.3	10.4	1.1	1.5	8.3	11.1	50.7	37.5	18.3	25.4	7.4	8.7	2.5	3.7	0.4	1.7
Jabal Akhdar.	689	672	33	30	23	19	50	32	196	248	291	247	64	54	14	21	18	21
	100	100	4.8	4.6	3.3	2.8	7.3	4.8	28.4	36.9	42.2	36.7	9.3	8.0	2.0	3.1	2.6	3.1
Derna.	695	505	61	31	24	18	190	127	301	203	77	82	22	24	11	6	9	14
	100	100	8.7	6.1	3.4	3.6	27.3	25.1	43.3	40.2	11.1	16.2	3.2	4.7	1.6	1.2	1.3	2.8
Total.	7784	7429	672	726	183	207	1220	1114	2110	1843	2587	2564	688	668	208	185	116	123
	100	100	8.6	9.8	2.4	2.8	15.7	15.0	27.1	24.8	33.2	34.5	8.8	9.0	2.7	2.5	1.5	1.6

TABLE 9

MEAN AND STANDARD DEVIATION OF SCARS.

Governorate.	Scars.	Mean Size. (mm) $\bar{x}$	Standard Deviation S	Standard Error. S.E.
Tripoli.	2586	4.85	2.0	0.03
Benghazi.	1483	7.51	1.5	0.03
Zavia.	1703	7.16	1.4	0.03
Khoms.	1234	7.77	2.7	0.07
Misurata.	1192	5.32	2.1	0.06
Gharyan.	1391	7.71	2.4	0.08
Sebha.	916	7.10	2.0	0.06
Alkhalij.	904	6.40	2.0	0.06
Jabal Akhdar.	1298	6.90	2.1	0.05
Derna.	1108	5.60	2.3	0.06
Total.	13815	6.50	2.3	0.02
	Male. Female	Male. Female.		
Total.	7112 6703	6.48 6.52		

TABLE 10

PERCENTAGES OF SCARS BETWEEN 5 TO 14 YEARS.

Governorate.	No: Examined.	Scar.	Percentage.	±
Tripoli.	2673	2488	93.1	0.50
Benghazi.	1836	1452	79.1	0.94
Zavia.	1728	1629	94.3	0.56
Khoms.	1373	1160	84.5	0.97
Misurata.	1257	1173	93.3	0.70
Gharyan.	1442	1332	92.4	0.70
Sebha.	869	850	97.8	0.50
Alkhalij.	919	817	88.9	1.03
Jabal Akhdar.	1292	1229	95.1	0.60
Derna.	1124	1036	92.2	0.80
Total.	14513	13166	90.7	0.22

ANNEX I

LIBYAN ARAB REPUBLIC
COMMUNITY HEALTH DEPARTMENT
TUBERCULOSIS CONTROL PROGRAMME

Serial No. of the Card

BCG Vaccination Scar Survey in School Children

Muhafida

Date of Examination

Name of Student..... Sex M F Age:

Name of School ..... Class Section

Scar: Present Absent

Arm: Right Left

Site: Correct Incorrect

Size of Scar: mm

Shape: Normal Abnormal

Signature of Investigator

LIBYAN ARAB REPUBLIC

Community Health Department
Ministry of Health
Tuberculosis Control Programme
Statistical Section

INSTRUCTIONS FOR THE BCG SCAR SURVEY AMONG THE PRIMARY SCHOOL CHILDREN

This survey will be carried out at present in the primary school children.

Unit of Sample. A Unit is a complete section of a class.

Method of selection of sample. The sample has been selected randomly covering all the schools for this survey. The sample includes all the classes of the primary schools and the examination is to be limited to few classes for the purpose. Out of these classes a particular number of students has been selected for examination.

Method of filling the examination card.

1) Serial Number. This will be given by the Central Statistical Section.

2) Mohafiza. Write the name of the mohafiza on the line and leave the square empty for use of the statistical section.

3) Date of examination. For this there are four squares. The two on the right are for the month and the two on the left side for the year. [0|4] will represent the month of April, and [1|1] as November. [7|4] in the left side will represent the year 1974.

4) Name of the student. Will be written complete as such.

5) Sex. Put the mark in the correct answer square as [✓] against Male or Female.

6) Age. Write the age in figures in two squares, as [0|5] for five years and [1|2] for twelve years of age.

7) Name of the school. Write the exact name of the school.

8) Educational level. For the present this survey is being done in the Primary School children, for which number I is alloted, so please put No [I] in the square against this column.

9) Class and Section. Write the number of the class in the right hand square and the number of the section in the left hand square.

10) Scar. Put the correct mark [✓] in the respective square for the presence or absence of the scar.

11) Arm. Put the correct mark [✓] in the respective square if the scar was on left arm or right arm.

12) Size of the scar. Measure the size of the scar in mm and write in the two boxes against this column. Up to 9mm write as [0|9], and 12mm write as [1|2].

13) Site of the scar. Put the correct mark ✓ in the respective square. The normal site is just above the insertion of the Deltoid muscle. If the scar is higher or lower than this, then it is not the correct site.

14) Shape of the scar. Put the correct mark in the respective square as The abnormal shape may be oblong, irregular, Keloid formation or any other apparent abnormality.

15) Name of the Investigator. Write the name of the Investigator.

16) Students without Scar. All those found without scar, will be vaccinated during the survey.

17) Absent Students. The first part of the card for all the students in the sample will be filled in, including those who are present or absent. Those who are not present at the time of the survey, the word "ABSENT" will be written in the empty space against the column-shape of the scar.

18) Evaluation of the Results. After the completion of the survey, all the cards will be collected in the Regional Tuberculosis and Chest Centres in Benghazi and Tripoli, for the Eastern and Western Region respectively. From the Regional centres, these will be despatched (under special arrangements) to the Statistical Section of the Ministry of Health for the compilation and evaluation of the results of this Survey.

(Dr Ashour Gebrill)
Director General

11 April, 1974