INTERNATIONAL TUBERCULOSIS SURVEILLANCE CENTRE

12th PROGRESS REPORT TO THE TSRU DIRECTING COMMITTEE

1988/1989

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CONTENTS

A. Skin sensitivity to human PPD and to PPD-scrophulaceum in Netherlands-army recruits

In connection with the surveillance of tuberculosis in the Netherlands all recruits entering the army are tested with 1 TU PPD RT 23 + Tween 80. This procedure is done since 1956.
The results of tuberculin testing in unvaccinated recrutes aged 20 years are given per calendar year in table 1.

Year of survey (mid-year)	Number tested	Induration ≥ 10 mm		Induration ≥ 8 mm		Induration ≥ 6 mm	
		No	%	No.	%	No.	%
1956	40,217	7,715	19.18	8,657	21.52	9,490	23.60
1957	38,163	6,235	16.33	7,063	18.51	7,845	20.55
1958	37,365	5,678	15.20	6,432	17.21	7,106	19.02
1959	41,101	5,580	13.58	6,025	14.66	6,511	15.84
1960	42,870	5,100	11.90	5,535	12.91	6,066	14.15
1961	44,918	4,921	10.95	5,300	11.80	5,793	12.90
1962	45,124	4,103	9.09	4,469	9.90	4,920	10.90
1963	44,600	3,421	7.67	3,742	8.39	4,161	9.33
1964	38,395	2,648	6.90	2,875	7.49	3,158	8.22
1965	38,999	2,461	6.31	2,756	7.07	3,278	8.40
1966	42,458	2,314	5.45	2,578	6.07	3,141	7.40
1967	34,177	1,697	4.97	1,894	5.54	2,259	6.61
1968	41,613	1,949	4.68	2,163	5.20	2,505	6.02
1969	41,035	1,792	4.37	1,995	4.86	2,304	5.61
1970	37,762	1,643	4.35	1,861	4.93	2,177	5.76
1971	44,460	1,972	4.47	2,200	4.99	2,478	5.62
1972	38,092	1,405	3.65	1,569	4.08	1,751	4.55
1973	41,628	1,134	2.72	1,356	3.26	1,622	3.89
1974	40,554	994	2.45	1,137	2.80	1,363	3.36
1975	38,473	872	2.27	1,016	2.64	1,182	3.07
1976	38,082	830	2.18	996	2.61	1,190	3.12
1977	42,987	890	2.07	1,044	2.43	1,201	2.79
1978	42,013	532	1.27	635	1.51	773	1.84
1979	44,665	521	1.17	629	1.41	747	1.67
1980	45,895	392	0.85	482	1.05	596	1.30
1981	45,893	386	0.84	480	1.04	600	1.31
1982	42,155	335	0.79	409	0.97	481	1.14
1983	44,331	325	0.73	395	0.89	468	1.06
1984	41,161	292	0.71	346	0.84	405	0.98
1985	43,265	196	0.45	243	0.56	346	0.80
1986	44,365	209	0.47	279	0.63	363	0.82
1987	45,737	189	0.41	257	0.56	344	0,75
1988	44,393	215	0.48	282	0.64	342	0,77

To obtain information about the prevalence of non-specific tuberculin sensitivity and possibly its trend one third of the 1986, 1987 and 1988 draft of army recruits (± 12.000 each year) were tested with PPD-scrophulaceum + Tween 80 in addition to the regular test with 1 TU PPD RT 23 + Tween 80.
The tests were made simultaneously, one test on the left, the other on the right (dorsal) site of the forearm. Testing and reading were done according to the standard WHO-protocol for tuberculin testing.

The results obtained in 1986, 1987 and 1988 together totalling 37.755 persons are given in table 2.

Indurations to 1 TU PPD RT 23 + Tween 80				Indurations to PPD-scrophulaceum + Tween 80			
≥ 6 mm		≥ 10 mm		≥ 6 mm		≥ 10 mm	
NR	%	NR	%	NR	%	NR	%
243	0.64	148	0.39	4.739	12.55	2.930	7.76

The correlation of the individual indurations to PPD RT 23 and to PPD-scrophulaceum is given in table 3.

Figure 1 gives graphically the distribution of the indurations per mm in promillages for this group of tested persons.

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TABLE 3

THE NETHERLANDS 1986,1987 and 1988

NON BCG - VACCINATED ARMY RECRUITS

PPD- SCROPHULACEUM + TWEEN 80

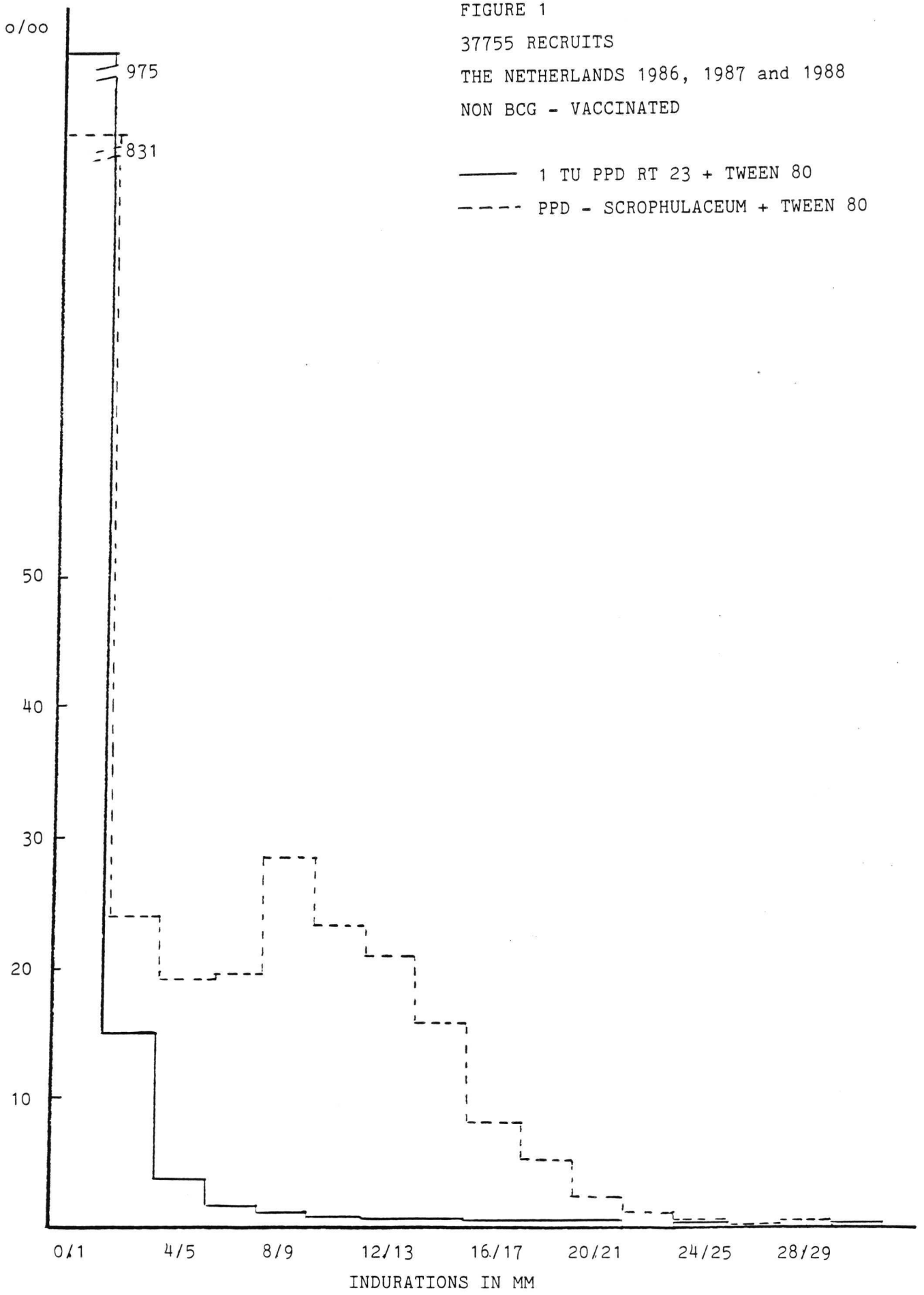
1 TU PPD RT 23 + TWEEN 80	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	totaal
0	30633	220	446	358	290	395	313	383	547	456	487	336	415	311	305	229	143	116	106	50	40	20	23	14	6	4	.	1	1	1	.	36649
1	119	16	16	4	1	3	4	3	4	5	1	1	.	4	1	.	.	1	1	1	.	.	.	.	.	.	.	.	.	.	.	185
2	241	7	38	17	6	8	7	5	7	9	7	8	11	5	8	7	3	3	4	1	2	.	.	.	.	.	.	.	.	.	.	404
3	69	.	7	3	3	7	3	4	4	3	6	2	5	4	6	2	3	.	3	2	1	1	.	.	.	1	.	.	.	.	.	139
4	22	1	3	2	1	3	2	2	4	3	3	3	4	2	1	3	4	1	1	1	.	.	.	.	.	.	.	.	.	.	.	66
5	22	.	3	.	2	3	1	1	5	5	8	2	3	2	2	2	1	1	.	.	3	1	.	.	2	.	.	.	.	.	.	69
6	4	.	1	.	1	.	.	1	4	3	3	1	3	1	1	.	.	2	.	.	1	2	.	.	.	.	.	.	.	.	.	28
7	4	.	.	1	.	1	.	.	.	2	2	2	4	2	3	.	3	.	.	.	.	.	.	.	1	.	.	.	.	.	.	25
8	4	.	.	2	.	1	2	.	2	.	1	3	1	1	2	1	1	.	1	1	.	1	.	1	.	.	.	.	.	.	.	25
9	5	.	.	.	.	1	1	.	1	.	.	2	.	2	1	.	2	.	.	2	.	.	.	.	.	.	.	.	.	.	.	17
10	1	.	.	.	.	1	.	1	1	1	2	.	3	1	.	2	2	1	.	.	2	1	.	.	.	.	.	.	.	.	.	19
11	1	.	1	.	1	.	.	.	1	.	.	.	.	.	.	.	1	1	1	1	1	.	.	.	.	.	.	.	.	.	.	9
12	2	.	.	.	.	1	.	.	.	2	1	.	1	.	.	2	1	2	1	1	.	.	1	.	.	.	.	.	.	.	.	15
13	2	.	1	.	.	.	.	.	.	.	.	1	1	.	3	.	.	.	1	1	.	.	1	.	.	.	.	.	1	.	.	12
14	1	.	.	.	.	.	.	.	1	.	2	.	1	1	.	1	.	.	1	2	.	.	1	.	.	.	.	.	1	.	.	11
15	2	.	.	.	.	.	.	.	1	.	.	1	.	.	1	2	2	.	2	2	.	1	.	.	.	.	.	.	1	.	.	15
16	2	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	1	1	1	.	1	.	.	1	.	.	.	.	.	.	.	9
17	1	.	.	.	.	.	.	.	1	1	.	.	.	.	.	1	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	8
18	2	.	.	.	.	.	.	1	.	.	.	1	2	2	1	.	3	1	2	1	.	.	.	.	.	.	.	.	.	.	.	16
19	1	.	.	.	.	.	.	.	.	.	.	.	.	1	.	2	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	6
20	.	.	.	.	.	.	.	.	1	.	.	1	.	.	1	1	1	.	1	1	4	1	.	3	.	.	.	.	.	.	.	15
21	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	1	.	1	1	1	.	.	.	.	.	.	.	6
23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	2
24	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.	.	.	.	.	.	2
25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	2
26	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0
27	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0
28	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0
29	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0
30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
tot	31139	244	516	387	305	425	333	401	584	491	523	364	454	339	337	257	174	130	128	70	57	29	28	20	9	6	0	1	3	1	0	37755

FIGURE 1

37755 RECRUITS

THE NETHERLANDS 1986, 1987 and 1988

NON BCG - VACCINATED



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A distribution of the results per year of testing is given in table 4:

Year of testing	Number of tests	Indurations in mm to PPD RT 23 + Tween 80				Indurations in mm to PPD-scrophulaceum + Tween 80			
		⩾ 6 mm		⩾ 10 mm		⩾ 6 mm		⩾ 10 mm	
		NR	%	NR	%	NR	%	NR	%
1986	13353	87	0.65	52	0.39	1556	11.65	925	6.93
1987	12380	80	0.65	47	0.38	1870	15.11	1206	9.74
1988	12222	76	0.62	49	0.40	1330	10.88	799	6.54
Total	37755	243	0.64	148	0.39	4739	12.55	2930	7.76

It can be concluded that so far no trend can be observed in the prevalence of sensitivity to PPD-scrophulaceum.

As in the past the distribution of reactivity to PPD RT 23 was geographically unequal in the Netherlands (being lowest in the northern agricultural part of the country and highest in the industrialized western part of the country). A distribution of skin-sensitivity to PPD RT 23 and to PPD-scrophulaceum was made per province.

Province	TOTAL NR TESTED	PPD RT 23 + tween 80 INDURATIONS ≥ 6 mm		≥ 10 mm		PPD-scrophulaceum + Tween 80 INDURATIONS ≥ 6 mm		≥ 10 mm	
		NR	%	NR	%	NR	%	NR	%
Friesland (rural)	1309	3	0.23	2	0.15	155	11.84	97	7.41
Groningen (rural)	1364	13	0.95	6	0.44	167	12.24	111	8.14
Drenthe (rural)	945	5	0.53	3	0.32	105	11.11	59	6.24
Overijssel (rural)	2840	6	0.21	5	0.18	340	11.97	211	7.43
Gelderland (rural)	4911	24	0.49	14	0.29	578	11.77	351	7.15
Flevoland (rural)	346	5	1.45	3	0.87	54	15.61	36	10.40
Limburg (industrial)	2870	44	1.53	25	0.87	317	11.05	177	6.17
Brabant (rural)	7274	37	0.51	24	0.33	834	11.47	490	6.74
Noord-Holland (industrial)	4848	25	0.52	16	0.33	617	12.72	382	7.88
Zuid-Holland (industrial)	7643	53	0.69	29	0.38	1137	14.88	744	9.73
Utrecht (industrial)	2230	13	0.58	8	0.36	302	13.54	185	8.30
Zeeland (rural)	1175	15	1.28	13	1.11	133	11.32	87	7.40
Total	37755	243	0.64	148	0.39	4739	12.55	2930	7.76

No variation between provinces and rural/industrial areas can be observed.

From this study during the three year observation period (1986 - 1987 - 1988) it can be concluded that non-specific tuberculin sensitivity is present in army recruits in the Netherlands.
No geographic variations within the country (coastal/inland provinces or rural/industrial areas) could be observed.
The observation time (3 years) is, however, too short to observe a trend in the non-specific tuberculin sensitivity.

B. Training courses of the National Tuberculin Teams into the standard tuberculin testing and reading technique and the start of the National Tuberculin surveys took place in:

- Kiyose (Tokyo) and Okinawa, Japan, November 1987;
- Riyad, Saudi Arabia, February 1988;
- Tanga and Muheza, Tanzania, July 1988;
- Aleppo, Raqua and Homs, Syrian Arab Republic, February 1989;
- Ho Chi Minh City and Hanoi, Vietnam, April 1989.

The study population in which the training courses took place regarded in most of the countries primary schoolchildren. In some of the mentioned countries there was the possibility to start at the same time a National Tuberculin survey.

Material and methods

The WHO standard Mantoux-test was performed throughout the training courses. The tests were made on the dorsal surface of the left or right forearm. The reactions were read after 72 hours, by measuring and recording the transverse diameter of the indurations in mm. As standard test 2 TU PPD RT 23 + Tween 80, produced in the State Serum Institute in Copenhagen was used.
For each individual, personal data and information about previous BCG-vaccination were recorded.
Disposable syringes and needles, provided by ITSC, were used.

The tests were read simultaneously by all the team members and the results were discussed.
The comparisons by double-blind readings were made between the ITSC reference nurses and the National team members.

1. Comparison of the Mantoux technique in Kiyose and Okinawa, Japan, November 1987

During the TSRU-meeting and a few days after it, demonstrations of Mantoux-reading and -testing techniques were given to the personnel of the TB-ward and of the Japan Institute of Tuberculosis in Kiyose-Tokyo.
After the meeting a visit was paid to the Anti-Tuberculosis Association in Okinawa on their request.
Besides the theoretical part some tuberculin testing and reading took place in one of the Okinawa's old-aged-peoples homes. Several hundreds of reactions were performed and the results were compared between a number of present medical and paramedical personnel involved in this kind of work. It was for the first time that they started to read the indurations of the tuberculin tests instead of the erythemas.

2. Training course of the National Tuberculin Team in Riyad, Saudi Arabia, 15 January - 18 February 1988

On request of WHO-Alexandria a training course and a start of the Saudi Arabian tuberculin survey should have taken place in Riyad in January 1988. Two nurses of the ITSC traveled for this purpose to Riyad.
Due to school-holidays the survey could not start. The training of the national nurses then took place in the out-patients dispensary of the Sahary Hospital, where hundreds of persons were Mantoux-tested and/or read daily.

Fifteen nurses were recruted from different places of Saudi Arabia and sent on turnes for one week training to Riyad. Not all of them were familiar with the tuberculin technique.
A comparison by double-blind reading took place. Two nurses from Riyad showed very good results and they were going to do the testing in the female schoolchildren in Riyad.
Male "nurses" were not trained except that during a few days theoretical advices were given.

To perform a tuberculin survey in Saudi Arabia a national team should be formed and trained. This task seems in practice impossible. The nurses are not permitted to travel or to enter the male schools. Saudi nurses are rare, all the work is done by foreign guest workers, who stay temporarily in Saudi Arabia and whose rights are limited.

There is not a direct responsible person at the Ministry of Health or elsewhere, who would take the responsibility for a national survey or anti-TB programme.

Dr Kaleta from WHO was designing the draft of a national programme, Dr A. Tajeldin (Irak) was taking interest and was organizing the activities, but his real obligations were others.

The following nurses took part in the training:
1 Emtithal Imael Bakdock (from Syria), Primary Health Centre, Gizan;
2 Araceli M. Echano (Philippines), Maternity-childrens Hospital, Tabouk;
3 Medgeli S. Frani (Philippines), TB-Chest Disease Hospital, Al Gasim;
4 Imam Abukuder (Saudi Arabia), Maternity Hospital, Medina;

5 Dekila Sale Ueihar (Saudi Arabia), El Hail;
6 Amna M. Hasim (Sudan), Chest Hospital, Al Taif;
7 Udaya Kumari (Egypt), Musadia Disp. for health care, Arar;
8 Elvira Coraming (Philippines), General Hospital, Layla (Riyad);
9 Bahiga Ahmed Shabaksky (Egypt), Primary health care center, Abha;
10 Dolores P. Tandih (Philippines), General Hospital, Dawadmi;
11 Theresiamna George (India), Chest Hospital, Dammam.

From the Anti-TB dispensary in Riyad:
1 Sabah Husein Muhamed (Egypt);
2 Sheha Masaud Asfer (Saudi Arabia);
3 Muna Muhamed Husein (Saudi Arabia);
4 Mr Zed Ali (Saudi Arabia).

The tables A, B and C give the correlation of the three nurses working in the anti-TB dispensary in Riyad.
The correlations are to be considered very good.
In addition 101 patients with sputum positive tuberculosis were tested. The histogram of the indurations obtained is given in Figure 2. It can be seen that all patients reacted with indurations of more than 10 mm.

TABLE A

RIYAD, SAUDI ARABIA

JANUARY/FEBRUARY 1988

SABAH HUSEIN MUHAMED - RIYAD

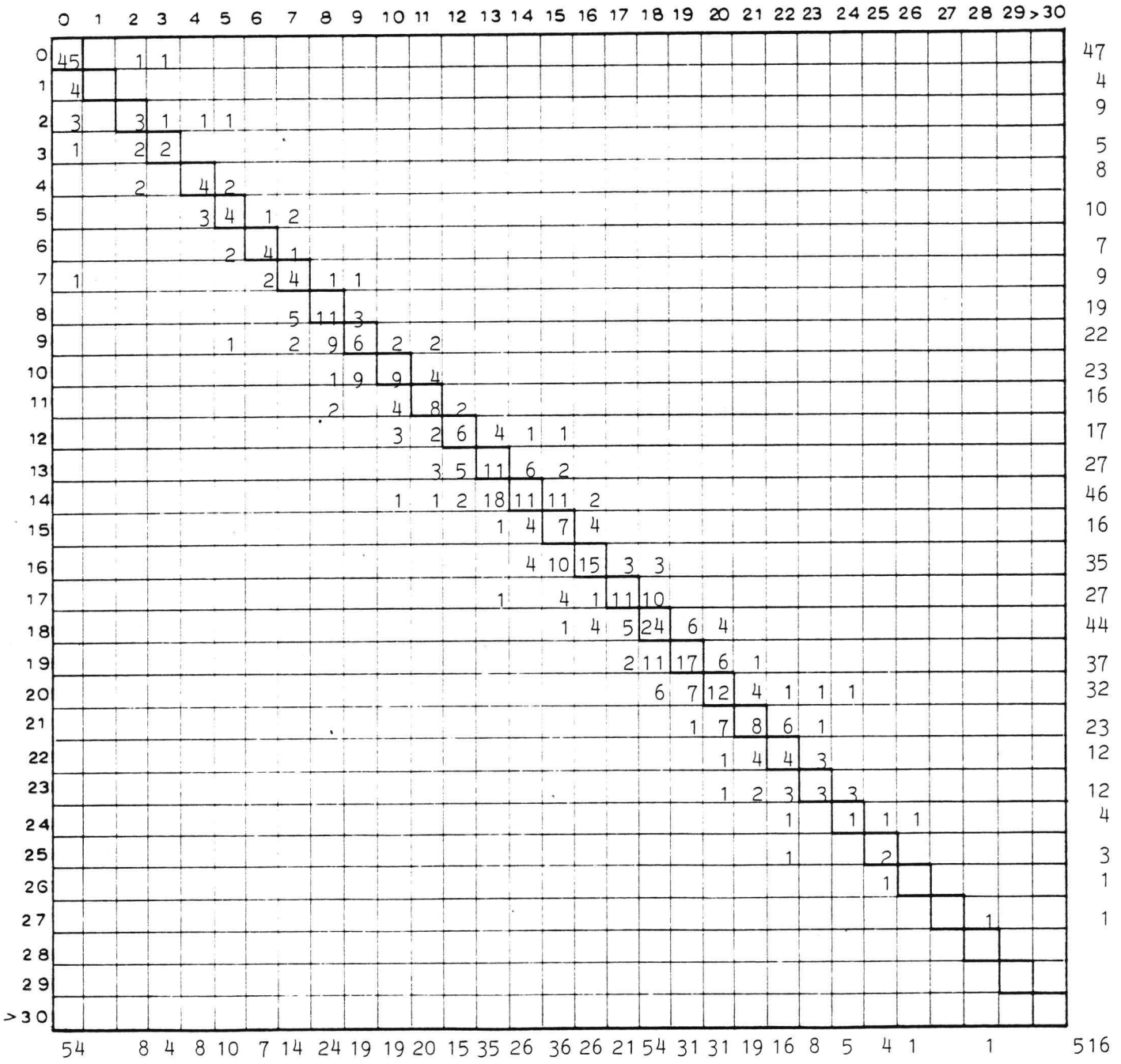

TABLE B

RIYAD, SAUDI ARABIA

FEBRUARY 1988

SHEHA MASAUD ASFER - RIYAD

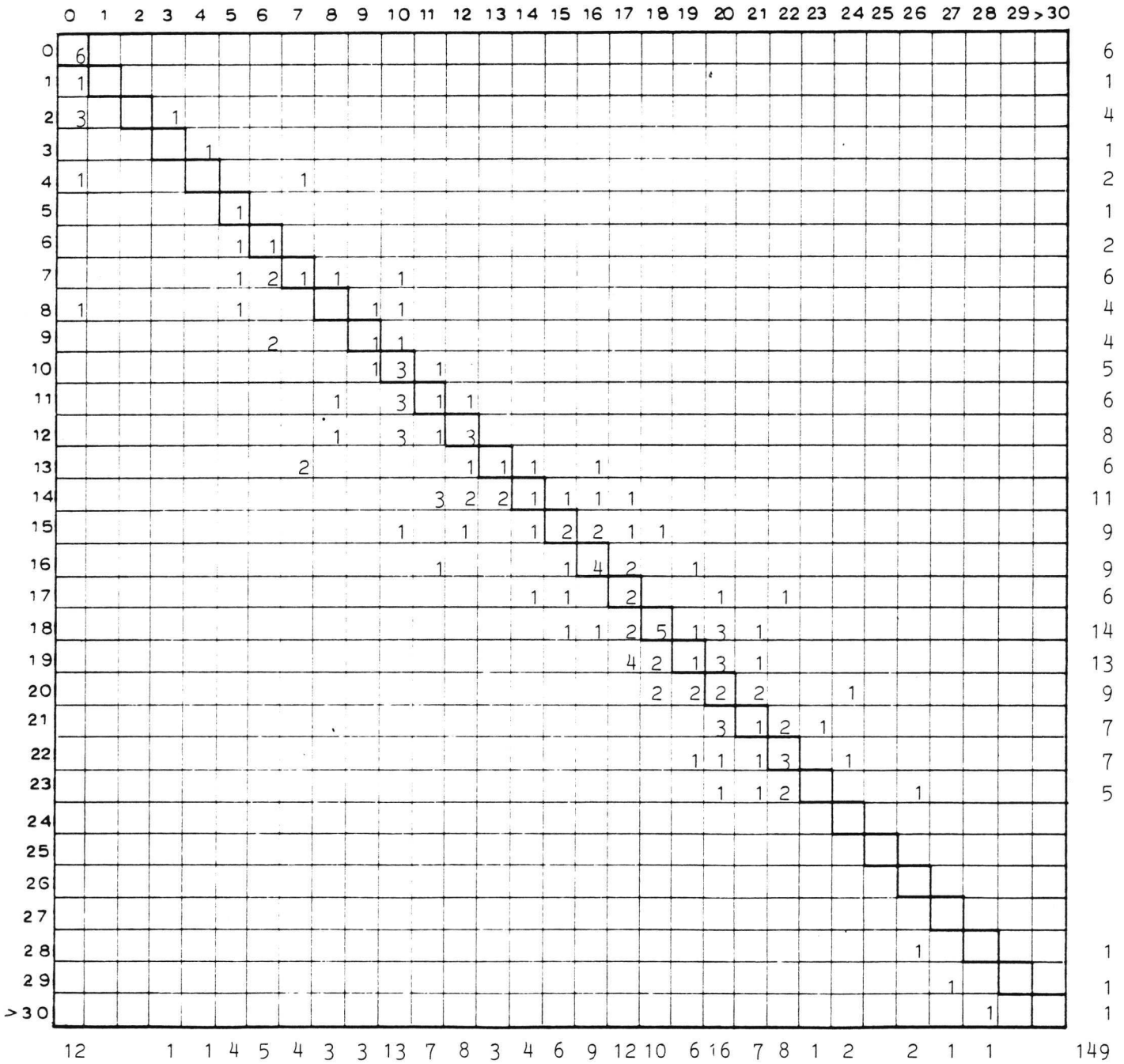

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TABLE C

RIYAD, SAUDI ARABIA

JANUARY 1988

MUNA MUHAMED H. HAKAMI - RIYAD

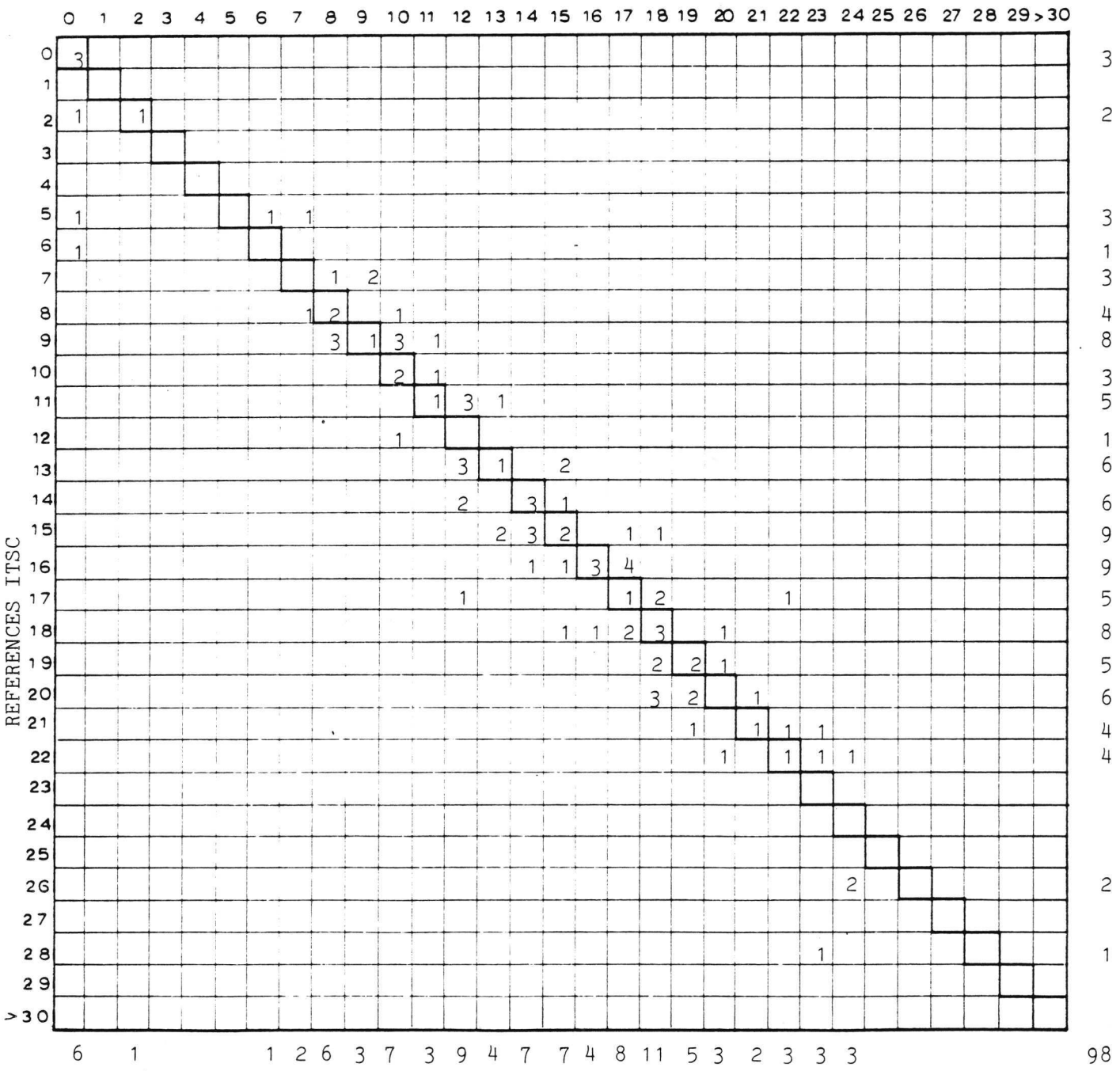
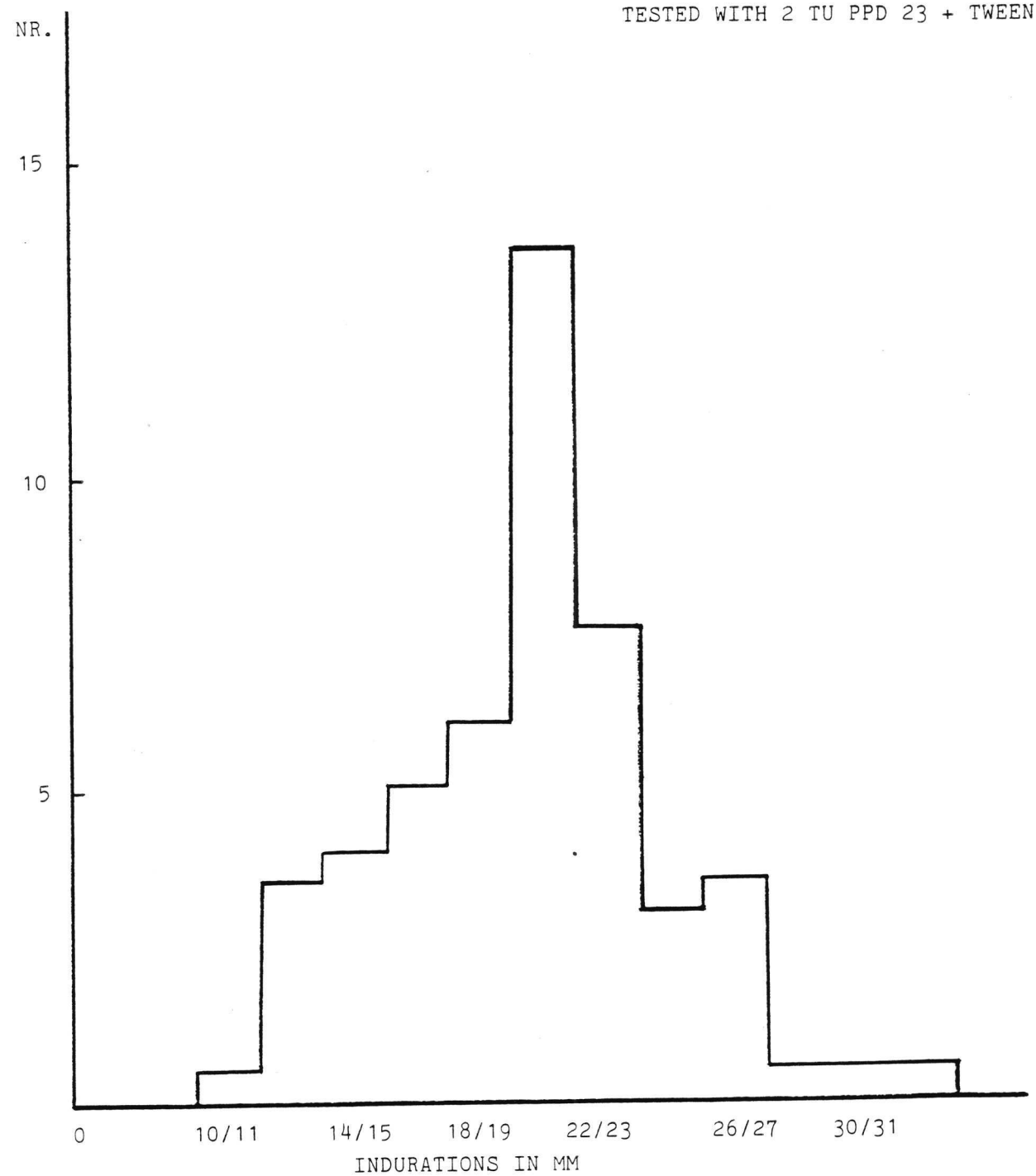


FIGURE 2
RIYAD, SAUDI ARABIA 1988
101 TB-PATIENTES
WITH POS. SPUTUM
TESTED WITH 2 TU PPD 23 + TWEEN 80



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3. Tuberculin survey and training course in Tanzania July/August 1988

According to the protocol for the National Tuberculin Survey in Tanzania the tuberculin testers are continually supervised and retrained, if necesarry.
The persons trained into the standard tuberculin testing and reading technique work about 2 months per year as a tuberculin tester and are not fully qualified paramedical staff.

On the request of the TLCU and the IUATLD a refresher training was given in July/August 1988 to the members of the Tanzanian team. In addition two new members were trained,

The training took place in Tanga Medical Centre and the practical part of it in the schools of Tanga Region, where the first tuberculin resurvey was carried out.
The schools were the same ones as those randomly selected in 1983 in the districts of Tanga and Muheza. The preparations for the tuberculin survey were done by the TLCU and the RTLC.

The data on the results of the tuberculin testing will be further analized by the TSRU.

Handling and use of the disposable material was introduced.
The number of children tested was about 2000. The number of the tests to be read was however, bigger, as (according to the protocol) half of the children had been additionally tested with PPD-scrophulaceum.

All the tuberculin reactions were double read between the ITSC reference and the four Tanzanian team members, the results were compared, discussed and several times controlled.
The results of the double-blind readings (last two days) were recorded and are reported hereafter.

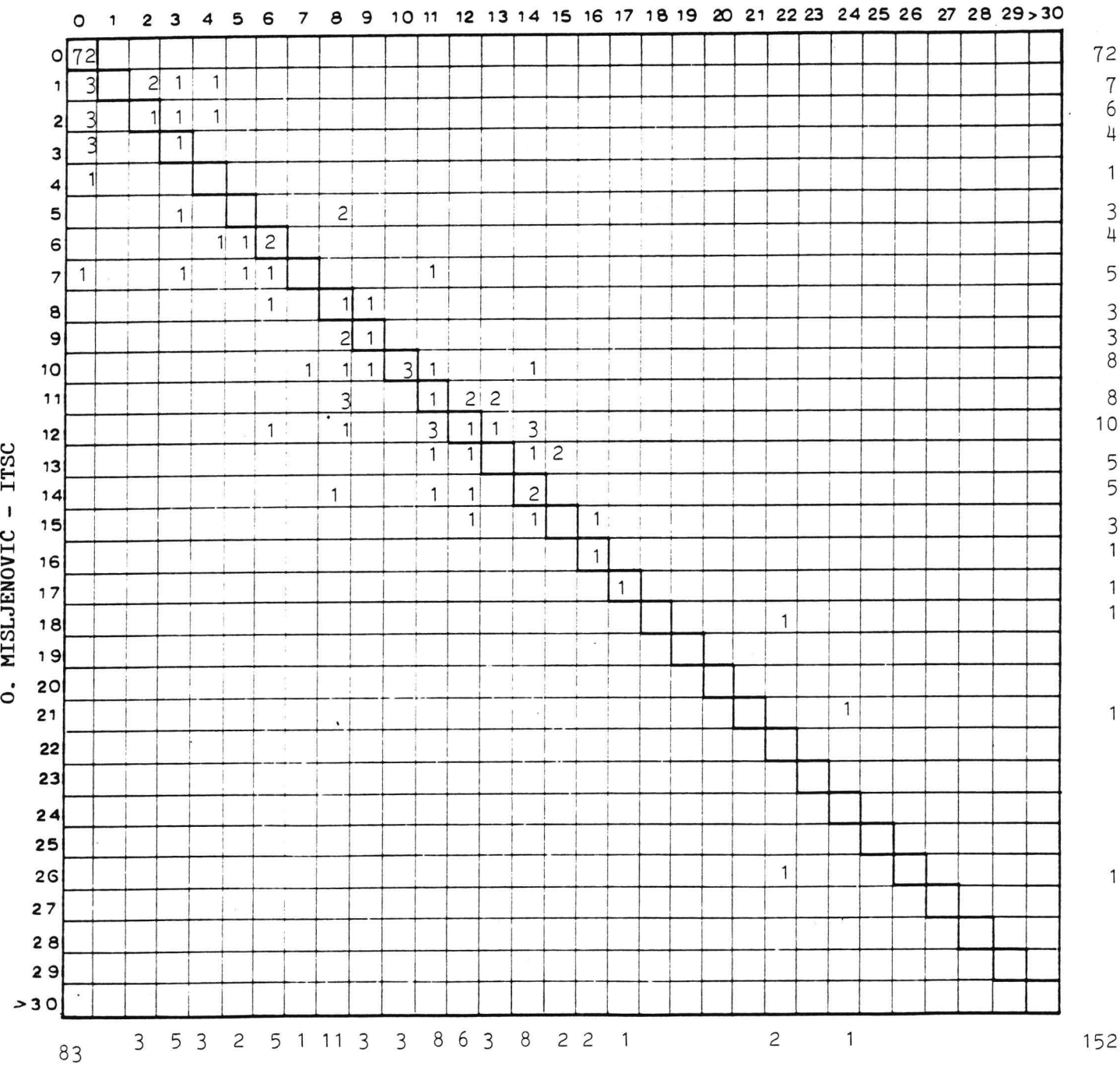
The Tanzanian National Team counts now four members. They are doing their best, working often under a very hard conditions.

The following tables show the correlation of the indurations read by the ITSC reference nurse and Mr E.Y. Mbwana, Mr J.M. Gibogo, Mr S. Maswille and Mr A. Mnape.

TANZANIA 1988

TABLE 1

MR. ERNEST Y. MBWANA



O. MISLJENOVIĆ - ITSC

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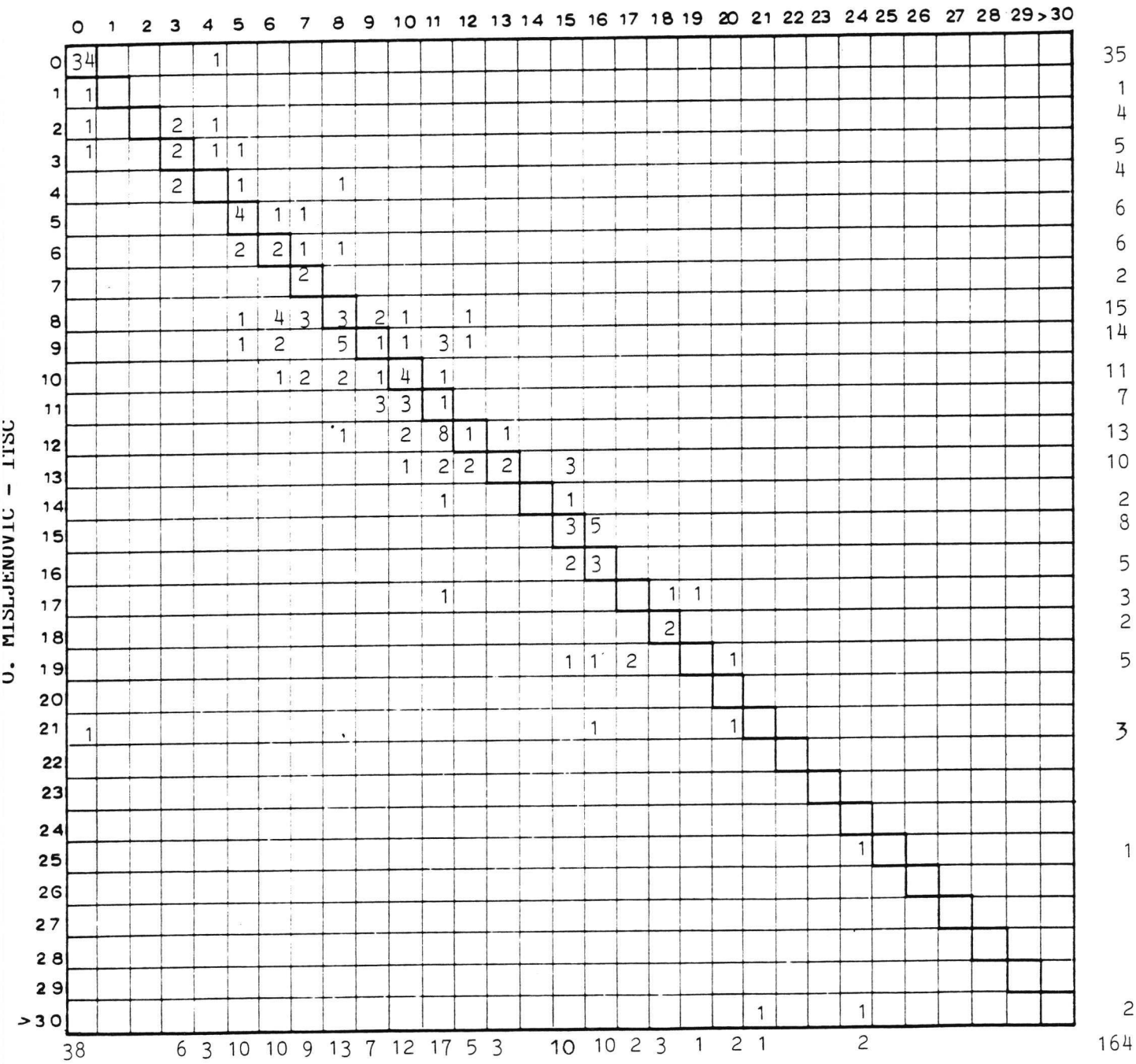
TANZANIA 1988

TABLE 2

MR. JOHN M. GIBOGO



U. MISLJENOVIC - ITSC

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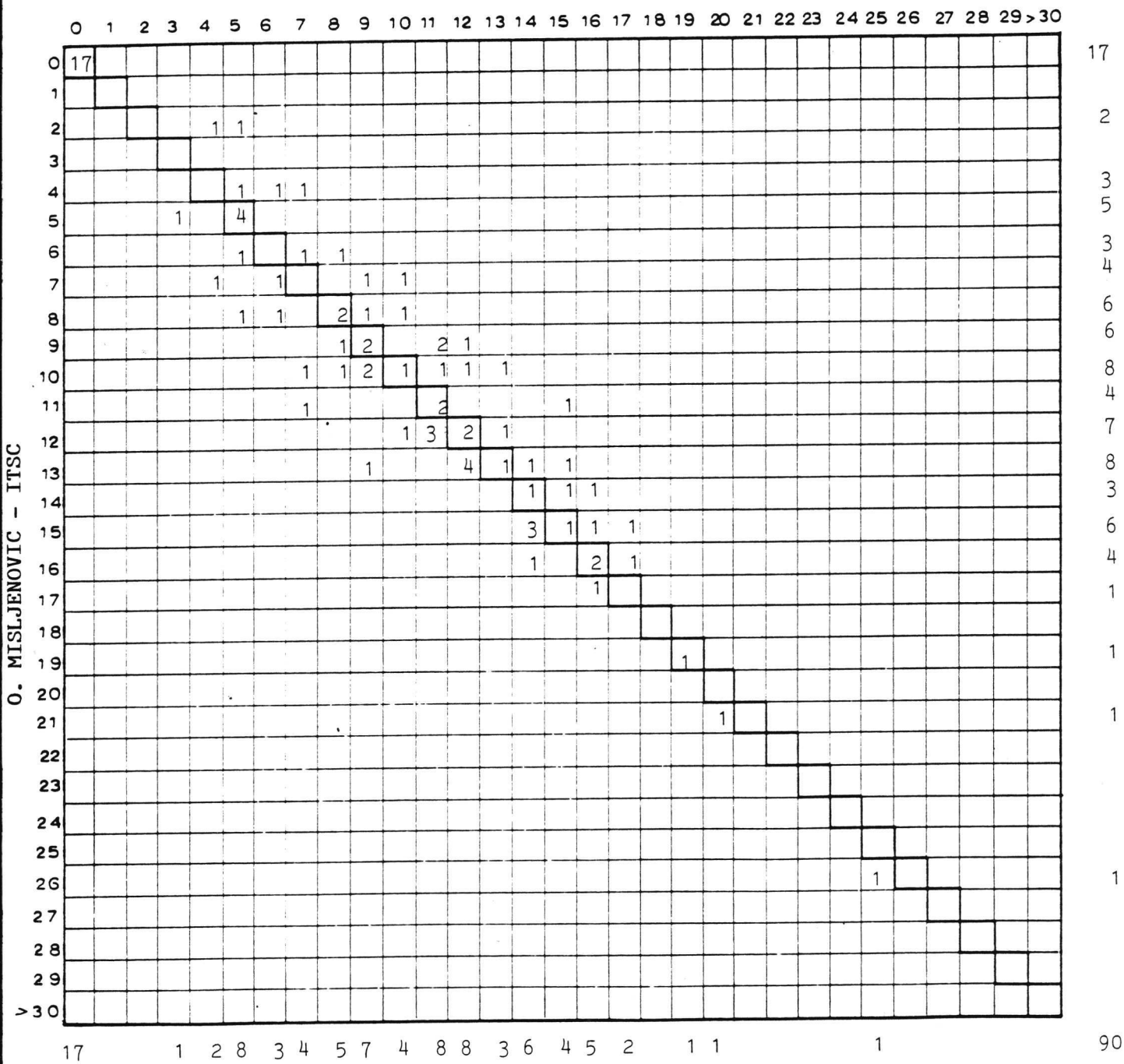
TANZANIA 1988

TABLE 3

MR. STEPHEN MASWILE



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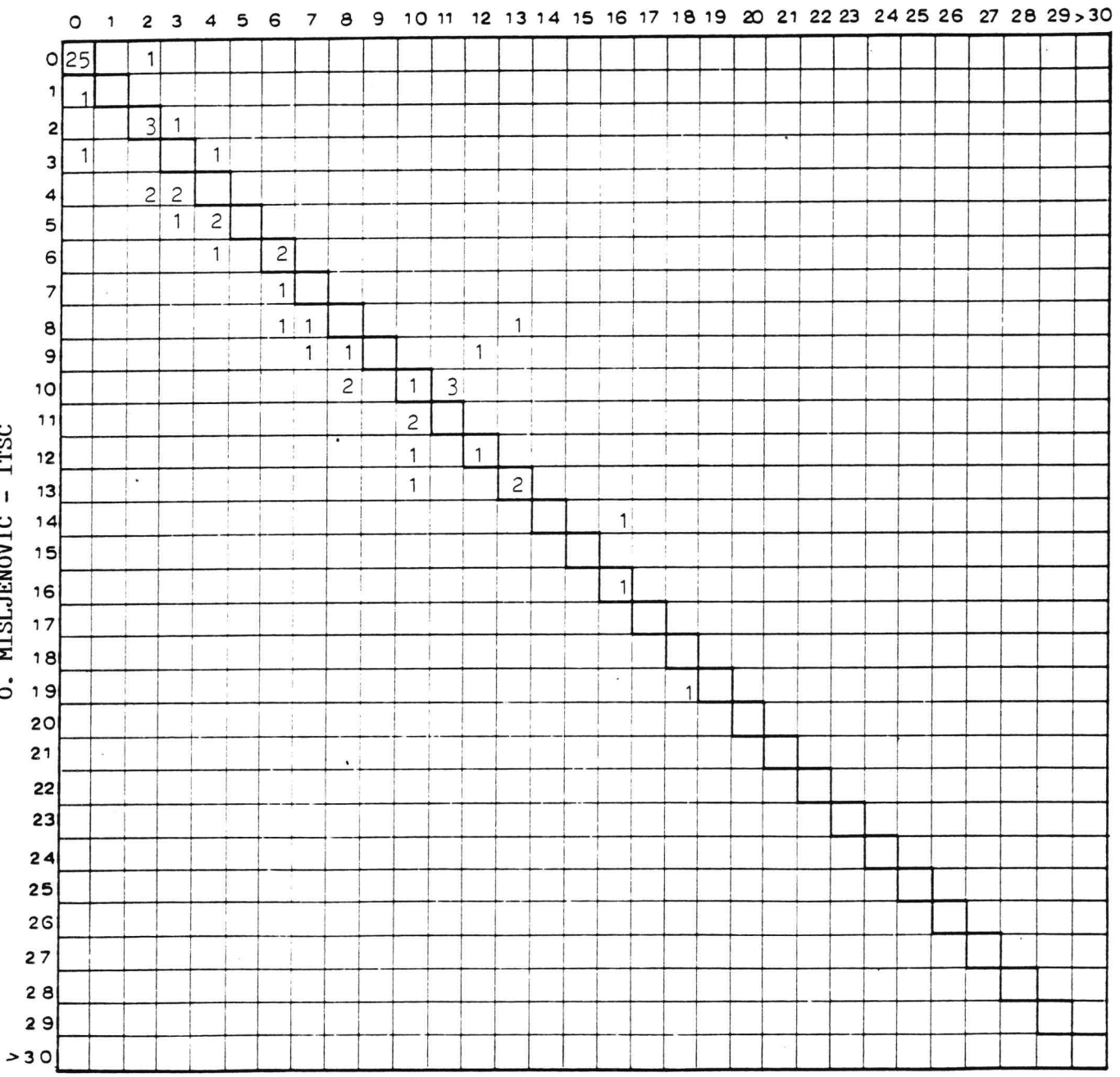
TANZANIA 1988

TABLE 4

MR. A. MNAPE



O. MISLJENOVIC - ITSC

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4. Tuberculin skin sensitivity in schoolchildren (aged 5-9) in three areas in the Syrian Arab Republic

February 1989

Preliminary report of the results of the second resurvey (February 1989) and comparison of the results obtained in the surveys made in 1978, 1983 and 1989.

Study population

In total 7816 schoolchildren were tested, aged 5-9 years, in primary schools in three areas of Syria; Aleppo town, Aleppo rural (Aziz and Afrin) in Homs and in Raqua and Tabqua.
The selection of the schools was made according to a protocol prepared by the Syrian authorities in 1978.

Material and methods

The WHO standard Mantoux-test was performed throughout the study. The test was made with 2 TU PPD RT 23 + Tween 80, prepared in the Statens Serum Institute in Copenhagen, Denmark.
The test was made on the dorsal surface of the left forearm.

The reactions were read after 72 hours by measuring the transverse diameter of the indurations in mm. For each individual age, sex and information about previous BCG-vaccination (through scar-survey) were recorded.

Results

The following table 1 shows the results of the 1989 survey for BCG- and non-BCG-vaccinated children separately.

A full report will be given by Mr Khaldoun Tabah from the University of Aleppo in due time.

SYRIA 1989

TABLE 1

BOYS AND GIRLS

TUBERCULIN INDICES TO 2 TU PPD RT 23 + TWEEN 80

	NON BCG - VACCINATED					BCG - VACCINATED						
	TOTAL NUMBER	indurations				TOTAL NUMBER	indurations				TOTAL NUMBER TESTED AND READ	PREVIOUSLY VACCINATED WITH BCG	
		⩾ 6 mm		⩾ 10 mm			⩾ 6 mm		⩾ 10 mm				
		Nr.	%	Nr.	%		Nr.	%	Nr.	%		Nr.	%
ALEPPO	1751	25	1.43	18	1.03	840	89	10.6	51	6.07	2591	840	32.4
AZAZ	272	8	2.94	8	2.94	494	75	15.18	48	9.72	766	494	64.5
AFRIN	250	6	2.4	5	2.0	394	75	19.04	47	11.93	644	394	61.2
HOMS	971	20	2.06	10	1.03	573	71	12.39	36	6.28	1544	573	37.11
RAQUA	359	31	8.63	19	5.29	1141	563	49.34	427	37.42	1500	1141	76.1
TABQUA	372	15	4.03	8	2.15	399	78	19.55	51	12.78	771	399	51.7
	3975	105	2.64	68	1.71	3841	951	19.6	660	17.2	7816	3841	49.14

VGB31/df/23
16 08 1989

Comparison of the results of the studies made in 1978, 1983 and 1989 in Aleppo and of the studies made in Raqua and Tabqua and in Homs in 1983 and in 1989.

Table 2 shows the comparison of the results in Aleppo, Azaz and Afrin. It shows that the percentage of reactors with 10 mm and more induration are decreasing.

ALEPPO - SYRIA

TABLE 2a

BOYS + GIRLS

	TOTAL NR TESTED AND READ	NR TESTED WITH PREVIOUS BCG-VACCINATION	% TESTED WITH PREVIOUS BCG-VACCINATION	NON BCG-VACCINATED				
				TOT.	INDUR. ≥ 6 mm		INDUR. ≥ 10 mm	
				NR	NR	%	NR	%
1978	2.352	201	8.5	2.151	48	2.2	38	1.7
1983	1.222	218	17.8	1.004	13	1.3	12	1.2
1989	2.591	840	32.4	1.751	25	1.43	18	1.03

AZAZ AND AFRIN

TABLE 2b

	TOTAL NR TESTED AND READ	NR TESTED WITH PREVIOUS BCG-VACCINATION	% TESTED WITH PREVIOUS BCG-VACCINATION	NON BCG-VACCINATED				
				TOT.	INDUR. ≥ 6 mm		INDUR. ≥ 10 mm	
				NR	NR	%	NR	%
1978	795	23	2.9	772	30	3.9	29	3.7
1989	1.410	888	63.0	522	14	2.7	13	2.5

Table 3 shows the comparison of the results in Raque and Tabqua in 1983 and 1989.
The results obtained in both years appear to be aqual and higher than in Aleppo and Homs.

RAQUA AND TABQUA - SYRIA

TABLE 3

BOYS + GIRLS

	TOTAL NR TESTED AND READ	NR TESTED WITH PREVIOUS BCG-VACCINATION	% TESTED WITH PREVIOUS BCG-VACCINATION	NON BCG-VACCINATED				
				TOT. NR	INDUR. ≥ 6 mm NR	%	INDUR. ≥ 10 mm NR	%
1983	3.081	630	20.4	2.451	145	5.9	111	4.5
1989	2.271	1.540	51.7	631	46	7.3	27	4.3

Table 4 shows the comparison of the results in the city of Homs obtained in 1983 and in 1989.
The results obtained in both years are equal. No decrease could be observed.

HOMS - SYRIA

TABLE 4

BOYS + GIRLS

	TOTAL NR TESTED AND READ	NR TESTED WITH PREVIOUS BCG-VACCINATION	% TESTED WITH PREVIOUS BCG-VACCINATION	NON BCG-VACCINATED				
				TOT. NR	INDUR. ≥ 6 mm NR	%	INDUR. ≥ 10 mm NR	%
1983	2.035	350	17.2	1.685	22	1.3	17	1.0
1989	1.544	573	37.1	971	20	2.1	10	1.03

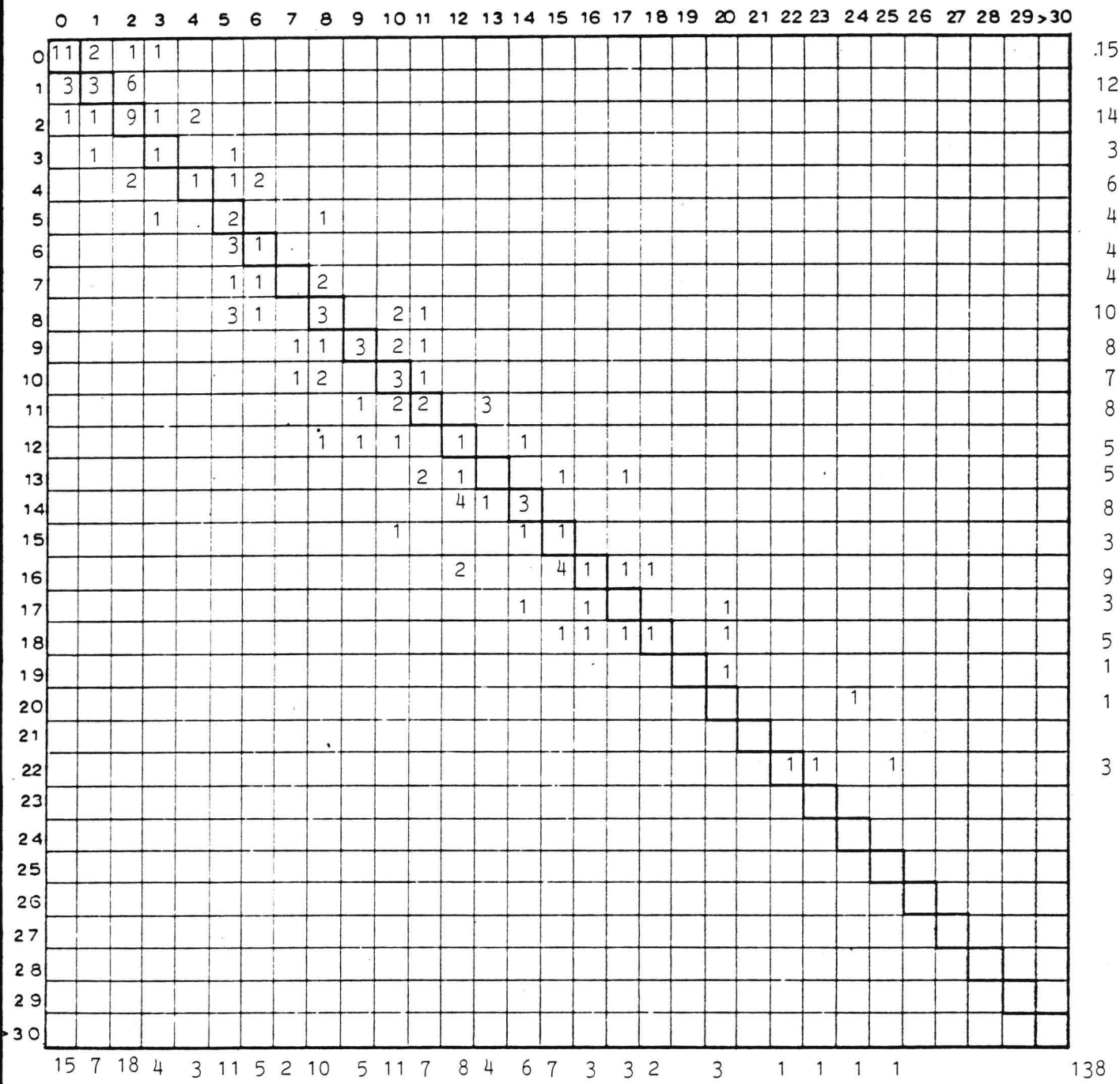
During the resurvey into tuberculin sensitivity the ITSC reference nurse made double readings with the members of the Syrian National Tuberculin Team.

Table 5 shows the results of the double-blind readings of Dr Khaldoun Tabah from Aleppo as principal investigator with ITSC reference Miss Misljenović.
The results appear to be very good.

SYRIA 1989

TABLE 5

KHALDOUN TABAH - ALEPPO



VGB31/df/27
16 08 1989

5. Training course of National Tuberculin Team and the results obtained by double testing schoolchildren in Ho Chi Minh City and in Hanoi, Vietnam

March/April 1989

Since 1986 a new National Tuberculosis Program was introduced in Vietnam.
In order to measure the magnitude of the tuberculosis problem and to obtain an impression of its trend two teams of tuberculin testers were trained in 1986 into the WHO standard Mantoux technique.

By invitation of the Ministry of Health of Vietnam and of the Medical Committee Netherlands-Vietnam two members of ITSC went again to Vietnam in March 1989 to:

- give a refresher course to the members of the National Tuberculin Team and to train several new members of this team;
- to perform double testing in Ho Chi Minh City and in Hanoi respectively with 1 TU PPD RT 23 + Tween 80 and 2 TU PPD RT 23 + Tween 80;
- to test a number of children in both locations with PPD RT 23 simultaneously with PPD-scrophulaceum to determine if non-specific tuberculin sensitivity is present in Vietnam.

Results

Total number of tested and read children in Ho Chi Minh City was 2809 of whom 79.1 % had been previously vaccinated with BCG.

Total number of tested and read children in Hanoi was 1112 of whom 9.2 % BCG-vaccinated.

5.1 Results of the training course

- In Ho Chi Minh City 7 members of the National Tuberculin Team were trained.
  The tables 1 - 7 show the members of the double readings with the reference tester/reader of ITSC.

- In Hanoi 4 members of the National Tuberculin Team were retrained.
  The tables 8 - 11 show the results of the double readings with the reference tester/reader of ITSC.

  As can be concluded from the correlation tables the results are very satisfactory.

5.2 Comparison of the indurations obtained with 1 TU PPD RT 23 + Tween 80 versus 2 TU PPD RT 23 + Tween 80 in the same children.

The motive for the comparison of 1 TU and 2 TU in Vietnamese children was the fact that previous studies by WHO were made with 1 TU PPD RT 23 + Tween 80 and that at present for international use in epidemiological studies 2 TU PPD RT 23 + Tween 80 is used. For reasons of comparison the results of previous studies with present studies this comparison was made.

- In Ho Chi Minh City 272 non-BCG-vaccinated children were tested with 1 and 2 TU PPD RT 23 + Tween 80 simultaneously.
  Table 12 shows the correlation of the individual indurations obtained by both products.
  The mean induration to 1 TU was 3.7 mm and to 2 TU it was 5.2 mm.
  Figure 1 gives the histograms to both products.

  At the same time 849 BCG-vaccinated children were tested simultaneously with 1 and 2 TU PPD RT 23 + Tween 80.
  Table 13 shows the correlation of the individual indurations to both products in these children.
  The mean induration to 1 TU PPD RT 23 + Tween 80 was 4.7 mm and to 2 TU PPD RT 23 + Tween 80 it was 6,8 mm in this group of vaccinated children.
  Figure 2 gives the histograms per mm induration to both products.
  It can be concluded that 2 TU elicit indurations of a wider diameter than 1 TU does.

- In Hanoi only smaller groups of children were tested simultaneously with 1 TU and 2 TU PPD RT 23.
  376 non-BCG-vaccinated children were tested as well as 58 previously BCG-vaccinated children.
  The correlation of the individual indurations to both products are given in the tables 14 and 15.
  The mean induration to 1 TU in non-BCG-vaccinated children was 0.8 mm, and the mean induration to 2 TU in the same group of children was 1.1 mm.
  In the BCG-vaccinated children the mean induration to 1 TU PPD RT 23 + Tween 80 was 1.4 mm and to 2 TU it was 1.8 mm.

5.3 Comparison of simultaneous test results with PPD RT 23 + Tween 80 and PPD-scrophulaceum + Tween 80.

To obtain information on the prevalence of non-specific tuberculin sensitivity in children in Vietnam 950 non-BCG-vaccinated children were tested with PPD RT 23 + Tween 80 and PPD-scrophulaceum.
(316 children in Ho Chi Minh City and 634 children in Hanoi.)

- In Ho Chi Minh City 316 children were tested with two simultaneously applied Mantoux-tests, one being 1 TU PPD RT 23 + Tween 80 and a biologically comparable dosis of PPD-scrophulaceum + Tween 80.
  (1 TU, because of reasons of comparability with previous WHO-surveys).

  Table 16 gives the results of the individual tests to both products. As can be seen from the table non-specific tuberculin sensitivity is present in the group of children with induration of less than 10 mm to PPD RT 23 + Tween 80.
  The overall mean diameter of indurations to PPD RT 23 was 2.5 mm and to PPD-scrophulaceum it was 3.7 mm.
  Figure 3 shows graphically the results per mm induration to both products.

- In Hanoi 634 children were tested simultaneously with 2 TU PPD RT 23 + Tween 80 and with PPD-scrophulaceum + Tween 80.
  Table 17 gives the results of the individual tests to both products. As can be seen from this table, like in Ho Chi Minh City, non-specific tuberculin sensitivity is present in the group of children reacting with indurations of less than 10 mm to PPD RT 23 + Tween 80.
  The mean diameter of indurations to PPD RT 23 was 2.04 mm, whilst the mean diameter of indurations to PPD-scrophulaceum was 2.33 mm.
  Figure 4 shows the results per mm induration to both products graphically.

Figure 1
Ho Chi Minh - Vietnam 1989
272 non BCG-vaccinated children

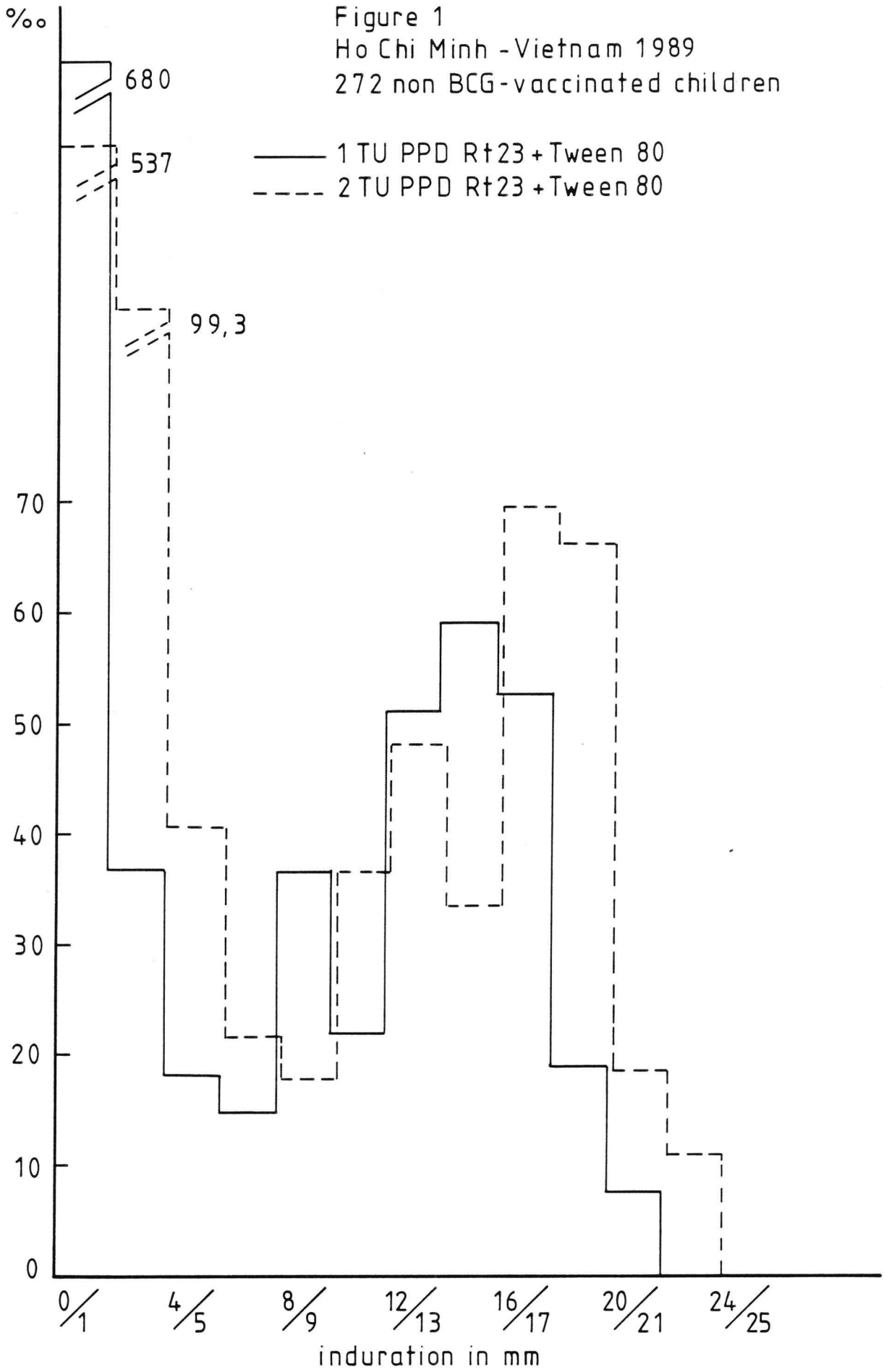


Figure 2
Ho Chi Minh -Vietnam 1989
849 BCG-vaccinated children

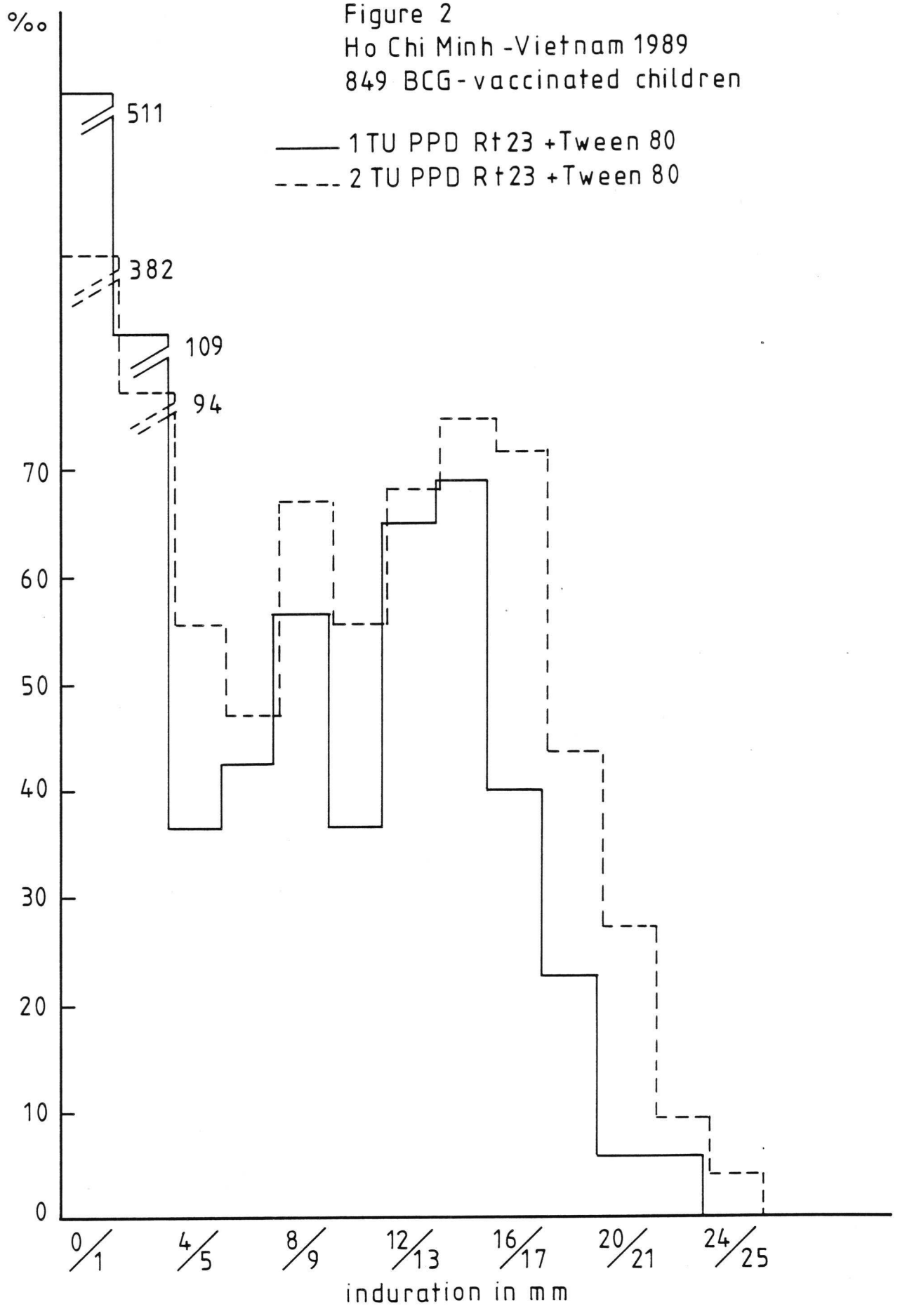
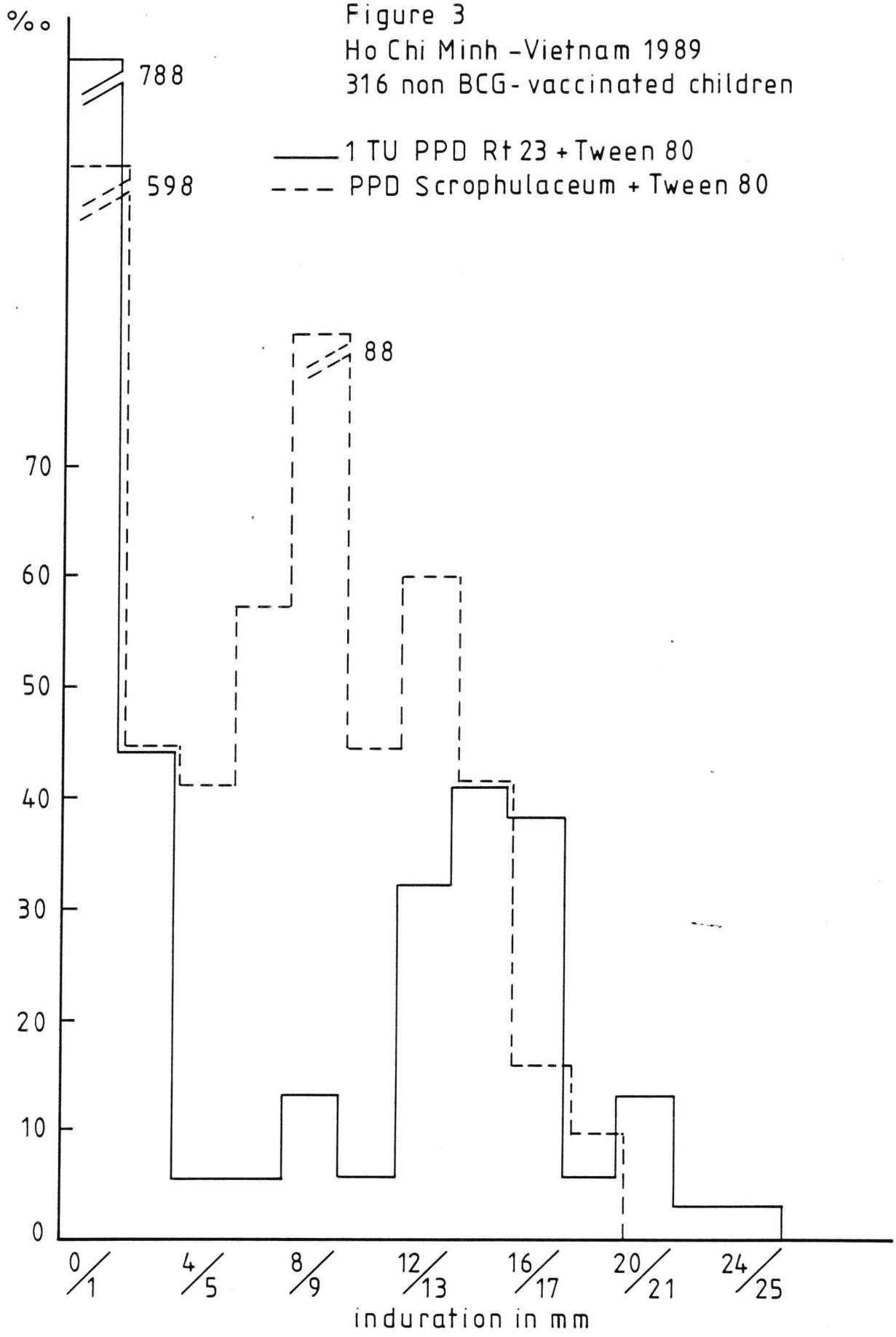


Figure 3
Ho Chi Minh -Vietnam 1989
316 non BCG-vaccinated children



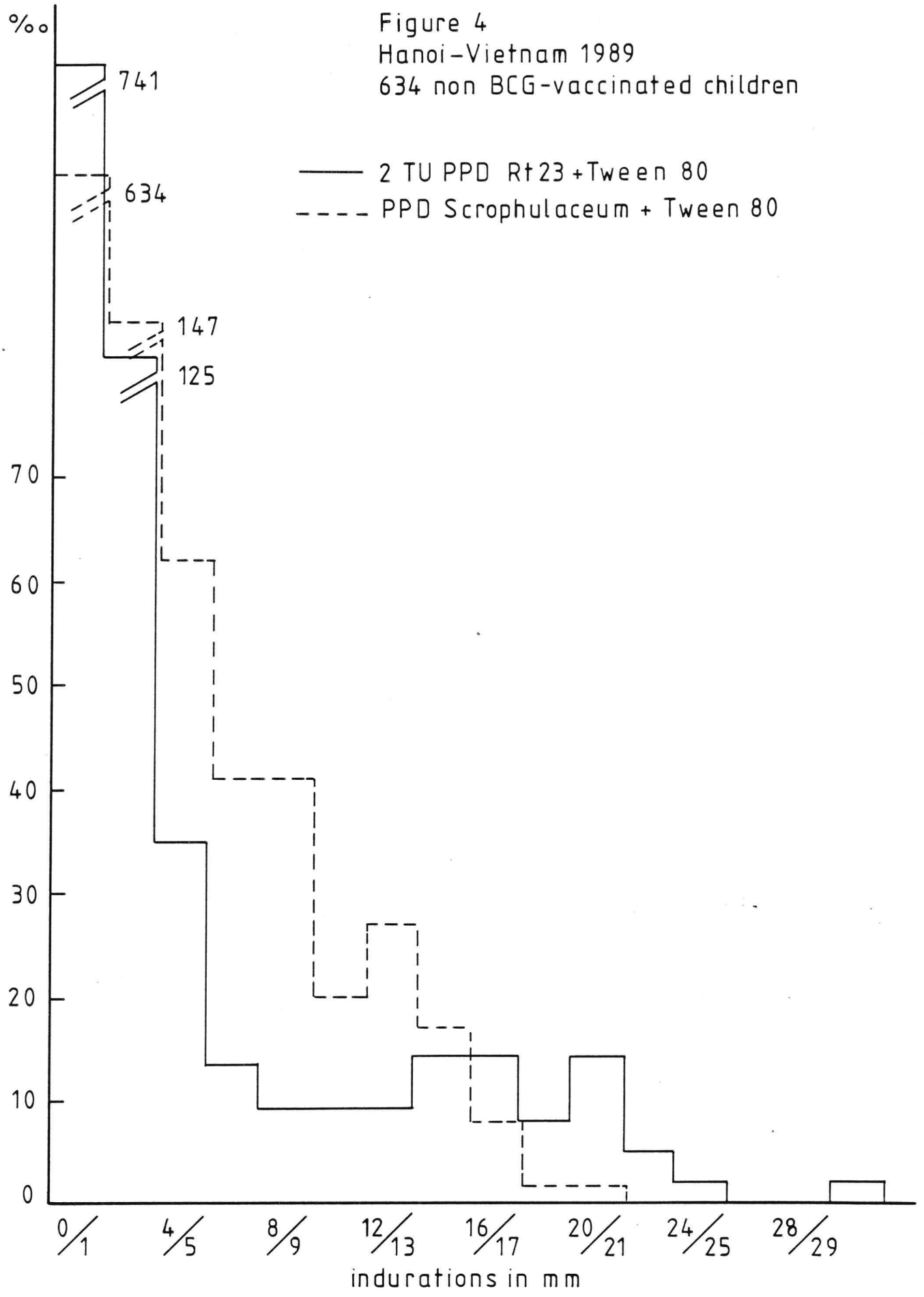


Figure 4
Hanoi–Vietnam 1989
634 non BCG-vaccinated children

Table 1
Ho Chi Minh - Vietnam 1989

Nguyen Thi Đieu

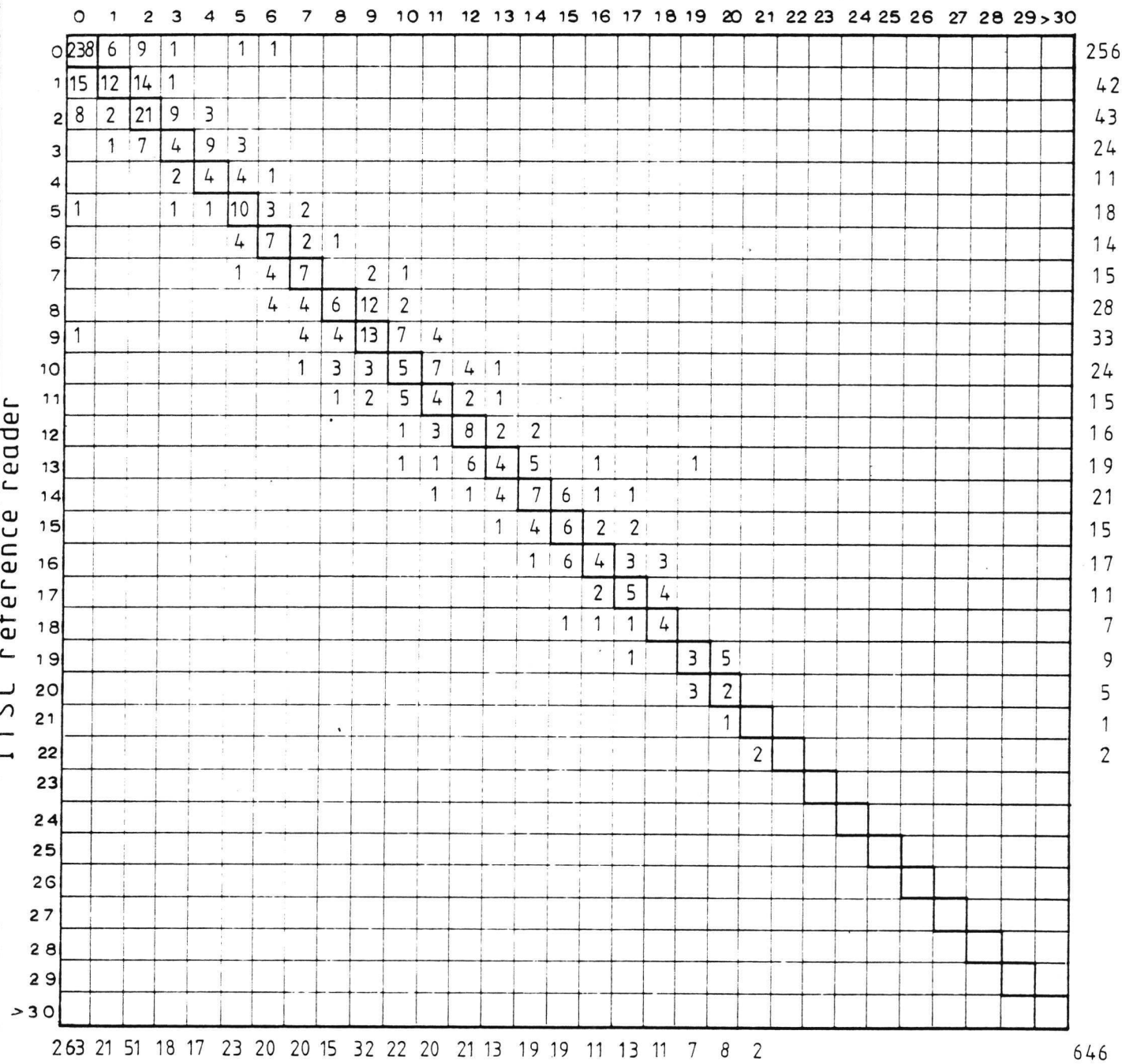


Table 2
Ho Chi Minh -Vietnam 1989

To My Lien

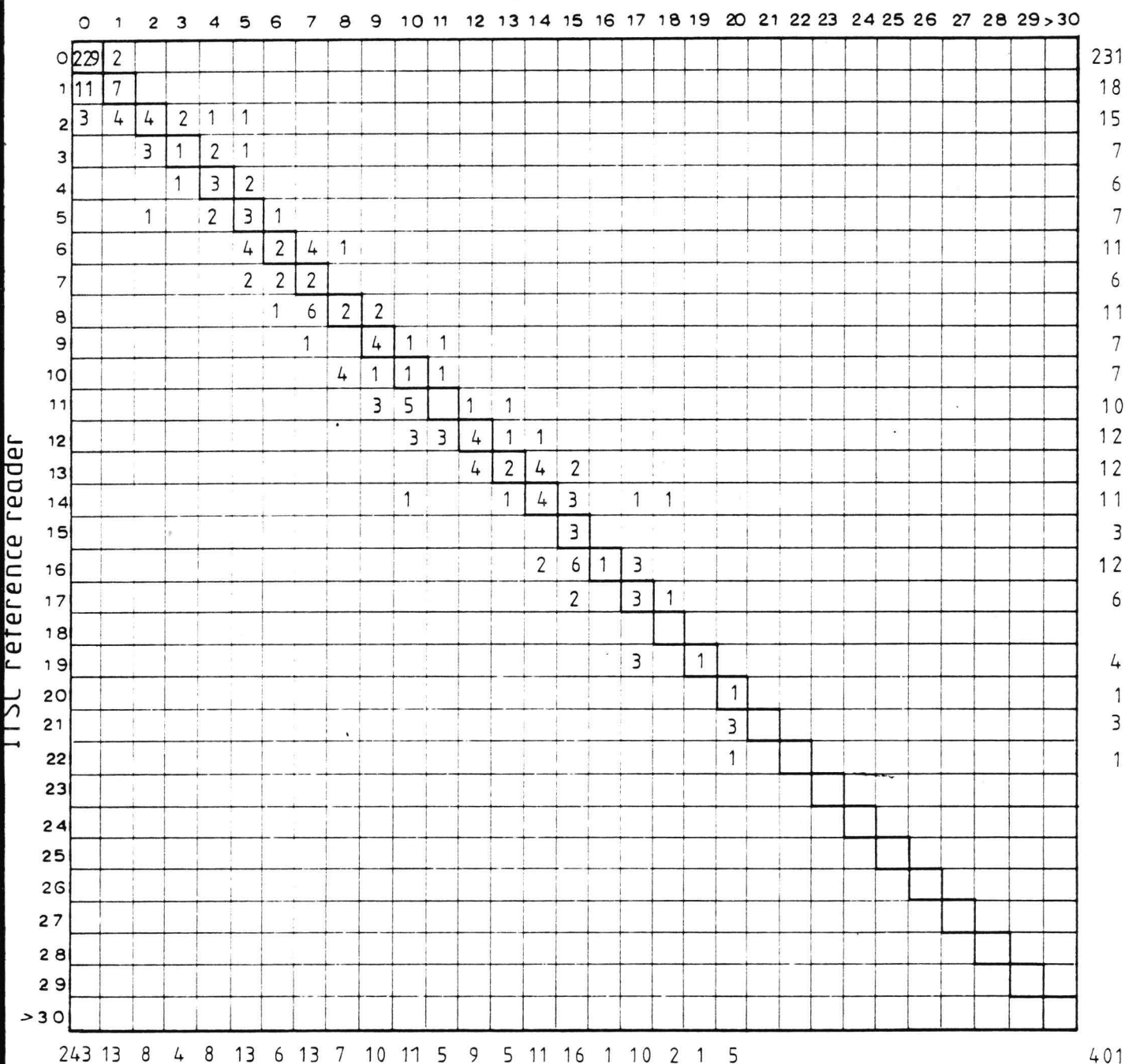


Table 3
Ho Chi Minh - Vietnam 1989

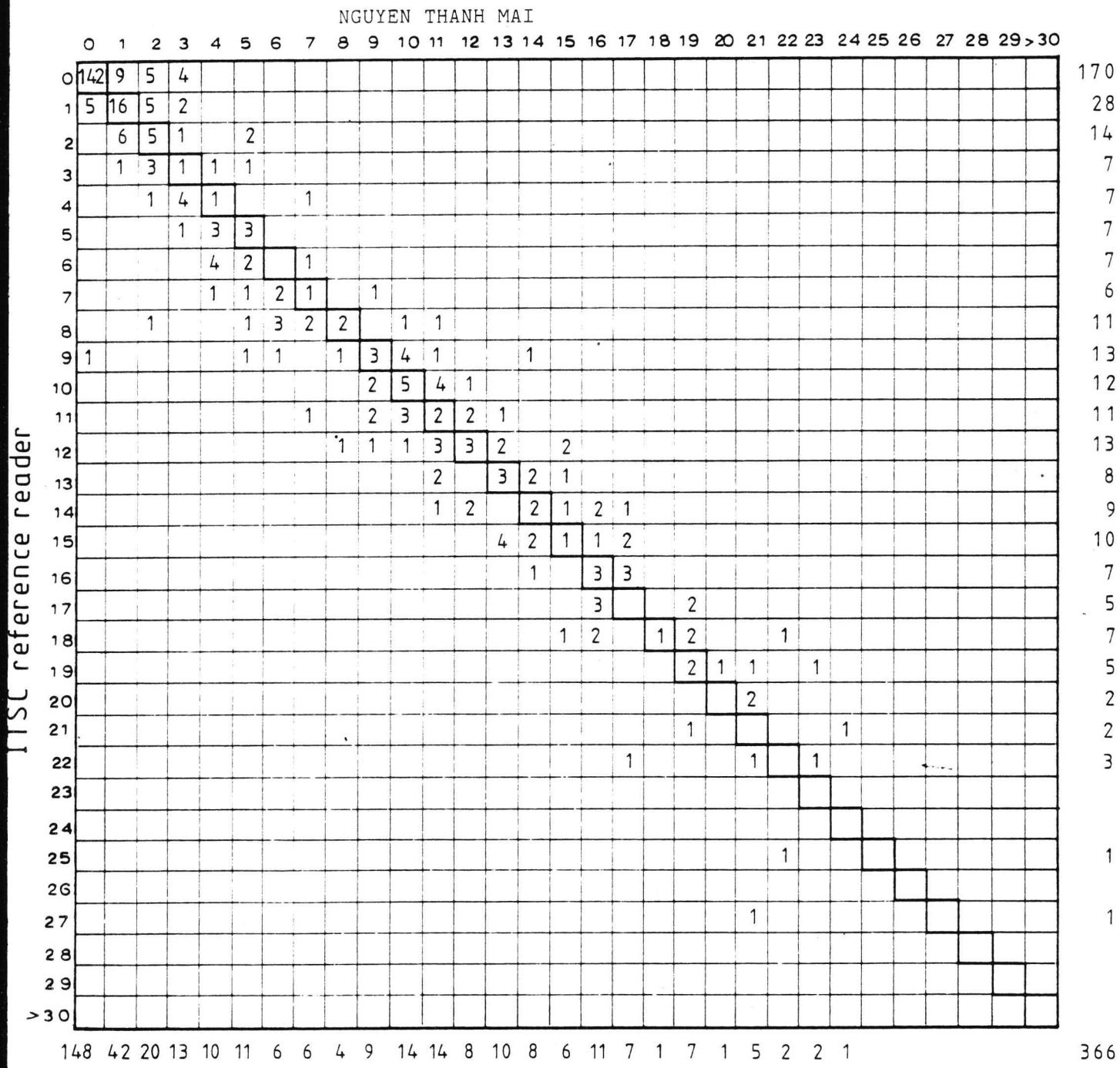


Table 4
Ho Chi Minh - Vietnam 1989

Truong Thi Anh

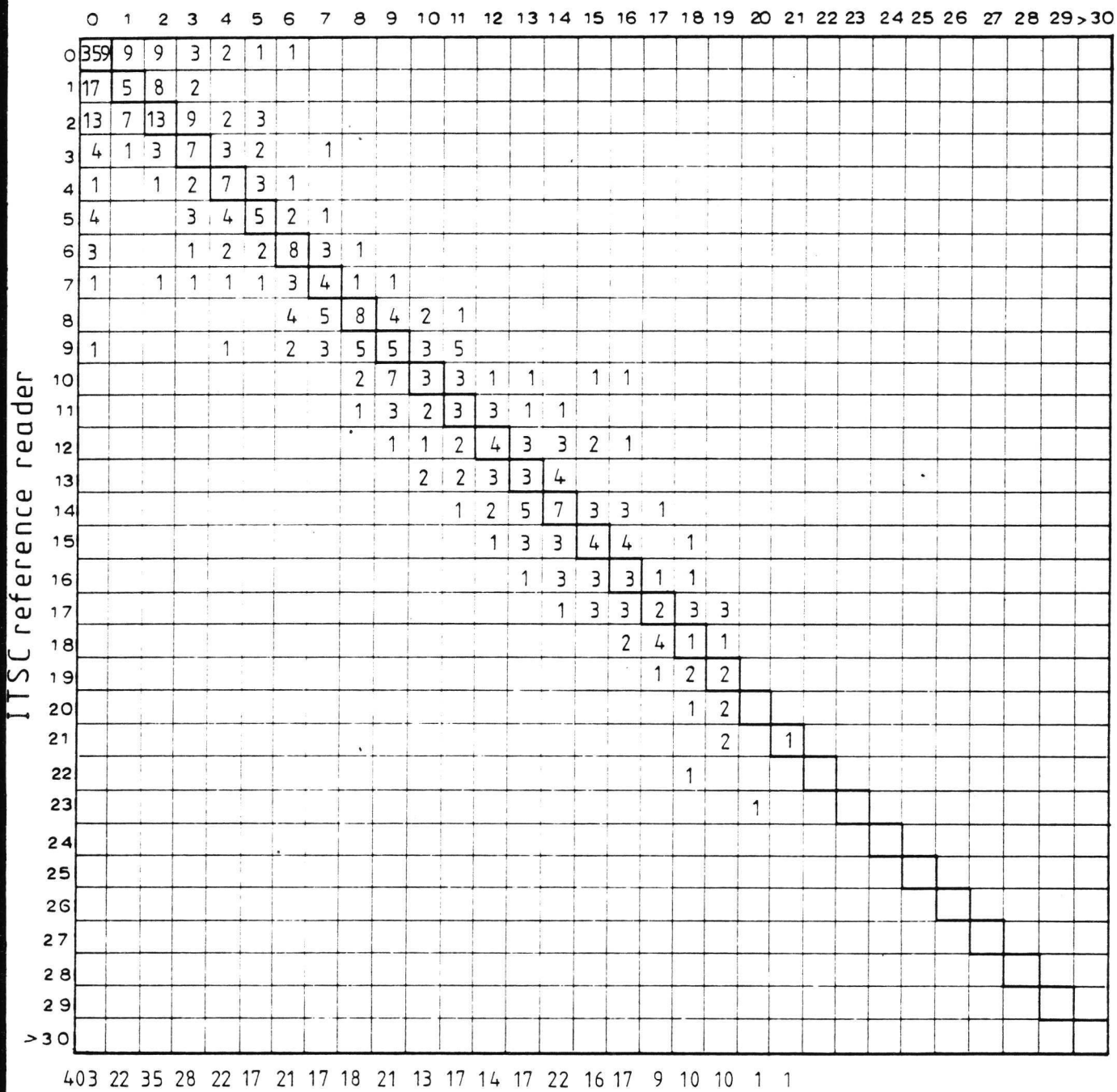


Table 5
Ho Chi Minh - Vietnam 1989

RAN KIEM DIEU HANH

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	>30	
0	165	40	7	1		1																										214
1	6	6	3	1																												16
2	4	5	10	4																												23
3	4	3	4	6	1	2																										20
4	1		2	4	1	4																										12
5	1		1		2	4	1	1																								10
6					1	6	3	1																								11
7						1	2	1	1	2	2																					9
8						1	2	4		2	2	1																				12
9					1	1	1			2	2	3		1																		11
10								1		2	3	3	1		2	1																13
11									1		4	6	1	3																		15
12								1		3	4	6	3	3	1																	21
13											2	3	3	2	5	2																17
14													2	3	4	4	1	1														15
15														2	4	6	1		1	1												15
16															3	7	1	2		1												14
17															1	3	1	4		1												10
18																1	2	1	1	2	1			1								9
19																1		2	1	1	1											6
20																	1	1		2												4
21																				1	1			1								3
22																																
23																				1			1									2
24																								1								1
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	187	54	27	16	6	20	9	9	2	11	19	22	10	14	20	25	7	11	3	10	3		1	3								483

Table 6
Ho Chi Minh-Vietnam 1989

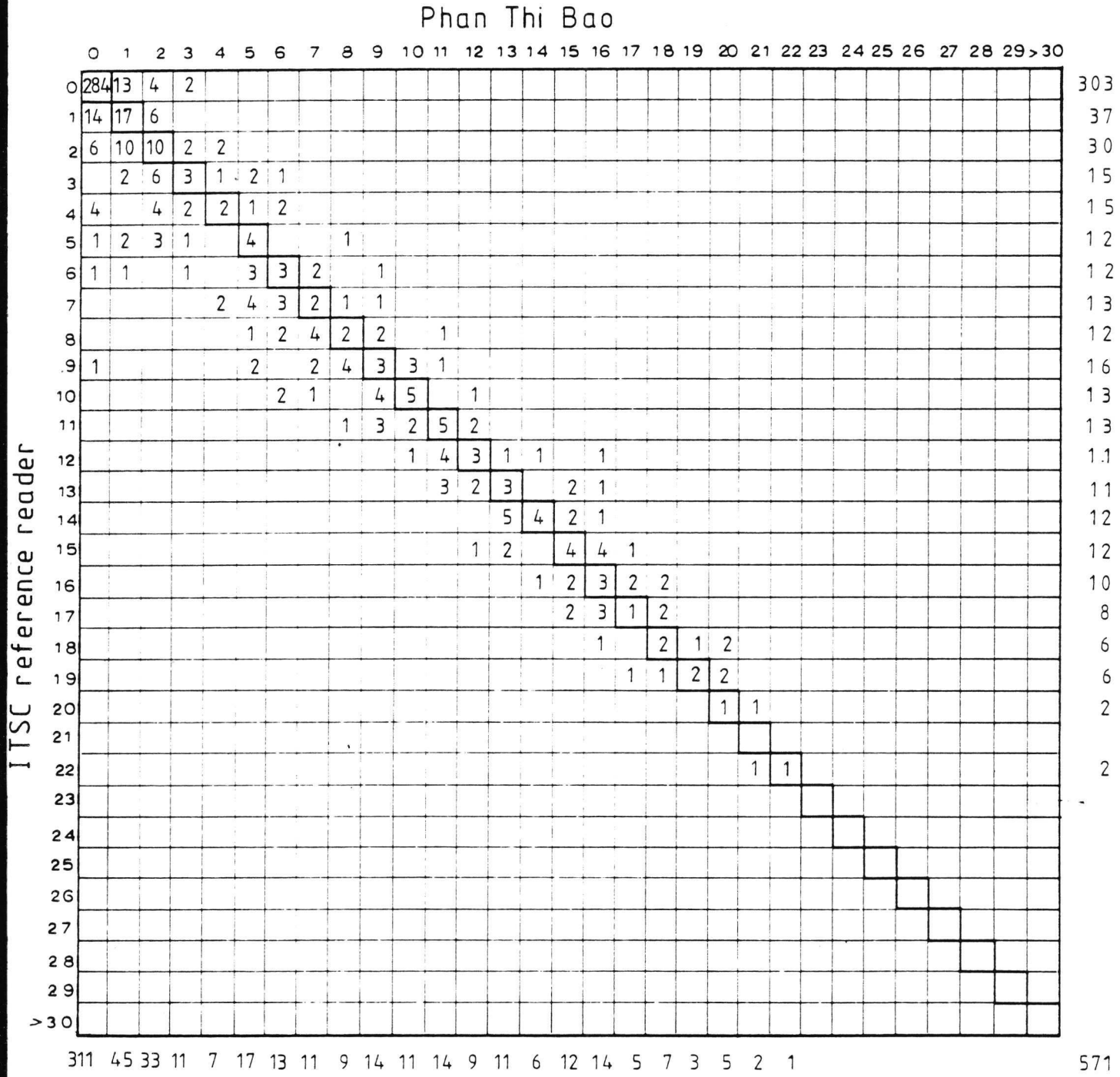


Table 7
Ho Chi Minh - Vietnam 1989

Bui Thi Thoi

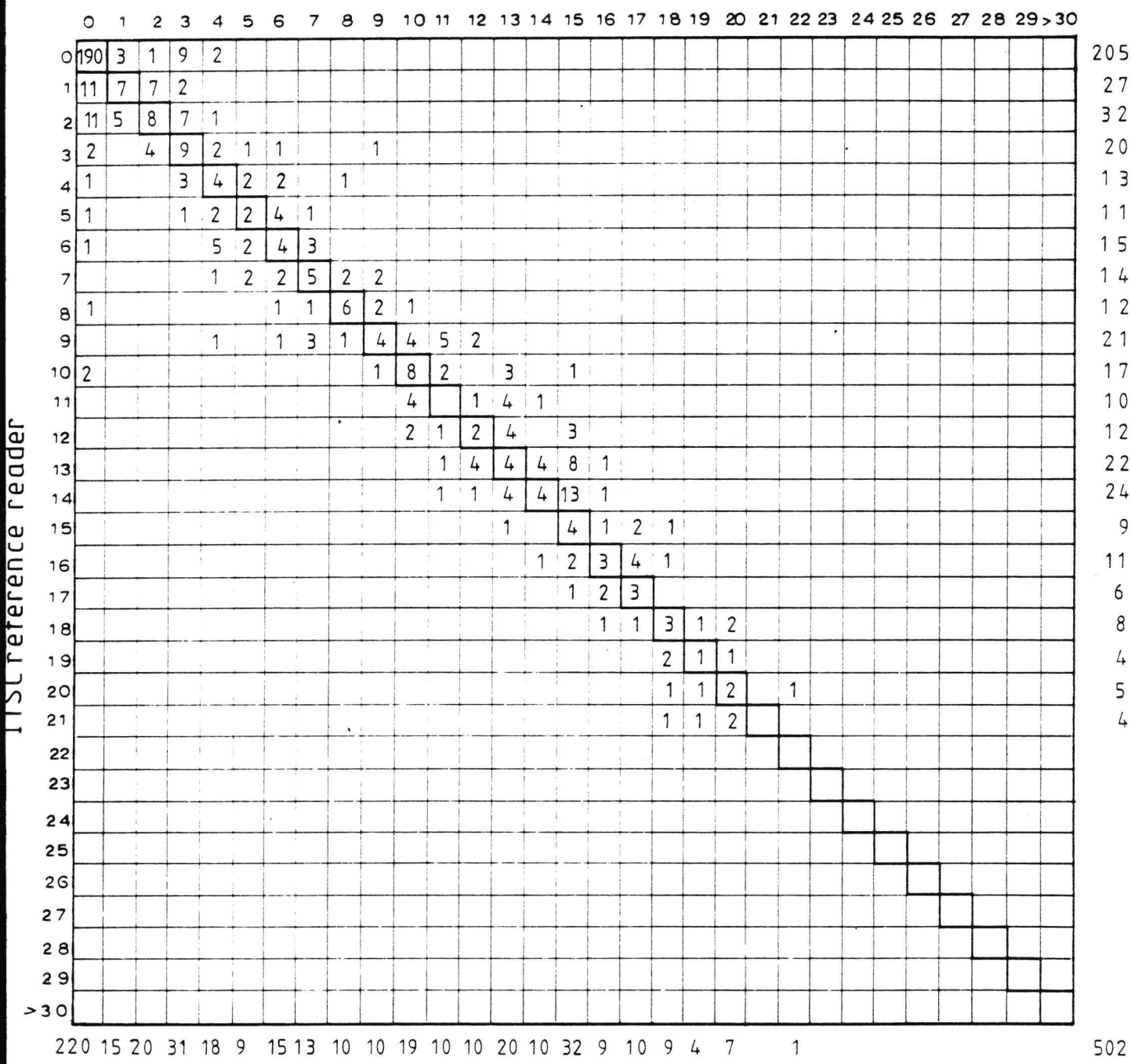


Table 8
Hanoi - Vietnam 1989

Thanh Nguyen Vān

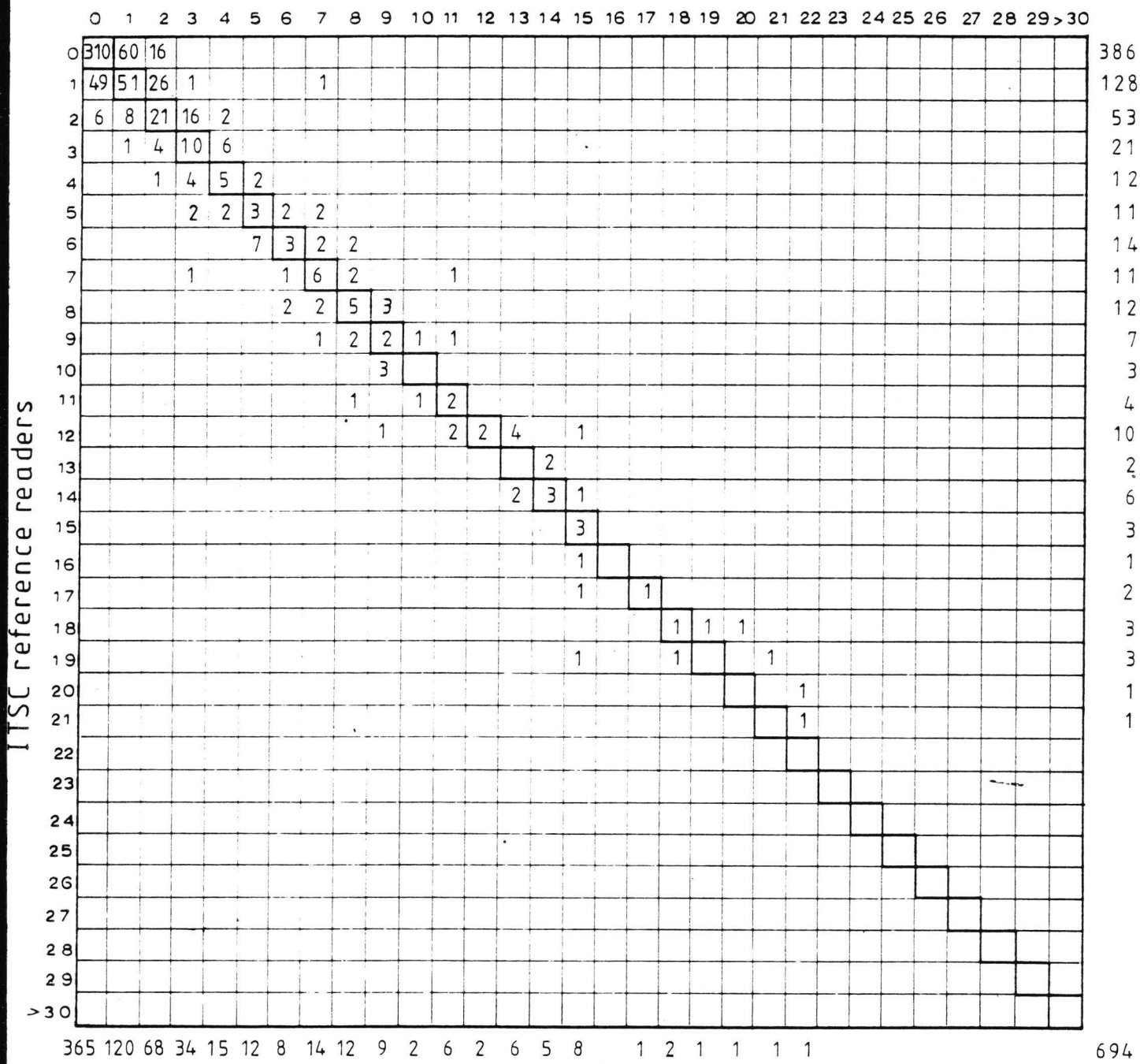


Table 9
Hanoi-Vietnam 1989

Thanh Dô-Hoāi

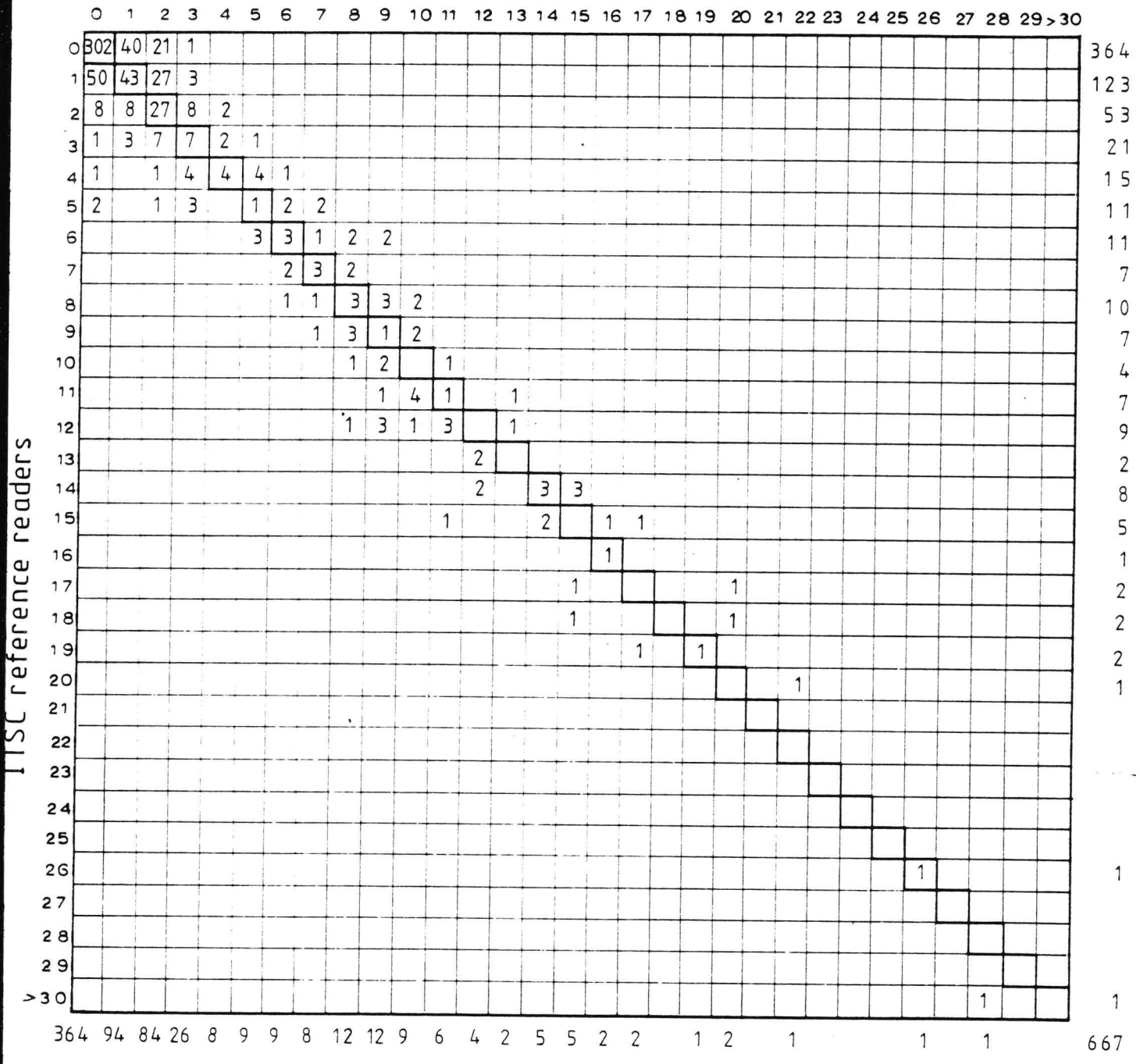


Table 10
Hanoi - Vietnam 1989

Dr. Nguyen Kim Quy

ITSL reference reader

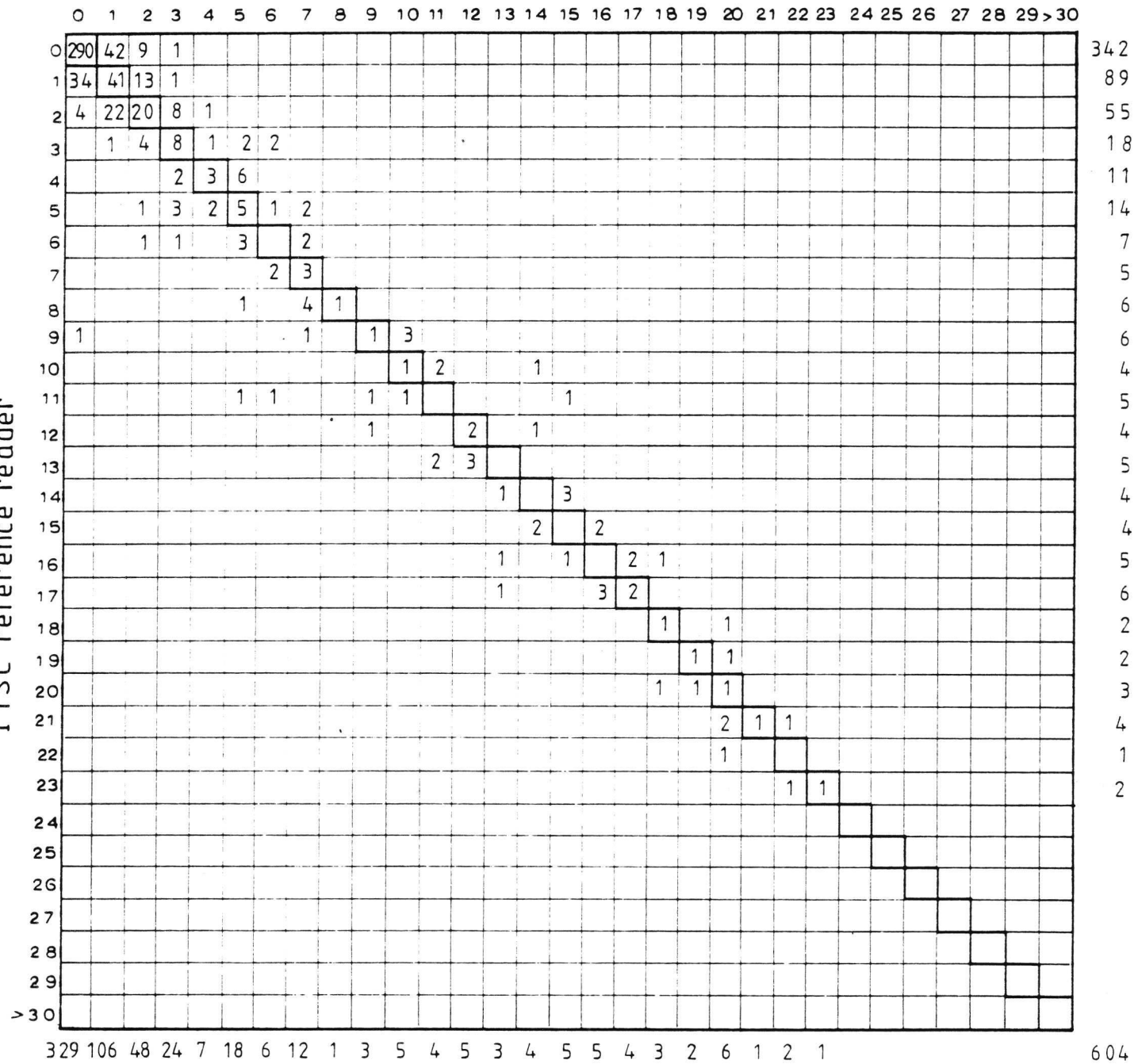


Table 11
Hanoi -Vietnam 1989

Mrs. Bui Thi Loan

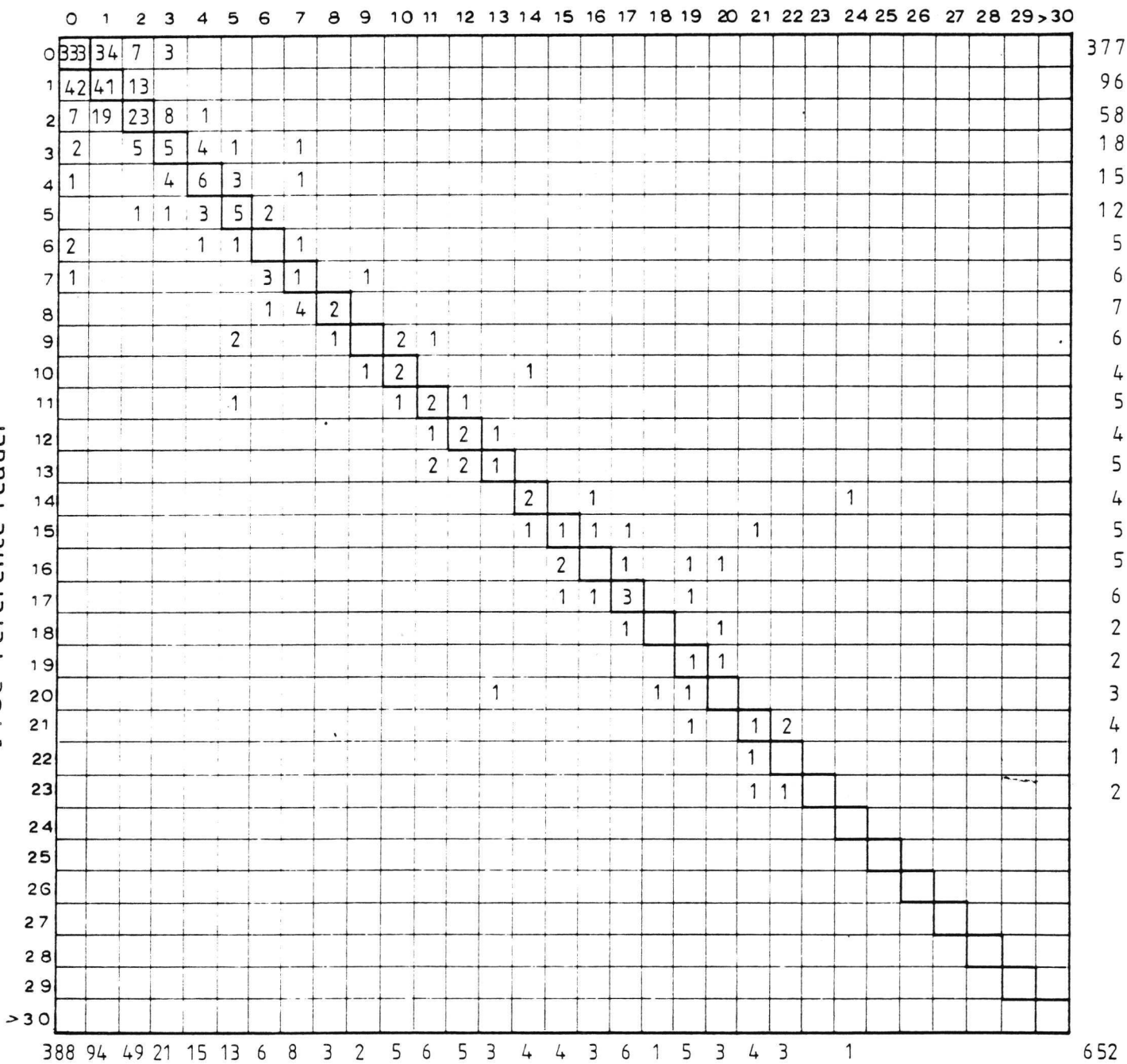


Table 12
Ho Chi Minh -Vietnam 1989
non BCG-vaccinated children

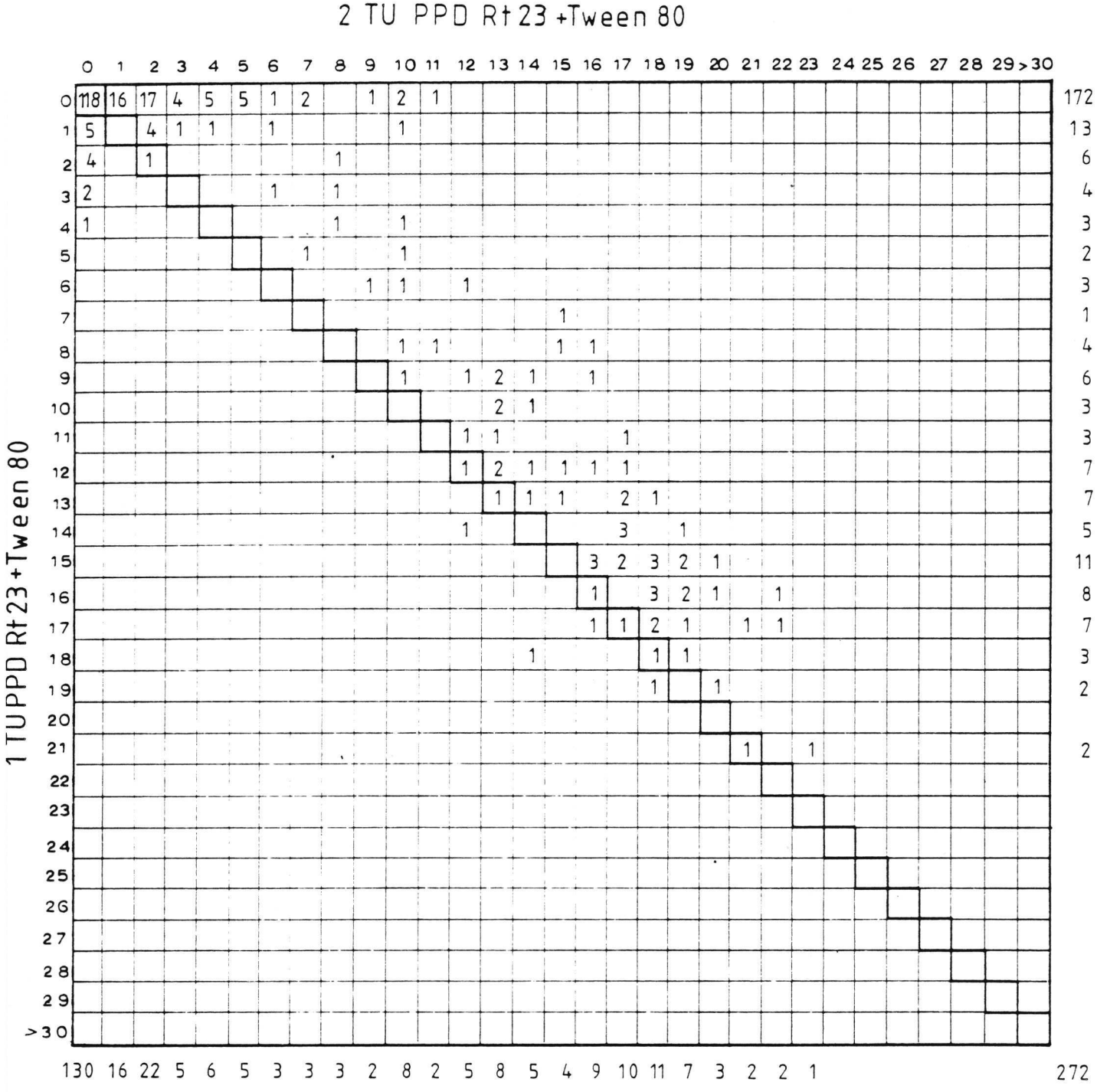


Table 13
Ho Chi Minh Vietnam 1989
BCG-vaccinated

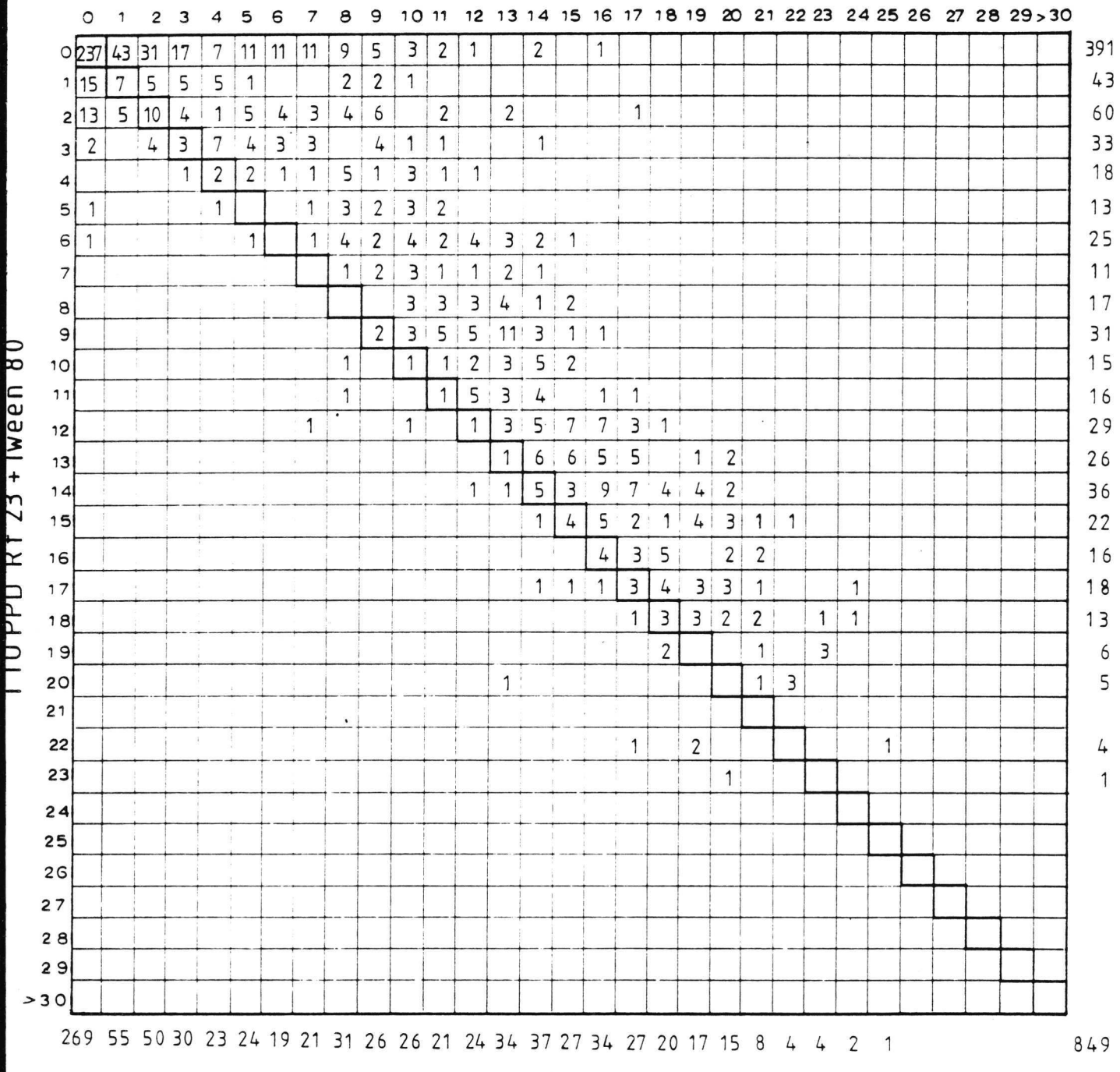


Table 14
Hanoi-Vietnam 1989
non BCG-vaccinated children

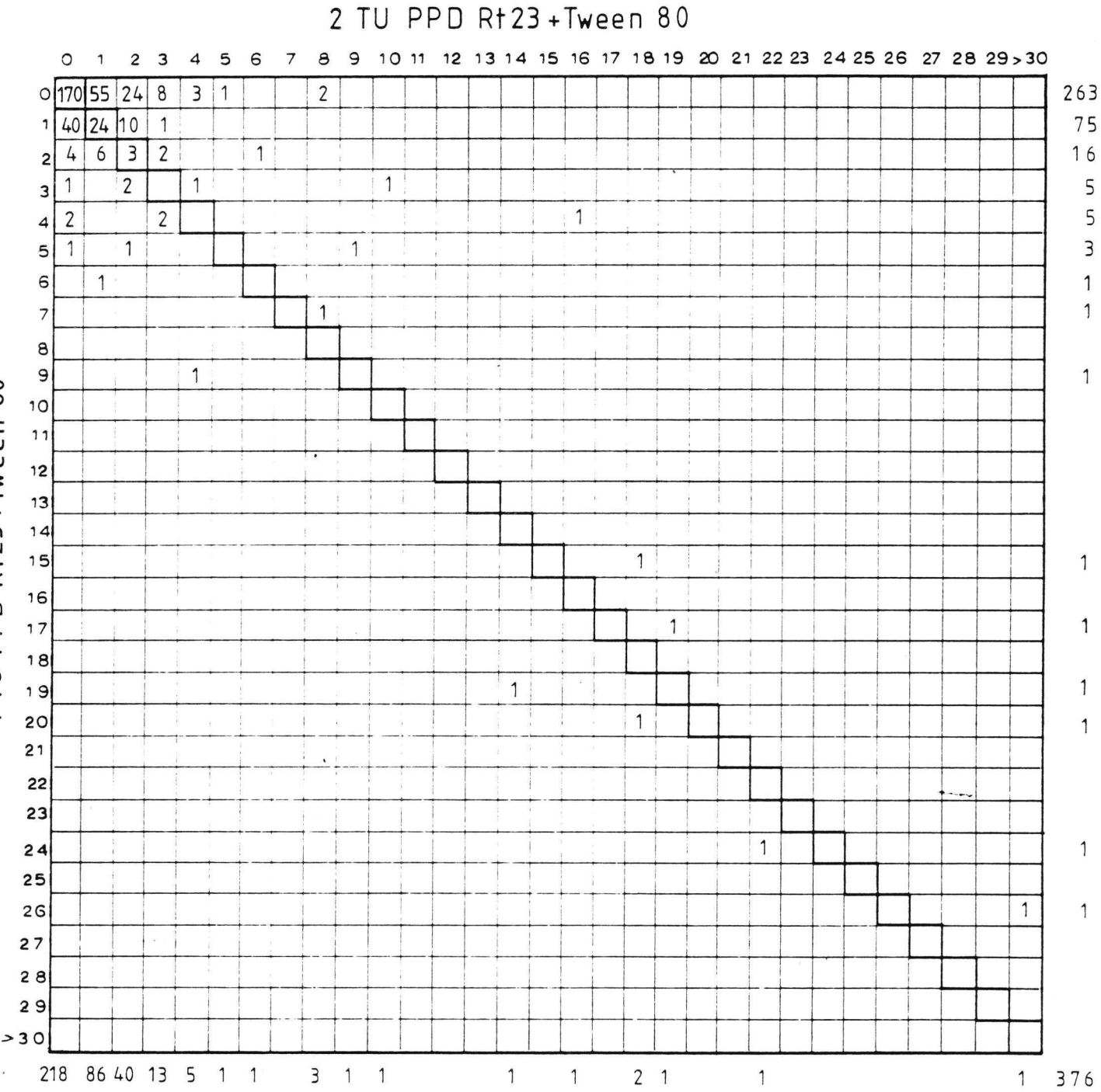


Table 15
Hanoi-Vietnam 1989
BCG-vaccinated children

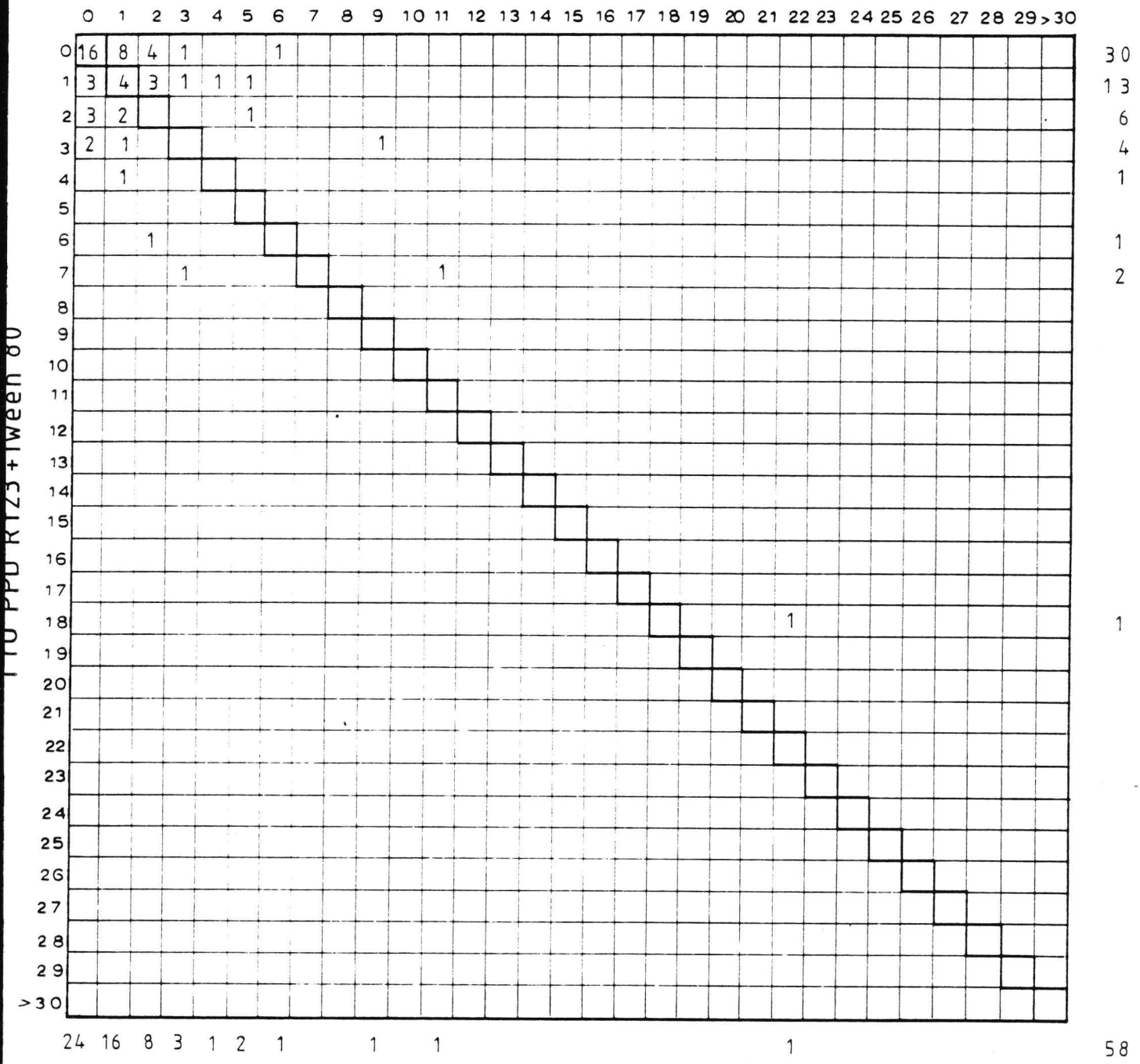


Table 16
Ho Chi Minh - Vietnam 1989

NON BCG - VACCINATED BOYS AND GIRLS

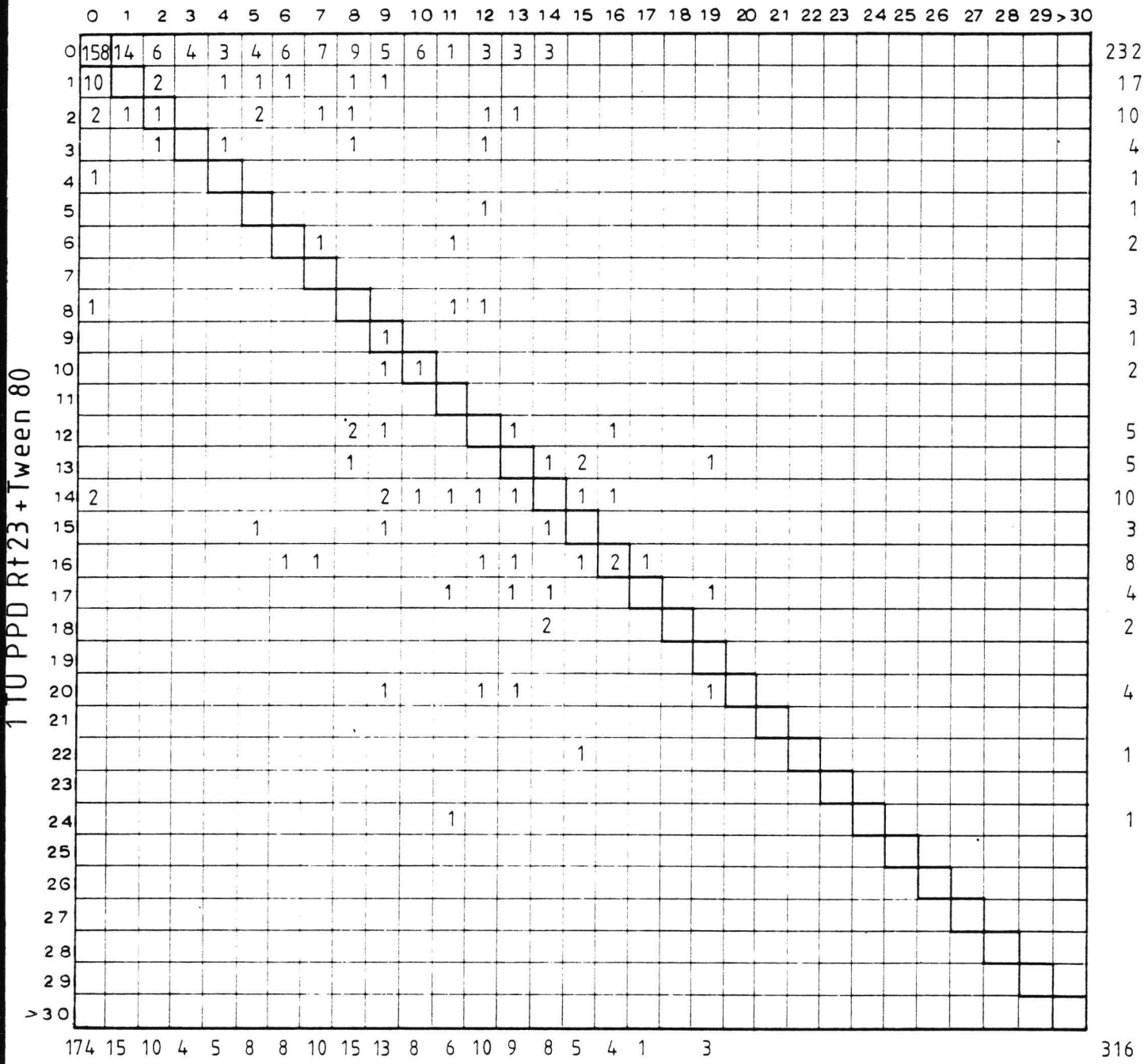
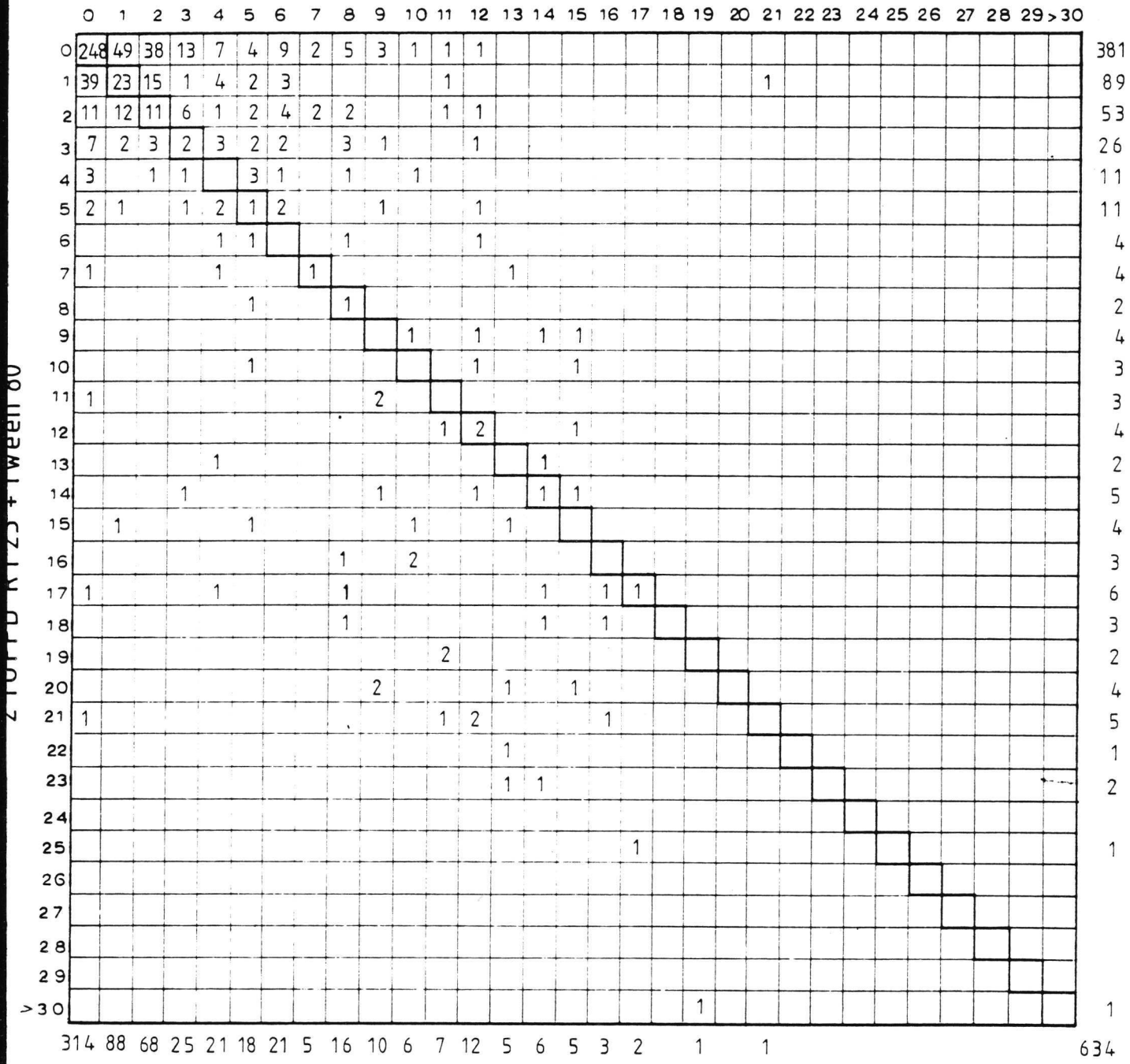


Table 17
Hanoi -Vietnam 1989
non BCG-vaccinated boys and girls

PPD-Scrophulaceum +Tween 80



Comparison of postvaccinal skin allergy to BCG-vaccins produced in three different centers (BCG YU=Yugoslavia Beograd, BCG DK=Denmark Copenhagen, BCG NL=Netherlands Bilthoven) in 5000 vaccinated new-borns in Cakovec Yugoslavia 1979-1987

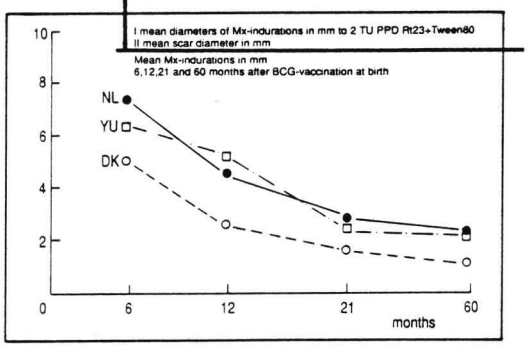
G. Pal
M.A.Bleiker
O.Misljenovic

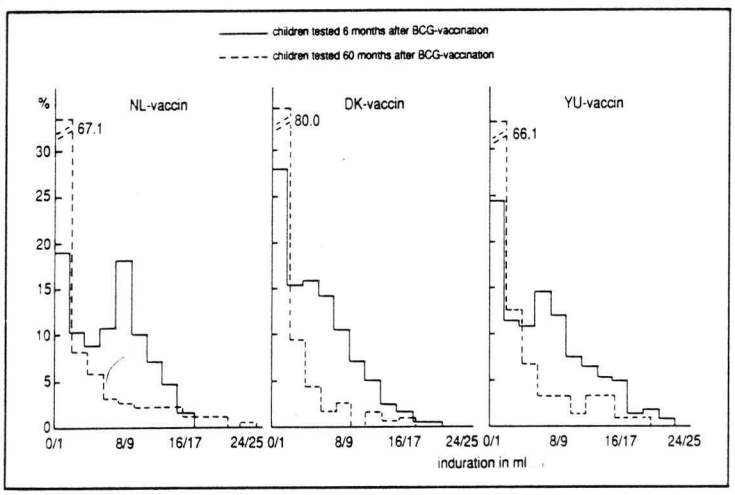
I.T.S.C.

Six, twelve, twenty one and sixty months after vaccination tuberculin testing was performed in subgroups of the vaccinated children.

origin of BCG	period in months after vaccination							
	6		12		21		60	
	I	II	I	II	I	II	I	II
RIV NL	N=274 7.3	4.4	N=341 4.6	3.8	N=189 2.8	3.8	N=255 2.6	4.9
Copenhagen DK	N=279 5.0	4.0	N=288 2.6	3.7	N=338 1.8	3.9	N=270 1.1	4.1
Beograd YU	N=248 6.6	4.8	N=295 5.2	4.7	N=262 2.4	4.1	N=245 2.3	5.4

Skin allergy after BCG-vaccination was found to be highest six months after vaccination and appeared to wane rapidly afterwards.





There was a definite difference in skin allergy potency between the three vaccins.

In the five-year observation period no case of tuberculosis was reported among the vaccinated children.

Bulletin of the International Union Against Tuberculosis and Lung Disease, Vol. 64, N° 2, June 1989

ORIGINAL ARTICLES

Guidelines for estimating the risks of tuberculous infection from tuberculin test results in a representative sample of children

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Introduction

There is now general agreement that the annual risk of tuberculous infection is the best single indicator for evaluating the tuberculosis problem and its trend in developing countries.

To obtain a reliable estimate of the annual risk of infection and in particular of changes in the risk during a particular period, tuberculin surveys should be carried out at intervals of several years. Each survey should be conducted in a representative sample of subjects of the same age or age-group, tested by the same technique.

Several basic points require particular attention in planning a tuberculin survey :

a) Those tested should constitute a representative sample of the population under study.

b) As far as possible, cohorts of children (or young adults) should be selected for testing, in which not more than a small proportion has been previously BCG-vaccinated.

c) Individual children previously BCG-vaccinated should be identified.

Coordination of a national tuberculin survey

The national tuberculin survey is usually coordinated by the Tuberculosis Control Unit (TCU) of the Ministry of Health. The Medical Officer in charge of the TCU bears the final responsibility for the survey.

Consent to survey and ethical aspects

The survey protocol should be submitted to the appropriate national health authorities for their consent. Consent to the conduct of the survey should also be obtained from regional, district and local authorities, and the survey team should be provided with a letter of introduction to the respective authorities.

In developed countries written consent from patients is often required. This is often practically impossible in developing countries. Experience has shown that for smooth conduct of the survey in such a situation, the village leaders should be kept well informed, and they may be asked to inform the parents.

Survey population

It will be clear that the maximum amount of information will be obtained if the entire population concerned is included in the survey and tested. In practice, however, this will make the survey very costly especially when a country or a large region is being surveyed. In general, it will therefore be necessary to resort to testing a sample of the population and to estimate from the result obtained the prevalence (and from this the risk) of infection in the population as a whole.

A general requirement is that the sample selected should be representative of the population ; the method indicated to produce such a sample is random selection. Often, however, this may produce immense practical difficulties and high costs and therefore several alternatives have been used to simplify the procedures. Often the objective of a survey may not just be to obtain a single figure as an average for a whole country ; the objectives of the survey, therefore, should be stated clearly before the design is made.

► The grab "sample"

The method most often used in the past is to identify a convenient survey population, more or less judiciously, and to include it **entirely**, without any sampling procedure at all. Obviously the representativeness of such a sample may be queried, but the procedure is very economical. It is therefore indicated for a preliminary study if little is known about the situation. Apart from providing practical experience it will yield some information on the prevalences of infection and non-specific sensitivity and on the BCG coverage. Such information is required to design a more elaborate survey. For continuous surveillance of the risk of infection the method may be further developed.

► The sentinel population

In certain circumstances it may be indicated to use a **particular population group, or groups,** for the survey. There may be sufficient evidence that such groups are representative, or that the groups could be of particular interest themselves (*e.g.* in areas where particular programme activities are being tested). The question of representativeness may then be less important if it is the intention to measure the trend rather than the actual value of the risk of infection.

In general it is indicated to select a sentinel population that is relatively large and well-defined and then to limit the survey population by selecting a particular (sentinel) age-group. The risk of infection in this age-group will be the index of the tuberculosis problem. A suitable population group is school entrants (6-7 years) and a practical method is to test them all in the selected areas. If one area is a large town it may be sufficient to select a random sample of the eligible schools. In either case the testing teams will not have to perform any sampling in the field.

The main practical advantages of using sentinel populations is that they are rela-

tively easily reached and that the results observed may be explained from the local situation. Surveys of this type have recently been carried out in Togo, Colombia (Bogota) and Brazil (Rio de Janeiro).

► **The national sample survey**

When it is preferable to conduct the survey in a **representative sample** of the population the best solution is often to randomly select a number of groups rather than of individuals. Schools entrants are again a very practical study population and an easy sampling method is to obtain a list of all schools and randomly select the number required. All eligible children attending the selected schools will then be included. A survey of this type has been carried out recently in Tunisia.

If school entrants are selected as a study population, the result of the survey obviously applies to them only, which means that the sample may not be representative if the proportion of children attending school is low. In such a case it may be preferable to select a cluster sample in the population following a step-wise procedure, using stratification as appropriate. For practical reasons it may be indicated to use in such a survey a somewhat broader age-group.

► **Size of the survey population**

A number of variables must be considered, and therefore provisionally estimated, when determining the size of a sample required to measure the trend in the risk of infection. These include the initial risk of infection, the annual decline, the interval betwen the measurements, the age of children tested and the degree of precision required. As regards the latter one would at least attempt to attain a statistically significant result between the prevalences observed at the two occasions, but it should be kept in mind that this is not a very high level of precision. Table 1 shows a number of values calculated according to various assumptions. Two further considerations must be taken into account when using these figures.

The data are calculated for simple random sampling. If cluster sampling is used a "cluster factor" should be applied. Depending on the number of clusters (or their size) and the efficiency of stratification this factor will be in the order of 2 to 2.5. Furthermore, the way of estimating the prevalence (see section "Estimation of prevalence of natural tuberculous infection" below) must be taken into account. In many instances the prevalence is estimated by doubling the number at the right-hand side of the second mode. Thus only half the expected prevalence will actually be observed. The sample size should of course

Table 1. Number of subjects required in each of 2 tuberculin surveys to demonstrate risk of infection, decreasing by 1 %, 3 %, 5 % or 7 % annually, with a significant 5 % level, with 80 % power

A. Annual risk of infection at the first survey : 2.0 %

Age of children when tested (years)	Annual decrease in risk of infection (%)	N. of subjects in each survey: surveys 5 years apart	surveys 10 years apart
7.5	1	43,369	11,103
	3	4,707	1,264
	5	1,652	465
	7	820	242
8.5	1	38,492	9,851
	3	4,139	1,110
	5	1,439	404
	7	707	208
9.5	1	34,649	8,865
	3	3,692	988
	5	1,271	356
	7	618	181
10.5	1	31,543	8,068
	3	3,331	891
	5	1,136	317
	7	547	159
11.5	1	28,982	7,410
	3	3,034	810
	5	1,025	285
	7	489	141

B. Annual risk of infection at the first survey : 1.5 %

Age of children when tested (years)	Annual decrease in risk of infection (%)	N. of subjects in each survey: surveys 5 years apart	surveys 10 years apart
7.5	1	57,120	14,629
	3	6,196	1,666
	5	2,174	614
	7	1,079	320
8.5	1	50,555	12,945
	3	5,431	1,459
	5	1,886	532
	7	926	274
9.5	1	45,376	11,616
	3	4,828	1,296
	5	1,660	467
	7	806	238
10.5	1	41,189	10,541
	3	4,342	1,164
	5	1,478	415
	7	710	209
11.5	1	37,734	9,655
	3	3,941	1,055
	5	1,328	372
	7	632	185

be estimated according to the expected observed (not the calculated) prevalence.

Analysis

A tuberculin survey will yield as its result the prevalence of infection and it is appropriate to calculate for this the 95 % confidence interval as a measure of the precision of the estimate. Considering this when designing the survey may be profitable, if only to prevent ending up with a design that cannot be analysed : the calculations should be strictly in accordance with the sampling method used.

For stratified cluster sampling the 95 % confidence interval of the estimate is :

$$I - p \pm 1{,}96 \sqrt{\frac{\varepsilon_s \varepsilon_i (p_{si} - p_s)^2}{k\,(k - s)}}$$, when

p is the percentage found in the entire sample,
p_{si} is the percentage found in cluster i of stratum s,
p_s is the percentage found in stratum s,
k is the total number of clusters, and
s is the number of strata.

When stratification is not used the value for s becomes 1. When the clusters are of unequal size (as will happen in a survey in schools) the values for $(p_{si} - p_s)^2$ should be multiplied by $(n_{si}/n)^2$, when n_{si} is the population in clusters si and n is the average cluster size.

The results of 2 surveys are compared by computing the 95 % confidence interval of the difference between the 2 prevalences found :

$$I - p_1 - p_2 \pm 1/2 \sqrt{W^2_1 + W^2_2}$$, when

p_1 and p_2 are the two prevalences observed and W_1 and W_2 are the widths of the respective confidence intervals. If the computed confidence interval includes the value 0, the difference may be said to be not significantly different (at the 95 % level).

C. Annual risk of infection at the first survey : 1.0 %

Age of children when tested (years)	Annual decrease in risk of infection (%)	N. of subjects in each survey: surveys 5 years apart	surveys 10 years apart
7.5	*1*	84,650	21,688
	3	9,176	2,471
	5	3,218	912
	7	1,597	477
8.5	*1*	74,714	19,140
	3	8,018	2,158
	5	2,782	787
	7	1,365	407
9.5	*1*	66,873	17,128
	3	7,106	1,911
	5	2,440	690
	7	1,184	352
10.5	*1*	60,530	15,501
	3	6,369	1,712
	5	2,164	611
	7	1,039	308
11.5	*1*	55,293	14,158
	3	5,761	1,548
	5	1,938	546
	7	920	272

D. Annual risk of infection at the first survey : 0.5 %

Age of children when tested (years)	Annual decrease in risk of infection (%)	N. of subjects in each survey: surveys 5 years apart	surveys 10 years apart
7.5	*1*	167,294	42,879
	3	18,122	4,889
	5	6,352	1,807
	7	3,151	946
8.5	*1*	147,258	37,741
	3	15,789	4,258
	5	5,475	1,556
	7	2,686	806
9.5	*1*	131,444	33,685
	3	13,949	3,761
	5	4,785	1,359
	7	2,320	695
10.5	*1*	118,644	30,403
	3	12,462	3,359
	5	4,228	1,200
	7	2,027	606
11.5	*1*	108,074	27,692
	3	11,236	3,027
	5	3,771	1,069
	7	1,787	534

Techniques of tuberculin testing and reading

The procedures described below are extracts from the WHO Technical Guide on tuberculin testing and reading issued in 1963 (1). The only differences in this text are **a)** the recommendation to inject 2 TU PPD Rt 23 with Tween 80 (instead of 1 TU of the same tuberculin) and **b)** the use of disposable syringes and needles. However, these changes have generally been applied in the last decade in most tuberculin surveys.

E. Annual risk of infection at the first survey : 0.25 %

Age of children when tested (years)	Annual decrease in risk of infection (%)	N. of subjects in each survey surveys 5 years apart	surveys 10 years apart
7.5	*1*	332,624	85,272
	3	36,019	9,725
	5	12,623	3,597
	7	6,262	1,886
8.5	*1*	292,396	74,956
	3	31,336	8,459
	5	10,862	3,094
	7	5,327	1,604
9.5	*1*	260,642	66,813
	3	27,643	7,461
	5	9,477	2,698
	7	4,594	1,382
10.5	*1*	234,940	60,222
	3	24,658	6,654
	5	8,360	2,379
	7	4,005	1,204
11.5	*1*	213,713	54,779
	3	22,196	5,989
	5	7,441	2,117
	7	3,523	1,058

► **Technique of injection (Mantoux test)**

The WHO standard tuberculin test is carried out with 2 TU PPD Rt 23 with Tween 80 added as stabilizing diluent.

Special **disposable** 1 ml syringes, graduated in hundredths of millilitres, are used with 25- or 26-gauge, 10 mm-long, **disposable needles.**

The test is given on the **dorsal** aspect of the forearm. The needle point is inserted in the superficial layer of the skin of the forearm while the skin is slightly stretched in the direction of the needle and lengthwise on the arm. The syringe is held by the barrel only and the plunger is not touched until the needle point has been satisfactorily inserted. The 0.1 ml volume is slowly injected and the finger is removed from the end of the plunger before the needle is withdrawn.

The injection should raise a flat, anaemic papule with pronounced pits and a steep border line. If the injection is made into the deeper layers of the skin (as shown by a dome-shaped and less anaemic papule), this will scarcely affect the result of the ensuing tuberculin reaction but may tend to make it more difficult to read.

The **volume injected should be exactly 0.1 ml as read on the gradation of the syringe** and should not be gauged by the size of the anaemic papule raised by the injection as this is inaccurate.

► **Measurement of reactions (Mantoux test)**

The test is read (examined) 3 or 4 days after it has been given. The reading is limited to a single aspect of the reaction, viz the induration. The test site is carefully palpated and if induration is present its limits are determined and its transverse diameter (transverse relative to the arm) is measured in millimetres. Use is made of a small transparent ruler (suitable length 10 cm) calibrated in millimetres.

The induration may be more or less easily recognizable, varying from a firm, well-circumscribed density in the skin to a soft, ill-defined swelling.

The widest **transverse diameter** of the induration is recorded in millimetres. If there is no palpable induration, "0" is recorded. The presence of additional features such as vesicles, bullae or lymphangitis may be noted. Sometimes, the firmness of the induration (its "quality") is also recorded. The recording should be made on a card or a list.

For details consult the WHO Guide.

Information to be obtained at tuberculin testing

► **Age.** As the risk of tuberculous infection is derived from the prevalence of infection, great care must be taken that the correct year of birth is reported for each child examined.

Table 2 below shows, for assumed prevalence of infection of 10 %, 15 % and 20 %, the annual risks of tuberculous infection which correspond to children examined at age 5 1/2, 6 1/2 and 7 1/2 years. These figures also assume a 5 % decrease in the risk of infection each calendar year.

It is evident that if the reported age is too low, the risk of tuberculous infection will be overestimated ; if it is too high, the risk will be underestimated.

► **Sex.** The data should be analysed for boys and girls separately, although in most areas the risk of infection appears to be similar up to the age of puberty. In many countries the prevalence of infection is greater in adolescent boys than in girls of the same age.

► **Previous BCG-vaccination.** Findings in children with previous BCG-vaccination must be excluded from an analysis of natural tuberculin sensitivity because of induced allergy after BCG. All children should be examined for a BCG scar, and if possible the calendar year or age, when given, should be recorded.

► **Ethnic group.** If several ethnic groups occur in the area being surveyed, the ethnic group of each child examined should be recorded.

Table 2. Estimation of the current risk of tuberculous infection (assuming a 5 % annual decrease in the risk), if the given prevalence of infection is observed at one of the following 3 ages

Prevalence (%)	Age (years) 5 1/2 (%)	6 1/2 (%)	7 1/2 (%)
10	*1.65*	*1.36*	*1.15*
15	*2.54*	*2.09*	*1.77*
20	*3.46*	*2.86*	*2.42*

Presentation of results

The results of the tuberculin tests should always be presented subdivided by age (usually for single years of age). Any other subdivision (*e.g.* by ethnic group or sex) should always be subsidiary to a subdivision by age.

Estimation of prevalence of natural tuberculous infection

Estimation of the prevalence of natural tuberculous infection is often complicated by the presence of **non-specific reactions**. Three situations may be considered, namely where there is a low, moderate or high frequency of infection with mycobacteria other than tubercle bacilli, giving rise to a corresponding frequency of non-specific reactions (which are usually smaller than the specific reaction but otherwise look the same). A different distribution of reaction size will be expected in each situation (Figure I).

a) If both an antimode and a mode can be identified in the distribution, this implies a low frequency of non-specific infections. All reactions greater than the antimode (which usually lies between 5 and 10 mm in induration) may be regarded as specific for tuberculous infection.

b) If there is no clear antimode but a mode can be identified in the distribution, this implies a moderate frequency of non-specific infections, the reactions to which have obscured the antimode. All reactions greater than the mode (which usually lies between 14 and 18 mm induration) may be regarded as specific for tuberculous infection, and doubling-over this number will provide an estimate of the total of specific reactions.

c) If neither an antimode nor a mode can be clearly identified, both having been obscured by a high frequency of reactions to non-specific sources, there are 2 possible approaches. One is to give 2 tests to each subject, one with tuberculin and one with a sensitin prepared from atypical mycobacteria, in order to separate the specific from the non-specific reactions on the basis of their relative reaction sizes. The other is to estimate the likely position of the mode and to proceed as in b.

Having estimated the numbers of unvaccinated subjects with reactions specific for tuberculosis infection, there is still a problem, in countries with **BCG-vaccination** following a negative tuberculin result, in estimating the prevalence of infection in a group in which there has been some previous BCG-vaccination. Diagrammatically, separately according to age, the information is as sketched and 2 main situations arise (Figure II) :

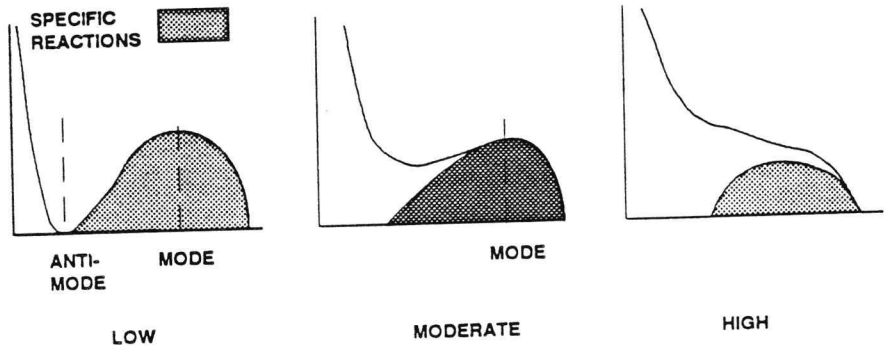

Figure I. Frequency of infections with MOTT.

a. All previous vaccinations made without prior tuberculin testing.

In these circumstances the best estimate of natural infection in the whole population of that age would be d/(c+d), and this is independent of the frequency or timing of the previous vaccinations. (This estimate assumes that the proportion of "a+b" with natural superinfection during the interval was the same as the proportion of "c+d" with a natural infection during that time.)

b. Previous vaccination only of those who were found to have a negative result at the time.

– If the previous vaccinations were carried out (following a negative tuberculin result) only a short time before the present study, the best estimate of the prevalence of natural infection would be d/(a+b+c+d).

– If all previous vaccinations were carried out at birth or only a short time after, the best estimate would be d/(c+d), which is bigger than d/(a+b+c+d). (This estimate assumes that the proportion of "a+b" with natural superinfection during the interval was the same as the proportion of "c+d" with a natural first infection during that time.)

– If, as is usually the case, the vaccinations were carried out some time between birth and the present study (following a negative tuberculin test), the best estimate of the prevalence of natural infection lies somewhere between the above two estimates, and the problem is to know where.

If all the previous vaccinations were carried out **at the same time** (*e.g.* at age 5), and the present testing was also carried out at the same age (*e.g.* at age 12), then d will represent infections up to age 5 in the whole group (a+b+c+d) plus infection from age 5 to age 12 in (c+d) only. The information on the age of

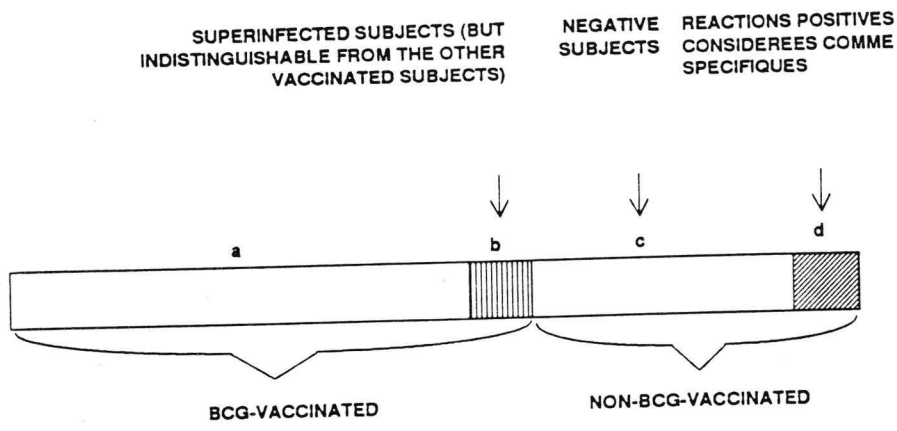

Figure II.

vaccination would permit an estimate of the prevalence of natural infection prevalence at age 12, lying between d/(a+b+c+d) and d/(c+d). More complicated situations could be dealt with on the same principle.

Assessment of the annual risk of infection

Two steps are needed :

a. **Estimation of the percentage decrease in the annual risk of infection.** This may be done from Appendix Table C of TSRU Report No. 1 (2).

Table 3 of the present report shows part of that table. The percentage decrease in the annual tuberculosis infection rates can be estimated most readily when 2 or more prevalence figures are available for subjects of the same age. If the prevalence of infection in children aged 10 years last birthday had been, for instance, 14.0 % in 1972, and 11.0 % in 1977, the corresponding figure in the table is 26. This is divided by the interval in years between the 2 surveys (5) to give the approximate annual percentage decrease in the rate, namely 5.2 %.

Table 3. Decrease in infection risk corresponding to various percentages infected by the same age at two different surveys (from TSRU (2), Appendix Table C, p. 104)

Percentage of persons already infected at the time of the earlier survey	the later survey: 6.5	7.0	7.5	8.0	9.0	10.0	11.0	12.0	...
7.0	8								
7.5	15	7							
8.0	22	14	7						
9.0	34	26	19	12					
10.0	45	37	30	23	11				
11.0	55	47	40	33	21	10			
12.0	64	57	49	43	30	19	9		
13.0	73	65	58	51	39	28	18	9	
14.0	81	73	66	59	47	36	26	17	8
etc.									

Divide the entry in the table by the interval in years between the surveys to obtain the approximate annual percentage decrease for use in Appendix Table B.

Table 4. Annual percentage risks of tuberculous infection corresponding to the percentage already infected by age 10.5 years (from TSRU (2), Appendix Table B, p. 92)

Percentage already infected	Approximate percentage decrease in risk of infection each year: 1		3		5		etc.	11		13	
	Risk this year	Risk 10 years ago	Risk this year	Risk 10 years ago	Risk this year	Risk 10 years ago		Risk this year	Risk 10 years ago	Risk this year	Risk 10 years ago
1.0	0.09	0.10	0.08	0.11	0.07	0.12		0.05	0.15	0.04	0.16
1.5	0.14	0.15	0.12	0.16	0.11	0.18		0.08	0.23	0.07	0.25
etc.											
11.0	1.05	1.16	0.94	1.27	0.84	1.38		0.59	1.76	0.52	1.89
12.0	1.15	1.27	1.03	1.39	0.92	1.51		0.64	1.92	0.57	2.07
13.0	1.25	1.38	1.12	1.51	1.00	1.65		0.70	2.10	0.62	2.25
14.0	1.35	1.49	1.21	1.64	1.09	1.78		0.76	2.27	0.67	2.44
etc.											

b. **Estimation of the level of the risk of infection in specific years.** Using the estimates just obtained, the level of the risk may be extracted from Appendix Table B of TSRU Report No. 1. Table 4 of the present report shows part of that table, for children aged 10.5 years. The third column gives information for a 5 % annual decrease in risk, and provides the following estimates of annual tuberculosis infection rates :

In 1972 : 1.09 %, and in 1962 : 1.78 % (from the findings of the earlier study)

In 1977 : 0.84 %, and in 1967 : 1.38 % (from the findings of the later study). ■

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