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Non-venereal Syphilis and Australia Antigen among the G/WI and G//Ana San of the Central Kalahari Reserve, Botswana

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Endemic syphilis, a treponematosis mainly affecting children, has been described as occurring in many parts of the world (Hudson 1928; Murray *et al.* 1952; Grin 1953; Willcox 1951). It has been distinguished from other non-venereal treponematoses on a variety of clinical and epidemiological grounds. Unlike classical sporadic venereal syphilis it rarely shows any primary lesion, and when it does this differs from the primary papules of yaws and pinta, the other well-recognised non-venereal treponematoses, by not growing into a papilloma or forming a squamous patch but becoming an ulcer. It is characterised by a tendency for the secondary stage to present as white plaques with painful superficial ulceration of the mucous membranes, particularly of the mouth, nose and throat; such mucous patches may be found in venereal syphilis but are hardly ever seen in yaws or pinta. Cardiovascular involvement has been reported in the tertiary stage, but is uncommon; it is unknown in yaws. Similarly, it is suspected that there may be central nervous system changes in some late cases of the disease, while yaws and pinta do not appear to go on to such a stage (Manson-Bahr 1966).

Endemic syphilis is a disease of rural communities, with a low standard of hygiene, living in dry areas. In these respects it differs from yaws and pinta, the former of which is found only in humid regions, while the latter tends to occur along the banks of rivers. The transmission of all three diseases is by direct skin contact, but whereas yaws and pinta appear to be highly infective and to spread even where the body is washed frequently, endemic syphilis is not universal even among those who, like the people with whom this paper is concerned, hardly ever get the chance to wash and whose unclothed bodies frequently huddle together around the fire.

The way of life of the G/wi and G//ana San ("Bushmen") of the Central Kalahari Reserve in Botswana has been described by Silberbauer (1966) and Tanaka (1969). It differs in only minor particulars from that of other San hunter-gatherers, to whom the G/wi and G//ana are culturally (Lee 1965) and biologically (Jenkins *et al.*, unpublished) akin. Both peoples speak dialects of Central Bushmen, and the dialects are mutually intelligible (Westphal 1963). They inhabit one of the more inaccessible regions of the Kalahari Desert, but practise somewhat circumscribed seasonal migration (Tanaka (1973). They have occasional contact with the Kgalagadi, a Tswana-speaking semi-nomadic cattle-keeping people apparently intermediate between the Negroes and the San (Schapera 1953), who are also to some extent desert-dwellers.

Their association with the Kgalagadi is particularly interesting in the context of non-venereal syphilis, since Murray *et al.* (1956), in their survey of the disease in the Bakwena Reserve, found by far the largest number of cases among the Kgalagadi in the desert areas. Though the Kgalagadi profess to despise the San (and are themselves said to be despised by

the Negro Tswana), they can be observed to adhere closely to San mores when they are visiting or travelling with them. (Conversely, they are the main sources of domestic cattle and firearms for the San; the introduction of both of these is making serious inroads on the traditional way of life). The level of hygiene of the Kgalagadi is not much, if at all, higher than that of the San, and the San practices of expressing friendship by standing close, and of securing attention by means of a hefty nudge of bare shoulder against bare shoulder, probably lead to free exchange of treponemata between the peoples.

The spread of Australia antigen (HAA, hepatitis-associated antigen), an apparently infective agent found in the serum of some persons who either have suffered or are suffering from hepatitis, is facilitated by unhygienic conditions (Macnab and Bersohn, 1971) as well as by such practices as the cicatrization found in many underdeveloped communities (Cruickshank *et al.*, 1972).

The Present Study.

The occurrence of non-venereal syphilis was noted incidentally in the course of a sero-genetic investigation of the G/wi and G//ana. One of the first cases seen displayed the characteristic child-to-mother transmission, an infected suckling being responsible for the primary sore on the mother's breast (Figs. 1-3). One of us (N.T.), who at the time of the arrival of the sero-genetics party had been resident in the Central Kalahari for rather more than a year, was aware of the presence of the disease and had sporadically treated it. No cases of jaundice were seen or heard of during either of the two field trips. The first batch of samples consisted of blood from ninety-two persons. On arrival in Johannesburg aliquots of sera from ninety of these were submitted for Kolmer testing and examination for the presence of Australia antigen. Forty-seven of them gave positive Kolmer reactions of varying strength. It was assumed that a titre of 1/32 or higher indicated the presence of active disease; on this criterion seventeen of the ninety persons, 18,9 per cent., were suffering from active treponematosis.

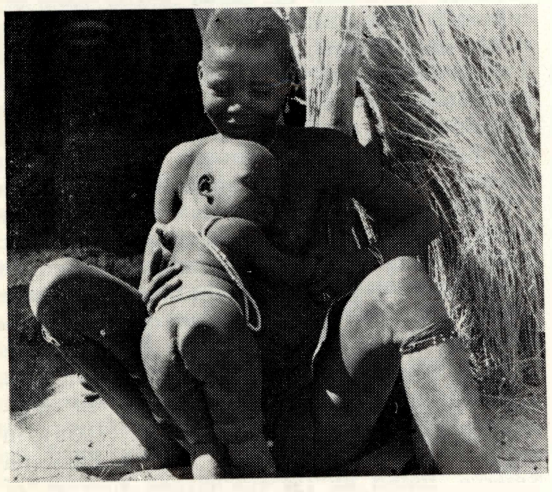


FIGURE 1.
Mother and her child showing lesions of non-venereal syphilis.

FIGURE 2.
Close up view of suppurating lesion in the natal cleft of the child shown in Figure 1.

FIGURE 3.
Close up view of the lesions on the breast of the woman shown in Figure 1.

It must be made clear that this assumption was arbitrary but convenient. At no stage during the two field trips was there time for an adequate clinical assessment of the population. We were guided to a certain extent by the findings of Murray *et al.* (1956, p. 1031) that the great majority of active cases had Kolmer titres of 1/40 or higher before treatment, falling in most instances to below 1/40 after treatment. Since their "latent" cases, though initially showing a wider range, also responded to treatment by a fall in titre, it seemed reasonable to suppose that although such cases might be clinically latent, the disease process was continuing in them. Our assumption had no practical consequences, since before the second field trip we sought the advice of Prof. J. F. Murray, who recommended that as far as possible we should attempt to give treatment to the entire population. We then approached Glaxo-Allenburys (S.A.) (Pty.) Ltd., the pharmaceutical firm, who very generously agreed to supply us free of charge with sufficient long-acting penicillin ("Triplopen" in single-dose 1,25 mega-unit vials) to make this possible. It was also thought that the presence of a borehole at !Koi!kom might induce some of the San to take to washing: as an encouragment, Messrs. Colgate-Palmolive kindly donated a quantity of soap.

In the course of the second field trip, penicillin was administered intramuscularly in doses appropriate to the age of the patient to everyone who would agree to take the injection. This meant, in fact, that *the entire available* population of the /Kade area of the Okwa Valley (see maps, Figs. 4 and 5) was treated. There were, however, a number of people omitted: women were away gathering foodstuffs, men were out on hunting-trips, and though all the persons who were seen and had the reasons for treatment explained to them readily consented to receive treatment, they were, of course, only a small segment of their respective populations. It was felt, however, that though the disease could not in so short a time have been eradicated among them, its prevalence would probably be reduced for a period, during which they might come to see the advisability of seeking treatment in Ghanzi should it recur.

An attempt on the part of one member of the party to encourage the use of soap by introducing a technique of washing with pulped *tsamma* melon (*Citrullus lanatus* or *C. naudinianus*) evoked only amusement in the onlookers and produced sticky discomfort in himself.

Table I.

Results of Kolmer Testing of Sera from all the Available G/wi and G//ana San of the /Kade Area of the Central Kalahari Reserve, Botswana.

	Number estimated	Kolmer Titre							Seropositive		1/32 and higher	
		1/2	1/4	1/8	1/16	1/32	1/64	1/128	Number	%	Number	%
16 Years and Under												
Male	22	0	0	0	2	6	5	3	16	73	14	64
Female	17	0	0	0	5	3	1	1	10	59	5	29
Over 16 Years												
Male	84	7	6	6	9	3	1	2	33	40	6	7
Female	80	10	5	12	7	7	3	5	49	61	15	19
Total	203	17	11	18	23	19	10	11	88	43	40	20

Results of the Serum Investigations.

The results of the Kolmer testing are set out in Table I, and those of the investigation for the presence of Australia antigen in Table II. Tables III(a), (b) and (c) represent arrays of the data on overall Kolmer positivity irrespective of titre, the first and second comparing positivity and negativity to age and sex, respectively, and the third comparing sex and age among those positive. In Tables IV(a), (b) and (c) a similar array is presented with regard to those with Kolmer titres of 1/32 or higher, and in Tables V(a) (b) and (c) the data concerning the presence of Australia antigen is arranged in the same fashion.

Table II.

Results of Testing of the Sera of all Available G/wi and G//ana San of the /Kade Area for Australian Antigen.

	Number Tested	Australia antigen positive Number	Percent
16 years and under			
Male	22	6	27
Female	17	2	12
Over 16 years			
Male	84	10	12
Female	80	11	14
	203	29	14

Table III.

Breakdowns by Age and Sex According to Kolmer Positivity at any Titre.

(a) *Comparison of children and adults by Kolmer positivity.*

	Number Tested	Kolmer +ve	Kolmer −ve
16 years and under	39	26	13
Over 16 years	164	82	82
Totals	203	108	95

$X^2_1 = 3{,}49;\ p > {,}05$

(b) *Comparison of males and females by Kolmer positivity.*

	Number Tested	Kolmer +ve	Kolmer −ve
Male	106	49	57
Female	97	59	38
Totals	203	108	95

$X^2_1 = 4{,}33;\ {,}05 > p > {,}02$

(c) *Comparison of Kolmer positives by age and sex.*

	Number positive	AGE 16 years and under	Over 16 years
Male	49	16	33
Female	59	10	49
Totals	108	26	82

$X^2_1 = 5{,}34;\ {,}05 > p > {,}02$

Table IV.

Breakdowns by Age and Sex According to Kolmer Positivity at Titres of 1/32 or Higher.

(a) *Comparison of children and adults by Kolmer titre of 1/32 or higher.*

	Number tested	Kolmer 1/32 or higher	Kolmer below 1/32
16 years and under	39	19	20
Over 16 years	164	21	143
Totals	203	40	163

$X^2_1 = 26{,}71$ for 1 d.f., $,001 > p$

(b) *Comparison of males and females by Kolmer titre of 1/32 or higher.*

	Number tested	Kolmer 1/32 or higher	Kolmer below 1/32
Male	106	20	86
Female	97	20	77
Totals	203	40	163

$X^2_1 = {,}11$ for 1 d.f., $p > {,}70$

(c) *Comparison by age and sex of those Kolmer positive at titres of 1/32 or higher.*

	Number positive	AGE 16 years and under	Over 16 years
Male	20	14	6
Female	20	5	15
Totals	40	19	21

$X^2_1 = 8{,}12;\ {,}01 > p$

Table V.

Breakdowns by Age and Sex According to Presence of Australia Antigen.

(a) *Comparison for children and adults by presence of Australia Antigen.*

	Number tested	*Australia Antigen Positive*	*Negative*
16 years and under	39	8	31
Over 16 years	164	21	143
Totals	203	29	174

$X^2_1 = 1{,}53;\ p > {,}20$

(b) *Comparison of males and females by presence of Australia Antigen.*

	Number tested	*Australia Antigen Positive*	*Negative*
Male	106	16	90
Female	97	13	84
Totals	203	29	174

$X^2_1 = {,}14;\ p > {,}70$

(c) *Comparison by age and sex of those with Australia Antigen.*

	AGE	
Number positive	*16 years and under*	*Over 16 years*
Male	16	6	10
Female	13	2	11
Totals	29	8	21

$X^2_1 = {,}76;\ p > {,}30$

Discussion.

The clinically apparent presence of treponematosis among the G/wi and G//ana San is confirmed by the results of serological investigation. When Kolmer positivity is considered irrespective of titre the difference between adults and children is not significant $X^2_1 = 3{,}49,\ p > {,}05$) but it becomes highly significant ($X^2_1 = 26{,}71,\ p < {,}001$) when only titres of 1/32 and above are taken into consideration. Under the former condition the overall difference between the sexes is significant ($X^2_1 = 4{,}33,\ {,}05 > p > {,}02$) due to an excess of affected females, but not under the latter ($X^2_1 = 0{,}11,\ p > {,}80$). Contrasting affected adults and affected children according to sex shows significant differences under both conditions, ($X^2_1 = 5{,}34,\ {,}05 > p > {,}01$, and $X^2_1 = 8{,}12,\ {,}01 > p > {,}001$), there being in either case excesses of affected adult females and male children. It therefore appears that the treponematosis is one which affects children to a greater extent than adults and is conveyed to adult females rather than to adult males.

This fits in with both the diagnosis of endemic non-venereal syphilis and with the observed pattern of play among the children. Boys tend to cluster together and to have far more bodily contact with one another than there is with or among the girls. Even the youngest toddlers are accepted into play patterns; and the ambulant child is often still being suckled. Examination of some of the pedigrees (for example, that in Fig. 6) discloses an absence of the quasi-hereditary appearance of congenital venereal syphilis and reveals that many of the husbands of infected women are not themselves infected. In short, the possibility that the condition could represent a bizarre manifestation of venereal syphilis in a population which had only lately become exposed to it, may be dismissed.

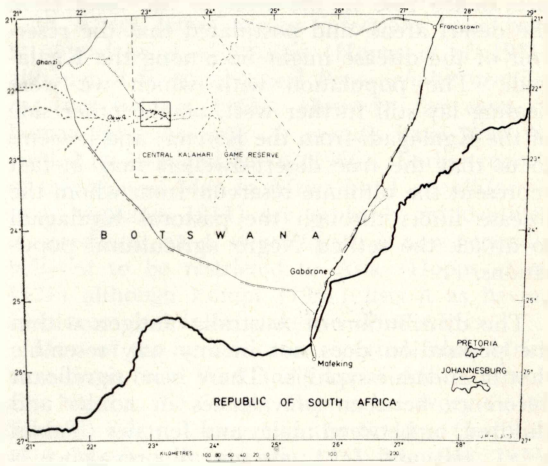


FIGURE 4.
Maps of parts of Botswana and the Republic of South Africa to show the location of the Central Kalahari Game Reserve and, within it, of the /Kade area.

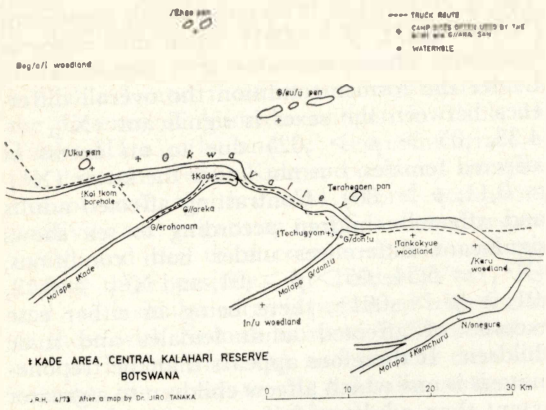
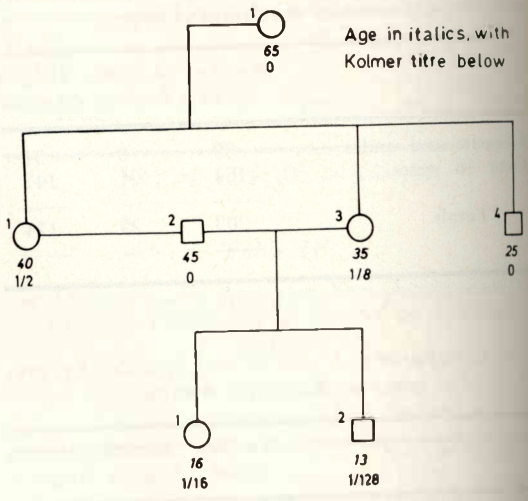


FIGURE 5.

Sketch map of the /Kade area showing the places where the study was carried out.

The prevalence of the disease is rather higher than the figures of around 20 per cent. found by Murray *et al.* (1956) in the non-Kalahari areas of the Bakwena Reserve, but similar to those they found in the Kalahari areas. The sera of 67 per cent. of the children (73 per cent. of the boys and 59 per cent. of the girls) gave a reaction on Kolmer testing; in 49 per cent. (64 per cent. of the boys and 29 per cent. of the girls) the titre was 1/32 or higher. The prevalence in adults was rather lower; though all those who had Kolmer titres of any level amounted to 50 per cent. of the total (40 per cent. of the men and 61 per cent. of the women) only 13 per cent. (7 per cent. of the men and 19 per cent. of the women) had titres of 1/32 or above. Murray *et al.*, found that the prevalence rose in the west of the reserve, in the desert areas, and postulated that the reservoir of the disease might lie among the Kgalagadi. The population with which we were dealing lay still further west, on the other side of the Kgalagadi from the Kwena; and it seems to us that the true desert-dwellers may in fact represent the ultimate reservoir from whom the disease filters through the pastoral Kgalagadi to attack the settled Negro agricultural populations.

The distribution of Australia antigen within the population does not in any way resemble that of endemic syphilis. There is no significant difference between prevalences in adults and children, or between males and females (Tables V(a), (b) and (c)); its overall prevalence is 14 per cent. which is closer to the figures found for tropical African than for Southern African populations by Macnab and Bersohn (1971). It seems probable that lack of hygiene plays a part in its spread, though none of the pedigrees collected shows a familial incidence; but there is no indication of any regular spread from children to adults or *vice versa*, or between spouses.



PART OF A G/WI FAMILY FROM !KADE

FIGURE 6.

Part of the /wi family pedigree to show how Kolmer titre is distributed among its members (see text for possible interpretation of these findings).

ACKNOWLEDGMENTS.

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References.

Cruickshank, J. G., Swanepoel, R., Lowe, R. F., Robertson, T. & Moore, H. (1972) *C. Afr. J. Med.* **18,** 113.

Grin, E. I. (1953) *Epidemiology and Control of Endemic Syphilis: Report on a Mass Treatment Campaign in Bosnia.* W.H.O. Monograph No. 11, Geneva.

Hudson, E. H. (1958) *Non-Venereal Syphilis: A Sociological and Medical Study of Bejel.* London.

Jenkins, T., Nurse, G. T., Tanaka, J. & Lane, A. B. (in preparation): The G/wi and G//ana of the Central Kalahari: a sero-genetic study.

Lee, R. B. (1965) *Subsistence Ecology of !Kung Bushmen.* Ph. D. Dissertation, University of California, Berkeley.

Macnab, G. & Bersohn, I. (1971) Australia Antigen and Antibody in Bantu Sera. Paper delivered at the National Congress of Blood Transfusion and Immunohaematology, Johannesburg, October, 1971.

Manson-Bahr, P. (1960) *Tropical Diseases.* 15th Edition. London.

Murray, J. F., Merriweather, A. M., Keen, P. & Sachs, S. B. (1952) Endemic Syphilis in Bechuanaland. *Med. III. London.* **6,** 407.

Murray, J. F., Merriweather, A. M. & Freedman, M. L. (1956) *Bull. Wld. Hlth. Org.* **15,** 975.

Schapera, I. (1953) *The Tswana.* London.

Silberbauer, G. (1965) *Bushman Survey Report.* Gaberones.

Tanaka, J. (1969) *Kyoto University African Studies* **3,** 1.

Tanaka, J. (1973) Subsistence Ecology of Central Kalahari San. In the press.

Westphal, E. O. J. (1963) The Linguistic Prehistory of Southern Africa: Bush, Kwadi, Hottentot and Bantu Linguistic Relationships. *Africa.* **33,** 237.

Willcox, R. R. (1951) Endemic Syphilis in Africa. *S. Afr. Med. J.* **25,** 501.