Primary Health Care for Isolated Indians in Northwestern Ontario

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THE NORTHWESTERN CORNER of the Province of Ontario, Canada, is a sparsely populated region of forests and lakes north of the 50th parallel. The population, predominantly Native Indian (Cree and Ojibwa), lives in isolated villages of 50–1,500 people. These villages are accessible only by air or by arduous canoe journeys (see map). The historical development of these communities has been studied extensively by anthropologists (*1–4*). The Crees and Ojibwas—seminomadic hunters-gatherers—became involved with fur traders in the 17th century and underwent fundamental social and economic changes. These changes were accelerated in the post-World War II years, when wage employment and dependence on government subsidies progressively replaced the traditional mode of living off the land.

No organized health services were available for the Indians in the region before World War II. After 1905, when the Canadian Government signed Treaty No. 9 with the region's Indian bands, a Treaty Party consisting of Indian Affairs officials visited all the settlements once a year. While the Indian agent distributed treaty money, settled various affairs with the chiefs and councils, and police officers dispensed justice and solved crimes, the accompanying physicians examined all who ventured forward, X-rayed their chests for tuberculosis, vaccinated them against smallpox, performed minor surgery, extracted teeth when necessary, and performed as many other functions as possible. During the rest of the year, the people obtained medical care from indigenous healers, traders, and missionaries.

In 1949, the Canadian Department of National Health and Welfare opened a 70-bed hospital in the town of Sioux Lookout and a network of nursing stations and health stations to the north. Over the years, the range of services in these facilities has been expanded and improved. Since 1969, the University of Toronto medical school has been providing permanent medical staff, visiting specialists, and other health professionals to the region (*5–7*).

In this paper, I describe the delivery of primary health care services in a region of isolated villages. The experience in northwestern Ontario should be of interest to health professionals who provide services to people in isolated and underdeveloped areas worldwide. After reviewing the health status of the population, I outline the organization of the health care system and the kinds of services provided. Since geographic isolation is an important barrier to medical care, I discuss in detail the use of transportation and communication facilities. Finally, I use data from a community health survey to evaluate the effectiveness of the mode of health care delivery in the region.

Health Status of the Population

Available health statistics from the region indicate that the Indian population generally fares poorly when compared with the remainder of the Canadian population. The Indian population is young and rapidly increasing,

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at an annual rate of 2.6 percent. According to the 1971 census, about 49 percent of the Indian population was under 15 years old. Thus, both the population growth rate and age structure resemble those of the developing countries in the Third World. The average infant mortality rate during the 1970s was 47 per 1,000 live births, almost 3 times the national rate. Diarrheal diseases accounted for 10 percent of all infant deaths. About 40 percent of the deaths of persons of all ages were the result of violence and accidents. Although exact figures were not readily available, alcohol abuse was implicated or directly involved in the majority of these deaths. Respiratory diseases such as pneumonia ranked second in importance. A high proportion of hospital admissions and visits to ambulatory clinics was due to respiratory, infective, and skin diseases. The average annual incidence of tuberculosis in the 1970s was an alarming 230 per 100,000 population, compared with only 17 per 100,000 for Canadians excluding Indians and Inuit (*8,9*).

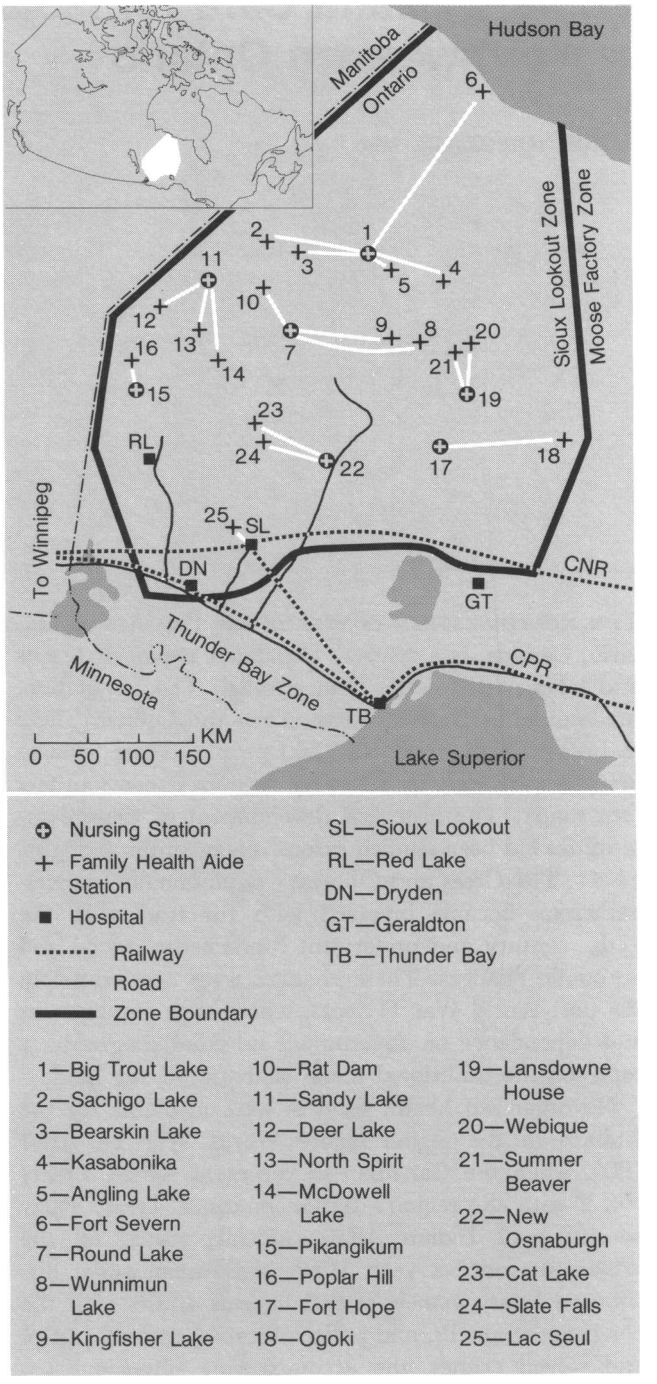
Environmental and socioeconomic conditions are important contributory factors to the poor health status of the population. A safe water supply, waste and refuse disposal, and electricity are not available in most of the isolated communities, and housing is generally inadequate and overcrowded. Income from the traditional pursuits of hunting, fishing, and trapping has declined greatly in recent years, but wage employment on the Indian Reserves is available to only a few people. Chronic unemployment and dependence on social assistance have become a way of life for the majority of residents in these communities.

Organization of Health Services

The Federal Department of National Health and Welfare is responsible for health services for Canadian Indians. For administrative purposes, the country is divided into regions (which correspond generally to Provincial boundaries) and smaller subunits called zones. The Sioux Lookout Zone in northwestern Ontario covers some 385,000 square kilometers, extending from north of the Canadian National Railway line to the shore of Hudson Bay. About 10,000 Indians live within that zone's boundaries. About 8,000 inhabit 25 scattered, remote communities, and the remaining 2,000 live in settlements along the railway and highway to the south as well as in several small mining and logging towns. My primary focus here is on health services in the 25 isolated communities.

The administrative center of the zone is the 70-bed hospital in the town of Sioux Lookout. The zone also has two kinds of field facilities—nursing stations and health stations. Seven communities with populations

The Sioux Lookout Zone



of more than 300 have nursing stations staffed with 2 to 4 outpost nurses who have received additional public health, midwifery, or nurse practitioner training. A nursing station consists of a clinic, office, simple laboratory, X-ray unit, two to five holding beds for patients requiring observation or awaiting evacuation to a hospital, and living quarters for the nurses. The 18 smaller communities have health stations staffed by native health auxiliaries called family health aides.

These workers, who have various kinds of training, experience, and educational backgrounds, are selected from the community to provide primary care services between visits by nurses and physicians. Each nursing station is responsible for one to five communities with health stations. The facilities in the health stations are considerably simpler than those in the nursing stations; they usually consist of a clinic in a community school or in a cabin.

Physicians from the base hospital visit all the outlying communities, in turn, at regular intervals; they usually see patients on referral from nurses or health aides. Many functions normally performed by physicians (such as prescribing antibiotics, suturing, and other medical procedures) are by necessity carried out by nurses and health aides. Although public health activities are emphasized for these health workers, much of their time is devoted to curative services. Communication between the various levels of health workers has been by high-frequency radio. Since the mid-1970s, however, telephone services via satellite gradually have become available, but not all communities are covered. Transportation is almost exclusively by small bush planes chartered from private companies. Only the larger communities have airstrips. Airplanes equipped with floats in the summer and skis in the winter have to land on lakes or rivers near the smaller villages. Patients needing tertiary care are sent to hospitals in Dryden, 95 kilometers from Sioux Lookout; Thunder Bay, 390 kilometers; Winnipeg, 440 kilometers; and Toronto, 1,200 kilometers.

The great distances between communities and the constant dependence on favorable weather for flying pose serious obstacles to the delivery of health services. From the percentage distribution of the population in the zone by distance from the nearest medical facility shown in the following table, it can be seen that more than 85 percent of the people live farther than 100 kilometers from the nearest hospital, and only slightly more than half live within 20 kilometers of a nursing station.

Distance (air kilometers)	*Percent of population*	
	Nursing station	*Hospital*
0–19	54.5	....
20–99	28.6	13.3
100–199	14.5	20.2
200–399	2.4	43.3
400–499	....	20.8
500–800	....	2.4

One community, Fort Severn on the Hudson Bay coast, is 750 kilometers from the base hospital. Only one community, New Osnaburgh, has access to the hospital by an all-weather road.

Health Expenditures

The operation of a health care system for this geographically scattered population requires a high level of financial resources. Although the zone is similar in some respects to the rural areas of many developing countries, the annual per capita health expenditure in the Sioux Lookout Zone is 50–100 times that of most developing countries. In the late 1970s, the total expenditures for the zone averaged Can$4.5 million a year. According to an economic analysis of the 1973–74 fiscal year data by Ruderman (*10*), the base hospital and the field facilities each accounted for about half of the total expenditures. Transportation of patients and health personnel accounted for almost 15 percent of the budget. The per capita health expenditure, after various adjustments, was Can$397 for 1973. This figure compared favorably with the Can$372 per capita for the whole of Canada for that year (*11*).

Communication and Transportation Systems

Analysis of clinic logs in the 25 communities during a 6-month period, from September 1977 to February 1978, indicated that of the 23,394 patient encounters, 2.8 percent involved the use of some mode of telecommunication, and 1.6 percent resulted in the transfer of patients to a hospital. Table 1 presents data on the use of telecommunications and transportation facilities initiated by physicians, nurses, and health aides. The data refer only to the centripetal (community to hospital) direction of flow. Personnel with the most training (physicians) used telecommunication facilities the least, whereas the health aides required consultation for 7.7 percent of the patient encounters. On the other hand, the use of transportation facilities was not influenced by the type of training of the health worker. (Collection of these data was part of the Telemedicine

Table 1. Number of patient encounters and use of communication and transportation facilities by health workers in 25 isolated communities, Sioux Lookout Zone, September 1977–February 1978

Types of health workers	*Number of patient encounters*	*Telecommunication*		*Transportation*	
		Number	*Percent*	*Number*	*Percent*
Aides	4,555	351	7.7	89	2.0
Nurses	17,414	280	1.6	245	1.4
Physicians	1,425	12	0.8	37	2.6
Total	23,394	643	2.8	371	1.6

SOURCE: Unpublished data from Telemedicine Project (principal investigators: E. Dunn, University of Toronto, and D. Conrath, University of Waterloo.)

Project of the Universities of Toronto and Waterloo (*12,13*).)

Some characteristics of emergency air evacuation were studied further. Data for 1976–77 were collected from the transportation log book kept in the emergency department of the hospital in Sioux Lookout. During these 2 years, a total of 2,951 patients from the 25 communities were flown to the hospital for a variety of medical reasons; 12.8 percent of these were classified as emergency evacuations. Emergency evacuations were defined arbitrarily as those requiring a land ambulance at the Sioux Lookout airport to complete the patient's journey to the hospital; however, this operational definition is not entirely satisfactory because although some conditions (such as eye injuries) may have serious consequences, they do not require transporting the patient by stretcher. From the age-sex distribution of emergency patients shown in table 2, it is evident that a large number of such evacuations were for women in their reproductive years.

About 86 percent of the people evacuated were eventually admitted into the base hospital upon arrival at Sioux Lookout; 12 percent were transferred to tertiary care hospitals under the care of medical-surgical specialists within 24 hours of their arrival, and only 2 percent were deemed well enough to be lodged in a nearby hostel without medical supervision.

Among children under age 15, acute respiratory problems and trauma constituted half of all emergency evacuations to the hospital. Abdominal pain, convulsions, and dehydration from diarrhea were next in importance. A different spectrum of problems was found in the over-15 age group; women with obstetrical problems accounted for 36 percent of the evacuations. Examination of the causes for this large group of women revealed that about half were simply in labor, a reflection of the zone's policy of requiring all deliveries, whenever possible, to take place in the hospital. Because of poor socioeconomic conditions, lack of prenatal care, and the large numbers of elderly multiparous and of teenage primigravida women, the population is considered to be at high risk obstetrically. The distance involved and the impossibility of predicting accurately the date of expected delivery pose a dilemma for the field nurses. From time to time, deliveries take place on the dock or in the back of a Cessna-180 aircraft. Miscalculated dates not only result in delays in evacuating patients when pregnancy is at term, but also in resentment by patients when delivery fails to materialize after a long wait in the hospital.

Accidents and injuries, important causes of both mortality and morbidity, accounted for about 20 percent of the evacuations in the over-15 age group. Abdominal pain, always a surgical emergency, ranked third.

A nurse teaches a health aide how to examine a child

Use of Primary Care Services

In addition to data collected from ambulatory care records, use of health services can be determined from community health surveys. In 1972–73, a health survey of a 20 percent random sample of the population of the isolated communities was conducted in the Sioux Lookout Zone under the direction of R. F. Badgley of the Department of Behavioral Science, University of Toronto. The survey included health history, physical examination, and selected anthropometric and laboratory tests. While the main purpose of the survey was to determine the health status

Table 2. Age-sex distribution of emergency air evacuation patients at Sioux Lookout hospital, 1976–77

Age group (years)	Males		Females		Total	
	Number	Percent	Number	Percent	Number	Percent
Under 1	13	3.4	12	3.2	25	6.6
1–14	36	9.5	20	5.3	56	14.8
15–24	26	6.9	83	22.0	109	28.9
25–44	25	6.6	89	23.6	114	30.2
45–64	22	5.8	16	4.2	38	10.0
65 and over	16	4.2	20	5.3	36	9.5
Total	138	36.4	240	63.6	378	100.0

of the population (I have reported a preliminary analysis (9)), the responses to several questions in the survey also provide information on the pattern of use of health services in the communities.

Table 3 lists the rate of use of health services by respondents who reported being sick during the recall period. About half of those who were sick actually used the available services. More females than males used the services ($\chi^2 = 6.9, P < 0.5$). The distribution of users in the various age groups followed a U-shaped pattern, with higher user rates among the very young and the very old and the lowest rates among young adults ($\chi^2 = 39, P < 0.5$). When all three types of health workers consulted were considered together, residents in communities with nursing stations were just as likely to use some kind of health services as those living in the smaller satellite communities ($\chi^2 = 0.35$, not significant). A higher educational level appeared to be associated with a lower use rate, but education was found to be a spurious variable because older people tended to have fewer years of formal schooling than the younger members of the community. In fact, of those people surveyed whose education was known, no one over 65 years had had any schooling and only a handful of adults over 45 had a smattering of schooling. On the other hand, most of the young adults had at least grade 4 education. When age groups were considered separately, the effect of education on the prevalence of sickness and the use of health services disappeared.

Table 3. Sioux Lookout Zone health survey: response to "Have you received any help for a health problem in the past 2 weeks from the Indian Health Services?"

Respondents' sex, age, education, and health facilities	Number of respondents	Percent respondents	
		Reported sick	Used services
Males	485	39.8	20.8
Females	568	44.5	27.8
Total	1,053	42.4	24.6
Age group (years):			
Under 5	191	49.2	33.5
5–14	385	30.6	16.4
15–19	71	26.8	15.5
20–44	274	44.9	25.9
45–64	87	67.8	35.6
65 and over	45	73.3	42.2
Education (age 15 and over):			
None	215	60.0	34.4
Grades 1–3	63	41.3	25.4
Grades 4–7	72	37.5	23.6
Grades 8 or higher	94	35.1	17.0
Health facilities:			
Nursing stations	529	42.7	23.8
Health stations	524	42.0	25.4

Based on the findings from the Sioux Lookout Zone survey, the relative frequencies of respondents' contacts with health personnel were as follows (57.6 percent did not report being sick during the 2-week recall period):

Contact	Percent of respondents
Reported being sick	42.4
No contact with health service	17.8
Did not seek help	13.5
Sought but did not receive help	4.3
Contact with health service	24.6
Nurses	13.5
Health aides	6.7
Physicians who traveled to communities	3.1
Hospitalized	0.4

The fact that only 4.3 percent of the respondents who were sick could not obtain help from any source is a tribute to the general availability of primary care services despite geographic obstacles.

About one-third of the respondents used some kind of drug—including all substances used for medicinal purposes, whether prescription, proprietary, or traditional. More than 70 percent of the users received their drugs through the government health service, and fewer than 30 percent bought their own from commercial stores in their villages. Only 0.6 percent admitted to using drugs from "traditional" sources. From my experience and observations, this proportion most likely represents gross underreporting. Generally, the use of drugs followed a U-shaped pattern in age-sex distribution similar to that for the use of health services in general. When age is controlled for, no association exists between drug use and educational level.

A Comparison of Health Outcomes

The 25 Indian communities in the Sioux Lookout Zone fall into two well-defined groups: communities with nursing stations and those with only health stations, or satellites. The two groups—4,500 people in the 7 communities with nursing stations and 3,500 in the 18 satellites—provide the framework for an "experiment." They differ markedly in medical facilities and primary medical contact but are similar in demographic and socioeconomic characteristics. The members of both types of communities belong to the same cultural and linguistic group, and they are similar in age-sex structure. Environmental conditions, in terms of topography and climate, do not differ appreciably. Housing and sanitation standards are similarly deficient in both types of communities, and income and educational levels are also comparable.

Various health status indicators, derived from both census and operations data, can be compared for the communities (table 4). With the exception of birth rate, all the other indicators—crude death, infant mortality, accidental death, hospital admission, and tuberculosis incidence rates were not significantly different between the two types of communities. Yet, the medical services available to the two groups were quite different. The nursing station communities had more physician visits on the average than the satellites. The mean number of physician-days per 1,000 population per year for 1971 to 1976 was 89.6 in nursing station communities, in contrast to only 49.8 in the satellites ($F = 28.8$, $P < .05$). The resident personnel providing primary care services in the satellites are indigenous auxiliaries with much less training and education than the nurses stationed in the larger communities. The nurses are usually university-level graduates with additional clinical training. Nursing stations are in fact mini-hospitals with far better equipment and facilities than the health stations in the satellites.

Further intra-zone comparisons can be made from the health survey data mentioned earlier. The mean rates of various survey-based health indicators were also compiled for the two types of communities (table 5). No significant differences could be found in the prevalence of sickness among respondents during the recall period, nor in the distribution of health status categories rated by the respondents themselves or clinically determined by the physician-examiner. The only significant difference was in the percentage of people requiring attention from a nurse for abnormalities discovered during the survey examination. This percentage was higher in the nursing station communities than in the satellites. However, for more serious conditions requiring the attention of a physician, no significant difference was seen.

Table 4. Vital statistics and morbidity data for 7 communities with nursing stations and for 18 with health stations, by 8-year mean rate (1970–77), Sioux Lookout Zone

Indicator	Nursing stations	Health stations	F value
Births per 1,000 population	39.7	33.6	[1]12.0
Deaths per 1,000 population	6.1	6.7	0.6
Infant mortality rate	44.7	44.6	0.0
Accidental deaths per 1,000 population	1.6	2.6	2.6
Hospitalizations per 1,000 population	180.8	155.5	4.8
New and reactivated tuberculosis cases per 100,000 population	267.0	228.8	0.3

[1] $P<0.5$; all remaining F values are not statistically significant.

One can conclude that the type of medical care input had little impact on the health status of the community, as determined by various available indicators based on both survey data and mortality and morbidity statistics. However, one should be cautioned that the indicators used were crude, and the survey may have been too limited in time and scope to project the effects on health status operating over a period of years. Even so, based on available information, the less sophisticated medical care given to residents of satellite communities did not have a noticeable effect on their health status. The implication for the organization of health services in an isolated region such as the Sioux Lookout Zone is that the most crucial factor in the delivery of services in all communities may be the assurance of basic primary care by workers other than physicians, with support from the communication and transportation systems. More intensive medical input in the form of more frequent visits by physicians or more sophisticated stationary health facilities is not likely to improve health status significantly. The health outcomes of the people studied indicate that indigenous health auxiliaries can provide just as effective services.

Discussion

Health care delivery in the Sioux Lookout Zone in northwestern Ontario is characterized by the following features:

- It serves a population composed of scattered, isolated Indian communities with socioeconomic and health

Table 5. Health status of respondents in 7 communities with nursing stations and those in 18 communities with health stations, Sioux Lookout Zone health survey

Indicator	Percent respondents: Nursing stations (N = 529)	Percent respondents: Health stations (N = 524)	Chi-square
Sick in past 2 weeks	42.7	42.0	0.2
Self-rating of health status:			
Good	76.8	77.7	
Fair	20.8	20.3	
Poor	2.4	2.0	0.3
Examiner's clinical summary:			
No deviations	1.7	4.2	
Minor deviations	27.3	30.3	
Deviations requiring treatment	70.0	64.6	
Deviations under treatment	1.0	0.8	5.6
Deviations requiring consultation with physician	19.8	23.0	1.0
Deviations requiring consultation with nurse	32.1	20.5	[1]11.7

[1] $P < 0.5$; all remaining chi-squares are not statistically significant.

status significantly poorer than that of the general population in Canada.

- It employs extensively nurses with an expanded role and indigenous health auxiliaries to provide primary care services in the communities.
- It depends heavily on the transportation and communication systems to provide support to the various levels of field facilities and personnel.

These features are by no means unique; they can be found in many parts of the world, including the underdeveloped rural areas within North America (*14,15*). The use of lower-level physician extenders or substitutes has been advocated by the World Health Organization, based on successful models in several countries (*16*). However, the use of physician extenders in the affluent industralized countries has been criticized by some. Roemer (*17*) noted that in these countries, which have far more economic resources than the developing countries, physician extenders are used almost exclusively among the urban and rural poor. He contended that such social inequity stems from the developed countries' unwillingness to train primary care physicians and their failure to require such physicians to serve in places of need. However, in a region such as the Sioux Lookout Zone the alternatives to using physician extenders would be to place physicians in each of the small settlements with populations ranging from 50 to 1,500 or evacuating every patient with a medical complaint to the nearest physician, who in this case might be anywhere from 40 to 750 kilometers away. Even if financial resources and physician supply were unlimited, such a mode of health care delivery would be inappropriate and indeed economically absurd. The Sioux Lookout Zone demonstrates that, despite geographic obstacles, primary health care services can be made available and accessible to the great majority of the region's inhabitants at a per capita cost that compares favorably with that for Canadians nationally. Although the questions of "quality of care" and "effectiveness" are not easily answered, at least in terms of certain health indicators, communities served by indigenous health aides do not appear to be different from communities served by better-trained nurses working in more elaborate facilities with more frequent physician visits.

Finally, primary health care services should not be delivered in isolation from general socioeconomic development and improvement in environmental conditions, if the greatest impact on health status is to be achieved. While the University of Toronto medical school was involved jointly with the Federal Government in the Sioux Lookout Zone in the 1970s, perhaps a lesson can be learned from an earlier example of a university project in Indian health. The results of studies from the Cornell-Navajo project in the 1960s indicate that despite the physician-intensive, richly endowed program, its impact on the health status of the population was negligible (*18*). The dominant causes of morbidity and mortality in Indian communities, whether in northwestern Ontario or the southwestern United States, require other than purely medical remedies.

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