MEDICAL-GEOGRAPHICAL OBSERVATIONS IN CENTRAL NEPAL

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MORE than a decade ago Nepal opened her doors to the world. Since then, political, economic, and social changes have dispelled much of the former air of mystery, but the medical geography of the country remains little known. There are no organized morbidity and mortality reporting systems. Difficult terrain limits communication and study of the diseases of the inhabitants. Health services are not well developed, and hospitals and physicians are few.[1] Even crude morbidity data for the major diseases are available for only one or two large population centers. With this situation in mind the writer records herein certain medical observations made while serving as physician for the 1959 American Himalayan Expedition in central Nepal. This expedition, concerned principally with geographical exploration, geology and mountaineering, was in Nepal from mid-September until the beginning of December 1959. For seven weeks the members lived and worked in and around two little-explored ranges of the central Nepalese Himalayas, the Mukut Himal and the eastern Kanjiroba Himal (Fig. 1).

Observations on disease along the expedition's route through the highlands complement those made in 1949 in adjacent lowlands and foothills of central Nepal by an ornithologic expedition sponsored by the Chicago Natural History Museum. The 1949 expedition crossed the India-Nepal border at Nautanwa (Fig. 1) and proceeded north through the gorges of the Kali Gandaki river to its sources near the Tibetan border, substantially the route followed by the 1959 expedition. The

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[1] P. Robinson, Maternal and Child Health Services in South-East Asia, IX, *The Journal of Tropical Pediatrics,* Vol. v (Nepal, 1960), pp. 130–131. Also J. H. Elliott, GUIDE TO NEPAL. (Calcutta: W. Newman & Co. Ltd., 1959).

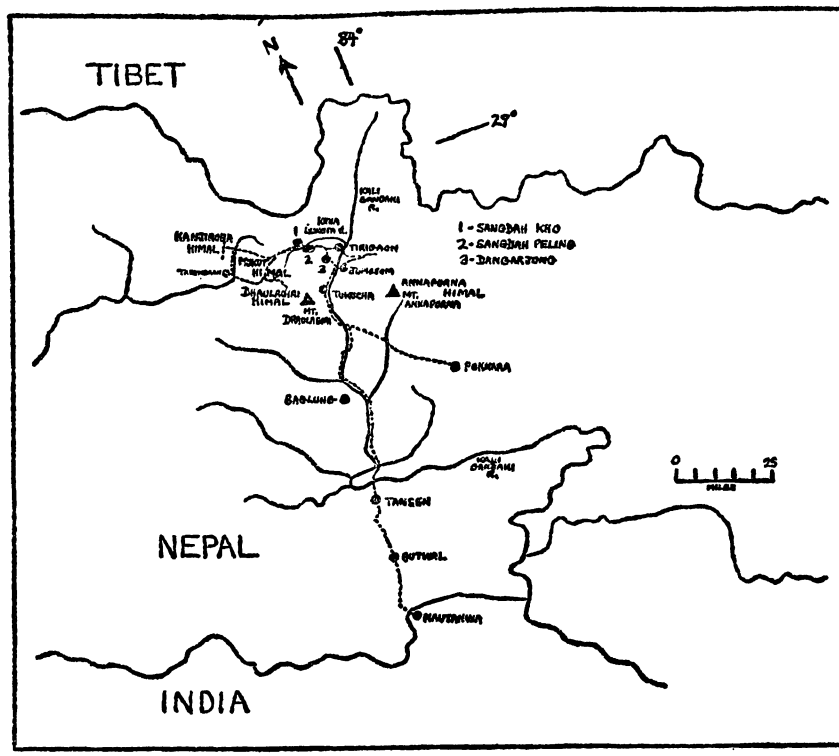

Fig. 1. West-central Nepal, showing places mentioned in text, and route of the 1959 expedition (dotted line).

1949 party did not travel extensively in the highlands above the Kali Gandaki sources. Its physician, C. E. Taylor, conducted dispensaries in thirteen villages, examining 785 patients and making 866 diagnoses. His medical observations[2] included some on malaria in lowland villages and on blood pressures of residents of Tukucha (8,500 ft.) and Jomosom (9,000 ft.).

Taylor's is one of the few descriptions of health conditions among the people of western and central Nepal. Information for other parts of Nepal is little more complete. Only malaria has received nationwide attention, in the course of an eradication program.[3] Health conditions among inhabitants of the

[2] C. E. Taylor, A Medical Survey of the Kali Gandak and Pokhara Valleys of Central Nepal, *The Geographical Review*, Vol. XLI, (July, 1951), pp. 421–437.

[3] A cooperative malaria eradication scheme involving personnel of the Government of Nepal, the World Health Organization, and the U. S. International Cooperation Administration.

lowlands, foothills, and particularly the valley of Katmandu have been documented to some extent.[4] Young Gurkhas have been examined through the years in the course of British Army recruitment, but this has shed little light on the pattern of disease in their home communities, to say nothing of the far more numerous non-Gurkha communities.[5] Only casual references in the mountaineering literature,[6] and several limited surveys as that for intestinal protozoa among Sherpas in Helembu at 9000 ft,[7] give information about the health of people living above 9000 ft. in the Himalayas.

Geographic Introduction

Nepal is a compact but geomorphologically diversified country.[8] Stretching across a rectangle some 500 miles long from east to west are four principal topographic bands: the lowland Terai, the foothills, the high Himalayas, and the southward extensions of the Tibetan plateau.

The southernmost Terai, rarely more than 20 miles wide, is dense jungle and open ricefields bordering the northern Indian plains. The southern part is inhabited by farmers similar racially and culturally to their Indian neighbors to the south. The Terai jungle, north of the rice country, is thinly populated by tribal peoples who retain their own languages and cultural identity.

North of the Terai, foothills rear up, rise in waves and meet the great ridges sweeping down from the Himalayan peaks. The foothills are sharply dissected by south-flowing rivers. In

[4] R. Svensson, Intestinal Parasites in Himalayan Regions, *American Journal of Hygiene,* Vol. LXIV, 2 (September, 1956), pp. 158–169.

[5] W. S. Millar, Some Aspects, Mainly Medical, of the Gurkha Recruiting Season, 1955, *Journal of the Royal Army Medical Corps,* Vol. CIII, (1957), pp. 147–154; D. C. Morely: Gurkha Bronchitis, *Journal of the Royal Army Medical Corps,* Vol. XCV (1950), pp. 185–195; D. J. Weatherall and F. Vella, Thalassaemia in a Gurkha Family, *British Medical Journal,* (June 4, 1960), p. 1711.

[6] For example see W. H. Murray, The Scottish Himalayan Expedition. (London: Dent, 1951), pp. 242–243 and elsewhere; C. Stonor, The Sherpa and the Snowman, (London: Hollis & Carter, 1955), pp. 43–44; C. Evans, Kangchenjunga, The Untrodden Peak. (London: Hodder & Stoughton, 1956), pp. 167–171.

[7] R. Svensson, *op. cit.* Also F. S. Jackson, H. Lehmann, and A. Sharih, Thalassaemia in a Tibetan Discovered during a Haemoglobin Survey among the Sherpas, *Nature,* Vol. CLXXXVIII (1960), pp. 1121–1122.

[8] P. P. Karan and A. Taylor, Nepal, *Focus,* Vol. VI (June, 1956).

the narrow, densely inhabited valleys the villagers support themselves by farming superbly terraced fields. In few areas are the valley floors broad enough to support large communities and extensive flatland agriculture. In the largest of these interior valleys lies Katmandu, the capital, and its satellite towns. Probably three-quarters of Nepal's population resides in the innumerable valleys of this foothill band. The people are distinctively Nepalese, in the more narrow sense, with a culture and religion transitional between Tibetan Buddhism and Indian Hinduism.

The third band, the high Himalayas, is characterized by peaks and glaciers, and the many high valleys, 7,000 ft. to 10,000 ft. above sea level, are thinly populated by people close to Tibetans racially, linguistically and culturally. Among these are the Sherpas of eastern Nepal.

The fourth and northernmost band is discontinuous within the political boundaries of Nepal. This is the arid high plateau, a southward extension of the Tibetan plateau. Only a few broad tongues of this desolate land project into Nepal. The valleys cutting the southern edges of these plateau tongues are inhabited by Nepalese—the Bhotians—who resemble their neighbors farther south in the Himalayan valleys, but are even more Tibetan in culture, religion, race and language.

It was in the arid valleys edging the Tibetan plateau, and north of the Himalayan crest, that the 1959 expedition spent much of its time, and it is with the Bhotian residents of these valleys that the next two sections will be concerned.

I. Sangdah, A Bhotian Village

A. The village and its people:

This "double-village" is composed of two settlements several miles apart, each occupied half the year by the same villagers. Such double-villages are not unusual in the high mountain country of Nepal adjacent to the Tibetan border.[9] The two

[9] Peoples of Nepal Himalaya, Vol. III (1957). H. Kihara, ed., (Scientific

(Continued on page 133)

Fig. 2. Peling (12,300 ft.), the summer settlement of Sangdah, a Bhotian double-village. Left foreground: wheat and buckwheat fields, recently harvested. Left background (on north wall of Keha Lungpa valley): abandoned fields of a former village.

Fig. 3. An elderly Bhotan woman of Sangdah village.

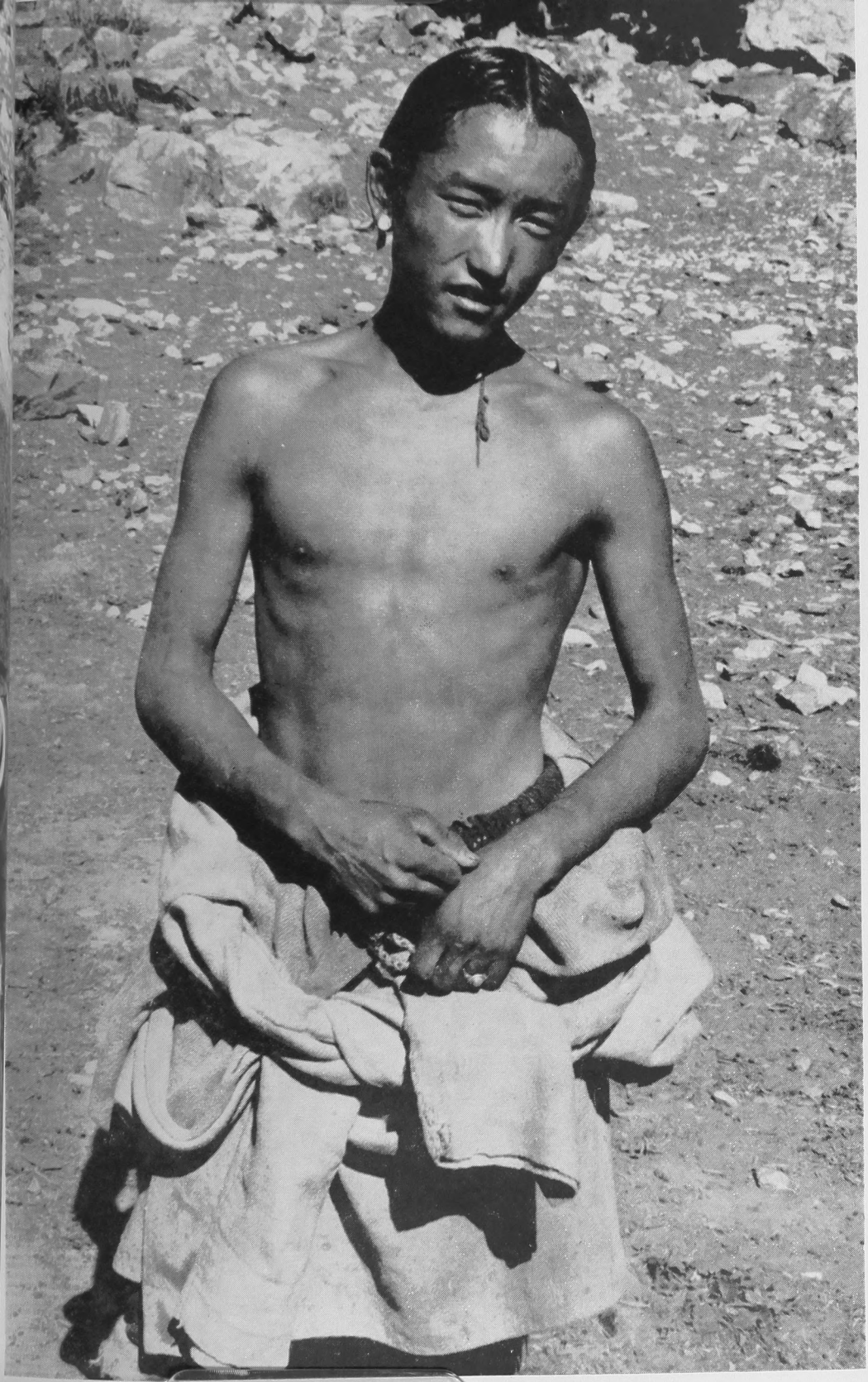

Fig. 4. A Sangdah villager: typical young male Bhotian.

Fig. 5. Sangdah men around a campfire at over 17,000 ft.

settlements perch on narrow bands of fairly level land above the gorge of the torrential Keha Lungpa, a large tributary of the Kali Gandaki (Fig. 1). Sangdah is about 11 miles south of Tibet and about 10 miles west of the Kali Gandaki valley. The altitude of Sangdah Kho is 13,000 ft.; of Sangdah Peling, 12,300 ft.

In mid-November, Kho, the winter settlement above the north bank, receives 10 hours of sunlight, while Peling on the south slope receives only 6½ hours. South of Peling, mountain walls soar to 21,000 ft., shutting out the winter sun for all but these few hours each day.

The 60 people of Sangdah, 34 males and 26 females, live in 13 households. They are racially and linguistically Tibetan, dress in Tibetan style, and their religion is Tibetan Buddhism. The society is organized around male household chiefs, and the clan is patrilineal, according to Kawakita who studied this village briefly in 1953.[10] Polyandry is practiced, the custom in the Himalayan highlands.

The Sangdah villages are small groups of flat-roofed, one- and two-storied houses surrounded by narrow terraced fields, each field protected by a fieldstone wall (Fig. 2). At each end of the village stand prayer walls decorated with white "chortens" (tower-like shrines) and "mani" stones (small flat stones incised with Tibetan Buddhist religious phrases and scriptural excerpts). White cotton prayer flags, mounted on tall poles, stand over most village houses. The walls of houses and storage buildings are constructed of fieldstone, plastered in part with mud. Floors are of stamped earth; roofs are timbered, thatched, and sealed with mud. The houses are connected by complex semisubterranean passageways, and many buildings are surrounded by walled threshing courts and paddocks.

Water is brought to both villages by channels from nearby streams. Neither water supply is protected from fecal contami-

Results of the Japanese Expeditions to Nepal Himalaya, 1952–1953, [Japan: Fauna and Flora Research Society, Kyoto University]), p. 38. [section by J. Kawakita].

[10] *Ibid.* p. 42.

nation, nor is defecation localized in one part of the village. The ground around the village is strewn with feces. Because of the cold this does not seem to be the health hazard it is in the lowlands. Human feces are not collected for fertilizer, but yak dung is gathered by the women for use as fuel.

The settlements are in the arid region north of the main crest of the Himalayas, close to the edge of the Tibetan plateau. The high peaks to the south, including Mount Dhaulagiri, one of the highest in the world, constitute a precipitation barrier. There are no large trees on the surrounding slopes. A few small juniper trees stand below Kho, and small shrubs are scattered on the slopes near both villages. The cultivation limit is about 13,200 ft., just 200 ft. higher than Kho itself.

The growing season dominates the lives of the hard working Sangdah villagers. They sow wheat at Peling about April 10, shortly after the annual migration down from Kho. About

Table 1. Foods available at Sangdah.

Staples:	*Meat and Animal Products:*
Wheat	Yak butter and cheese
Buckwheat	Eggs (rarely eaten)
Potatoes	Goat, sheep, chicken (meat eaten infrequently)
Beverages:	*Other Foods:*
Tea	Amaranth flour
Yak milk	Ghee
Water	Salt*
Chang (mild sour beer)	Rice* (a luxury)
Raxi (distilled, from wheat)	Sugar* (rarely used)
	Oranges and other fruits* (rare luxuries)
	Herbs, roots, wild plants (a few species gathered at various times of the year; not important foods; eaten as vegetables or used for seasoning)

* Obtained by trade (usually barter)

June 10 they sow buckwheat at Peling.[11] While continuing to live at Peling they go to Kho the last week of May to sow wheat, and after the buckwheat sowing at Peling again return briefly to Kho the last week of June to sow more buckwheat there. Potatoes are also cultivated, and a little amaranth for use as a flour. In early September they begin to reap wheat and buckwheat at Peling and about a month later at Kho. Some of them move up to Kho to stay at that time, but Peling is not finally closed and locked (with mud seals on the wooden doors) until the first week of November when the women have completed grain threshing there. From early November until early April they all live at Kho, occupying themselves with care of the livestock and occasional trading trips. The villagers owned about 200 yak, 400 goats and sheep, 20 dzos (yak-cattle hybrids) and 30 horses in 1953.[12] In 1959 the numbers of animals were not ascertained. They are owned by householders and herded communally by the village youths.

Foods available to Sangdah villages are listed in Table 1.

B. The survey:

On October 11 and 12, 1959 the 51 villagers present in Peling were examined and questioned with the help of the expedition Sirdar, Ang Dawa (a Sherpa) and the Nepalese liaison officer, Mr. Manik Tuladhar. (Nine of the 60 inhabitants of Peling were absent at this time: 6 young men were working as shepherds on the slopes above Kho, and 3 men were away on a short journey to Mukutgaon with a yak train.) The name, age, and sex of each villager examined was recorded. These people, like many highland Nepalese, count their years with considerable precision, so ages could be learned by questioning. Each was questioned about any past and present complaints or illnesses, and about smallpox vaccination. The following were then observed: general appearance; gait; hair; skin of head, neck, extremities (and trunk in about half the group);

[11] *Ibid.* p. 40.
[12] *Ibid.* p. 41.

external condition of the eyes, ears, and nose; mouth (gums, teeth, lips, tongue, throat); neck (palpation of thyroid gland, lymph nodes); pulse; extremities (joints, long bones, hands, feet). Heart and lungs of about half the group were examined by palpation and auscultation. The abdomen was palpated in about one fourth of the group.

The villagers were cooperative, evidently because they were intensely curious and wanted medicine. Indicated medicines were supplied when possible, and the healthy were given vitamin capsules and/or hard candy.

C. Results:

1. *General observations.* The Sangdah villagers were sturdy, lean, well-muscled people of medium height. (Figs. 3, 4, 5). The ages and sex of the population are presented in Table 2. At the time of these examinations no village women were obviously pregnant, and there were only two children less than five years old, an infant male and a boy of one. Nineteen (8 females, 11 males) of the 51 examined made no complaints,

Table 2. Sangdah villagers.

Age	Females	Males	Total	Males Away from Village at Time of Survey
0–4	0	2	2	
5–9	2	2	4	
10–14	4	4	8	6
15–19	6	3	9	
20–29	3	2	5	3
30–39	3	3	6	
40–49	4	3	7	
50–59	2	4	6	
60–69	2	1	3	
Over 70	0	1	1	
	26	25	51	9
			60 = Total Population	

Age	Female				Male				Total Number		Per Cent with Goitre
	Normal	Goitre Group			Normal	Goitre Group			Examined	Goitre	
		1	2	3		1	2	3			
0–1					1				1	0	—
1–4					1				1	0	—
5–9	2				2				4	0	—
10–14	4				4				8	0	—
15–19	3	2	1						9	6	67
20–29		2	1		1	3			5	4	80
30–39	1	2			2	1			6	3	50
40–49	1	1	1	1	3	1			7	3	43
50–59		1	1				1		6	6	100
Over 60	2				1	3			4	1	25
						1					
									51	23	45

Table 3. Sangdah Goitre Survey (51 villagers).

claimed good past health, and seemed normal (except for goitre and/or periodontal disease, see below).

2. *Periodontal disease* was readily apparent in everyone older than 5 years. The gingival tissues were reddened, swollen, and often spongy. The gum surfaces were generally intact and spontaneous bleeding was not observed. The teeth were usually clean, and free of tartar and caries. Some older villagers had few or no teeth.

3. *Goitre* was the next most prevalent condition (Table 3). The thyroid gland was examined with the subject facing the examiner, and classified as recommended by Perez and his associates:[13] normal: gland smooth, firm, slightly compressible, with each lobe roughly the size of a thumbnail. Doubtful normal (here included with normals): very slight enlargement. Group I: palpable enlargement, not visible with the chin at right angles to the neck. Group II: greater enlargement, visible with chin at right angles to the neck. Group III: more extensive enlargement, visible at a distance.

Of the 51 glands examined, 23 were significantly enlarged; two others were doubtfully so. Goitres were found in 13 of 26

[13] C. Perez, N. S. Scrimshaw, and J. A. Muñoz, Classification of Goitre and Techniques of Endemic Goitre Surveys. *Bulletin of the World Health Organization*, Vol. XVIII, Nos. 1 & 2 (1958), pp. 217–232.

females and 10 of 25 males, all over 15 years of age. The 23 enlarged glands were diffuse goitres without nodules. One 68-year-old woman, with a normal gland with several nodular areas, said she had had a goitre when she was younger and that it had gradually disappeared in recent years. According to the villagers, none of the nine men temporarily away from the village had goitres. None of those examined seemed to be mentally deficient, nor did any appear to be cretins. One man 22 years old, with a Group I goitre, said he had been deaf for two years, and examination showed partial bilateral nerve deafness.

4. *Smallpox and smallpox vaccination.* (Table 4) Three villagers had had smallpox in the past. A 44-year-old woman, never vaccinated, had smallpox when she was about 7 (in 1922 or so) in Dangarjong, a village about 10 miles away. Scars were visible on several parts of her body. There were no cases in Sangdah at that time. A man 48 and a woman 61 both said they had had smallpox in Sangdah about 30 years ago (1929 or so) during a severe epidemic in which many villagers died. Neither had ever been vaccinated and both bore scars of the disease.

Questioning and examination revealed that only 11 of 51 vil-

Table 4. Status of smallpox vaccination in Sangdah.

Age	Female		Male		Totals	
	Not Vaccinated	Vaccinated	Not Vaccinated	Vaccinated	Not Vaccinated	Vaccinated
0–1			1		1	
1–4			1		1	
5–9	2		2		4	
10–14	4		3	1	7	1
15–19	5	1	3		8	1
20–29	2	1	2		4	1
30–39		3	2	1	2	4
40–49	3*	1	2*	1	5	2
50–59	1	1	3	1	4	2
Over 60	2*		2		4	
	19	7	21	4	40	11

* One person in each of these groups had had smallpox in the past.

lagers had been vaccinated, by government vaccinators who had periodically visited towns in the Kali Gandaki valley, but never Sangdah. With only 27 per cent of the population even partially protected against smallpox, Sangdah could easily experience another epidemic should the virus be reintroduced. In this respect Sangdah appears to be representative of many of the remote highland villages in this region of Nepal.

5. *Cardiovascular status.* The villagers did not complain of any symptoms suggestive of diseases of the cardiovascular system, and examination of about half the group revealed only one abnormal heart. Pulses of all, except two infant boys whose pulse was not taken, were normal in rhythm, rate and other characteristics. A 22-year-old man who complained of indigestion and pain in the right upper quadrant of the abdomen after eating fatty foods had a grade I apical systolic murmur. His pulse rate was regular (64 per minute), and his heart was of normal size and free of other murmurs and thrills. Lungs and abdomen were not remarkable, nor was his past history revealing.

6. *Pulmonary and respiratory diseases.* Symptoms and signs relating to the lungs and respiratory tree were remarkably few. There were no complaints or findings suggestive of tuberculosis, bronchial asthma, or chronic bronchial infection, decidedly different from the usual situation in lowland and foothill villages a few miles south. Three children, two 6 years old and one 12, had purulent nasal discharges or coryza, but in all other respects seemed perfectly well. Two others, boys aged 10 and 13, had moderately swollen cervical lymph nodes, but no complaints or other unusual physical findings.

7. *Eye diseases.* Older residents could remember no epidemics of eye diseases in Sangdah or other villages of the region. Only 3 persons had any complaints or physical findings: a one-year-old boy had mild bilateral conjunctivitis; a woman of 61 had mild conjunctivitis, chronic according to her account; a 68-year-old woman had mature bilateral cataracts.

8. *Skin diseases.* Most villagers had clear complexions. The

skin of the adults was clean and lightly oiled (on the head, neck, and extremities). Ectoparasites were not seen on any villager. The children, despite being fairly dirt-coated, were remarkably free from impetigo, furuncles, and other skin diseases, in contrast to children in the lowlands. A 16-year-old girl had a small pedunculated papilloma on her neck. A woman 44 years old was the only person with a skin infection—a large, draining, purulent abscess anterior to the right ear.

9. *Bone and joint diseases.* Nine villagers complained of bone and joint disorders, and 4 of them had physical deformities. Four middle-aged persons (46, 53, 55, 58) complained of pains in various joints, but the offending joints were not abnormal. A 13-year-old girl with moderate scoliosis had suffered low backaches for about 3 years. Another girl of 20, normal on physical examination, complained that she had low back pains when she worked. A 10-year-old boy was severely deformed by extreme scoliosis.

Two men, 51 and 55 years old, had a peculiar joint condition described by Tayor[14] as "Lumpek knee": "We coined the name 'Lumpek knee' for what appeared to be a form of traumatic arthritis of the knees, which we encountered first at Lumpek. . . . The cases had certain characteristics in common. They occurred in males who had spent their lives in carrying loads up and down steep mountain trails. The onset of the disease was insidious, without inflammation. As the condition developed, the knee became somewhat swollen and very painful whenever the man walked down a steep hill, particularly if he carried a load. . . . In two elderly patients the knees had the typical appearance of Charcot's joints. . . ." In both cases at Sangdah the condition had advanced to the Charcot's joint stage. Taylor suggests that the cause may be excessive joint trauma incident to carrying heavy loads down steep hills. However, venereal disease cannot be ruled out as an underlying cause.

10. *Headache.* Four women complained only of occasional

[14] C. E. Taylor, A Medical Survey of the Kali Gandak, *op. cit.*

mild headaches; their histories and results of physical examination were not remarkable.

11. *Gastrointestinal and abdominal complaints.* Seven persons complained of gastrointestinal or abdominal symptoms. A 22-year-old man, mentioned above because of his heart murmur, described episodes of right upper quadrant abdominal pain and indigestion after he ate fatty foods. Examination of his abdomen revealed no tenderness, masses, or enlarged organs. A man of 40 complained that he had midepigastric pain after he drank raxi (distilled liquor). Four women (15, 18, 20, and 36 years old) complained of occasional episodes of vague abdominal pain, nausea, and indigestion; none had been troubled by diarrhea or dysentery, nor had any apparent physical abnormalities. A 15-year-old girl, who said she had had no symptoms, told of recently having passed several large roundworms, which her description suggested were *Ascaris lumbricoides.*

The feces scattered around the village consisted almost entirely of well-formed stools, confirming the absence of complaints about diarrhea and dysentery. This differs from the usual finding around many lowland villages in the Kali Gandaki

Table 5. Summary: Health Survey of 51 Sangdah villagers.

Conditions	Number Affected (Symptoms or Physical Findings)	Per Cent
Periodontal Disease	49	96
Goitre	23	45
Bones and Joints	9	18
Gastrointestinal-Abdominal	7	14
Headache	4	8
Pulmonary-Respiratory	3	6
Eye	3	6
Skin	2	4
Lymphadenopathy	2	4
Cardio-Vascular	1	2
Smallpox Vaccination	11	22
No Disease by History or Physical Examination (Other Than Goitre and/or Periodontal Disease)	19	37

valley. The Sangdah villagers were certainly not reticent to discuss the subject of diarrhea and dysentery.

The observations in Sangdah are summarized in Table 5.

II. Other Medical Observations in the Highlands

The expedition spent almost two months in country more than 9000 ft. above sea level west of the upper Kali Gandaki valley. In more than a hundred miles of travel through this barren land we passed through only six villages, including Sangdah, populated by about 500 persons. They were separated from each other by stretches of 10 or more miles of uninhabited mountains, plateaus, and gorges. A few level sites were occupied by ruins of abandoned villages; others held the temporary yurt encampments of refugees from Tibet, of whom we met about 50.

The general description of Sangdah applies to Tirigaon, Dangarjong, and other Bhotian villages we visited, except that none of the others happened to be double villages. In Tirigaon and Dangarjong portions of the population were examined for goitre, and the status of smallpox vaccination was also assessed in the two communities.

a) *Tirigaon*

Seventy persons live in this purely Bhotian community perched on a bluff above the Kali Gandaki river. At 9,300 ft. it is the lowest Bhotian village found in the region.

On November 17 the writer conducted a dispensary in Tirigaon, encouraging all those with complaints of any kind to appear for examination. Twenty-six (11 females, 15 males) of the 70 residents were examined, and the range of complaints and physical findings was similar to that in Sangdah. Periodontal disease was again very common.

Thyroid glands were examined in the course of physical examination (Table 6). Although the sample is small, the results are striking. Only one person made a specific complaint referable to the thyroid—of unsightliness due to its great size. The

Age	Number		Per Cent With Goitre
	Examined	Goitre	
0–5	2	0	—
6–12	4	1	25
13–18	4	1	25
Over 19	16	14	88
	26	16	62

Table 6. Tirigaon Goitre Survey (26 villagers).

finding of goitre was incidental in the villagers who visited the dispensary for other complaints. Fourteen of the 16 adults examined had enlarged thyroids; only 2 of 10 younger persons were so affected. Of the 16 goitres 5 were in females, 11 in males. In addition, the gland of one adult was doubtfully normal. All glands were diffusely enlarged except for that in a 70-year-old man, an asymmetrically enlarged nodular goitre. A 30-year-old man with a Group II enlargement was a deaf mute, and a 10-year-old boy, one of the two children with goitre, was a cretin.

The extent of smallpox vaccination was inquired about, and those who came to the dispensary were examined for vaccination scars. In this respect, Tirigaon differed strikingly from the more remote community of Sangdah. Tirigaon, near a major north-south trade route, had been visited several times by government vaccinators. Thirteen of 15 females and 8 of 10 males examined had vaccination scars. Several villagers assured us that "almost everyone" had been vaccinated.

b) *Dangarjong*

In this Bhotian village, with a population of 160, standing at 10,200 ft. on a slope about a mile west of the Kali Gandaki, the people seemed as healthy as those in Tirigaon. The goitre rate appeared to be high, although again the sample was small, and many, if not most, of the villagers had been vaccinated against smallpox. A government vaccinator had visited the village

Age	Number		Per Cent With Goitre
	Examined	Goitre	
0–5	4	0	—
6–12	4	1	25
13–18	7	4	57
Over 19	11	9	82
	26	14	54

Table 7. Dangarjong Goitre Survey (26 villagers).

in 1956 and vaccinated "everyone." On each of the dozen arms there was time to examine was a large single vaccination scar. The vaccinator had used the multiple puncture technique with vaccine apparently kept fresh in spite of the long journey from Pokhara.

On October 9, 26 villagers (16 females, 10 males) were selected at random for thyroid gland examination from a crowd gathered to watch expedition activities. The results of this small sampling are similar to those in Tirigaon (Table 7). No nodular goitres, cretins, or deaf-mutes were seen in this group. Of the 14 goitres, 9 were in females, 5 in males.

c) *Other Bhotian villages*

Other villages, such as Mukutgaon and Tarengaon, were even more remote than Sangdah. Limited observations in these places revealed that goitre was almost as prevalent as in Sangdah, and that smallpox vaccination was limited to those few villagers whose travels south and east had brought them in contact with vaccinators. These people were not conspicuously affected by diarrheal-dysenteric or pulmonary disease. No additional cases of Lumpek knee were noted. Periodontal disease was common.

No systematic examinations were made of refugees from Tibet encountered by the expedition.[15] Our impression was

[15] Following the flight of the Dalai Lama from Tibet in March, 1959, many thousands of Tibetans fled their country in subsequent months, crossing into Nepal and India at many border points.

that their health was similar to that of the Bhotians. None of a small group observed near Tekochen La in the Kanjiroba Himal had been vaccinated.

d) *Medical facilities*

There are no hospitals, dispensaries, or physicians in the Himalayan and plateau regions of central and western Nepal. The nearest medical care, at hospitals in Pokhara and Tansen, is many days and miles south over difficult trails. Few sick highland villagers could afford to be transported to these hospitals; few of the seriously ill could stand the rigors of the trip. The sick Bhotian relies, and for lack of an alternative must rely, on local remedies, herbs, and ointments, administered by one of his fellows.

III. Notes on Health and Medical Facilities in the Foothills of Central Nepal

The expedition spent almost a month in the foothills of the Himalayas, first in walking north through the Kali Gandaki gorges, and later in walking out from Tukucha to Pokhara (Fig. 1). Since 1949, when Taylor visited this region, facilities for medical care have been substantially improved. These will be described below; some of the most prevalent diseases encountered in central Nepal will also be touched on.

West of Katmandu were two active mission hospitals: one in Tansen (Tansing), about 35 miles north of the Indian border, the other in Pokhara, a large town about 100 miles west of Katmandu, connected with it by a regular air service. In Pokhara a small hospital, staffed by one physician and no nurses, was supported by the Gurkha Welfare Fund. In addition to these three hospitals, small government dispensaries, staffed by compounders trained in India, were established in several towns such as Riri Bazar and Baglung. In Tukucha, the principal trade center of the northern Kali Gandaki valley, the only person with any medical skills was a Lama, trained in

compounding in Benares and in Tibetan traditional medicine in Lhasa. In the Terai, the narrow lowland border strip separating the foothills from India, there were additional facilities, small hospitals and/or dispensaries, in several towns. Two preventive services have appeared in the region: periodic visits by government smallpox vaccinators, and in some of the larger communities, such as Pokhara, modest mosquito control efforts aimed at malaria. A country-wide malaria eradication campaign was just getting under way in 1959.

The United Mission Hospital in Tansen had about 40 beds, in four wards, allocated equally to males and females, in September, 1959. The plant consisted of an operating room, laboratory, X-ray unit, pharmacy, shop, power-generating unit, and storerooms. Another building, to house 40 more beds, was under construction. A busy outpatient clinic (123 patients were seen the day we were there) was open five days a week. Maternal and well-baby clinics were held in another building in the center of town. The staff at full strength included three American and European physicians, a few American, European, and locally trained nurses, and a few technicians. Once a month a Tansen physician visited a leprosy institution, several days' walk from Tansen, to attend the 200 patients there. According to conversations with the staff, tuberculosis, the dysenteric diseases, typhoid fever, malaria, and leprosy were the most prevalent diseases seen at the hospital. Genito-urinary tract infections, kala-azar, eye infections, and fractures were also commonly seen.

In Pokhara the hospital operated by the Nepal Evangelistic Band consisted, in December 1959, of five aluminum huts and three constructed of local materials. Two new metal huts being erected were expected to raise the bed capacity from 22 to 40. Two wards for tuberculosis patients were being planned. The hospital was also maintaining a 30-bed leprosy unit in another part of Pokhara, and many ambulatory leprosy patients living in the town were being treated in the outpatient clinic. The staff consisted of three European physicians and

five European nurses. Another physician and two nurses were expected to join the staff. The ward turnover was about 400 patients a year; about 17,000 patient visits were made to the outpatient department in a year.

The most frequently encountered disease was tuberculosis, usually pulmonary, but in many cases abdominal. Patients with pulmonary tuberculosis were rarely hospitalized; they were boarded in town and followed in the clinic. Typhoid fever, diarrheal and dysenteric diseases, and leprosy followed tuberculosis in prevalence, according to the staff. Malaria, although less prevalent than in the past, remained troublesome. Cases of kala-azar were seen frequently, and complicated cases of mumps, measles, chickenpox, and whooping cough. There had been no smallpox in Pokhara in the preceding years, and cholera had not appeared there.

Tukucha, 8,500 ft. above sea level in a cool, windy valley on the edge of the highlands, is above the malaria zone (transmission stops at about 6,000 ft. according to World Health Organization entomologists in Katmandu). The Lama compounder described the commoner diseases in that community. Of those he was called on to treat, the most severe and prevalent were those of the chest—tuberculosis, pneumonia, asthma. Gonorrhea, dysentery, typhoid fever, eye infections, "dropsy" (heart disease), and arthritis or rheumatism followed roughly in that order. Leprosy and kala-azar were not found in Tukucha.

In the central Nepal foothills, at least in and around Tansen, Pokhara, and Tukucha, tuberculosis is the most prevalent disease. Malaria, the dysenteric diseases (including amebiasis), typhoid fever, and leprosy, not necessarily in that order, follow in importance in the Pokhara and Tansen areas. In Tukucha, a transitional area between the lowland foothills and the high Himalayas, leprosy and malaria are absent. They are replaced by gonorrhea, eye infections, and "dropsy" as prevalent and serious diseases. In the lowland foothills, but not in the area represented by Tukucha, kala-azar is also common. Asthma was said to be troublesome in Tukucha, but not in Tansen or

Pokhara. In all three areas goitre is less prevalent than in the highlands.

Summary

It was feasible to make certain medical observations among some seldom visited highland villagers in central Nepal in the course of the American Himalayan Expedition in 1959. The most thoroughly observed population was that in Sangdah, a Bhotian village over 12,000 ft. above sea level and 11 miles south of Tibet. Periodontal disease, endemic goitre, and bone and joint conditions were the most conspicuous ailments among 51 villagers examined and questioned with the help of interpreters. Goitre was not seen in villagers under age 15, but 62 per cent of those over 15 were affected. The people of Sangdah were far more free from pulmonary, ocular, and gastro-intestinal diseases than villagers in the foothills only a few miles away. Only 11 of 51 had been vaccinated against smallpox. In general the villagers in Sangdah and other remote highland communities in the region enjoy good health, despite the prevalent endemic goitre and lack of any medical care. The Sangdah villagers' diet was adequate in most respects in spite of the rigorous environment. Bhotian villagers closer to the Kali Gandaki valley, a north-south trade route, had been more extensively vaccinated, reflecting the accessibility of their communities to government vaccinators. The disease patterns in these villages resembled that in Sangdah, although small surveys suggested even higher goitre rates (82 and 88 per cent respectively of those adults examined).

In the foothills of central Nepal medical care was more readily available, and the disease patterns were entirely different. Tuberculosis was probably the most prevalent disease. Other highly prevalent and serious diseases included leprosy, malaria, the dysenteric diseases (including amebiasis), typhoid fever, kala-azar, eye infections, and genito-urinary tract infections. There were well-staffed hospitals in Tansen and Pokhara, and the interest in developing or improving medical care was growing throughout the region.