The Reassessment of the Age and Sex of the Indian Knoll Skeletal Population: Demographic and Methodological Aspects

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The purpose of this paper is to report the results of a reassessment of the age and sex of the Indian Knoll skeletal population. This large group of skeletons, probably the largest racially homogeneous collection in North America, has been previously described in detail (Snow, '48), based upon a study begun in 1941.

In the original study, only one primary set of aging criteria was utilized for the adult group: cranial suture closure; on this basis, the demographic description was made. However, the present reassessment, carried out by the authors in the summer and fall of 1959, was based upon a composite of criteria, as it is felt that the entire skeleton is better than any one part in judging age at death (Brooks, '55). This paper is therefore of interest not only because it presents new demographic information on this large prehistoric American Indian skeletal series, but also in that it presents a comparison of two evaluations of age of the same series involving differing methodological approaches.

In addition, data will be presented relative to the use of dental attrition in the evaluation of skeletal age. The authors believe that, when certain conditions are met, the degree of tooth wear may be used as a supplementary indicator of age.

The site

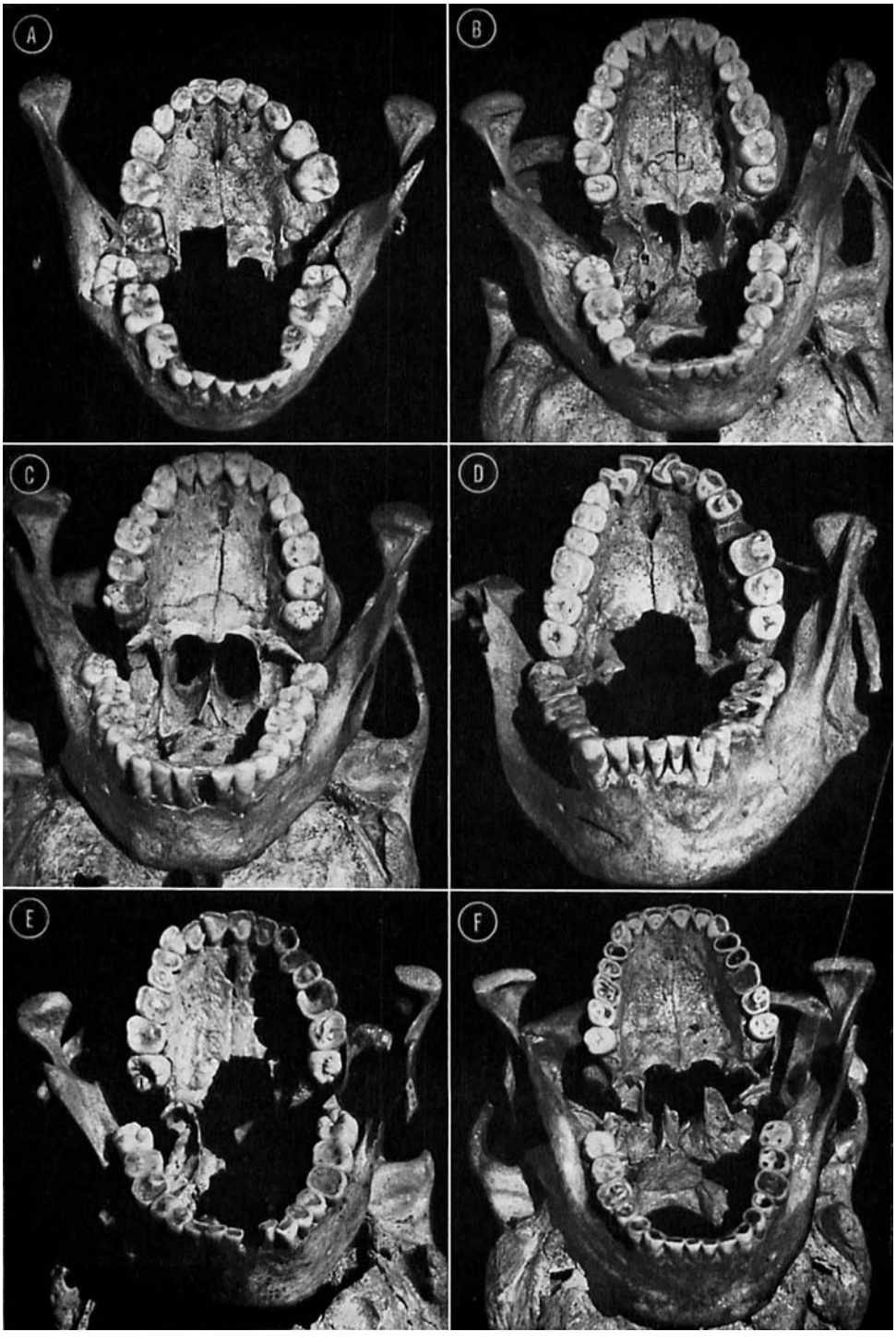
The name Indian Knoll refers to a prehistoric "shell heap" located on the banks of the Green River in west-central Kentucky. This site has yielded not only abundant skeletal material but also numerous cultural artifacts: some 67,000 separate items have been catalogued. Carbon-14 dates obtained from excavated material have given an average of 5302 years (Libby, '55). This dating, plus analyses of the cultural manifestations, has served to place Indian Knoll in the Archaic period of Eastern archaeology, a period characterized by the use of ground stone but lacking agriculture, pottery, and perhaps the bow and arrow. (Spearthrowers, however, were used by the people.)

The first excavation of the site occurred in 1915 when C. B. Moore of Philadelphia removed 298 burials. Of those that are still preserved, most are located at the U.S. National Museum. During the WPA-sponsored investigations of the 1930's the investigation was completed, except for a very small area (Webb, '46). The total number of skeletons from both excavations, has been listed by Snow ('48, p. 384) to be derived from at least 1234 individuals.

In his description of the skeletal remains, Snow has pictured the people as being slender and gracile and about the size of the modern Hopi Indians of the Southwest. He further characterizes them (p. 401) as having high-vaulted heads, prognathous faces, moderately-protruding cheekbones, and a strongly-everted gonial region. Morphologically, Snow's Indian Knoll type belongs to the Amerindian race of the Mongoloid stock, and more specifically, to Neumann's Sylvid (now Iswanid) type (see Neumann, '52, pp. 17 ff.).

METHODS

Only those skeletons preserved at the University of Kentucky Museum of Anthropology were re-examined. This included some 880 documented burials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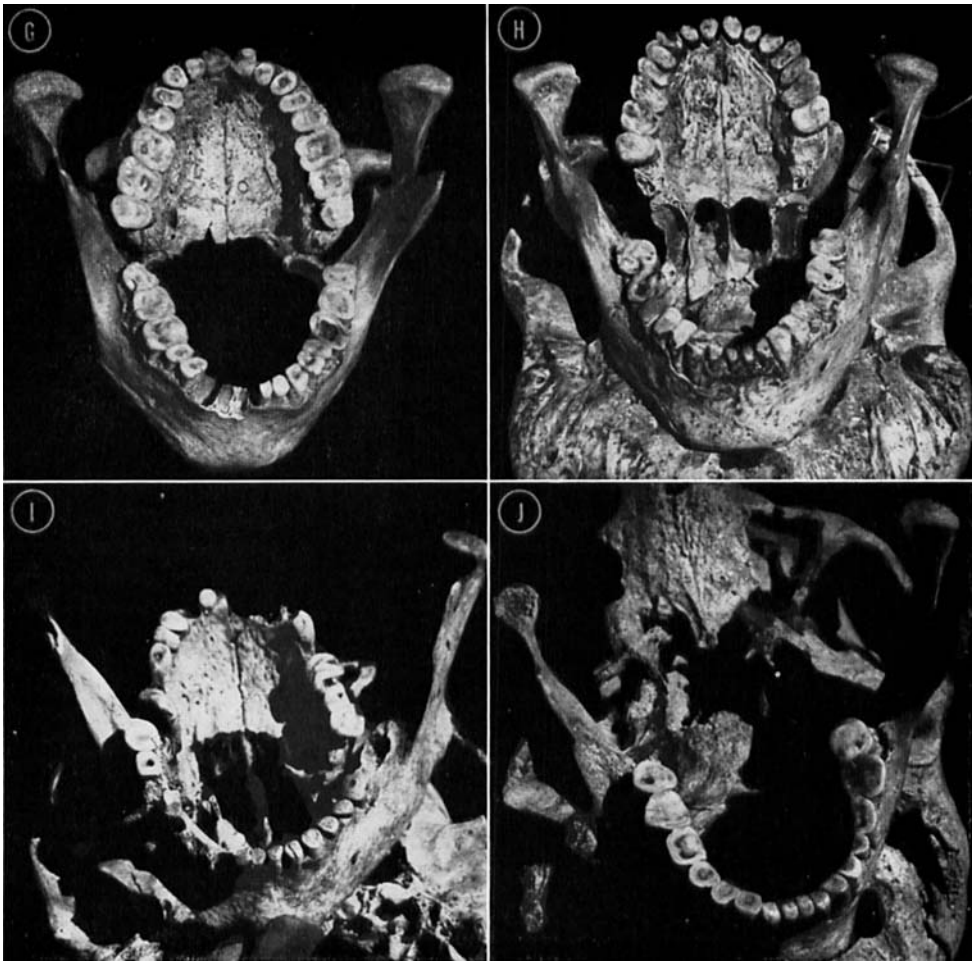

Fig. 1 Increasing tooth wear and associated age at Indian Knoll. A, no. 691, 5 years; B, no. 501, 19 years, female; C, no. 701, 21–22 years, female; D, no. 611, 26 years, male; E, no. 821, 28–29 years, female; F, no. 860, 30 years, female; G, no. 690, 30–33 years, female; H, no. 661, 35 years, male; I, no. 685, 35–40 years, female; J. no. 705, 45–50 years, male.

and fragments, largely cranial, of 48 others removed by the University party. These fragments were attributed to Moore's investigation and were labeled "D.A.," i.e., "material from previously disturbed area." Post-cranial DA fragments were not included in this study because their associations could not accurately be determined. Still others were omitted from this paper either because they were on loan or simply missing. (Their storage place has been changed several times over the years.)

The authors independently assessed the age and sex of each skeleton. The results were then compared and differences resolved. Only after a final decision had been made was the original 1941 evaluation noted.

For all ages, sexing involved primarily the pelvis, although the skull and long bones were also examined. In those cases where a definite assignment could not be made, a reasonable approximation was felt to be better than a mere question mark. Sexual dimorphism, especially in the pelvis, was marked at Indian Knoll, and hence the uncertainties were almost entirely limited to the infant and small children. In spite of the demonstration

of sexual differences in the infant pelvic girdle (Reynolds, '45), approximately 18% of the Indian Knoll infants were placed into an undetermined category; the figure for the entire series was 5%.

The criteria for exact aging varied, of course, with the particular age group to which the individual belonged, and also with the degree of preservation of the skeleton. Both dental (tooth eruption and, to some extent, attrition) and skeletal (developmental age-associated indicators) information was considered. Standards for the public symphyseal surfaces presented by McKern and Stewart ('57) were utilized. Tooth calcification (third molar) was also used in the sub-adult range (Johnston, '61).

In each case, the final assessment was based upon as many of the criteria as were available. Degree of closure of the vault sutures was not observed except when extreme fragmentation necessitated it.

Dental attrition was employed at all ages as an accessory means of age estimation. The standards of wear of Leigh ('28) were followed. The extreme wear has been well described by the same author ('25). In spite of laboring under the misapprehension that these people were a late pre White contact group that practiced agriculture, Leigh's summary of the extreme conditions he observed are very complete. He says that "the writer has never seen lesions of attrition so generalized, developed so early in life and with such far-reaching pathological results as in the crania of these Kentucky people" (p. 185).

The attrition associated with advancing age is shown in figure 1. The extreme range of wear made it possible to use successive exposure of the dentine and pulp cavity as an indicator of age. However, it must be emphasized that these sort of criteria are valid only within the context of the particular series under observation, and only in conjunction with other appropriate indicators, when available.

RESULTS

Demographic aspects

The total number of burials examined in the second (1959) assessment was 873, of which 48 were from the "disturbed area." Table 1 shows the number of individuals in 1959 and 1941 in each age category, while table 2 indicates the breakdown of the results of the 1959 investigation by sex.

A high rate of infant mortality is indicated for the Indian Knoll population when it is noted that 20.48% of the total are in the under one year age group. Other peaks are at 25–29 years (14.06%) and 30–34 years (14.91%).

The average age of the entire series in the 1959 investigation, including the DA

TABLE 1

Grouping of estimated ages of Indian Knoll series, 1941 and 1959

Age	1941[1]		1959[1]	
	No.	%	No.	%
years				
Under 1	170	15.1	170	19.47
1–4	167	14.9	84	9.62
5–9	94	8.5	54	6.19
10–14	97	8.5	53	6.07
15–19	96	8.5	59	7.15
20–24	271	24.2	74	8.48
25–29	131	11.7	129	14.78
30–34	51	4.6	133	15.23
35–39	21	2.6	88	10.08
40–44	11	0.9	19	2.18
45–49	4	0.4	9	1.03
50 and over	8	0.8	1	0.11
Total	1122	100.0	873	100.00

[1] Includes disturbed area burials.

TABLE 2

Grouping of 1959 assessment of Indian Knoll population by age and sex

Age	Male	Female	?
years			
Under 1	65	75	30
1–4	50	29	5
5–9	35	18	1
10–14	24	28	1
15–19	26	33	0
20–24	26	48	0
25–29	78	50	1
30–34	77	56	0
35–39	58	30	0
40–44	9	10	0
45–49	9	0	0
50 and over	0	1	0
Total	457	378	38

burials, is 18.56 years. Omitting the infants, those under one year, the average is raised to 22.93 years, again emphasizing the high infant mortality. If an Indian Knoller could survive the first year of life, his expectancy would be increased 4.37 years.

The frequency distribution of the Indian Knoll population is compared to some other populations in figures 2 and 3. Figure 2 shows a comparison to an Austrian Bronze Age group and a sample of Egyptians from the Roman Period; the figures are from Krogman, ('58). The distributions are not similar, Indian Knoll standing apart from the other two curves. This, however, is not surprising when it is noted that these two groups are from cultural levels more technologically and economically advanced, and are indicative of a trend toward greater longevity that has continued to the present day.

Indian Knoll is similar, in terms of population distribution, to the groups shown in figure 3. The same general distribution can be observed in small samples of Neanderthal, Cro-Magnon, and Mesolithic peoples (all from Krogman, '58), and a prehistoric group of Hawaiians (Snow, '60). They can all be observed to have a peak at the 11 year and younger category and in the vicinity of 21–30 years. In three of the 5 examples, the younger class has the larger percentage.

Keeping in mind the average life expectancy at Indian Knoll of 18.56 years, we may examine some other averages, again given by Krogman ('58, p. 246). He finds the average in urban Rome of 2000 years ago to be about 20 years, in 11–13th century England, 35–39 years, in 1900 A.D. in the United States, slightly less than 50 years, and, in many living primitive peoples, "the peak in the curve of death is in the 20's or 30's."

Fig. 2 Indian Knoll compared to more advanced populations.

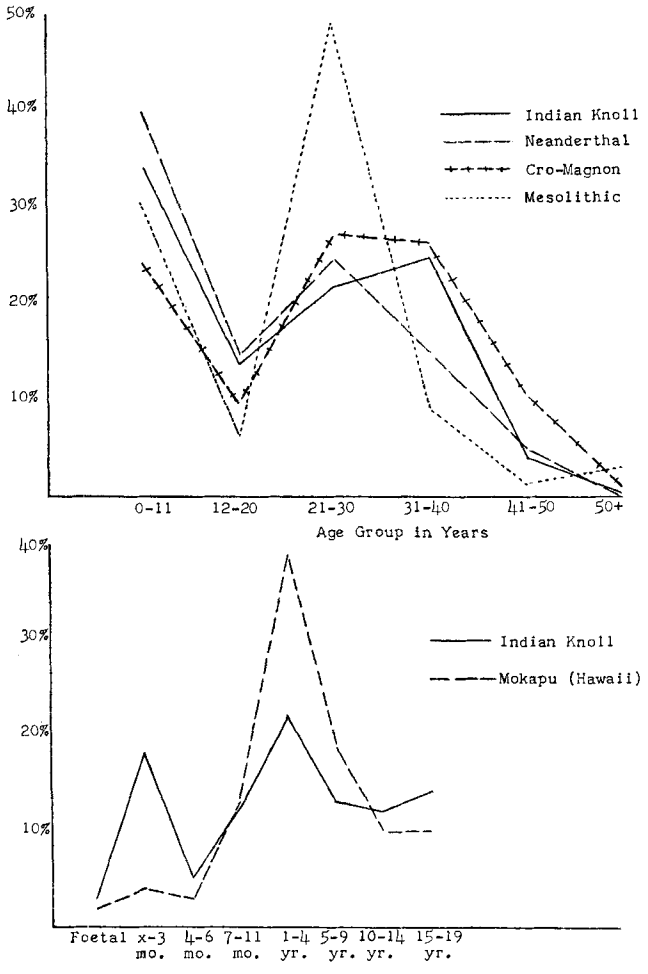

Fig. 3 Indian Knoll compared to more primitive groups.

Methodological aspects

The present study, when compared to the results of the 1941 evaluation, gives a comparison of ages at death of the same skeletal series based, in 1941, on the standards of cranial suture closure of Todd and Lyon ('24 and '25), and, in 1959, on the information gained from the *entire* skeleton.

It is not within the scope of the present paper to summarize the criticisms leveled against the use of cranial suture closure in the aging of skeletal remains. However, recent publications by Cobb ('52), Singer ('53), Brooks ('55) and McKern and Stewart ('57) have all pointed out the variability that exists between individuals in the attainment of closure of these sutures. Singer, after observing closure in 430 skulls of various racial affiliations, has concluded that assessment of age based on these criteria alone ". . . is a hazardous and unreliable procedure" (p. 59). McKern and Stewart, in addition, found ranges as high as 21 years among young American males exhibiting similar degrees of suture closure.

In the comparison of the two assessments of the Indian Knoll series, differences were also noted. Figure 4 shows the shift in the frequency distribution between the two evaluations.

The average age of the skeletons over 20 years of age (thus eliminating those

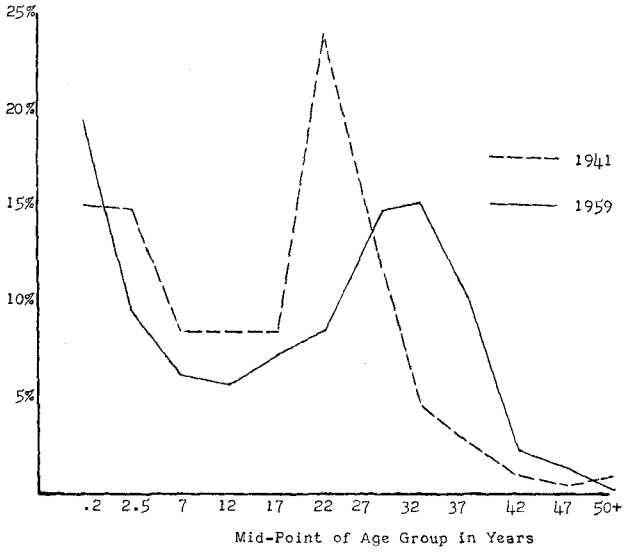

Fig. 4 Distribution of the two assessments.

TABLE 3

Comparison of the two sex assessments of the Indian Knoll series

Assessment	Male	Female	Undetermined
	%	%	%
1941 (Snow)	48.8	40.5	10.7
1959 (Johnston and Snow)	52.3	43.3	4.4

where suture closure was not a factor in aging) was 26.1 years in 1941 and 30.7 years in 1959. (Both figures are based only on those skeletons located at the University of Kentucky.) The mean increase, due to differing methodologies of skeletal aging, is therefore 4.6 years. This number becomes significant when it is noted that McKern and Stewart ('57), in correlating estimated age based on degree of suture closure with known age, computed a standard error of estimate of 4.4614 years. The extreme closeness of these figures seems to indicate that, on the average, a 4½-year error may be expected when aging skeletal material by means of cranial suture closure.

The sex ratios of the two assessments are very similar, as shown in table 3. This indicates that constant results may be expected when sexing skeletal material, unless a low degree of sexual dimorphism makes any degree of certainty difficult.

SUMMARY AND CONCLUSIONS

A reassessment of the Indian Knoll skeletal population, in terms of age and sex, and subsequent comparisons, to an earlier assessment, and to other populations, have led to the following conclusions:

1. The demography of the Indian Knoll population is similar to the more primitive, non-agricultural groups, and exhibits little over-all similarity, in terms of age distribution, to more economically and technologically advanced groups.

2. The average difference between skeletal aging by means of closure of the cranial sutures and by means of a composite of skeletal and dental criteria was, at Indian Knoll, 4.6 years. This average is very close to the standard error of estimate of McKern and Stewart ('57) of 4.4614 years, between predicted and actual ages.

3. The sex ratios of the two studies of the same population were similar, indicat-

ing that skeletal sexing, at least as far as Indian Knoll is concerned, gave relatively constant results.

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