Maternal Health and Socioeconomic Status of Nonreservation Indians

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AMERICAN INDIANS have a high infant death rate and a median age at death which is lower than the U.S. native white population. Therefore, we assumed that the status of maternal health among Indians is poor also and attempted to measure the incidence of anemia, infection, and toxemia of pregnancy in obstetrical patients at the Public Health Service Indian Hospital at Tahlequah in eastern Oklahoma during 1965.

American Indians in Oklahoma are not confined to reservations, and some marry members of other ethnic groups and reside in urban areas. This situation afforded the opportunity to measure the occurrence of complications of pregnancy and to relate these complications to the socioeconomic and cultural characteristics of the patients.

Patients' Socioeconomic Characteristics

The setting. The Indian Hospital at Tahlequah is in the Ozark foothills midway between Fort Smith, Ark., and Tulsa, Okla. The hospital serves a six-county area of more than 4,309 square miles on which there are 20.9 Indians per square mile—more than in any other area outside an Indian reservation and more than are on most reservations. The hospital, with an average daily patient load of 40, has a capacity of 59 beds, 13 of which are for maternity patients. More than 23,000 outpatient clinic visits were registered in 1965, and 2,174 of these were by maternity patients.

Eligibility for medical service is governed principally by blood quantum and income. Members of the Five Civilized Tribes (Cherokee, Creek, Choctaw, Chickasaw, and Seminole) must be one-half Indian or more if over 20 years of age, and one-fourth Indian or more if 20 or under. Eligibility is determined by the blood quantum recorded on the tribal rolls for an enrolled person, or, if too young to have been enrolled, by the blood quantum recorded for his enrolled ancestors. Rolls of the Five Civilized Tribes were closed in 1902 or 1906, depending on the tribe.

Adult members of other tribes, such as Sioux or Osage, must prove their Indian ancestry by current tribal enrollment, but no stated blood quantum is required. Non-Indian wives of eli-

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gible Indian men are provided medical care on an equal basis with their husbands.

The income ceiling for two persons is $3,000; for six or more, $4,500. However, other circumstances are considered in deciding about eligibility for medical care, including health insurance and other financial resources.

Cherokee mothers are described in detail because the hospital is in what was until 1907 the Cherokee Nation. Also, the obstetrical patient load in this hospital was 73 percent Cherokee, 7 percent Creek, 5 percent other tribes, and 15 percent non-Indians. Eighty-six percent of these non-Indian patients were married to Cherokee men.

The Cherokee. In 1839 the Cherokee were moved over the Trail of Tears from their homelands in Georgia, Tennessee, and North Carolina to the Indian Territory, now Oklahoma, where the tribe established itself as a nation. From 1841 until 1907 the Cherokee Nation functioned as a modern state with its own constitution, legislature, court, and school systems, and a highly educated citizenry. The Cherokee syllabary, invented by Sequoyah in the early 1800's, was used in the printing of a newspaper, school texts, the Bible, ritual training prayers and medicinal lore, and official documents. In 1965 surveys indicated that the number of Cherokee adults who read in their own language was increasing (*1*), and publication of a Cherokee language newspaper was resumed.

The fullblood faction controlled the institutions of the Cherokee Nation until political power passed to the mixed bloods in the 1880's. When the Cherokee Nation was dissolved and the State of Oklahoma was formed in 1907, the mixed bloods had been assimilated into the growing population of the State, intermarrying with white persons. Although fullbloods tried to maintain a consistently Cherokee style of life without interference from the State's increasingly powerful white citizens, the method that best allowed them to survive as Indians, both physiologically and sociologically, was noninvolvement with white persons and their institutions (*2*, *3*).

Descendents of the fullblood faction maintained their style of life within the region, and in 1965 more than 9,500 Cherokees lived in 50 to 60 settlements scattered throughout the area served by the hospital. These settlements are cohesive, insulated communities, mostly in isolated rural areas, and populated by descendants of Cherokee families who moved to these sites between 1840 and 1895.

The growing Cherokee population has prompted some Indians to migrate to other States and others to form new settlements or to move individually or in family clusters to municipalities within the area. The total Cherokee population in this area nears 12,000 (*4*, *5*).

On the whole, these Cherokees are poor. A 1964 survey showed that the median annual per capita income by county of residence ranged from $450 to $650, or roughly half the per capita income of neighboring white persons (*6*).

The Tahlequah Indian Hospital, because of its relatively strict requirements for admission, serves a population of impoverished Indians. Some of these persons are functionally Indian, that is, reside in Indian communities; others, functionally white, live as members of the general Oklahoma society.

Sample and Methods

Cultural and socioeconomic information was obtained by interviewing obstetrical patients hospitalized for delivery. Interviews with 329, or 95.4 percent, of the 345 mothers were conducted by Mr. Saeger or his assistant, thus assuring uniformity of interviewing technique.

Among the 16 mothers not interviewed were those who left the hospital before the interviewer was notified. The few who refused interviews represented less than 5 percent of the group.

Data on income were not completely verifiable. Consequently, when the interviewers had cause to doubt respondents' answers, inquiries for verification were made through local community health or welfare agencies.

The blood quantum of mothers was recorded and verified by reference to tribal rolls. The blood quantum of each infant's father was recorded as reported by the mother with no verification. In three cases, the father's blood quantum was recorded as unknown. When analysis involved a blood-quantum category, these three persons were dropped from the sample.

The following four blood-quantum categories were established:

Fullblood—persons with no non-Indian ancestors.

Halfblood—persons less than fullblood but halfblood or more, for example, persons who were seven-eighths or three-fourths Indian were recorded in this category.

One-fourth blood—persons less than one-half but one-fourth or more Indian.

Non-Indian—persons less than one-fourth Indian.

The interview included a series of questions designed to provide an estimate of standard of living, based in terms of income of Oklahoma Department of Public Welfare stipends and on the hospital's scale of income for patients' eligibility. Determination of both welfare and hospital scales includes consideration of the number of dependents in the family. Other questions on number of inhabitants per room in the mother's dwelling, method of heating, water supply, and similar factors were included to gather data which would validate the income-based estimate of standard of living by relating income to other aspects of standard of living.

Complete medical data were obtained from the hospital records for all but seven of the 345 patients studied. For those seven, the only unknown fact is the week of pregnancy at the time of the first prenatal clinic visit. All patients were cared for as prenatal outpatients and postpartum inpatients by Dr. Tyler, who also decided the final diagnosis of morbidity and performed 162, or 47 percent, of the deliveries. The remaining deliveries were performed by the other four staff physicians.

Toxemia, infection, and anemia were the complications studied. Toxemia, defined by Eastman and Hellman (*7a*), is a disease occurring after the 24th week of pregnancy in which hypertension, albuminuria, edema, or any combination of the three are present. Blood pressure elevation levels were considered abnormal if 140/90 mm. Hg. or greater were recorded on two or more occasions 4 or more hours apart. Blood pressure recordings taken during labor were not considered. Roughly three-fourths of the women in whom toxemia was diagnosed had hypertension as their only apparent abnormality.

Albuminuria was abnormal if 100 mg. of protein or more were detected in a single random urine specimen using a paper dipstick method. Albuminuria was never the only sign of toxemia in any of these patients.

Edema was abnormal if it involved the hands, face, or sacral regions or if it involved the legs and feet and did not respond to outpatient parenteral diuretic therapy. If one or more of these diagnostic criteria were met any time between the 24th week of pregnancy and the fourth postpartum day, the patient's condition was diagnosed as toxemic. Despite absence of hypertension or albuminuria, a diagnosis of toxemia was made in two patients in whom facial edema developed during oral diuretic treatment.

Intrapartum infection was said to have occurred when a patient in active labor had an oral temperature of 100.4° F. or higher. The site of infection was determined by clinical examination and confirmed by bacteriological studies when indicated.

Postpartum infection was said to have occurred when a patient met the criteria for puerperial morbidity of the Joint Committee on Maternal Welfare, United States, as stated by Eastman and Hellman (*7b*) ; that is, a temperature of 100.4° F. on any two of the first 10 postpartum days, excluding the first 24 hours after delivery. The patient's temperature had to be taken by a standardized technique at least four times daily.

In our study, this definition was modified to include only the postpartum hospitalization period of 4 days. For the diagnosis of postpartum urinary tract infection, a patient had to meet two of the following three criteria.

1. Clinical history of dysuria, urgency, or hematuria.

2. Pyuria of 10 or more white blood cells per high-power field on the microscopic examination of a catheterized or clean voided urine specimen.

3. Culture of a catheterized or clean voided urine specimen in which there was a growth of 10,000 colonies of a single bacterial species per milliliter of urine.

If two of these criteria were met, a diagnosis of urinary tract infection was made regardless of the temperature of the patient. In other cases infection was diagnosed in the absence of fever only if warranted by clinical evidence and the diagnosis could be supported by bacteriological findings. One patient was afebrile but had clinical bronchitis, and her sputum when cultured grew *Pseudomonas*.

Anemia was diagnosed if the patient's hematocrit was less than 30 percent any time during pregnancy. Hematocrits were determined by a capillary tube method at least twice, during the pregnancy and during puerperium.

Final diagnoses were made at a complete review of the outpatient and inpatient record of each patient. This review was made within 10 days after the final discharge of the patient from the obstetrical ward of the hospital. The chi-square test was used to determine the statistical significance of the relationships studied.

Socioeconomic and Cultural Parameters

Living standards. Four standard of living categories, all near or below the poverty-deprivation line, were established as shown in table 1 (*8, 9*). Group I consisted of the mothers whose average annual family incomes ranged near the poverty-deprivation line, and groups II, III, and IV were those with successively decreasing incomes ranging from mild to extreme poverty (*10*). These three groups comprised 72 percent of the entire sample. The intermediate category, group III, were patients with annual incomes comparable to stipends paid to clients of the Oklahoma Department of Public Welfare and the Bureau of Indian Affairs.

We observed that the income available to unmarried mothers and their offspring could not be accurately determined. All unmarried mothers, therefore, were placed in a separate category. The analysis of living standard and blood quantum includes 325 of the 338 mothers for whom medical data were complete. Four families with unknown incomes and one family consisting of a white staff doctor and his white wife were dropped from living standard and blood-quantum analysis (table 2).

Strong correlations existed between the living standard classifications based on income and those based on descriptive items. In each category downward from group I, the numbers of dependents and occupants per room in the home increased, more primitive methods of disposal of human waste and refuse were used, the source of water supply and means of transporting water became more rudimentary, the use of wood rather than gas for heating and cooking was more prevalent, but anomalously, the percentage of homeowners increased, probably because so many very poor Indians live on tax-free restricted Indian allotments and homesteads.

Generally, families were large, with a mean of 4.9 dependents per family. Thirty-five families had more than nine dependents. The mean household population was 6.1. However, Wahrhaftig (*1*) found a median of 4.9 persons per household in a single sample based on an entire community as opposed to our sample, which represents families of childbearing age only. The two samples tend to corroborate one another.

Although 87 percent had poverty level incomes, these families were surprisingly independent. Of the families of the 329 mothers reporting income, 249, or 76 percent, were either self-supporting or living on income from past employment; 25, or 8 percent, were partly self-supporting but obtained significant financial support from other sources, such as social agencies or relatives; and only 55, or 17 percent, were totally dependent on social agencies or relatives for their financial support (*1*). The small quantities of U.S. Department of Agriculture surplus commodity foods distributed to families at the deprivation level of income by

Table 1. Living standard groups, by monthly income and number of dependents

Group	Number of dependents								
	1	2	3	4	5	6	7	8	9 or more
I	$84 or more.	$168 or more.	$217 or more.	$267 or more.	$293 or more.	$312 or more.	$333 or more.	$353 or more.	$376 or more.
II	$57–83	$114–167	$141–216	$163–266	$185–292	$202–311	$218–332	$231–352	$250–375
III	$41–56	$61–113	$79–140	$94–162	$109–184	$120–201	$131–217	$139–230	$152–249
IV	Less than $41.	Less than $61.	Less than $79.	Less than $94.	Less than $109.	Less than $120.	Less than $131.	Less than $139.	Less than $152.

Table 2. Probable social function according to blood quantum group of mother and father

Probable social function [1]	Blood quantum groups		Number
	Mother	Father	
Indian	Full	Full	78
	do	Half	23
	Half	Full	37
Indeterminate	Half	Half	31
	Quarter	Full	5
	None	do	24
	Full	Quarter	7
	do	None	26
Non-Indian	Half	Quarter	5
	do	None	39
	Quarter	Half	5
	None	do	26
	Quarter	None	14
	do	Quarter	4
	None	do	1
Total			325

[1] Omits 4 families whose incomes were not known.

State welfare offices were not considered in defining the term "self-supporting."

Cultural factors. All families in the sample qualified as Indian by hospital admission requirements, but the investigators wanted to distinguish between functionally Indian and functionally non-Indian families, based on the blood quantum of both spouses. In view of the relatively low rate of assimilation of fullblood Indians into the general society, it is quite likely that a fullblood Indian man married to a fullblood Indian woman constitute a functionally Indian couple—one that would reside in a Cherokee Indian community. The scarcity of persons of less than one-half Indian blood within Cherokee communities is evidence that a quarter-blood man married to a quarter-blood woman usually constitute a functionally non-Indian couple who probably would not live in a Cherokee settlement.

No statement of the social participation could be made about a number of possible pairings; for instance, fullblood Indian men, functioning within a Cherokee community, do occasionally bring white wives home to live with them. On the other hand, fullblood Indian men sometimes cut their ties with their community of birth, marry white women, and function as members of the general society.

The family categories in table 2 should be regarded as statements of probable social function. On this basis 138, or 42 percent, of the families were classified as functionally Indian; 94, or 29 percent, of the families were considered functionally non-Indian; the function of 93, or 29 percent, of the families was indeterminate.

When estimates of social function were matched with estimates of standard of living, only 26 percent of the families in the highest income group were functionally Indian, while 45 percent were considered functionally non-Indian. Conversely, 55 percent of the families in the lowest income group were functionally Indian, while only 18 percent were considered functionally non-Indian (table 3).

The investigators wanted to distinguish between urban and rural families. Homes connected with city sewerage were within the limits of towns with populations of more than 2,500. Therefore, use of city sewerage was taken as an

Table 3. Relationship of social function to living standard [1]

Living standard group	Social group						Total	
	Indian		Indeterminate		Non-Indian			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
I	10	7	11	12	17	18	38	12
II	31	23	24	26	35	37	90	28
III	50	36	34	37	23	25	107	33
IV	27	20	13	14	9	10	49	15
Unmarried mothers	19	14	10	11	9	10	38	12
Total	137	100	92	100	93	100	[2] 322	100

[1] $\chi^2=17.8$; df=8, $P<0.05$.
[2] Omits 4 families whose incomes were not known and 3 families in which the father's blood quantum was unknown.

index of urban residence. On this basis, 79, or 24 percent, of the families were classified as urban. A high correlation between urban living and higher income categories and between rural living and lower income categories was recorded in table 4.

Additional analysis revealed that functionally Indian families were largely rural. Although 42 percent of the families studied were classified as functionally Indian, only 13 percent were urban residents, accounting for 23 percent of the total listed as urban. On the other hand, functionally non-Indian families constituted 29 percent of the total sample, with 38 percent classified as urban residents, accounting for 46 percent of the total listed as urban (table 5).

The level of education was generally low. Thirty-six percent of the mothers and 44 percent of the fathers about whom information was available had not gone beyond the eighth grade. More mothers than fathers had completed high school, although several fathers had additional vocational training. No attempt was made to obtain educational information on unmarried fathers.

There was a significant relationship between level of education and standard of living (table 6). Only three of the fathers and seven of the mothers who had completed high school reported incomes in standard of living group IV; only one mother and three fathers with less than a seventh grade education reported incomes in living standard group I.

The functionally Indian families had a very low level of education. Of the fathers who had graduated from high school, only 24 percent were functionally Indian, and 47 percent were functionally non-Indian. Of the fathers who had not gone beyond eighth grade, 58 percent were functionally Indian, and only 32 percent were functionally non-Indian. Of the mothers who never went beyond the eighth grade, 53 percent were functionally Indian, and only 21 percent were functionally non-Indian (table 7).

Analysis of socioeconomic and cultural fac-

Table 4. Relationship of rural or urban residence to living standard [1]

Living standard group	Residence				Total	
	Rural		Urban			
	Number	Percent	Number	Percent	Number	Percent
I	19	8	20	25	39	12
II	60	24	30	38	90	28
III	89	36	19	24	108	33
IV	44	18	5	6	49	15
Unmarried mothers	35	14	5	6	40	12
Total	247	100	79	100	[2] 326	100

[1] $\chi^2=30.32$; df=4, $P<0.01$.
[2] Omits 3 families in which the father's blood quantum was unknown.

Table 5. Relationship of social function to rural and urban residence [1]

Social group	Place of residence				Total	
	Rural		Urban			
	Number	Percent	Number	Percent	Number	Percent
Indian	120	49	18	23	138	42
Indeterminate	69	28	24	31	93	29
Non-Indian	58	23	36	46	94	29
Total	247	100	78	100	[2] 325	100

[1] $\chi^2=19.8$; df=2, $P<0.001$.
[2] Omits 4 families whose incomes were not known.

Table 6. Relationship of living standard to mothers' education [1]

Living standard group	8th grade or less		9th grade or more		Total	
	Number	Percent	Number	Percent	Number	Percent
I	6	5	33	16	39	12
II	20	17	70	34	90	28
III	53	45	55	26	108	33
IV	28	24	21	10	49	15
Unmarried mothers	10	9	29	14	39	12
Total	117	100	208	100	325	100

[1] $\chi^2=33.9$; df=4, $P<0.01$.

Table 7. Relationship of social function to mothers' education [1]

Social group	8th grade or less		9th grade or more		Total	
	Number	Percent	Number	Percent	Number	Percent
Indian	62	53	76	37	138	42
Indeterminate	30	26	63	30	93	29
Non-Indian	25	21	69	33	94	29
Total	117	100	208	100	325	100

[1] $\chi^2=8.91$; df=2, $P<0.02$.

tors. Through the hospital, good medical care was available to many persons who were both Indian and poor. Detailed consideration of maternity patients in the hospital revealed that this single population contained distinguishable subgroups differing both in social participation and in degree of poverty. The functionally Indian population was more impoverished, more rural, and less educated than the functionally non-Indian population. Both subgroups had equal access to health facilities. The question was whether there were correlative differences in health and response to treatment.

Maternal health status. Toxemia of pregnancy, present in 86, or 25 percent of the 345 patients, increased in frequency as the living standard of the married mothers decreased (table 8). The unmarried mothers had an incidence of toxemia between that in the group III and IV married patients. Further analysis showed that toxemia also increased as parity and maternal age increased. No relationship could be shown, however, between toxemia and blood quantum, urban or rural residence, and level of education.

Intrapartum and postpartum infection, diagnosed in 103, or 30 percent of the patients, occurred in unmarried mothers with a significantly greater frequency than in married mothers (table 8). Seventeen of the 21 infections diagnosed in the unmarried mothers involved the urinary tract. No relationship could be found between infection and the living standard of married mothers, blood quantum, place of residence, or education.

Anemia, diagnosed in 30, or 9 percent of the patients, was attributed to iron deficiency in 10, and to acute postpartum blood loss in 17 patients. Two patients had megaloblastic anemia, and the cause of one patient's anemia was unknown. No relationship could be found between anemia and living standard, marital status, blood quantum, place of residence, or education.

Maternity care. Maternity care was measured by the trimester of pregnancy of the patient's first prenatal visit and the frequency of her visits to the clinic. In this study, the mean menstrual week of pregnancy at the first prenatal clinic visit was 23.7 weeks; the greatest number of patients came to the clinic for the first time in the 24th week. The mean number of prenatal clinic visits was 6.3 visits per patient. Twenty, or 6 percent, of the patients received

no prenatal care, but one patient attended clinic 21 times during her pregnancy.

Infection of the genital tract, including episiotomy wounds, occurred in 8, or 40 percent, of the 20 patients who received no prenatal care. This was a significantly higher incidence of infection of this site than was found in the group who received some care. Neither the incidence of toxemia nor anemia was influenced by the duration or frequency of prenatal clinic care.

Unmarried mothers sought prenatal care later in pregnancy than married mothers (table 9); five, or 13 percent, of the 40 unmarried patients had no care before delivery. No relationship between the duration or frequency of prenatal care and living standard, blood quantum, place of residence, or education could be shown.

Table 9. Relationship between living standard group and duration of prenatal care

Living standard group	Total	No prenatal care or care during last trimester only	
		Number	Percent
I	37	12	32
II	88	20	23
III	106	25	23
IV	49	19	39
Unmarried mothers [1]	39	22	57
Total	[2] 319	98	31

[1] For married mothers compared to unmarried mothers $\chi^2=13.8$; df=1, $P<0.001$.
[2] Omits patients whose income was not known and those whose period of gestation at first prenatal visit was not known.

Maternal Health and Socioeconomic Status

Nonreservation American Indians in this study had a higher incidence of toxemia than the 6 or 7 percent reported in the recent standard obstetrical text by Eastman and Hellman (*7b*). The patients at highest risk for this condition were married mothers with the lowest living standard. Analysis of their ages showed that older mothers with larger families had a higher than average incidence of toxemia. Nulliparous patients had an incidence of toxemia intermediate between the older patients with more than five children and those who had one or two previous pregnancies. Our impression is that this high incidence of toxemia is also related to a high incidence of chronic renal disease associated with latent infection.

Because of the high incidence of urinary tract infections and toxemia among unmarried mothers, these patients required additional consideration. As a group they were younger and had had fewer children than the married women in the study.

Although it was difficult to determine the actual sources of income and the number of people dependent on a given income in their families, unmarried mothers had a low standard of living. None owned her own home; 33 of 40, or 83 percent, lived with other people, and 7, or 17 percent, rented their homes. The houses of 25 of 40 either had no heat or only a wood stove. Only 12, or 30 percent, of the unmarried mothers had inside toilets, while 25, or 64 percent, of the group I married mothers had inside toilets. In general, the unmarried mothers had

Table 8. Relationship of living standard to complications of pregnancy

Living standard group	Total patients	Patients with complications					
		Toxemia [1]		Infection		Anemia	
		Number	Percent	Number	Percent	Number	Percent
I	39	3	8	10	25	3	8
II	90	23	25	27	30	6	7
III	108	28	26	29	27	7	6
IV	49	18	37	9	18	5	10
Unmarried mothers	40	11	28	21	53	6	15
Total	326	83	25	96	29	27	8

[1] $\chi^2 = 9.9$; df = 4, $P<0.05$.

a living standard above that of the group IV mothers, but below that of the group III mothers when measurements other than income were used.

Although unmarried mothers came to the clinic for prenatal care late in their pregnancies, once care was started they attended the clinic regularly. Eleven, or 28 percent, of the unmarried mothers did not get prenatal care until the third trimester of pregnancy, but 20, or 50 percent, had more than six clinic visits.

Education has been shown by other investigators to have significant influence on maternity care (*11*, *12*), but such a relationship could not be confirmed in this study. Since 39, or 11 percent, of these patients had less than a sixth grade education, health education should be given in elementary school or the prenatal clinic to reach all of the potential maternity patients in eastern Oklahoma.

Whether a patient lived in a rural or an urban environment did not affect the frequency or duration of medical care received or the occurrence of maternal morbidity. Since urban areas usually afford their residents transportation and communication advantages, we assumed that these advantages either were not present or did not influence the health status of the urban dwellers in this study. Such a result could occur if a community were too small to be functionally urban, or if the persons studied were too poor to avail themselves of these advantages.

Summary

This study of nonreservation American Indians living in eastern Oklahoma shows that within the patient population served at a given Public Health Service Indian Hospital, two distinct cultural groups could be identified. The group that functioned socially as Indians was more impoverished, more rural, and had less education than their functionally non-Indian counterparts.

Patients with a lower standard of living had a higher incidence of toxemia of pregnancy, but no relationship between living standard and postpartum infection or anemia was found. Racial and social function, educational attainment, and rural or urban living could not be related to maternal morbidity. Maternity care did not influence the occurrence of either toxemia or anemia, but patients who received no prenatal care had a higher incidence of genital tract infections than those who went to the prenatal clinic.

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