



ASSESSMENT OF LADAKH SMALLPOX ERADICATION PROGRAMME ACTIVITIES

by

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INDEXED



1. Introduction

An assessment survey was organized in the Ladakh area in the latter part of September 1975. Ladakh differs in many ways from other Indian districts. Ladakh covers an area of nearly 97 782 km², the tehsil Leh alone accounting for 82 696 km². It is bounded on the east by Tibet (People's Republic of China), on the south by Himachal Pradesh, on the north by Pakistan and on the west by Kashmir. Its altitude ranges between 8000 and 13 000 ft above sea level. The altitudes of Leh and Kargil area are 11 500 ft and 8500 ft, respectively. The climate is characterized by extremes of heat and cold; the annual rainfall is approximately three inches.

According to the 1971 census, there are altogether 104 250 inhabitants (52 258 males and 51 992 females) living in Ladakh. From this total, 51 391 persons live in tehsil Leh, 46 039 in tehsil Kargil and 6820 in the Zaskar area. The density of population is low - about two persons per km². In the Dras area there are Dard Brokpas, speaking the Shina dialect and belonging to the Sunni Muslim sect. Tehsil Kargil is a homeland of the Balti people, a majority of whom belong to the Shia orthodox Muslim sect. The Leh tehsil and Zaskar areas are predominantly Buddhist. The Leh capital itself is a cosmopolitan town of Ladakhis, Tibetans, Yarkandis, Kashmiris, etc. Polyandry, though abolished by law, continues in practice.

At present in the entire Ladakh area there are only about 250 villages occupying about 20 000 housing units: 35% of the villages have populations below 200 inhabitants each; about 40% of the villages have populations ranging from 200 to 499 persons; and 21% have populations between 500 to 999. There are only seven villages having 1000 inhabitants or more. Houses in the villages are usually scattered over large areas in the valleys.

As far as the smallpox situation is concerned, there seems to be a traditional absence of the continuity of smallpox transmission in this area. From time to time, smallpox infection has been introduced into Ladakh by returning pilgrims or newcomers from the central India or the Kashmir Valley. Smallpox outbreaks of various sizes had been detected in the inhabited part of the Indus Valley and the valley of Dras affecting mainly the larger population centres of Dras, Kargil, Khalsi, Leh and their neighbouring villages during the periods of 1945-47, 1955-57 and 1967-68. The last outbreak caused by imported cases was found in the Tankse area near Pangong Lake in 1973.

2. Material and methods

Five assessment groups, each consisting of one medical officer and one senior health supervisor, were sent to various mohallas of Leh capital and rural areas of the Dras, Kargil and Khalsi valleys (Fig. 1) with the following objectives:

- (i) to assess the vaccination status of selected samples of the population;
- (ii) to assess epidemiological data showing the history of smallpox transmission in selected localities;

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(iii) to assess the effectiveness of the Ladakh smallpox eradication activities.

2.1 Population surveyed

Altogether, 1010 persons (586 males and 424 females) were interviewed and examined in this survey. Of that number, 284 were under 15 years of age. The urban population sample represented by Leh capital dwellers was comprised of 384 persons (210 males and 174 females) and the remaining 626 persons (376 males and 250 females) represented a sample of the rural population. Of this total, about 20% of the persons were interviewed and examined in Khalsi Valley, about 30% in the Dras area and the remaining 50% in Kargil Valley. Fig. 1 shows the localities selected for this survey and their geographic location in the Ladakh. A detailed account of age and sex distribution as well as residence of all sampled persons is given in Table 1.

2.2 Interviewing technique

Ordinarily, a team of two persons - an experienced medical officer accompanied by a health supervisor - carried out the interview/survey travelling from mohalla to mohalla, from one cluster of houses to another one in their allotted areas interviewing randomly selected persons and collecting patient epidemiological and immunization data. The questions included demographic data (identification of persons by age, sex, ethnic group and language), detailed information on recent or previous vaccinations (history of primary vaccination as well as revaccination) and information on recent or previous smallpox illness (of the respondent or any of his family members, including information as to whether the respondent had ever seen or heard of smallpox transmission in his or neighbouring blocks). Finally, each respondent was asked if he knew of the recent search activities, if he had ever seen the smallpox recognition card, if he knew about the reward for notification of an unknown smallpox outbreak (Rs. 100/-, Rs. 1000/-) and if he knew where to report suspected cases with fever and skin eruptions. Even the means by which the respondent received the information about the reward was noted. If a small child were examined, the proper information was generally obtained from an adult respondent, usually the mother. All pertinent information was entered on special epidemiological investigation sheets (Appendix).

2.3 Examination technique

The interview was followed by an examination and each selected person was checked in the following way:

- (i) examination of face;
- (ii) examination of right arm and hand;
- (iii) examination of left arm and hand.

For entries to epidemiological sheets, the following criteria were used:

- (i) A person with smallpox facial scars - a person who had at least five characteristic round depressed facial scars on his face with a base diameter of 2 mm or more.
- (ii) A person with vaccination scar - a person with visible characteristic vaccination scars on right or left arm.

The few cases in which doubts arose about the identity of skin changes on the face or arms were classified as "negatives".

3. Results

3.1 Vaccination status of population surveyed

This survey was aimed at obtaining an estimate of the vaccinated portion of the population with respect to age- and sex-groups and at comparing vaccination levels in Leh Municipality with those in rural areas. The vaccination data are presented by age-groups and by sector of population in Table 2.

In urban areas only 3.6% of the population was found without any smallpox vaccination scars. The lowest vaccination status, i.e., 17.2% unprotected, was found among females in the age-group of 30 to 39 years. Otherwise there were only slight differences between sexes based on the fact that 2.4% of the males in contrast to 5.2% of the females were found without any evidence of recent or previous vaccination. About 5% of all children under five, in contrast to 1.5% of children from five to 14 years, were also found unprotected. The considerably lower percentage of vaccinated children under five years was a result of the fact that considerably smaller proportion of children in the age-group of 0-1 year had been vaccinated.

In regard to rural areas, the percentage of unvaccinated persons were found substantially higher in comparison with those in urban areas, reaching 18%. The highest percentage (more than 20%) of persons without vaccination scars was found among females 40 years old or over and, surprisingly, among males in the age-group of 15 to 19. There were substantial differences between groups classified according to sex, as well: a rate of about 11% unprotected was found among females living in rural areas in comparison with about 22% among males without any vaccination scar. Furthermore, there were substantial variations in the rates of unprotected individuals among selected localities, ranging from 9% in the Khalsi Valley to 27% found in the Dras area.

Table 3 shows further results of a physical examination for the presence of smallpox postvaccinal scars. Of a total of 384 urban dwellers only 98 (i.e. 25.5%) were found with primary vaccination scars only; more than 70% were found with revaccination scars. Of these, 51% informed that revaccination had been done within the last three years.

Of a total of 626 rural dwellers, 202 (i.e., more than 32%) were found with primary vaccination scars only; about 50% had revaccination scars. Forty per cent. gave information that revaccination was done within the last three years. There were variations in the rates of persons with primary vaccination scars only, ranging from 26.4%, found in Dras area, to 39.1%, found in Khalsi Valley. Similarly, there were variations in the rate of the number of persons who had been revaccinated within the last three years ranging from 38.1% in Kargil Valley to 44.9% found in Khalsi Valley. With very few exceptions there was a good correlation between statements made and the results of physical examination for the presence of postvaccinal scars.

Table 4 shows the number of insertions originally made on the primary vaccination sites of examined persons. About 23% of all rural inhabitants were found with three or more insertions on the primary vaccination site. Even in urban areas one insertion on the primary site is still infrequently encountered.

3.2 Smallpox facial scars in population surveyed

Of a total of 1010 persons examined, 27 individuals (i.e., 2.7%) were found with visible "pock marks". As shown in Table 5, there were no persons with facial scars that could be found in either rural or urban population groups below 20 years of age. A male of 25 years of age from Kargil Valley who had suffered an attack of smallpox in 1955 was the youngest case found in this survey. The percentage of persons with pock marks then showed a substantially increasing age-dependent trend. The highest proportion of "positives" (about 8%) was found in both males and females among older age-groups mainly from 50 years onwards.

There were no significant differences between sexes in relation to facial scars. However, there were substantial differences between the urban and rural dwellers due to the fact that only 0.5% of the persons with facial scars were found in Leh Municipality in contrast to 4% found in rural areas. Furthermore, there were substantial variations in the rates of persons with facial scars among selected rural localities, ranging from 2% in the Dras area to nearly 9% found in Khalsi Valley.

Detailed interviewing of persons with facial scars revealed that 18% of those questioned had suffered smallpox attacks before 1947 - about 40% between 1945-47 and 32% between 1952-55. Only 10% had developed the disease during the past 20 years. No person interviewed stated that he was suffering from smallpox after 1967-68. It was further found that 55% of those persons with facial scars had become infected in the same locality in which they were interviewed, 20% in the same tehsil and 15% in other tehsils of Ladakh. Approximately 10% stated that they had been affected by smallpox outside Ladakh territory, predominantly in Kashmir or Punjab.

3.3 Further information on history of smallpox transmission

In the course of interviewing 1010 persons, additional information could be obtained about smallpox in 924 households. Excluding households of persons with facial scars, an additional 27 households had suffered from smallpox infection in the past. Detailed interviewing showed that 8% of these had been affected by smallpox before 1945, 11% during 1945, 33% during 1947, 40% from 1955 to 1957 and 8% during the period between 1965 and 1967. No information was obtained indicating that any household or its members had been affected by smallpox after 1968.

Of a total of 1010 persons (excluding persons with facial scars and persons giving a "positive" history of smallpox in their households) 21 individuals (i.e., 2.1%) claimed to have seen a smallpox case in the localities of their residences. Of these, 8% had seen smallpox cases before 1945, 37% between 1945 and 1947, 48% from 1955 to 1957 and 7% in the period between 1965 and 1967. No person in the sampled population claimed to have seen a case of smallpox after the year 1968.

Similarly, there were 47 individuals (i.e., 4.9%) of the interviewed sample claiming they had heard of smallpox transmission in the locality of their residences or neighbouring tehsils. Of these, 9% had heard of cases of smallpox before 1945, 47% between 1945 and 1947, 29% from 1955 to 1957 and 8% in 1965 to 1967. Surprisingly, 7% stated they had heard of cases occurring near the Tibetan border in 1973.

3.4 Last known smallpox outbreaks in Ladakh

The last discovered smallpox outbreaks affecting a total of 12 persons and resulting in five deaths were detected in the Durbuk area, specifically in Laga, Bukruk and Punpun villages near Pangong Lake in Changtang subdivision of Leh tehsil in early November 1973.

In the first case, a 70-year-old male, accompanied by five other persons, began a pilgrimage to Bodhgaya (Bihar) from their villages on 3 October 1973. The group reached Leh, taking a bus to Srinagar on 7 October. From there they travelled by public-carrier lorry and railway train reaching Gaya district in Bihar in approximately October. The pilgrims spent some days in Gaya and Bodhgaya and began their return trip at the end of October, reaching Srinagar on 1 November. The group reached Leh Municipality by bus on 3 November, the same day the first case felt ill. He received treatment in the local district hospital, where he died on 10 November. The remaining members of the group reached the Durbuk area on 4 November, all falling ill and developing rashes within four to five days of their arrival, resulting in four deaths within the tenth day. Furthermore, six secondary cases occurred in three separate foci in Laga, Bukruk and Punpun. Fig. 2 shows the pilgrimage route and the affected locality.

Outbreak-containment measures were initiated on 27 November and the entire population of 20 villages surrounding the affected areas were vaccinated and the whole of Changtong and Chashul areas were searched for additional cases from 11 to 20 December 1973. No further case of smallpox was discovered. Groups consisting of two basic health workers and one health inspector were posted in affected areas for daily surveillance activities as well as further vaccination by the end of the year 1973.

The outbreak was reported to State and Central levels on 26 February 1974.

3.5 Assessment of periodical active search operations

Finally, the survey was aimed at estimating the effectiveness of the searchers' field-work as well as the level of information of the general population about the periodic searches for smallpox cases, the reward for notification of unknown smallpox outbreaks and the knowledge of where to report suspected cases.

As shown in Table 6, out of 363 persons questioned in Leh Municipality, only 23.4% knew of a recent search or had seen searchers searching for cases. Thirty-eight per cent. had been shown smallpox recognition cards. About 16% of all interviewed persons knew about the reward of Rs. 1000/- for reporting any unknown smallpox outbreak and additionally nearly the same percentage knew about the reward of Rs. 100/- without any knowledge of the recent increase of the reward. Forty-three per cent. knew where to report suspected cases of fever and skin-eruptions.

In regard to rural areas, the percentage of those well informed was still smaller. Only 13% had seen a searcher during the recent search and only 16% had ever seen smallpox recognition cards at all. Approximately 14% questioned knew about the reward of Rs. 100/- and only 12% knew about the new reward of Rs. 1000/- for reporting an unknown smallpox outbreak. Eighteen per cent. of those interviewed gave satisfactory answers as to where to report suspected cases.

During the survey, 12 rumours were reported and investigated, two of which were found to be active cases of chickenpox. The remaining cases were classified as impetigo, scabies and dermatitis.

4. Discussion

One way of meeting the need to assess the smallpox eradication programme during its execution, detect "weak spots" requiring remedial action and adequately focus on any subsequent "mopping-up" activities is to carry out health interview surveys. Apart from the descriptive character of the present survey, which is the first of its kind to have been carried out in the Ladakh area, its analytic aspects should be emphasized since attention was concentrated on comparisons between estimates made for various population sub-groups, mainly based on age, sex and character of locality.

The survey shows that the strategy of the local NSEP programme has been based on vaccination effort and that the aspect of surveillance is still suffering heavily, even at present. The vaccination efforts of previous years were quite sufficient to achieve good population coverage in general. Vulnerable sectors of the population were located, allowing the establishment of proper guidance for future activities. On the other hand, it should be realized that the interview and scar-survey technique cannot be used as an accurate quantitative measure of immunity but can only provide data on presumptive protection. Variation between individual immunological responses to an antigen as well as variation in potency of those vaccines used in an observed locality are factors which cannot be measured by questionnaires.

The survey shows that the Ladakh area is one where the surveillance system needs further strengthening and the level of information to the general public should be increased. More emphasis is now required on all types of basic methods of surveillance activities (regular search weeks, market searches, special searches, secondary surveillance systems) on training programmes and on continuing involvement of the local regular health staff in smallpox surveillance activities. Similarly, as in many Indian States, the Ladakh smallpox eradication programme has reached the point at which surveillance activities have not only become increasingly important but also difficult as a result of complacency on the part of health workers on various levels. A high-quality surveillance system cannot exist, unless State, district and PHC medical officers continue to motivate and stimulate their staff.

Historical data obtained from the sampled population support the view that there was no continuous and unbroken chain of smallpox transmission in Ladakh area. Smallpox infection was introduced into Ladakh only from time to time. The inhabited valleys of Dras, Kargil, Khalsi and Leh experienced smallpox transmission of various sizes during 1945-47, 1955-57 and 1967-68. No rumour concerning a suspicious case was received during the survey. Although the possibility still exists that unknown smallpox foci could be hidden in Ladakh territory, the probability seems to be rather low. However, the establishment of a high-quality surveillance system with the ability to detect any such hidden foci seems to be first priority for the Ladakh Smallpox Eradication Programme at present.

5. Conclusion

The reported survey was an inexpensive source of information for the Public Health Service and has confirmed that health interview surveys are a practical method of detecting "weak links" in local smallpox eradication programmes.

In particular, the results provided local health officers with crucial information, thus permitting them to modify the present local strategy based on vaccination effort and to reinforce surveillance activities on all levels. Although there is still the possibility that an unknown smallpox focus could persist in Ladakh, the probability is very low.

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TABLE 1. AGE-SEX DISTRIBUTION AND RESIDENCE OF SAMPLED PERSONS

Age-group	Urban population			Rural population			Total		
	Males	Females	Total	Males	Females	Total	Males	Females	Total
0-4	12	9	21	24	17	41	36	26	62
5-9	18	17	35	29	22	51	47	39	86
10-14	15	18	33	78	25	103	93	43	136
15-19	23	23	46	61	29	90	84	52	136
20-29	63	34	97	74	64	138	137	98	235
30-39	31	34	65	49	53	102	80	87	167
40-49	25	22	47	29	24	53	54	46	100
50+	23	17	40	32	16	48	55	33	88
Total	210	174	384	376	250	626	586	424	1 010

TABLE 2. VACCINATION STATUS OF SAMPLED PERSONS

Age-group	Urban population			Rural population		
	Vaccinated	Unprotected		Vaccinated	Unprotected	
		No.	%		No.	%
0-4	20	1	4.8	36	5	12.2
5-9	35	0	0.0	46	5	9.8
10-14	32	1	3.0	80	23	22.3
15-19	44	2	4.3	70	20	22.2
20-29	93	4	4.1	118	20	14.5
30-39	60	5	7.7	83	19	18.6
40-49	47	0	0.0	43	10	18.9
50+	39	1	2.6	38	10	20.8
Total	370	14	3.6	514	112	17.9

TABLE 3. RESULTS OF SCAR SURVEY IN SAMPLED POPULATION

	Urban population		Rural population	
	No.	%	No.	%
Total persons examined	384	-	626	-
Persons without vaccination scars	14	3.6	112	17.9
Persons with primary vaccination scars only	98	25.5	202	32.3
Persons with revaccination scars visible	272	70.8	312	49.8
Of total persons examined, revaccination scars:				
Within last three years	196	51.0	251	40.1
More than three years	76	19.8	61	9.7

TABLE 4. NUMBER OF INSERTIONS ON VACCINATION SITE

No. of scars on primary vaccination site	Population			
	Urban		Rural	
	No.	%	No.	%
1	40	10.8	65	12.6
2	269	72.7	332	64.6
3	42	11.4	112	21.8
More	5	1.4	5	1.0
Unknown	14	3.8	0	0.0
Total	370		514	

TABLE 5. AGE DISTRIBUTION OF PERSONS WITH SMALLPOX FACIAL SCARS

Age-group	Total surveyed	Persons with facial scars		Smallpox cases: persons who have ever			
				Seen		Heard of	
		No.	%	No.	%	No.	%
0-4	62	0	0.0	0	0.0	0	0.0
5-9	86	0	0.0	0	0.0	0	0.0
10-14	136	0	0.0	0	0.0	0	0.0
15-19	136	0	0.0	0	0.0	0	0.0
20-29	235	6	2.6	3	1.3	9	3.8
30-39	167	8	4.8	7	4.2	9	5.4
40-49	100	6	6.0	5	5.0	12	12.0
50+	88	7	8.0	6	6.8	17	19.3
Total	1 010	27	2.7	21	2.1	47	4.7

TABLE 6. ASSESSMENT OF PERIODICAL ACTIVE SEARCHES

	Population			
	Urban		Rural	
	No.	%	No.	%
Total number of persons questioned	363	-	585	-
Those who know of periodical search	85	23.4	77	13.2
Those who saw Smallpox Recognition Card	138	38.0	94	16.1
Those who know:				
of reward Rs. 100/-	57	15.7	73	12.5
of reward Rs. 1000/-	58	16.0	84	14.4
Those who know where to report	157	43.3	107	18.3

FIG. 1. LADAKH AREA - GEOGRAPHICAL LOCATION OF SAMPLED AREAS

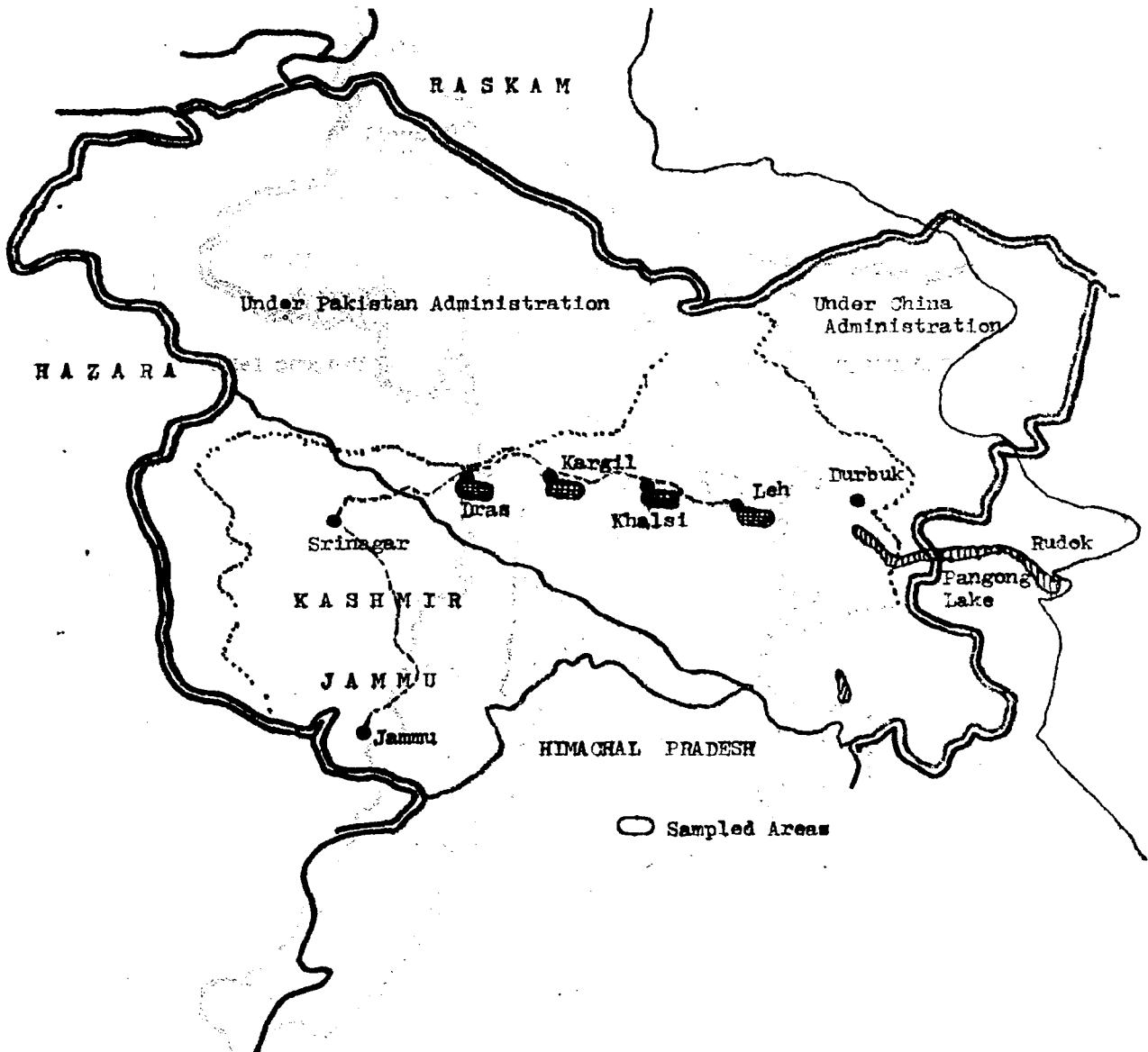
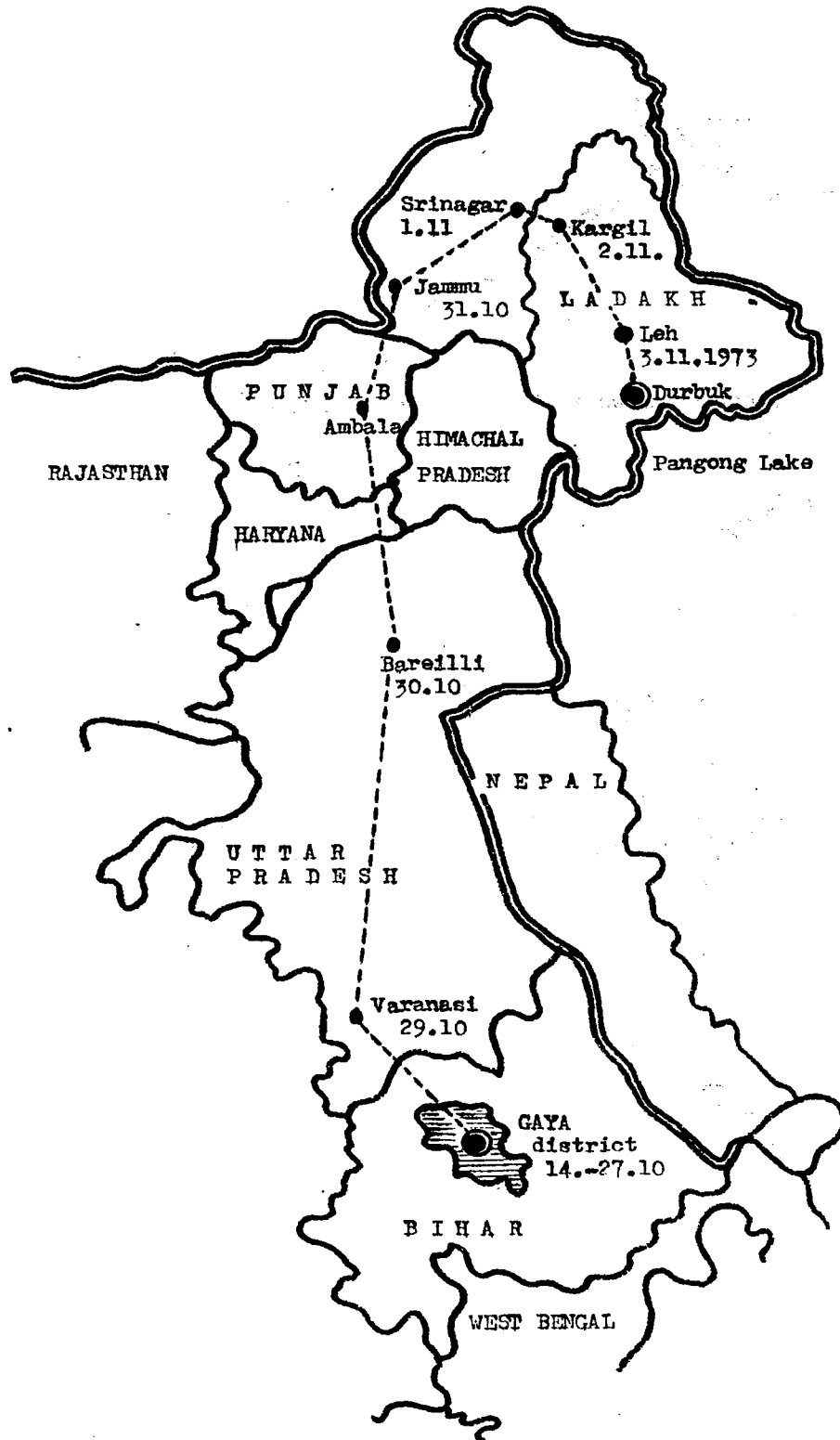


FIG. 2. SCHEMA OF PILGRIMAGE-TOUR OF DURBUK PILGRIMS - 1973



A. PERSONS WITH SMALLPOX FACIAL SCARS

No.	Full Name	Sex	Age	Detailed Address	Occupation	Approx. date of disease	Locality where he got SPX		
							District	Block	Locality

B. PERSONS WITH FEVER AND SKIN ERUPTIONS

No.	Full Name	Sex	Age	Detailed Address	Occupation	Approx. date of disease	Diagnosis	Date of Rash	Vaccination Status

District	Block	Locality	Assessors	Date