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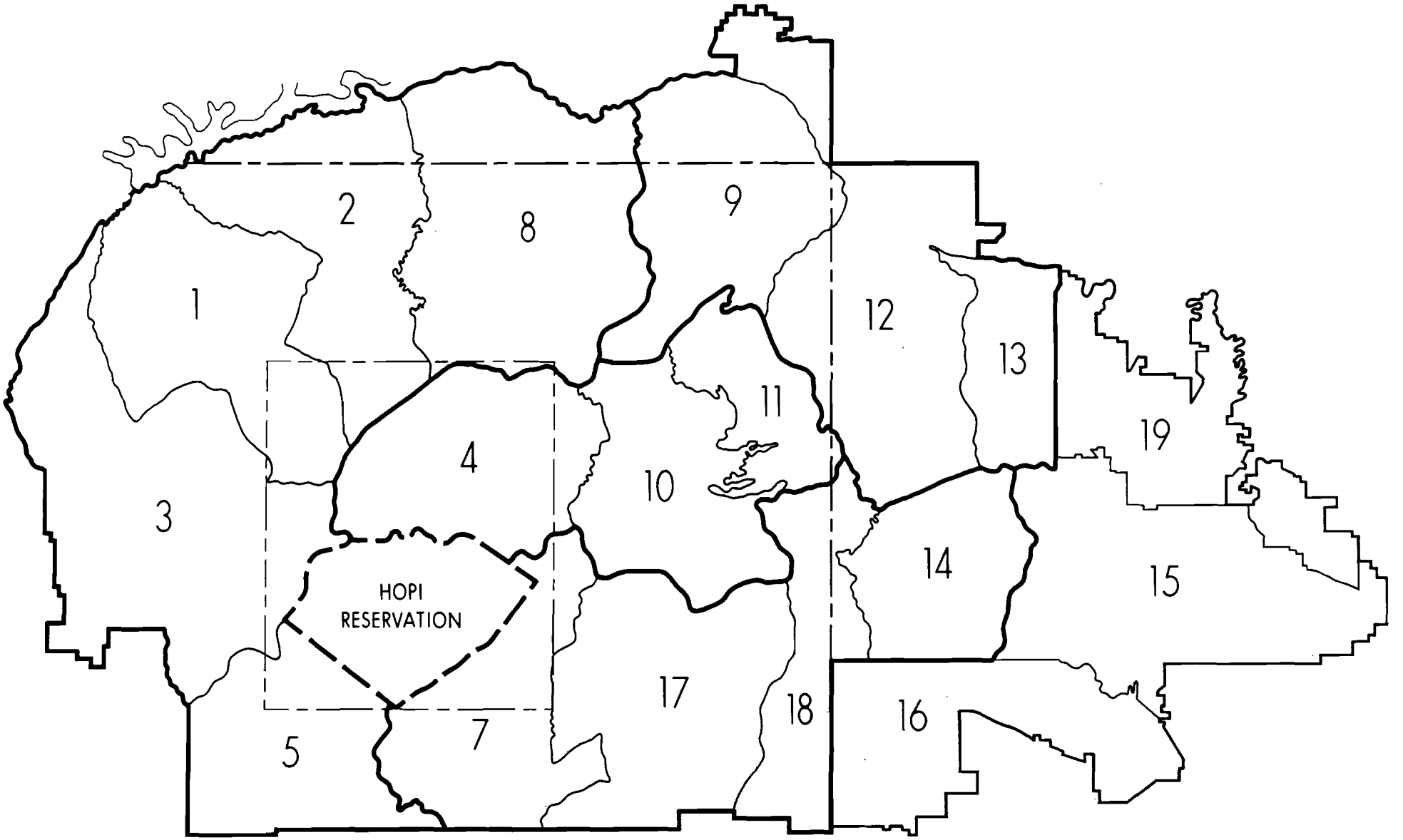
LAND MANAGEMENT DISTRICTS ON THE NAVAJO INDIAN RESERVATION



ABSTRACT

Summary of Findings and Recommendations

Over the past forty years, the rate of hospital admissions on the Navajo Reservation has been responsive to changes in both health care facilities and disease patterns. In general, changes in the latter have been along the same lines as in many other populations: as acute infectious diseases have declined, man-made and degenerative diseases have emerged to a more prominent position.

As crude mortality rates (number of deaths per 1,000 population) have fallen since the late 1930s, the proportionate contribution to mortality of accidents has more than doubled whereas gastro-intestinal and respiratory diseases, primarily infectious in origin, have declined by more than half. The same shifting diagnostic pattern is observed when hospital discharges are examined. Between 1959 and 1968, even as the number of hospitalizations increased rapidly due to increased availability of care, the proportion of cases diagnosed as due to infectious and parasitic causes declined. From 1968 through 1977, as the number of hospitalizations reached a plateau, the absolute number as well as proportion of cases due to infectious and parasitic disease both declined. Hospitalization due to accidents followed a different course: they increased both absolutely and relatively between 1959 and 1968 and remained essentially unchanged between 1968 and 1977. Closer scrutiny of discharge data from 1972-1978 and analysis of police records of automobile accident fatalities on the Reservation both support the impression that the accident rate may have reached a plateau sometime in the early 1970s.

The age distribution of patients has also changed over the past twenty years or so. Between 1959 and 1977 the proportion of patients ten years of age and under declined from 32.5 to 22.0 percent. The proportion 65 and above increased from 6.1 to 8.2 percent. The decrease in pediatric admissions reflects both the decline in crude birth rates during the period and improved child health, which is also seen in the decline in infant mortality rates and in the number of children with diagnoses of severe malnutrition. The gradual increase in both the relative and absolute numbers of admissions of elderly people reflects the increase in the number of elderly in the population and, as we shall suggest below, other aspects of social change.

More detailed analysis of hospital utilization was possible using economic survey data and IHS records from the 1970s aggregated by land management district of residence of patients. The technique used for analysing the data was stepwise multiple regression. We used a number of different socio-economic variables as well as distance from the nearest hospital as independent variables and several different measures of hospital utilization as dependent variables.

The first dependent variable examined was the average annual (1972-1976) hospitalization rate for the population of each land management district. It was found that the variation in rates was best explained by the average distance of each population from the nearest hospital: the further a land management district is from a hospital, the lower the rate of hospitalization. The next variable of importance was the proportion of men working full time: that is, once distance is controlled, the higher the proportion of fully employed men, the lower the hospital-

ization rate. Finally, with the first two variables controlled, the smaller the average household size, the higher the rate. Thus, it appears that access to a hospital is especially important, but once that factor is taken into account, the people living in communities dependent largely upon wage work are likely to be healthier than those living in communities where wage work is not available. Lastly, small families may not be able to care for sick members at home and may therefore be more likely to depend upon a hospital to provide services once provided by the family itself.

A similar analysis was done using average age of patients from each land management district as the dependent variable. Again distance is important. The greater the distance from a hospital offering surgery, the older the patients. Subsequent independent variables of importance are a measure of involvement in wage work and average age of male household heads in each land management district. The higher the proportion of family income derived from wage work, or the lower the proportion derived from welfare, the older the average age of patients. And the older the average age of male household heads, the older the patients. It appears that people from more remote communities tend to be older; and controlling for distance, the more involved in wage work population is, the older the patients. This suggests that in communities where many people have jobs, there will be fewer people available at home to take care of elderly relatives. Once again, then, the hospital may be used to provide services once provided by the family.

We then examined hospitalization rates for a number of different diagnostic categories and operative procedures. The diagnostic categories were: diarrheal disease, influenza and pneumonia, myocardial infarctions, and motor vehicle accidents. The types of surgery were cholecystectomies, appendectomies, and a number of gynecological procedures.

The independent variables which best explained admissions for diarrheal disease were the proportion of families living in hogans and the proportion of men working full time. That is, the higher the proportion living in hogans and the lower the proportion of men employed full time, the higher the rate of hospitalizations for diarrheal disease. It was also noted that within this category there was a major decrease in the number of children 1-4 years of age during the period 1972-1978.

A similar analysis was done using the rates of hospitalization for influenza and pneumonia. In this case distance to the nearest hospital is important; the greater the distance, the lower the rate. The proportion of fully employed men is also negatively related to the rate once distance is controlled: the lower the proportion, the higher the rate. Since the proportion of working males is strongly inversely related to the average age of male household heads, those areas with high rates of admission are characterized by older populations with low rates of employment.

Both diarrheal diseases and influenza and pneumonia are infectious in origin, and we had expected that they would be found in areas characterized by low levels of involvement in the wage economy. That turned out to be the case. Myocardial infarctions and motor vehicle accidents were chosen because they are examples of degenerative and man-made diseases respectively and have become increasingly important as infectious diseases

wane. We had hypothesized that hospitalization rates of people with these diagnoses would be highest in areas that are most highly involved in the wage economy. This turned out not to be the case.

With regard to myocardial infarctions, we observed no increase in the number of cases during the period 1972-1978 despite the clinical impression that such an increase had occurred. When the regional distribution of hospitalized cases was considered, distance from the nearest hospital is weakly inversely related (the greater the distance, the lower the hospitalization rate). Once distance is controlled, the proportion of men working full time is also weakly inversely related to the rate: the greater the proportion of fully employed males, the lower the rate. Since employment and age are inversely related, it is likely that lower rates are found in younger working populations. Clearly, myocardial infarctions are still not a major health problem among the Navajos, however.

Motor vehicle accidents have been of major and increasing significance over the past generation. We have suggested that the rate may have begun to level off in the early 1970s, partly as a result of the oil embargo and lower speed limits. When hospitalization rates for the population of each land management district are examined, it appears that the best explanatory variable is once again distance from the nearest hospital. With distance controlled, the proportion of men employed full time becomes significant: the higher the proportion, the lower the hospitalization rate. With these two variables controlled, average household size became important: the larger the average household in a district, the lower the rate. Large households tend to be found in

communities where the population is on the average older than in communities where small households are found. Since accidents occur mostly at younger ages, it may be that we are once again observing an age effect. Because, however, employment and age are inversely related and we have shown that the rates are lower in the populations with higher rates of full employment (i.e., younger populations), it is not clear just how important age is as a confounding variable.

The point to be made here is that myocardial infarctions and automobile accidents do not appear to be found most commonly in communities in which wage work is relatively common. We stress relatively common because in fact even in the district where full time employment of men is greatest, only 56 percent of male household heads are so occupied. Thus the hypothesis that man-made and degenerative diseases would be observed most commonly in those populations most involved in the wage economy was not confirmed, though it must be kept in mind that we have not been able to calculate age-specific rates due to lack of adequate population data. The result is that differences in age structure may well confound some of our interpretations. On the other hand, there is a relationship between the hospitalization rates for infectious diseases and lack of involvement in the wage economy.

Several different types of surgical procedure were examined in order to understand the relative differences that population characteristics and accessability might have on utilization patterns. We shall summarize these results briefly. Gall bladder surgery is best explained by access to hospitals in which surgery is done. Appendectomies are unrelated to access and no clear pattern of explanatory variables emerges.

Gynecological surgery is a very different matter. We examined bilateral tubal ligations, Caesarean sections, certain categories of hysterectomies, and induced abortions (per 1,000 deliveries for women in different age groups). We observed that among women of all ages variables related to degree of involvement in wage work were the best predictors (at the land management district level) of rates of these procedures: the greater the dependence upon wage work, the higher the rates. For younger women, access to hospitals was not an important explanatory variable whereas for older women in some instances access did enter along with socio-economic variables as of some explanatory value.

We infer from these results that changes in the Navajo population are such that new demands will be made upon the health care system as disease patterns, attitudes and the local economy change. It is based upon this inference that our recommendations are made. The decline in infectious diseases is in most populations accompanied by an increased awareness (and often an increased incidence) of diseases of a man-made or degenerative nature. This appears to have occurred on the Navajo Reservation where accidents rose sharply in the several decades after World War II. It is likely that other categories of health problems of a psycho-social nature will also become more obvious in the future, either because they really have increased in incidence and prevalence or because there is growing awareness on the part of an increasingly sophisticated population and health care system that attention may be turned to new problems as old ones wane. Thus we have suggested that services to deal with elderly chronically ill patients at home and in nursing homes be expanded; that preparation be made to deal with children

with behavioral, learning, and emotional problems referred by families and schools; and a variety of other kinds of supportive services be considered as well. Finally, we have speculated briefly that should development of large scale extractive industries on and around the Reservation increase, occupational and environmental hazards which have not yet had an impact on the health of the population will also increase.

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INTRODUCTION

The following report was designed to examine a number of hypotheses concerning changes in hospital utilization and morbidity patterns on the Navajo Reservation. The report itself is not organized around those hypotheses and includes a good deal of information that is not crucial for their examination. This introduction therefore provides a brief summary of data in the report bearing directly on the hypotheses.

1. Since 1955, outpatient utilization rates have increased whereas inpatient rates have either increased less rapidly or remained constant.

It was observed that both in terms of visits per person and in absolute volume, outpatient visits have increased rapidly since 1955. Inpatient utilization (in Navajo Area I.H.S. facilities) increased rapidly from 1955 through 1962, from 6,000 to 12,000 admissions. Between 1962 and 1975, admissions increased by only 50 percent, to about 18,000. Since 1975, the number of admissions has remained about constant.

It is reasonable to infer but impossible to prove that there is a causal relationship, with increased outpatient utilization preventing serious illnesses requiring hospitalization. Indeed, using synchronic data from Navajo Area service units, one can show that there is no relationship between the number of hospitalizations per 1,000 population and the number of clinic visits per person. Instead, number of hospitalizations is related to average number of miles from the nearest hospital, and clinic visits per person is related to the number of available clinics per person within a service unit. Many other factors in addition to the increasing availability of clinics are probably related to the slowing of hospital utilization, including better housing and improved nutritional status.

2. Distance is the most significant variable explaining hospital utilization. Other variables such as measures of economic and educational attainments are not likely to be as important.

Distance is the single best variable explaining average annual hospitalization rates (1972-1976), using land management districts as the units of analysis. In a multiple regression model, however, once distance has been controlled, socioeconomic variables are important. The proportion of men working full time in wage work is inversely related to the hospitalzation rate: the higher the proportion of employed men, the lower the hospitalization rate.

In the best three variable model, once distance and employment are controlled average household size enters as an important explanatory variable: the larger the household size, the lower the rate.

We infer that the health of families in districts with a relatively high proportion of men engaged in full time employment is better than the health of families in districts where employment is less readily available. Moreover, districts with more employment have on the average smaller households, but it may also be that in small households hospital utilization is high because of the absence of kin who might in larger households be available to take care of an ill member. Hospitals, then, may be increasingly used to provide care that might under other circumstances be provided in the home.

3. Since 1972, the patterns of discharge diagnoses have shifted so that accidents and degenerative diseases are accounting for an increasing proportion of hospitalizations.

This hypothesis was partially confirmed. In recent years there has been a decline in the absolute and relative number of hospitalizations due to infectious and parasitic (primarily diarrheal) diseases and respiratory diseases (influenza and pneumonia). The decline in diarrheal diseases is accounted for largely by a decline in discharges in the 1-4 age group.

On the other hand, discharges due to accidents have not changed impressively in recent years although since the mid-1950s the mortality rate from accidents has increased by approximately 60 percent. Myocardial infarctions are remarkably rare, a phenomenon observed by many other investigators, and the rate has not changed significantly since the early 1970s.

4. There are regional differences in discharge patterns with populations characterized by higher economic and educational levels also showing higher rates of hospitalzation for man-made and degenerative diseases.

This hypothesis too was partially confirmed. Infectious diseases (diarrheal disease and influenza and pneumonia) tend to be found in areas characterized by low socio-economic status and low involvement in the wage economy. This is especially true for diarrheal disease.

On the other hand, man-made diseases (attributed to accidents) and degenerative diseases (myocardial infarctions) are not found most commonly in areas characterized by relatively high rates of involvement in the wage work economy. It must be emphasized that it is hospitalized morbidity that is being discussed. In each case the single best explanatory variable is distance from the nearest hospital, in contrast to diarrheal

disease particularly where distance from the nearest hospital is not a significant variable.

In addition to examining the hypotheses discussed above, we analyzed data pertaining to two other issues as well: the changing age distribution of patients and variations in the utilization of different surgical procedures. With regard to the age composition of the hospitalized population, we have observed that from the time of transfer of responsibility to the I.H.S. in 1955 to the late 1960s, the proportion of patients admitted annually increased about equally in all age groups. From the late 1960s to the present, however, as the number of admissions reached a plateau, the number of admissions of children ten years of age and below decreased and the number of admissions of adults 65 and above continued its slow increase. In 1959 32.5 percent of admissions were in the younger age group and 6.1 percent in the older group. By 1977 the proportions were 22.0 and 8.1 percent respectively.

The decline in number of admissions in the pediatric age group is probably a result of improved child health and a declining birth rate. This trend is likely to continue. The increase in hospitalizations of elderly people may be the result of an increase in the proportion of elderly people in the population as well as of changes in Navajo family life such that older people are less likely now than in the past to be successfully cared for at home.

When we examined the relationship of distance from hospitals and socio-economic variables to the average age of patients from different land management districts, we observed that older patients tended to come from areas most distant from hospitals offering surgery and from

areas where dependence upon welfare is lowest and dependence upon wage work highest. In the absence of actual field observations, these data are interpreted to mean that as families move into the wage work economy, they tend to be less dependent upon kin for a variety of forms of assistance. Thus, when an elderly person becomes ill, it may be increasingly difficult to find someone in the family to provide care at home, and the hospital may be relied upon to provide nursing service. This is especially important in more remote areas from which many young people have emigrated, leaving behind an older population. The situation is exacerbated when the people who remain in the area have jobs and are therefore less likely to be at home much of the time. This is an important problem that bears further investigation. If our interpretation is correct, it has implications for the types of services that the I.H.S. and other agencies will be called upon to provide in the future. We shall return to this issue again briefly below.

With regard to the average annual rates of different forms of surgery across the Reservation, our analyses followed the same form as those described above. We attempted to assess the relative contribution of access to hospitals and socio-economic variables in explaining the rates of gallbladder surgery, appendectomies, and various types of gynecological procedures.

In general, it was found that cholecystectomies were best explained by access to a hospital providing surgery. The incidence of appendectomies was unrelated to distance and was explained best by a two variable model that included a measure of involvement in the larger society. The inference drawn was that appendicitis is ubiquitous.

On the other hand, several forms of gynecological surgery were unrelated to access to a hospital and were best explained by measures of involvement in the wage work economy. In this regard we examined hysterectomies, Caesarean sections, bilateral tubal ligations, and induced abortions. As a control, we also examined spontaneous abortions, which were best explained by measures of poverty rather than by relative affluence.

In general, then, it appears that hospitalizations for diarrheal disease and, to a lesser degree, influenza and pneumonia are related to low socio-economic status. Man-made and degenerative diseases are not related clearly to socio-economic variables. In contrast to many other studies which have examined the relationship between the incidence of surgery and the availability of surgeons, we have added additional variables related to the population served and find that only in the case of cholecystectomies is access to surgery the most significant explanatory variable. In other instances, particularly those that might reflect changing attitudes towards childbearing, we find that measures of what might be called modernization are the best explanatory variables.

Implications of the findings and recommendations

With regard to planning for hospital location, while access of under-served populations is clearly important, other factors such as housing for staff, schools for children of staff, and many other considerations will be important as well. Especially since the population appears to be very mobile, and probably will continue to be so, planning hospital location is probably not most usefully addressed with the data presented here. Moreover, as roads improve and a Reservation bus system is developed,

access may be increased regardless of where new hospitals might be located in the future.

The data presented in this report may be more appropriately used in considering the types of services that may be required. Judging by the changes we have documented in the age distribution of patients and in diagnostic categories, the following ought to be considered. With regard to children, it appears that the acute infectious diseases that have been endemic for so many years are waning in importance. The result may well be that other kinds of problems will come to the attention of the health care system, particularly emotional, behavioral, and learning difficulties -- what some pediatricians are now calling the "new morbidity". It is likely that school systems will increasingly become a source of referrals for problems that previously went unnoticed or unattended. Without making any judgement about whether it is good or bad for the health care system to assume responsibility for these conditions, it appears inevitable that demands will increase. Some thought therefore ought to be given to how they should be met: e.g., increased recruitment of school psychologists, pediatricians trained to deal with psychosocial problems, and the like.

With regard to the other end of the age spectrum, we have noted that there appears to be a relationship between increased hospital utilization by the elderly and changes in family organization. It would be important first to be certain that the relationship we have suggested in fact exists. Assuming our interpretation to be correct, however, there are likely to be increasing demands for care of the elderly chronically ill patient. Acute care hospitals may not be the best way of dealing

with such problems: alternatives such as home care and the establishment of nursing homes need to be considered. Whether the IHS or the Tribe provide these services is not the issue here. Whatever agency provides them, it is clear that personnel able and willing to provide supportive rather than curative care will need to be recruited. This would represent something of a change in focus for the I.H.S.

Furthermore, an increasing body of epidemiological work suggests that morbidity and mortality may both increase in populations in which there are few mechanisms of social support. We do not refer here only to psychiatric morbidity but to morbidity from all causes. This may be reflected in our data, but one must be cautious about over-interpreting what we have observed. The point we wish to make, however, is that the continuing migration of young families from rural hinterlands may leave the older generation with little in the way of emotional as well as more tangible forms of support, and the health care system as well as other service agencies may be increasingly called upon to deal with the problems that result.

The findings in regard to the determinants of gynecological surgery suggest that important changes are taking place in the way women (and men too, presumably) view childbearing, desired family size, the control of fertility, and the acceptability of certain symptoms and conditions as inevitable. This change, whether it is called acculturation, sophistication, or something else, is likely to be reflected in changing demands being made upon the health care system by an increasingly knowledgeable population. Such demands may cover issues already discussed -- e.g. different kinds

of pediatric and geriatric care -- as well as others such as counseling services, family planning, problems of adolescents, alcohol and substance abuse, disabled and crippled children, and so on. That is to say, the decline in acute infectious diseases coupled with an increasingly knowledgeable population may lead to increased attention being paid to problems of a psycho-social nature.

The health problems to be confronted by the Navajo population and therefore by the providers of health services in the future are not likely to be limited to those of a psycho-social nature, however. For example, already environmental consequences of the exploitation of natural resources with implications for the health of the population have emerged. We are referring to the results of uranium mining on the eastern part of the Reservation. There is every reason to expect that such problems will grow in significance, particularly if large scale extraction of natural resources becomes a reality in the future. Such possibilities, though real and important, go beyond the bounds of this report. It is worth keeping in mind, however, that occupational diseases and exposures to various environmental hazards may pose problems that have not been addressed here and have not yet developed to any significant degree.

Chapter 1: Changing Patterns of Mortality and Morbidity and the Utilization of Services.

Throughout the first half of the nineteenth century, the administration of Indian affairs was under the jurisdiction of the War Department and from time to time military physicians treated Indian patients, including giving smallpox vaccinations. In 1849, when Indian affairs were transferred to the Department of the Interior, civilian physicians were recruited and within twenty-five years about half the reservations had a physician. Services increased slowly in the latter part of the 19th century and in the first decades of the present century. Nonetheless, by the time of the Merriam Report in 1928, facilities and personnel were found to be still woefully inadequate.

From the beginning of the present century to 1940 the number of hospitals, nurses and physicians increased. The increase was most rapid in the 1930s when employment opportunities were limited elsewhere in the nation. A sharp reversal occurred after 1940 as a result of the recruitment of many health workers by the armed forces and the closing of many hospitals for lack of funds. The decline continued after the war as a result of a change in Indian policy to favor termination of their special status. In the health field this was reflected in the recommendations of the Hoover Commission that state authorities assume more control over Indian health programs, that Indian hospitals be turned into community hospitals for the treatment of all citizens, and that Indian hospitals and physicians charge fees. The result was that from 189 fulltime physicians employed in 1939, the number dropped to 102 in 1955. The number of nurses remained essentially constant, 596 and 607 respectively.

The number of dentists did increase, from 28 to 35. The number of hospitals declined from 81 to 48; total beds from 4,253 to 2,777; and the total daily average hospital census from 3,172 to 1,818.

Proposals had been made from time to time since 1919 to transfer responsibility for Indian health from the Bureau of Indian Affairs to the Public Health Service, and a number of Public Health Service physicians had been detailed to the Bureau over the years, but it wasn't until the early 1950s that such a transfer was seriously contemplated by Congress. A number of reasons were offered in support of the transfer. First, it was claimed that the recruitment of staff would improve as benefits for personnel were better in the PHS than the BIA. Second, professional medical supervision would replace lay control of health programs. Third, the full resources of the Public Health Service could be brought to bear on problems of Indian health. Fourth, it was thought that the Public Health Service might be more successful in obtaining appropriations for health programs. Fifth, it was thought that duplication of health related efforts might be diminished. Sixth, the Public Health Service was thought to have more direct access to state and local health authorities and to federal funding agencies within the Department of Health, Education and Welfare that made grants to states for a variety of health related purposes (USPHS, 1957). We might also speculate that improvement of health was seen as a necessary prerequisite before successful termination of the Indians' special status could be accomplished, similar to the reasoning behind the passage of the Navajo-Hopi Long Range Rehabilitation Act (Krug, 1948). And finally, transfer of responsibility for health care from the B.I.A. to the P.H.S. was seen by some as a means of weakening

of the hegemony of the Bureau when it became clear that states were unwilling to assume responsibility.

Since the transfer in 1955, appropriations increased from 24.5 to 155.1 million dollars in 1972 (in current dollars). The number of hospitalizations increased from 50,143 in 1955 to 102,472 in 1972 or from 150.2 to 218.2 per 1,000 population. Outpatient visits increased from 455,000 to 2,235,881; or from about 1.4 to 4.8 visits per person. And causes of mortality and hospitalized morbidity changed markedly. Table 1 shows crude death rates (per 100,000) in 1955 and 1971. Influenza and pneumonia, deaths in early infancy, and tuberculosis all decreased. Cirrhosis, diabetes, homicide, and suicide have all increased. Accidents, diseases of the heart, and neoplasms remained essentially unchanged.

Table 2 shows selected hospital discharge diagnoses in 1955 and 1972. Infective and parasitic diseases and influenza and pneumonia decreased. Neoplasms and accidents increased.

It is evident that within a relatively short period infectious diseases have declined dramatically in significance and degenerative and man-made disease have increased in significance. How much of this is due to improved health services and how much to other changes in the situation of Indians cannot be determined by these data. Almost certainly the availability of more antibiotics and staff to dispense them have had a significant impact.

Navajos' mortality rates and patterns over the past century are similar to those recorded for all American Indians. Because of the dispersed nature of settlement, however, they appear not to have suffered from epidemics to nearly the same degree as the neighboring Hopis (Kunitz,

Table 1

LEADING CAUSES OF DEATH

INDIANS AND ALASKA NATIVES IN 24 RESERVATION STATES*

	Crude Death Rates per 100,000 Pop.		Percent Change
	1971	1955	
All Causes	771.7	927.2	- 17
Accidents	157.1	155.6	+ 1
Diseases of heart	142.0	133.8	+ 6
Malignant neoplasms	62.5	59.1	+ 6
Cirrhosis of liver	45.6	14.2	+ 221
Cerebrovascular disease	42.8	46.4	- 8
Influenza and pneumonia	38.6	89.8	- 57
Certain causes of mortality in early infancy	29.6	67.6	- 56
Diabetes mellitus	23.0	13.9	+ 65
Homicide	20.6	15.9	+ 30
Suicide	18.7	8.7	+ 115
Congenital anomalies	10.9	19.0	- 43
Tuberculosis	7.8	55.1	- 86
Arteriosclerosis	6.5	-	
Nephritis and nephrosis	6.0	-	
Septicemia	5.3	-	
Bronchitis, emphysema, and asthma	5.1	-	
Enteritis and other diarrheal diseases	4.4	39.2	
Infection of kidney	3.7	-	- 89

-Data not available

*Source, USPHS a; 1974; 32.

Table 2

IHS: ALL HOSPITALS, SELECTED DIAGNOSIS

	No.	%	No.	%
	1955		1972	
Infective & parasitic (inc. tbc)	3,645 (2,130)	9.6 (5.6)	6,206 (594)	6.1 (0.6)
Neoplasms	479	1.3	2,142	2.1
Influenza & pneumonia	6,021	15.8	5,990	5.9
Complications of pregnancy & puerperium	1,552	4.1	3,907	3.9
Deliveries	6,340	16.7	12,819	12.7
Accidents	3,782	9.9	15,190	15.0
TOTAL	38,035*		101,278	

*Excluding Alaska Natives and patients admitted to contract facilities.

1974a, 1974b; Johansson and Preston, 1978). Precisely (or evenly approximately) what their mortality rates were in the decades before the 1940s is difficult to say, though Morgan (1973) has provided figures from Ramah starting in the 1890s which are displayed in Table 3. The Ramah population was only a few hundred in the period 1890-1920, so the crude mortality rates may be subject to considerable fluctuation. The peak rate occurring in the period 1915-1919 may be attributed to the influenza pandemic of 1918. What does seem evident is that the rate increased in the late teens and then began to decline slowly in the 1920s and 1930s but only declined dramatically in the post-war years, particularly in the 1940s and 1950s.

A study by Kimball (1940) in districts 4, 5, and 7 indicated a crude mortality rate of 13.6 per 1,000, somewhat lower than Morgan's estimate of the rate at Ramah in the late 1930s. It is not clear which rates are more representative of the total reservation population. The population surveyed by Kimball may have been more representative than that at Ramah, but it appears that he didn't do a complete ennumeration and it is possible that his figures are biased in a downward direction.

Johnston's estimates of mortality rates for the entire tribe between 1945 and 1955 are roughly comparable to Morgan's (see Table 4). And the crude mortality rates calculated for the period 1968-69 for the different Navajo Reservation Indian Health Service catchment areas (service units) are all in the same range as those estimated for the 1950s (see Table 5). Finally, using more recent data, we have estimated crude mortality in 1974 at 5.7 per 1,000 (Kaltenbach, 1976). What is true of crude mortality is also true of infant mortality rates. In 1949-51 the average

Table 3: Crude mortality rates of Ramah Navajos*

Years	Average annual crude mortality rates
1890-94	14.1
1895-99	8.4
1900-04	8.7
1905-09	16.1
1910-14	15.7
1915-19	27.1
1920-24	26.6
1925-29	25.8
1930-34	20.5
1935-39	20.2
1940-44	23.4
1945-49	15.3
1950-54	12.0
1955-59	6.3
1960-64	6.5

*Source: Morgan, 1973; 289

Table 4: Estimated Navajo Crude Mortality Rates*

Year		Males		Females	
		rate	± 2 standard deviations	rate	± 2 standard deviations
1945		11.1	10.4 - 11.8	10.5	9.8 - 11.2
1950	a	11.5	11.0 - 12.0	9.9	9.4 - 10.4
	b	10.6	10.1 - 11.1	9.2	8.7 - 9.2
1955		8.5	8.1 - 8.9	6.7	6.3 - 7.1

*Source: Johnston, 1966; 174.

Table 5: Navajo mortality rates per 1,000 population, 1968-1969*

Service Unit	Crude mortality rate
Chinle	6.9
Crownpoint	7.2
Fort Defiance	7.0
Gallup	5.8
Kayenta	7.0
Shiprock	5.6
Tuba City	8.2
Winslow	5.1

*Source: Kunitz, 1976a; 25.

annual rate was estimated to be 139.4 per 1,000 live births (Hadley, 1955). By 1970 it was estimated to be 31.5 (USPHS, 1971; Kunitz, 1976a).

Declining mortality rates are generally caused by a reduction in acute infectious diseases. Navajos are no exception. Table 6 shows the proportionate distribution of deaths by cause in 1954-56 and 1965-67. Table 7 shows the proportionate distribution in 1974, when a different diagnostic coding system was in effect. It is clear that the category labeled "influenza and pneumonia" in Table 5 and "respiratory" in Table 6 has declined considerably in relative importance. Considering that mortality has been generally stable between the mid-1950s and 1974, these figures suggest a reduction both in the absolute as well as the relative importance of respiratory disease as a cause of death. Similarly, the condition labeled "gastritis" in Table 5 and "digestive" in Table 6 also shows a reduction in both relative and absolute importance.

Most dramatic, however, is the increase in importance of accidents as a cause of death between the mid-1950s and the mid-1970s. Not only has the relative importance increased but we can calculate that the absolute importance has increased as well. For instance, if we assume that the crude mortality rate in 1955 was 7.6 per 1,000 and that 16.8 percent of the deaths were due to accidents, then the accident mortality rate was 127 per 100,000. In 1974, 38.5 percent of the deaths were due to accidents. If the crude mortality rate was 5.7 per 1,000, then the accident mortality rate was about 223 per 100,000, an increase of almost 60 percent over a twenty year period.

No really adequate study of the accident phenomenon among Navajos has yet been done so we are not in a position to explain the observed

Table 6: Leading causes of death, Navajo Area (in percent)

Causes	1954-56	1965-67
1. Accidents	16.8	22.9
2. Diseases of the heart	4.2	6.5
3. Malignant neoplasms	3.4	7.4
4. Influenza & pneumonia (excluding newborns)	14.2	8.1
5. Certain diseases of early infancy	9.6	7.4
6. Gastritis	10.5	5.6
7. All others	41.3	42.1
TOTAL	100	100

Source: U.S.P.H.S., 1971; 27.

Table 7: Leading causes of death, Navajo Area, 1974

Causes	Percent	Number
1. Accidents	38.5	283
2. Symptoms & ill-defined conditions	20.7	152
3. Circulatory	8.6	63
4. Mental disorders (alcoholism)	5.6	41
5. Respiratory	5.4	40
6. Digestive	5.4	40
7. Infective/parasite	4.2	31
8. Neoplasms	4.2	31
9. Perinatal mortality	3.9	29
10. Genito-urinary	1.9	14
11. Endocrine, nutrition, metabolic	1.5	11
TOTAL	99.9	735

Source: derived from Kaltenbach, 1976.

increase. It undoubtedly has to do with the long distances Navajos must drive, the quality of cars and roads, alcohol consumption, and the type of instruments and utensils used in everyday life. We can say that mortality rates reached their present low levels in the mid-1950s as a result of a decline in infectious diseases, particularly tuberculosis. Since that time, while infectious diseases in general have continued to decline, mortality from degenerative diseases (such as circulatory disorders) and from causes of a man-made nature (accidents) have risen. This parallels the experience of many other populations undergoing the epidemiologic transition (Omran, 1971).

We have pointed out that facilities and personnel declined between 1940 and 1955 throughout the Indian Health Service. The same was true on the Navajo Reservation. Table 8 indicates the number of government hospitals and beds in 1940. Including tuberculosis hospitals, there were eleven facilities with 564 beds and 48 bassinets. By 1949 only five hospitals remained: Fort Defiance, Tuba City, Shiprock, Winslow, and Crownpoint (Pijoan and McCammon, 1949). Table 9 indicates the number of hospitals and beds available in 1956 and 1973. It is evident that the number of beds increased after 1955 but the number of hospitals has remained essentially unchanged.

Table 10 shows the number of (government) hospital beds and admissions in 1940, 1955, and 1973. The number of beds per 1,000 population has decreased continuously over the 33 year period but admissions per 1,000 have followed a somewhat different pattern, declining between 1940 and 1955 and then increasing between 1955 and 1973. Since 1955 admissions have not increased in a linear fashion, however (Broudy, 1977). Between

Table 8

NAVAJO MEDICAL SERVICE HOSPITALS, 1940

	Date of construction	Capacity** beds	bassinets
Chinle, Az.	1932	15	2
Navajo Med. Ctr. Fort Defiance, Az. (General Hospital & tbc. san.)	1912 (new hosp. 1938)	226	14
Kayenta, Az. (tbc. san.)	1927	47	2
Leupp, Ax	1908	29	3
Tuba City, Az.	1911	28	6
Winslow, Az. (san.)	1933	50	-
Crownpoint, N.M.	1914 (new hosp. 1929)	65	10
Fort Wingate, N.M.	1889	35	4
Shiprock, N.M.	1908	43	4
Toadlena, N.M.	1926	12	-
Tohatchi, N.M.	1927	14	3
		564	48

*Underhill, 1963:226.

**Navajo Medical News, Sept. 28, 1940.

Table 9: Navajo Area PHS Hospitals, 1956* and 1973**

Location	1956 Date	1956 No. beds general	1956 No. beds tbc.	1956 Accredition	1973 No. beds
Crownpoint	1939	56	0	Unaccredited	56
Fort Defiance	1938	98	100	Unaccredited	110
Shiprock	1912	46	0	Unaccredited	66
Tuba City	1953	75	0	Provisional	75 (125 in 1975)
Winslow	1934	57	0	Provisional	40 (closed in 1976)
Gallup	1961	--	--		200
TOTAL		532	100		547

* USPHS, 1957; 250.

** Committee on Interior and Insular Affairs, 1974; 92.

Table 10: Navajo reservation hospital beds and admission

Year	Estimated Pop.	No. beds* (govt. hospitals)	Beds 1,000 Pop.	No. Admission	Admissions 1,000 Pop.
1940**	50,000	564	11.3	9,142	182.8
1955	80-82,000	432	5.3	6,620***	81.7
1973	130,000	547	4.2	18,000***	138.4

* mission hospitals excluded

** all 1940 data from Navajo Medical News, 1940

***Source: Broudy, 1977

1955 and 1962 admission doubled, to about 12,000. The number increased only about 50 percent (from 12,000 to about 18,000) from 1962 to 1975. The number has remained virtually unchanged since then.

It must be pointed out that these data are only for Indian Health Service hospitals serving the Navajo Reservation. Mission and community hospitals are not included. In addition, the hospitals that are included also admit non-Navajos (members of other Indian tribes and a few non-Indian Public Health Service beneficiaries). The number of non-Navajos is small, however. The greatest sources of bias are in the failure to count Navajos admitted to other hospitals, an issue to which we shall return below, and the possible underenumeration of the Navajo service population. The result is that these figures represent an underenumeration of the number of beds available and the number of Navajos admitted to hospitals and also an undercount of the denominator for which the rates are calculated. Nonetheless, they do adequately reflect general trends.

Average length of hospital stay has also declined markedly over the years. In 1940 it was 20.5 days in Navajo medical service hospitals (Navajo Medical News, 1940); in 1955 and 1956 it was between 14 and 16 days in the Albuquerque Area hospitals, which at that time included the Window Rock (Navajo) Sub-area (USPHS, 1957; 254); and in Navajo Area hospitals it was 10.6 days in 1967 and 8.3 days in 1972 (USPHS, 1974b). As we shall indicate in more detail below, it has continued to decline to even lower levels since 1972.

With average length of stay declining and hospital admissions reaching a plateau, hospital occupancy rates have changed over the past twenty years or so. In 1955 and 1956 occupancy rates in Navajo Area

Indian hospitals averaged 72.5 and 69.9 percent respectively. By 1957 the rate had increased to 77.8 percent and by 1966 to 83.6 percent. In 1973-1974 the figures decreased to 69 percent (with a range of 57-81 percent) and by 1976-1977 occupancy had declined even further to an area average of 60 percent (with a range of 48-72 percent).

As Table 11 suggests, the slowing of the rate of increase of hospital admissions appears to be due primarily to the decline in pediatric admissions beginning in the late 1960s. Between 1959 and 1968 the number of admissions in all age groups increased substantially and the proportionate age distribution of patients remained essentially unchanged. Beginning in the late 1960s, the rate of increase of admissions began to decline and the number of pediatric admissions actually decreased somewhat from 1968 through 1977. On the other hand, the number of admissions of people 65 and above continued to increase, though at a much slower rate than in the period between 1959 and 1968. The result has been a shift in the age distribution of patients such that by 1977 patients under 10 years of age (excluding newborns) were only 22 percent of the total compared to 32 percent in 1959 and 29 percent in 1968.

The point to be made here is that the decline in the number of beds as a result of World War II and subsequent federal Indian policy was reflected in a decline in hospital utilization. As a result of a change in policy regarding the provision of health care, admissions increased rapidly in the six or seven year after transfer to the Public Health Service and then began to level off. Though beds per 1,000 did not increase, it appears that staff did increase in number. We have not been able to find adequate data on staffing patterns in the years following

Table 11: Discharges, NAIHS hospitals, Selected years and age groups (excluding newborns)

Age	1959		1968		1974		1977	
	#	%	#	%	#	%	#	%
≤10	3,156	32.5	4,854	29.1	4,572	25.5	4,087	22.0
≥ 65	595	6.1	1,195	7.2	1,350	7.4	1,501	8.1
TOTAL DISCHARGES	9,708		16,688		17,906		18,616	

transfer, but there is no doubt that the numbers of nurses (both hospital and field) and physicians grew. Though high rates of staff turn-over have continued to be a problem, the doctor and dentist draft assured that available positions would be filled. With an end to the military draft in the early 1970s, vacancies have once again become something of a problem. In 1977 there were 126 positions available for physicians, eleven of which were unfilled (May, 1977). Of 548 nursing positions, 43 were unfilled. The shortage of nurses led to the closing of 85 beds in Reservation hospitals in the early 1970s, twelve of them at the Shiprock hospital in 1973 (McKenzie, 1974).

The fact that average length of stay has declined continuously over almost forty years is important and in large measure related to the decline in tuberculosis, which was responsible for very long hospitalizations until not too many years ago, and to the increasing use of antibiotics starting in the late 1940s. We do not believe shortened length of stay was entirely the result of declining manpower and facilities because in fact the major declines occurred after transfer to the Public Health Service, not before.

More detailed information on hospital utilization is available for the years 1972-1978. This material is described in detail in Appendix I. Suffice it to say here it includes data on all hospital discharges of Navajo patients treated in Indian Health Service, contract, and some non-IHS non-contract facilities. Table 12 shows the pattern of discharges in fiscal years 1972-1978 by major ICDA diagnostic category along with Average Length of Stay (ALOS) in each category in each year.

Table 12: Length of Hospital Stay and Proportionate Distribution by Diagnostic Category
(All Navajo Hospitalization)

		1972		1973		1974		1975		1976		1977		1978	
	Diagnosis	LOS	% dischrgs.	LOS	% dischrgs.	LOS	% dischrgs.	LOS	% dischrgs.	LOS	% dischrgs.	LOS	% dischrgs.	LOS	% dischrgs.
I	infective & parasitic	12.5	4.31	7.9	3.90	6.9	3.43	7.3	3.38	5.4	5.00	5.8	3.46	5.2	2.76
II	neoplasms	11.6	1.08	8.4	.89	8.4	1.09	9.3	1.12	8.4	1.03	7.5	1.21	7.9	1.18
III	endocr. nutr. metab.	13.5	.94	10.5	.96	10.5	.98	10.4	.90	8.1	1.20	7.9	1.12	7.1	1.16
IV	blood & blood forming	10.8	.55	8.9	.59	8.4	.54	6.5	.40	5.5	.49	6.4	.47	7.3	.36
V	mental	15.8	2.94	26.9	2.58	13.6	2.28	17.0	2.38	9.7	2.43	7.0	2.26	6.2	2.60
VI	nervous system	10.2	4.94	9.4	4.58	6.8	4.65	6.9	4.78	6.3	4.17	7.7	3.84	5.6	4.50
VII	circulatory	12.5	1.88	14.2	1.84	9.2	2.12	8.7	1.89	8.8	2.02	9.0	1.92	9.1	1.95
VIII	respiratory	8.8	9.53	9.0	9.12	6.9	8.67	6.6	8.32	6.1	6.68	5.5	7.19	5.8	7.19
IX	digestive	12.3	4.58	9.5	4.76	8.3	4.93	8.5	5.19	8.6	5.14	8.5	5.13	8.4	5.32
X	genitourinary	11.5	4.43	12.5	4.31	7.9	3.78	8.5	3.78	7.9	3.83	8.1	3.89	7.5	4.19
XI	pregnancy & childbirth	5.0	18.81	4.6	19.80	3.6	20.43	3.4	20.86	3.4	19.58	3.3	21.06	3.3	21.05
XII	skin & subcutan.	13.9	2.03	9.9	2.20	7.8	2.44	9.0	2.28	9.9	3.06	7.7	2.62	8.2	2.33
XIII	musculoskeletel	14.6	1.53	17.0	1.63	10.4	1.56	11.1	1.53	9.8	1.65	10.0	1.52	9.6	1.58
XIV	congenital	12.4	1.00	9.7	2.09	8.0	1.92	7.4	1.79	6.0	1.81	7.0	2.07	7.4	2.04
XV	perinatal morb. mort.	9.1	2.89	8.3	3.05	7.0	3.37	6.8	2.96	7.2	2.33	5.7	2.75	4.5	3.71
XVI	ill-defined	9.5	6.71	8.7	6.80	6.9	6.89	7.1	7.62	6.9	7.42	5.9	7.81	6.8	7.41
XVII	accidents	9.7	15.53	10.7	16.21	8.4	14.59	7.9	13.74	7.1	13.76	7.2	13.90	6.5	14.31
XVIII	missing DX	5.0	15.23	4.4	14.68	3.1	16.32	3.1	17.10	3.1	18.39	3.4	17.77	3.2	16.36
	$\bar{X}$ LOS	8.9		8.6		6.3		6.3		5.8		5.6		5.4	
	Total discharges	25,292		25,987		25,852		25,239		26,107		27,027		25,726	

There are several noteworthy items in the table. First, the total number of discharges remained virtually unchanged each year. Second, average length of stay has declined consistently from one year to the next, and this pattern repeats itself within virtually all diagnostic categories. Third, the proportionate distribution of discharge diagnoses has changed in small but substantively significant ways. For instance, diseases of the respiratory system accounted for 9.5 percent of the discharges in 1972 and 7.2 percent in 1978. Infective and parasitic diseases have also declined substantially, from 4.3 to 2.8 percent. Perhaps surprisingly, the proportion of discharges related to accidents has also declined, from 15.5 to 14.3 percent.

These changes are even more graphic when we examine data for a longer period of time. Table 13 shows the proportionate distribution of discharge diagnoses as tabulated by the Public Health Service from Navajo Area Hospitals (both federal and contract) from 1959, 1968, and 1977. There are problems caused by changes in the coding system such that infectious diarrhea, which was often coded under "gastro-intestinal" in the first two years, was coded under "infectious and parasitic" in 1977. To correct for this, we have shown gastro-enteritis separately at the bottom of each column. When these figures are combined with the infectious and parasitic category, we observe the changes in Table 14.

Though the number of hospitalizations increases from one year to the next, the category of infectious and parasitic diseases decreases relatively and, in the second period, absolutely. The same is essentially the case with tuberculosis and influenza and pneumonia. In each instance the numbers increased from 1959 through 1968, probably as hospital

Table 13: Distribution of discharge diagnoses, Navajo Area Hospitals

	1959		1968		1977	
	#	%	#	%	#	%
Total-newborns & deliveries omitted	9,679		14,945		16,098	
Infective & parasitic**	506	5.2	715	4.8	1,400	8.7
Neoplasms	147	1.5	238	1.6	440	2.7
Endocrine, etc.	182	1.9	333	2.2	336	2.0
Blood, etc.	47	2.5	96	0.6	83	0.5
Mental	102	1.1	735	4.9	838	5.2
CNS	686	7.1	1,211	8.1	975	6.0
Circulatory	229	2.3	387	2.6	512	3.2
Respiratory*	1,840	19.0	2,430	16.3	1,613	10.0
Gastro-intestinal	1,325+	13.7	1,917+	12.8	1,285	7.8
Genito -urinary	403	4.2	926	6.2	679	4.2
Skin	402	4.2	443	2.9	500	3.1
Congenital	131	1.3	252	0.2	287	1.8
Perinatal	137	1.4	217	1.5	248	1.5
Accidents	1,488	15.4	2,751	18.4	2,947	18.3
	7,625		1,265		12,103	
Others	2,054	21.2	229	15.3	3,995	24.8
*influenza & pneumonia	1,049	10.8	1,746	11.6	942	5.8
**tbc	195	2.0	225	1.5	130	0.8
**dysentery	72		150		156	
+gastro-enteritis	734		848		62	

Table 14: Number and proportion of hospitalizations caused by infectious and parasitic diseases

	1959		1968		1977	
	#	%	#	%	#	%
Infective & parasitic (inc. gastro-enteritis)	1,200*	12.4%	1,500*	10%	1,400*	8.7%
Total (minus newborns and deliveries)	9,679		14,945		16,098	

* approximate

utilization increased, and then declined dramatically starting in the late 1960s even as hospitalizations for all causes remained essentially unchanged.

On the other hand, accidents have not increased impressively in their relative contribution to hospitalizations but in absolute numbers have almost doubled. Mental illness increased, but this was almost certainly the result of the establishment of a psychiatric service in the mid-1960s. Interestingly, accidents and mental illness diagnoses increased most rapidly in the 1960s and tended to reach a plateau in the 1970s. It appears that infectious diseases are indeed decreasing in incidence and severity and are being replaced only partially by man-made, psycho-social, and degenerative diseases. Indeed, it is reasonable to speculate that mental health services are a prototype of the adaptation being made by the health care system. There is no reason to believe a priori that mental illeness is increasing. Rather, the health care system is discovering new problems to treat as the old and obvious ones wane in importance.

In the next chapter we shall describe a number of diagnostic patterns in more detail. The point to be made here is simply that there is some evidence that infectious diseases have declined as a cause of hospitalization and that the importance of accidents as a leading cause of morbidity as well as mortality may be beginning to decline as well. Furthermore, the decline in average length of stay may reflect a number of important changes: increased accessibility of hospitals such that patients can get to care before their disease is too severe; ability to follow patients more easily in out-patient facilities and therefore a greater willingness

on the part of staff to discharge early; pressure due to lack of personnel to discharge earlier than in the past.

We may also use the hospital discharge data to calculate rates of discharges for populations residing in different land management districts. When chapters (the smallest unit of local government) are aggregated into land management districts and a weighted average of distance from the nearest hospital is calculated, it is possible to do a multiple regression analysis (see Table 15) using some of the 1974 economic data described in Appendix I as the independent variables and average annual discharge rate (1972-1976) as the dependent variable. Appendix II presents a brief analysis of these economic variables.

Using a model with only one independent variable, the best predictor was distance, with an R^2 of 0.24. The best two-variable model was one which included both distance and the proportion of males working 50-52 weeks, which gave an R^2 of 0.46. The best three-variable model added household size and has an R^2 of 0.66. Of special note is the fact that average educational level of male heads of households was highly correlated ($r = .73$) with proportion working 50-52 weeks. The high correlation between these two independent variables means that it is difficult to distinguish between their effects. Neither distance and employment ($r=.-.24$) nor distance and education ($r=.42$) are strongly correlated suggesting that the effects of distance and employment/education are indeed distinguishable.

In the two variable model, when distance is controlled, fulltime employment is inversely related to hospitalization: the higher the

Table 15

Coefficients of Determination, R^2, for the first and each consecutive predictor variable entered into the model; in order of entrance

Dependent variable:

Average Number of Hospitalizations (1972-1976) Per 1,000 People

VARIABLE	R^2	Regression Coefficients	Standard Error
NEARH	.2363	-1.307**	0.325
HSIZE	.4647	-1.694*	0.599
WORKM	.6599	-0.201**	0.050

For the 3 variable model F= 9.03 and PROB F= 0.0014

*$p < 0.05$

**$p < 0.001$

proportion of men working fulltime, the lower the hospital discharge rate. Because employment is so highly correlated with education as well as with per capita income and the availability of such domestic conveniences as electricity, running water, and bathrooms, it is probable that the health of the families of wage workers is better than the health of other people. The result is lower hospital discharge rates.

Finally, we have observed that household size contributes about 20 percent to the explained variance of hospitalization rates. That is, controlling for distance and employment, the larger the average household size in a district, the lower the hospitalization rate. Household size is inversely related to income, involvement in wage work, and levels of education. This is congruent with the observations reported by others that stability of wage work makes possible the weakening of kin ties and the development of nuclear families. If this is the case, then it is reasonable to suggest that in smaller families there is less likelihood that there will be someone available to care for an ill member. Hence, dependence upon hospitals may increase to take the place of help previously provided by kin.

The tendency that has been observed by other investigators (Callaway, et al, 1976) for young people to leave the Reservation hinterland for wage work in communities on and off Reservation is reflected in the age of patients. The mean age of patients giving a Reservation address ranges between 26 and 27.6, depending upon the year, compared to a range of 24 to 25 for patients residing off Reservation. Median ages of the two groups are closer, never differing by more than a year and ranging between 22 and 24. This would seem to indicate that among patients from

the Reservation there is a small number of quite elderly people who contribute to an increase in the average age but are not numerous enough to significantly inflate median age above that of patients from off Reservation.

Turning our attention now to those patients from Reservation communities, we are interested in examining the relationship between age and socio-economic characteristics (see Table 16). The best single-variable regression model with mean age of patients as the dependent variable includes distance from surgery as the independent variable, explaining 22 percent of the variance. The greater the distance, the older the patients.

The best two-variable model adds proportion of income from welfare and explains 38 percent of the variance. Controlling for distance, the lower the proportion of income derived from welfare, the older the patients.

Two three-variable models are about equally effective, each explaining 62 percent of the variance. The first includes distance from surgery, substitutes wage work for welfare (the higher the proportion of income from wage work, the older the patients), and adds average age of male household heads. That is, the further a population is from a hospital providing surgery, the greater the dependence upon wages, and the older the male household heads, the greater the age of patients.

The second model is the same as the first but substitutes average educational level of male household heads for distance from surgery. The greater the educational level, the lower the age of patients.

Clearly, age bears no easily understood relationship to the variables we have measured. It appears that mean age of patients is increased as

Table 16

Coefficients of determination R^2 for each consecutive model; variables presented in order of entrance

REGRESSION: MEAN AGE OF PATIENTS

VARIABLE	R^2	Regression Coefficients	Standard Error
NEARS	.2164	0.027*	0.011
WELF	.3778	-0.013*	0.005
AMHH	.5222	1.137*	0.296
WAGE ⟶ WELF	.6214	0.024**	0.005
EDM ⟶ NEARS	.6232	-0.134*	0.054

(⟶) replaces; Final model F=7.72 PROB > F= 0.0028

*$p < 0.05$

**$p < 0.001$

distance from surgery increases. And, controlling for distance, welfare is inversely and wage work positively related to age of patients. This may be interpreted to mean that families with heavy dependence upon wage work are unable to care for elderly members when they fall ill. Conversely, when families have a high proportion of support from welfare, extended kin networks may be especially significant as a means of sharing income and providing aid, and this may be reflected in the ability to care for ill elderly family members at home.

Lastly, when distance and source of income are controlled, the age of the population as measured by mean age of male household heads is positively related to mean age of patients. Thus, there is some evidence that older patients are from remote areas with older populations dependent upon wage work.

In the preceding analyses we have used average annual discharge rates for fiscal years 1972-1976 for two reasons: 1. because we wanted to use the population and economic survey data from 1974 and 1975 as rough mid-points; and 2. because in fiscal year 1977 the Indian Health Service hospital in Winslow, Arizona was closed, thus influencing access of those people living in districts 5 and 7. The effect on these populations was substantial in terms of hospitalization, though we cannot measure the impact in terms of morbidity and mortality. Between F.Y. 1976 and 1978 the number of hospital discharges of people residing in communities in district 5 declined from 785 to 333 (-57.6 percent). In district 7 the change was from 1,413 to 943 (-33.3 percent). The next largest decline was recorded for the district 8 population, from 1,205 to 1,068 (-19.9 percent). Overall, the change in number of discharges for Navajos giving Reservation address was from 21,563 to 21,539 (-0.1 percent).

We have shown that throughout the Indian Health Service outpatient visits have increased dramatically since 1955. This also seems to be the case on the Navajo Reservation, and an important question is whether outpatient use has had the effect of slowing the rate of hospital use. In fiscal year 1940 the Navajo Medical News (1940) reported that there were "54,403 dispensary patients for a total of 161,176 out-patient treatments." As they were estimating a population of 50,000 Navajos at that time, it would appear that "dispensary patients" refers to the number of visits and "out-patient treatments" to the various things done during those 54,403 visits. If this is the case, then the number of visits per person was about 1.1 in that year. Table 17 displays the number of out-patient visits in fiscal years 1955 and 1956. With an average of 36,448.5 visits each year and an estimated population of about 81,000, the average number of visits per person was about 0.5 per year. As with hospital admissions, the number evidently declined as a consequence of the decline in manpower and facilities at the same time as the population had increased by at least 50 percent. Five years later the number of visits had increased dramatically, to 189,080, about a five fold increase, leading to a clinic visit rate of about 2 per person.

By the early 1970s the number had a little more than doubled. Table 18 shows a significant increase in the total number of out-patient visits per year from 1971 through 1978. In 1978, for instance, with an estimated population of almost 142,000, the number of visits per person was about 4.5. This represents an increase of about one visit per person over 1973 when the estimated population was about 130,000. It

Table 17: Outpatient visits F.Y. 1955-1956*

	Total Medical	Therapeutic Treatments		Prevent. Services
		Hospital	Field	
1955	36,719	31,224	2,438	3,057
1956	36,178	28,948	4,948	2.282
1955-56 average	36,448.5			

*Source: U.S.P.H.S., 1957; table 53 (p. 255)

Table 18: Number of clinic visits per year

YEAR (F.Y.)	Number outpatient* visits at I.H.S facilities
1971	436,072
1972	454,291
1973	469,047
1974	missing data
1975	537,573
1976	581,640
1977	588,180
1978	635,808

* Sources: Navajo Health Systems Agency; 1978; Vol. I, p. 411 and Navajo Area, IHS, 1979b.

must be pointed out again that the population estimate is for those Navajos residing on the reservation, not all those entitled to services, which may include a considerable but unknown number of off-reservation Navajos. In addition, the number of clinic visits does not exclude non-Navajos seeking treatment at Navajo Area Indian Health Service facilities or Navajos seeking treatment at non-Navajo facilities. Of the sources of bias, under-enumeration of the service population is probably most significant. Thus, the figures for number of visits per person are likely to be somewhat inflated. Nonetheless, the important point is that outpatient visits have continued to rise at a rapid rate whereas hospitalizations have reached a plateau. Though these data alone cannot prove a causal relationship, it appears reasonable to suggest that the increasing utilization of outpatient facilities has probably resulted in early detection and treatment of many illnesses which in previous years would have been seen in a hospital somewhat later in the course of the disease, resulting in a higher likelihood of hospitalization for a longer period of time than at present.

We may examine the relationship between clinic and hospital utilization more closely using the synchronic data in Table 19. If the hypothesis that OPD visits cause hospitalizations to decline is correct, then we would expect to see an inverse relationship between average clinic visits per person and hospitalization rate per 1,000 population (using IHS service units as the populations). In fact, there is no relationship whatever between the two variables (Spearman's rho = .38). There is some evidence that visits per person is inversely related to the population per clinic (Spearman's rho =-.5). There is also an inverse relationship

Table 19: Hospital and clinic utilization, Navajo Reservation, F.Y. 1976*

	Population*	No. clinic visits	Visits person	Population clinic	No. hospital discharges	Hospital. rate/ 1,000	Miles to nearest hospital
Chinle	22,972	110,880	4.8	1,276	3,087	134	64
Crownpoint	11,553	67,707	5.9	888	2,264	196	33
Ft. Defiance	17,195	90,363	5.3	2,456	2,881	168	36
Gallup	18,538	90,505	4.9	1,685	3,822	206	28
Kayenta	12,493	53,552	4.3	2,082	1,176	94	59
Shiprock	29,152	98,378	3.4	2,242	4,413	151	46
Tuba City	12,628	72,440	5.7	1,578	2,485	197	38
Winslow	9,941	45,756	4.6	1,656	2,641	266	56

*Source: Navajo Health Systems Agency, 1978; Vol. p. 255

**Estimated from Davis & Kunitz (1978)

between the average distance from a hospital and the hospitalization rate (Spearman's rho = -.55). From these data, crude though they are, it appears that clinic visits and hospitalizations vary independently and are related to the availability of facilities.

This is not to say that over a period of years increasingly available outpatient facilities have not contributed to the levelling off of hospitalization rates. In fact, we believe this to be the case. It is to suggest, rather, that there is no simple relationship between outpatient and inpatient utilization and that both seem to be responsive to the availability of services (White, et al, 1976). Indeed, it is likely that other factors in addition to the health care system itself are responsible for the changing pattern of hospital utilization. For example, since 1955 the number of miles of paved road has increased appreciably, as has the ownership of motor vehicles. Thus, it is now simply easier to get to hospitals earlier in the course of an illness than may have been true in previous years.

Moreover, preventive measures have been of some importance. The proportion of homes with running water has increased considerably in recent years. In 1960 virtually no Navajo homes on Reservation had running water. By 1978 it was estimated that 57 percent of homes had running water, though not necessarily indoor toilets (Navajo Area I.H.S., 1979a). And, though there is some evidence that per capita income (in constant dollars) has in fact declined, surplus food commodities from the Department of Agriculture may have been an important supplement to the diet of many Navajo families, perhaps particularly children. There is no information on how completely surplus commodities are used by families. Many observers have been of the impression that much of it is

not used, for instance powdered milk. It is true, however, that overt protein-calorie malnutrition is virtually never seen any longer though it was not unknown as recently as the late 1960s (Wolfe, 1961; Van Duzen, et al.,1969) and was a common underlying cause of infant death in the late 1930s (Safran, 1940). Thus, it appears reasonable to conclude that many other factors in addition to the increasing availability of out-patient facilities have contributed to the changing pattern of hospital utlization: that is, to the levelling off of admissions, the shortening of average length of stay, and declining occupancy rate.

Since the 1960s there has been an increasing number of requests from Navajo individuals as well as from tribal agencies for the establishment of nursing homes for elderly Navajos. This was the product of several factors acting together. The proportion of elderly Navajos has probably not increased dramatically over the years because high fertility rates and declining infant mortality have kept the Navajos a young population. Migration of young people from rural areas, however, may have worked to reduce the number of people available to care for elderly parents and grandparents. In addition, without much livestock under their control, elderly people may no longer be in positions of control within their families (Levy, 1967). Moreover, in the past youngsters have often been available to help care for elderly grandparents, but with school attendance increasingly seen to be important by Navajo parents, such assistance may no longer be forthcoming.

These changes in Navajo life occur at a time when the Indian Health Service needs to recruit new kinds of patients. We have indicated that there is every reason to believe that child health has improved measurably

since 1955. This is reflected in the decline in the number of children admitted to hospitals since the late 1960s. In consequence, hospital occupancy rates have declined. Thus, elderly patients and those with chronic diseases may be partially filling the void left by the declining number of pediatric admissions. For example, in the new Tuba City hospital a renal dialysis unit was put in part of what had been planned as a pediatric ward.

We would not maintain that service providers are necessarily creating new needs which they can fill and therefore protect the existence of their agency and their own jobs. That may be part of the picture, but the other part seems to be that there really has been a change in the way elderly Navajos are able to be cared for by their families, and the PHS is providing a service that families may no longer be able or willing to provide. In the absence of any field data, these must remain tentative explanations, but they accord with the facts as we now know them.

Another point we must make is that the Public Health Service assumed responsibility for Indian health at a time when mortality rates on the Navajo Reservation had already reached low levels. Since then the rates have declined only slightly, if at all. What has changed is the proportionate distribution of mortality by cause. In general, infectious diseases have declined and man-made diseases (accidents) have increased. We have shown in this chapter that the same pattern is observed in causes of hospitalization. In such a situation, indeed, morbidity becomes a more sensitive indicator of the population's health than mortality since mortality cannot go much lower. Though we have only hospital data,

which are subject to all sorts of biases, we believe they are a valid reflection of important changes in the health of the population and in general show remarkable improvement over the past several years.

In addition, of course, agency statistics reflect not only what is happening in the population but what is happening in the agency itself. We have shown that there was a relationship between hospital and clinic utilization patterns on the one hand and federal Indian policy on the other between 1940 and 1955. After 1955 utilization rates rapidly increased as services once again improved. The evidence suggests, however, that the utilization of services is not a bottomless pit. At some point the rate of increase of utilization begins to slow. This is probably the result both of limits placed on the care that will be provided as well as a diminution in the rate of increase of demands made by patients who, after all, have better things to do than spend all their time in hospitals and clinics. Unfortunately, with the data at hand we cannot disentangle the relationships between these two factors any further.

Finally, we need to ask whether the hospital utilization data upon which we have relied for much of our discussion may bias in some manner the nature of our conclusion regarding the reality of the epidemiologic transition? We have shown that access to hospitals and involvement in the wage work and educational systems of the larger society both appear to be predictive of hospital utilization. It is entirely reasonable to believe that: 1. those people making most use of hospitals are more acculturated to Anglo-American society than those who do not use the hospital much; and 2. those who are most acculturated may be a relatively

small proportion of the total population and may not have disease patterns which are representative of those experienced by people who do not use the hosital or use it only infrequently.

We think this is not a serious source of error. If anything, it appears that access to hospitals has increased from year to year and that differences in utilization depending upon distance and "acculturation" should have been greater in the past than they are now. Indeed, if this is the case, then use of hospital utilization data to chart changes in disease patterns ought to lead us to underestimate rather than overestimate the magnitude of the changes that have occurred.

Chapter 2: Utilization Patterns by Diagnostic Categories, 1972-1978.

In the previous chapter we showed that there has been a slight change in the proportionate distribution of some of the major diagnostic categories. In the present chapter we explore some of these categories in more detail. Specifically, we are interested in two closely related issues: 1. the degree to which the change from infectious to degenerative and man-made diseases is proceeding at different rates across the Reservation depending upon level of economic development; and 2. the impact that access to hospitals has on utilization. Clearly, if access is of overwhelming importance, it will be difficult to detect the impact of economic development on morbidity using utilization data.

In the first section of the chapter we deal with four diagnostic categories: infectious diarrheas, influenza and pneumonia, myocardial infarctions, and motor vehicle accidents. The first two categories are infectious diseases and have been major causes of morbidity and mortality for many years. The second two are degenerative and man-made causes of morbidity and mortality and would be expected to be highest in those populations which are most involved in the wage work economy.

In the second section of the chapter we deal with a number of surgical procedures: cholecystectomies, appendectomies, bilateral tubal ligations, caesarean sections, induced abortions, and hysterectomies. These procedures vary in urgency and necessity, and differences in rates from place to place on the Reservation may be expected to reveal differences in attitudes towards the utilization of various forms of health care.