

Impacts of Sociocultural Condition on Regional Endemics of HTLV-1 and HBV among Islands in Southwestern Japan

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ABSTRACT: The transmission pathways of two oncogenic viruses, human T-lymphotropic virus type 1 (HTLV-1) and hepatitis B virus (HBV) are very similar: maternal, sexual and by transfusion. Furthermore, individuals infected with these viruses become lifelong virus carriers. Both of these viruses are known to be endemic in Nagasaki. In trying to correlate the endemicity of these viruses with the sociocultural attributes, such as birth place, religion, sex and age, we surveyed residents (2262 in total) aged over 40 years, in three islands of Nagasaki. Markers included anti-HTLV-1 antibody and HBV related markers (HBsAg/HBsAb) in sera.

The prevalences of people infected with HTLV-1 in Mishima, Narao, and Oshima were 41.1, 29.3 and 12.9 %, respectively, while those of HBV were 55.8, 35.1 and 31.7 %, respectively. HTLV-1 and HBV were endemic in all three islands. The penetrations by two viruses seemed to be correlated with each other in each island. This profile was more discrete, if we analyzed people born in the respective islands. However, the evidence to suggest the preferred coinfection of these 2 viruses could not be demonstrated.

These results suggested that the intermarriage in a closed community of islands had a favorable effect to maintain the endemicity of these viruses. Christians in these islands tend to intermarry within their religion. Of males in Oshima, Christians born on the same island were significantly more anti-HTLV-1 positive than non-Christians. Similarly, male Christians of Narao and Oshima showed significantly higher prevalence of HBV markers than non-Christians. The results were consistent with the conjecture.

In the case of HTLV-1, while the prevalence increased with age in both sexes in highly endemic Mishima and Narao, it remained constant in less endemic Oshima. These profiles were also seen in the subjects born in the respective islands. The age related increase of the seropositive population could hardly be explained by the dominant horizontal infections. The age independent seroprevalence in Oshima rather suggested that human factors of each island played a significant role for the decreased frequency of maternal infections of HTLV-1 in these several decades in the other two islands.

In contrast, the prevalence of HBV markers were relatively unaffected by age except for Mishima. This suggested that the maternal infection of HBV is more efficient and dominant than that of HTLV-1. In case of Mishima, the younger female showed significantly lower prevalence.

INTRODUCTION

The prevalence of infection of human T-lymphotropic virus type-1 (HTLV-1) related with adult T-cell leukemia/lymphoma (ATLL) is reported to be high in southwestern Japan, especially in the islands located along with Kyushu¹⁾ and Okinawa²⁾ with a marked variation among local populations. As a cause of clustering of HTLV-1 in these geographically restricted areas³⁾, the impact of historical human movement^{4, 5)} has been speculated. Gallo⁶⁾ has proposed the possibility that HTLV-1 had been brought to southwestern Japan from hot foci in Africa by Portuguese in the 16th century. Recently Hinuma⁷⁾ has postulated that the carriers of HTLV-1 in Japan originated from Jomon people, who were the earliest inhabitants of Japan in the pre-historic period. Though these hypotheses tried to explain the regional difference of HTLV-1, a marked variation of the seropositivity among local populations within a hyperendemic area can not be elucidated.

As for the causes of local variation of HTLV-1 infection in an island in the Eastern China sea, differences in the extent of the exchange by trade and/or the different risk of the transmission by mosquito biting have been speculated by Tajima⁸⁾. Considering diversification of man-environmental system among the islands in the Eastern China sea, by the recent industrialization⁹⁾, the impact of sociocultural attributes of dwellers on the viral infection should be examined. Especially, for estimating local differences of seropositivity of this viral infection, the effect of human movement may influence a cross-sectional observation by which most seroepidemiological studies were carried out because this virus was recently identified.

In addition to HTLV-1, another oncogenic virus, hepatitis B virus (HBV), is also endemic in southwestern Japan¹⁰⁾. Though both viruses have either vertical (mother to child) or horizontal transmission, the distribution among international regions has been reported to be distinctly different from that of HTLV-1: the high rate of HBV carriers has been observed in Taiwan and Korea where HTLV-1 carriers are seldom seen⁸⁾. Moreover, different positive

rates among ethnic groups living in a common environment seem to indicate an important role of migration on regional variation of HBV seropositivity.

We have found previously¹¹⁾ marked geographical variations of seropositivity of anti-HTLV-1 and/or HBV related markers among local communities within a highly endemic Nagasaki prefectural area. Moreover, it has been speculated in our previous study that the human ecological setting of local population has influenced their regional variations in different ways between the two viral infections.

This study tried first to examine the extent of regional variations of seropositivity of HTLV-1 and to estimate the impact of the socioeconomic attributes of dwellers on them. Moreover, by comparing the epidemiological characteristics of HTLV-1 with that of HBV, we expect to get some clues for understanding the epidemic of HTLV-1.

MATERIAL AND METHODS

Subjects: We selected the following three

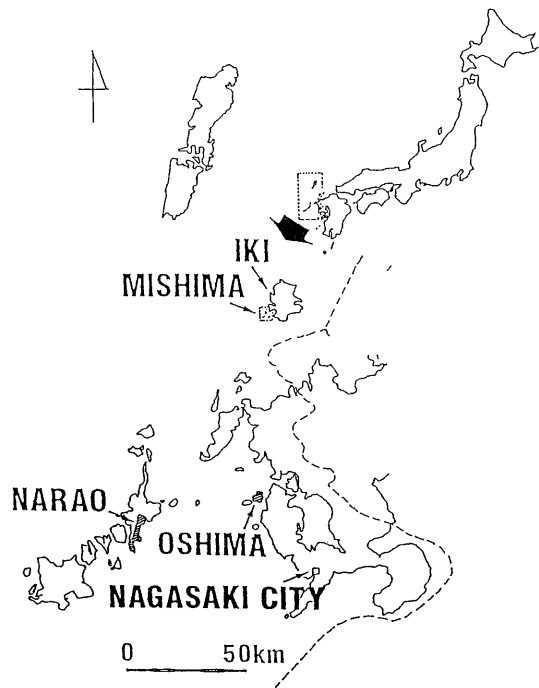


Fig. 1. Location of islands

Table 1. Sociocultural characteristics of each local population (%)

	Male				Female				Both sexes			
	n	Nat ¹⁾ (%)	Rel ²⁾ (%)	Occ ³⁾ (%)	n	Nat ¹⁾ (%)	Rel ²⁾ (%)	Occ ³⁾ (%)	n	Nat ¹⁾ (%)	Rel ²⁾ (%)	Occ ³⁾ (%)
MISHIMA	50	72.0	0	80.0	82	62.2	0	65.9	132	65.9	0	71.2
NARAO	100	84.0	22.0	46.0	293	74.7	19.5	36.2	393	77.1	20.1	38.7
OSHIMA	481	52.2	11.2*	23.7*	773	49.0	12.6*	17.4*	1254	50.2	12.1*	19.8*
Total	631	58.8	8.1	32.3	1148	56.5	9.6	26.2	1779	57.3	9.1	28.4

1) Nat; Native: percentage of persons who were born in the present residential place.

2) Rel; Religion: percentage of Christian

3) Occ; Occupation: percentage of workers engaged in agriculture and/or fishing

* The denominators in Religion and Occupation are different from total number of subjects.

islands located in the Eastern China sea of Nagasaki Prefecture (Fig. 1). The sociocultural attributes of dwellers, such as origin, religion, and occupation, are summarized in Table 1.

1) Mishima (Iki); it consists of three small islands located about 10 min. by sea from the main island of Iki. The population was about 650 in the 1985 census. The main island of Iki has been human settlement since the Yayoi period, but this district is a traditional fishing village since the Edo era. Most of the dwellers (80% male and 66% female) are engaged in coastal fishery and/or self-sufficient agriculture. Judging from the higher percentage of native dwellers who were born within Iki, it is a rather sedentary community. Immigrants of these islands come mainly from the main island of Iki. There are documents which show many Christians in the main island, Iki, in the 16th century, but all the subjects in this study were Buddhists.

2) Narao; it is a town located in a large island named Nakadohri-jima in the Kami-Goto islands. It has been a fishing village since the pre-Edo era. The population is about 4,700 in the 1985 census. In spite of developing as a base of large scale fishing industries, a big emigration to the main land has been progressing, but, the percentage of natives was the highest among the three islands of this study. Immigrants in the town came mostly from other places within the Goto islands. The composition of the main religion of family was varied among districts of the town, and about 20% of subjects were Christians.

3) Oshima; a coastal island located 60km north of Nagasaki city and the population in the 1985

census was about 7,000. The first colonist from the mainland of Nagasaki is recorded in the 16th century. By developing a coal mine in 1936 the population had rapidly increased to about 20,000 from 3,000 in the former period, but is now decreasing in spite of building a shipyard industry. By immigration of coal mine workers from the mainland in the past, the percentage of natives being born in the island was the lowest among the three islands; 52.2% in male and 49.0% in female. Some districts in this island are made up of immigrants from Christian villages of the mainland of Nagasaki and over 10% of subjects in both sexes were Christians.

Methods: In these islands, health surveys including health examination and the interview on socioeconomic conditions have been carried out for voluntary dwellers aged over 40 years since 1986. On the sera collected in health surveys, the detection of markers for infections of HTLV-1 and HBV were carried out by the following methods; antibody to HTLV-1, was detected by the gelatin agglutination assay (Serodia-ATLA) and confirmed by the indirect immunofluorescence method using MT1 and MT2 cells as a target for 1/10 dilution of test sera¹²⁾; by the passive hemagglutination (PHA) for hepatitis B surface antibody (HBsAb) and by reversed PHA (RPHA) for antigen (HBsAg). In this study, we defined HBV marker positivity as the positive case in HBsAg and/or HBsAb as evidence of infection of HBV.

Age adjusted rate: we calculated the age adjusted rate by age structure of the whole population.

RESULTS

1. The epidemiology of HTLV-1

1) Regional variation in seropositivity of anti-HTLV-1 (Table 2, Fig. 2)

The prevalence rate of anti-HTLV-1 in the total subject (19.6%) shows that HTLV-1 is highly endemic in the area involving islands in the study. However, a marked variation of seropositivity was found among islands; the

crude positive rate in combined sexes was significantly higher in Mishima (41.1%) and Narao (29.3%) than that in Oshima (12.9%). The regional variation of the positivity remained as a similar trend to the crude rate. While the crude rate of females (21.4%) was significantly higher than that of males (16.7%) in the total subject ($\chi^2=6.887, p<0.001$), there was no statistical difference of the positive rate by sex in each island. Moreover, the order of the positive rate in each island was almost the same between

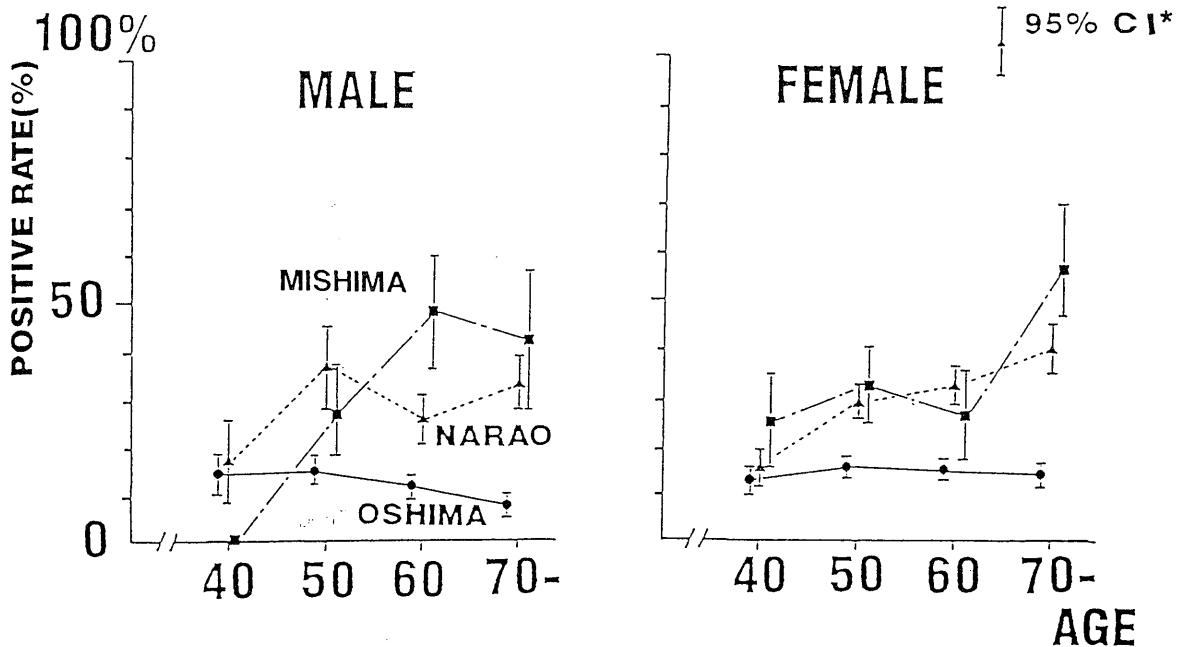
Table 2. Positive rates of anti-HTLV-1 (%)

	Male		Female		Both sexes	
	n	positive (%)	n	positive (%)	n	positive (%)
MISHIMA	64	23 (35.9) 40.2	99	44 (44.4) 45.3	163	67 (41.1) 43.8
NARAO	189	55 (29.1) 29.4	455	134 (29.5) 30.3	644	189 (29.3) 29.7
OSHIMA	590	63 (10.7) 10.5	865	125 (14.5) 14.5	1455	188 (12.9) 13.0
Total	843	141 (16.7)	1419	303 (21.4)	2262	444 (19.6)

* P<0.01, ** P<0.001, ns: not significant by chi-square test

n: number of the subjects

Numerals in bold type are age adjusted rates



* CI: Confidence Interval

Fig. 2. Positive rate of anti-HTLV-1

sexes; the highest rate was in Mishima (males 35.9%; females 44.4%), the intermediate rate was in Narao (male 29.1%; female 29.5%) and the lowest rate was in Oshima (males 10.7%; females 14.5%).

As shown in **Fig. 2**, the age distribution was specific to each island. In males, the positive rate sharply increased between the age of 40s and 50s in Narao, and of 40s and 60s in Mishima. Differing from these two islands, the rate in Oshima slightly decreased with age. In females, the positive rates in Mishima and Narao continuously increased with age until the age of 70s, whereas that in Oshima showed no difference through ages.

2) Impacts of sociocultural attributes on seropositivity of anti-HTLV-1 (**Table 3, 4, Fig. 4**)

With the use of personal sociocultural attributes of dwellers, birth place and religion (**Table 3**), the seroprevalence of male Christians was significantly higher than that of non-Christians in a coastal island, Oshima. Moreover, it should be noted that the profile was more

significant among natives (37.5% in Christians vs. 5.6% in non-Christians). To omit the bias by immigration in the cross-sectional observation, the age distribution of seropositivity was analyzed in the natives (**Fig. 4**). The positive rates increased significantly with age in the highly endemic islands (Mishima and Narao) but not in the less endemic island (Oshima).

2. The epidemiology of HBV

1) Regional variation of seropositivity of HBV markers (**Table 5, Fig. 3**)

The high seropositivities of HBV markers in the crude rate of the total subject (34.4%) showed the dominating infestation by HBV in this study area. The order of prevalence from high to low islands was almost the same as that of anti-HTLV-1, but the extent of regional variation was smaller in the prevalence of HBV markers ranging from 55.8% to 31.7% than that of anti-HTLV-1 ranging from 41.1% to 12.9%. In relation to sex-difference, there was no significant difference in either total subjects or subjects in each island.

Table 3. Comparison of positive rates of anti-HTLV-1 by sociocultural attributes

	ORIGIN ¹⁾					
	Male			Female		
	Nat.	immig.	χ^2 (P) ³⁾	native	immig.	χ^2 (P)
MISHIMA	10/ 38 26.3	5/ 12 41.7	0.423 (0.515)	22/ 51 43.1	14/ 31 45.2	0.032 (0.857)
NARAO	27/ 84 32.1	2/ 16 12.5	1.655 (0.198)	65/219 29.7	17/74 23.0	1.234 (0.266)
OSHIMA	28/250 11.2	31/229 13.5	0.315 (0.574)	58/378 15.3	54/392 13.8	0.380 (0.537)
Total	65/372 17.5	38/257 14.8	0.167 (0.432)	145/648 22.4	85/497 17.1	4.551 (0.033)
	RELIGION ²⁾					
	Chr.	non-Chr.	χ^2 (P)	Chr.	non-Chr.	χ^2 (P)
MISHIMA	—*	15/ 50 30.0	—	—*	35/ 80 43.8	—
NARAO	6/22 27.3	23/ 78 29.5	0.040 (0.839)	17/ 57 29.8	65/235 27.7	0.106 (0.744)
OSHIMA	10/29 34.5	24/228 10.5	12.862 (0.000)	8/ 53 15.1	53/366 14.5	0.014 (0.905)
Total	16/51 31.4	62/356 17.4	4.744 (0.029)	25/110 22.7	153/681 22.5	0.000 (1.000)

Means of Nat. and Rel. are same in Table 1.

* Christians were none in Mishima.

In regards to the age dependent increase of seropositivity, we could not see a significant increase in males. The clear age dependency was observed only in female (Fig. 3): the rate in Mishima sharply increased between the age of 40s and 60s, and those in Narao and Oshima slightly increased.

Table 4. Positive rate of anti-HTLV-1 by the combination of origin and religion

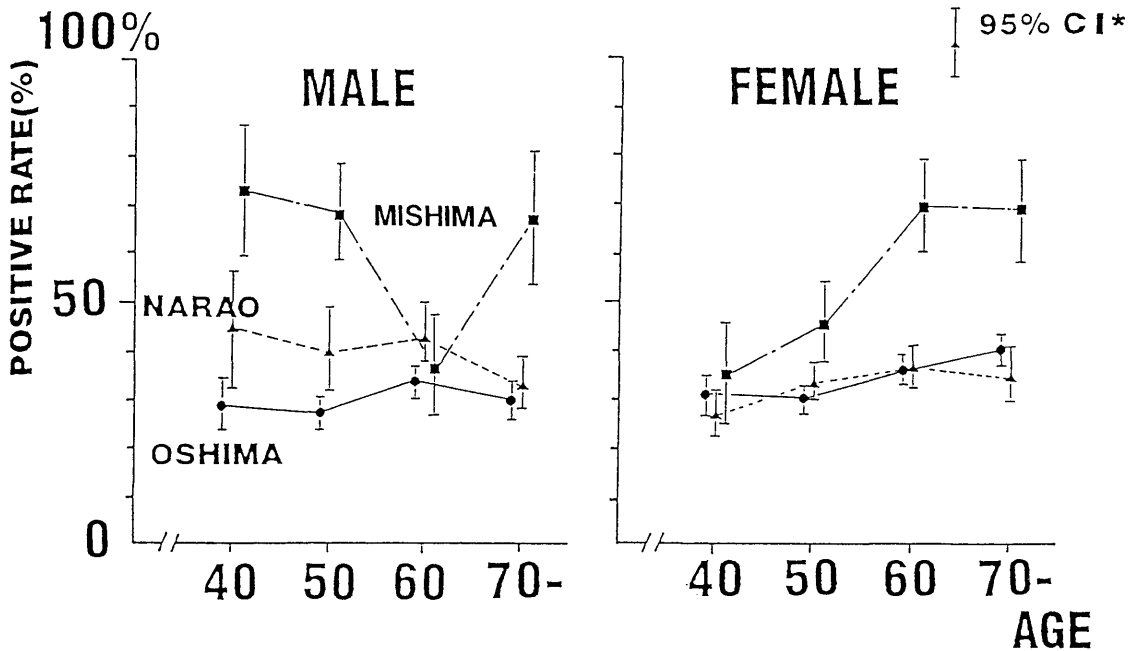
MALE	NARAO	
	Native	Immigrant
Christian	6/18 (33.3)	0/ 4 (0.0)
non-Christian	21/66 (31.8)	2/12 (16.7)
FEMALE		
Christian	12/ 39 (30.8)	5/18 (27.8)
non-Christian	53/180 (29.4)	12/55 (21.8)
MALE	OSHIMA	
	Native	Immigrant
Christian	9/ 24 (37.5)	1/ 5 (20.0)
non-Christian	7/124 (5.6)	17/104 (16.3)
FEMALE		
Christian	5/ 29 (17.2)	3/ 23 (13.0)
non-Christian	29/191 (15.2)	23/174 (13.2)

2) Impacts of sociocultural attribute on HBV seropositivity (Table 6, 7, Fig. 4)

As with HTLV-1, significant differences of HBV markers positivity by sociocultural attributes of dwellers were found only in males; the rate of natives was significantly higher than that of immigrants in Mishima and those of Christians tended to be higher than non-Christians in Narao and Oshima. Moreover, the trend in the combined analysis of religion and birth place was different from that of anti-HTLV-1: the immigrant Christians showed the highest prevalence while the native non-Christians showed the lowest in either Narao and Oshima (Table 7). In regard to age distribution of positivity of HBV markers in natives (Fig. 4), no consistent age difference was found in males, whereas the positive rate in females significantly increased with age in Mishima and was almost constant throughout ages in Oshima and Narao.

3. Relationship of personal seropositivity between anti-HTLV-1 and HBV markers

Since these two viruses are distributed in similar fashion within our target islands, it is



* CI: Confidence Interval
Fig. 3. Positive rate of HBV (hepatitis B virus) markers

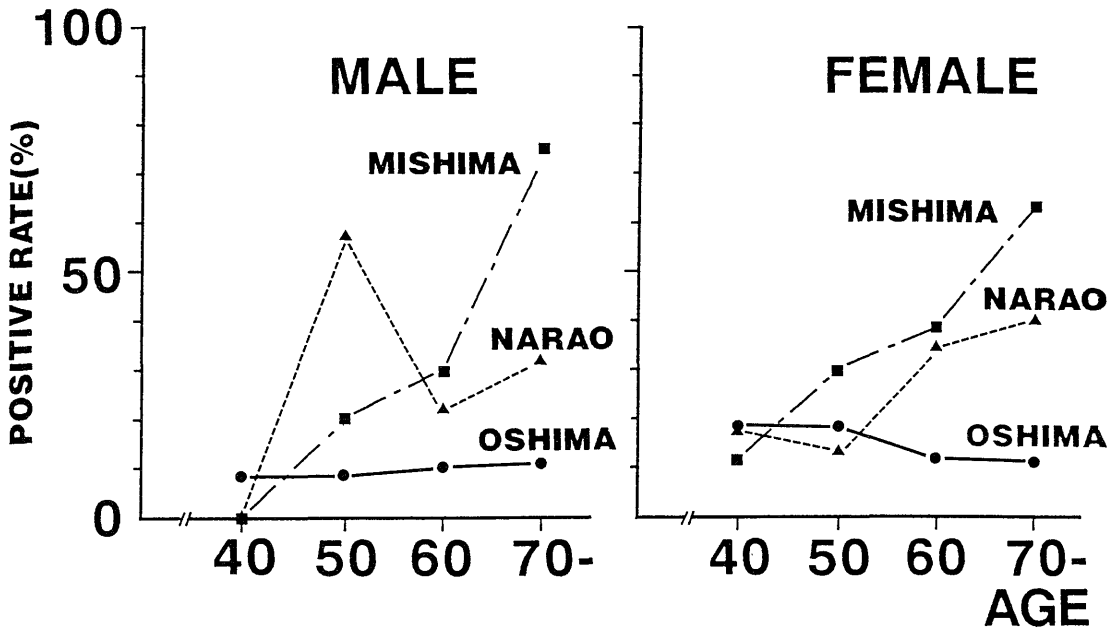


Fig. 4-1. Positive rate of anti-HTLV-1 by the native

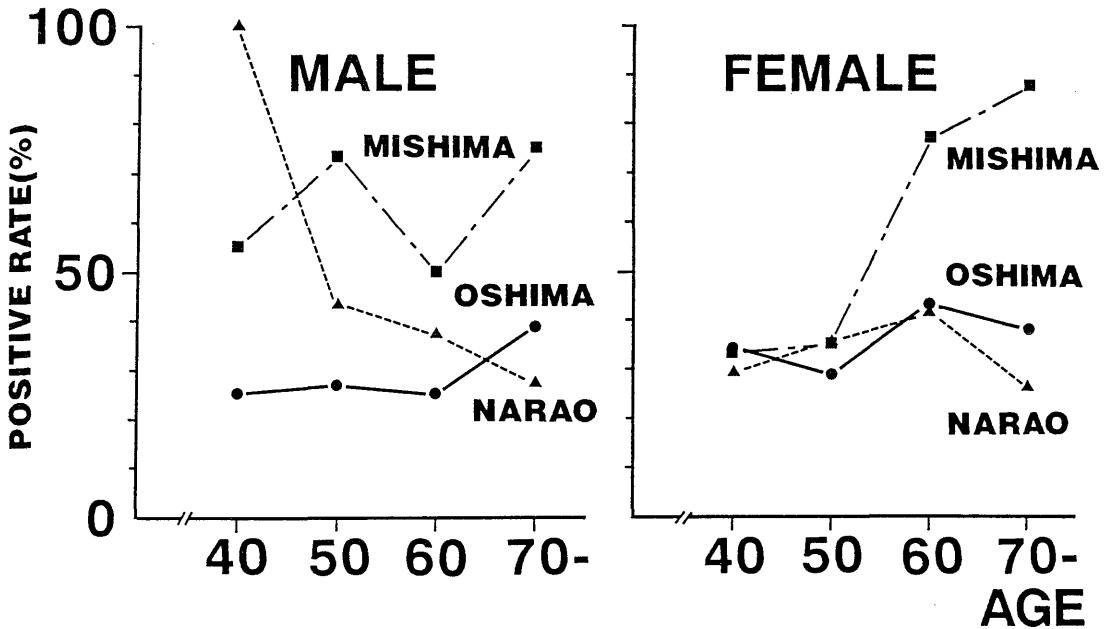


Fig. 4-2. Positive rate of HBV markers by the native

possible some of residents were doubly infected and preferentially transmitted both viruses by the maternal transmission pathway. Therefore, we calculated the relationship of personal seropositivity of anti-HTLV-1 and HBV markers

(Table 8). No significant relationship between anti-HTLV-1 and HBV markers in either males or females indicated that these viruses have been independently transmitted in the community, even if the order of positive rate as a

Table 5. Positive rates of HBV markers (%)

	Male			Female			Both sexes					
	n	HBsAg (%) ¹⁾	HBsAg (%) ²⁾	HBVm (%) ³⁾	n	HBsAg (%)	HBsAg (%)	HBVm (%)	n	HBsAg (%)	HBsAg (%)	HBVm (%)
MISHIMA	64	9(14.1)	28(43.8)	37(57.8)	99	8(8.1)	47(47.5)	54(54.5)	163	17(10.4)	75(46.0)	91(55.8)
		12.8¹⁾	44.0 ns	56.8 *		7.5 ns	50.3 **	57.0 **		9.8 **	47.6 **	56.8 **
NARAO	189	7(3.7)	67(35.4)	74(39.2)	455	17(3.7)	135(29.7)	152(33.4)	644	24(3.7)	202(31.4)	226(35.1)
		4.1 ns	35.5 *	39.6 *		3.6 ns	30.0 ns	33.6 ns		3.7 ns	31.3 ns	35.1 ns
OSHIMA	590	17(2.9)	147(24.9)	163(27.6)	865	25(2.9)	275(31.8)	98(34.5)	1455	42(2.9)	422(29.0)	461(31.7)
		2.9	24.9	27.6		2.9	31.5	34.2		2.9	29.0	31.7
Total	843	33(3.9)	242(28.7)	274(32.5)	1419	50(3.5)	457(32.2)	50.4(35.5)	2262	83(3.7)	699(30.9)	778(34.4)

Abbreviations in statistical significance are same in Table 2.

1) HBsAg: hepatitis B virus surface antigen

2) HBsAb: anti-HBsAg

3) HBVm: hepatitis B virus markers (HBsAg/HBsAb)

4) Numerals in bold type are age adjusted rates.

Table 6. Comparison of positive rates of HBV markers by sociocultural characteristics

	ORIGIN					
	Male			Female		
	native.	immig.	χ^2 (P)	native	immig.	χ^2 (P)
MISHIMA	24/ 38	3/ 12	3.920	28/ 51	14/ 31	0.732
	63.2	25.0	(0.047)	54.9	45.2	(0.392)
NARAO	29/ 84	8/ 16	1.380	76/219	28/ 74	0.237
	34.5	50.0	(0.239)	34.7	37.8	(0.626)
OSHIMA	75/250	67/229	0.031	139/378	119/392	3.554
	30.0	29.3	(0.858)	36.8	30.4	(0.059)
Total	128/372	78/257	0.939	243/648	161/497	3.210
	34.4	30.4	(0.327)	37.4	32.4	(0.073)
	RELIGION					
	Chr.	non-Chr.	χ^2 (P)	Chr.	non-Chr.	χ^2 (P)
MISHIMA	—*	27/ 50	—	—*	40/ 80	—
		54.0			50.0	
NARAO	13/22	24/ 78	5.904	17/ 57	65/235	0.106
	59.1	30.8	(0.015)	29.8	27.7	(0.744)
OSHIMA	14/29	63/228	5.225	19/ 53	127/366	0.026
	48.3	27.6	(0.022)	35.8	34.7	(0.869)
Total	27/51	114/356	7.722	36/110	232/681	0.028
	52.9	32.0	(0.005)	32.7	34.1	(0.867)

Abbreviations are same in Table 4.

community was almost the same between them.

DISCUSSION

The seroprevalence of anti-HTLV-1 in each island was higher than that of Nagasaki Prefecture^{13, 14)} in general. However, the prevalence was considerably different in each island: 41.1, 29.3 and 12.9% in Mishima, Narao and

Oshima, respectively. This is probably reflected by sociocultural specificity of each island. On the one hand, Mishima and Narao are relatively closed communities and people of these islands are mainly engaged in traditional agriculture and/or fishery. On the other hand, Oshima has experienced a coal mine industry since the 1930's and contemporary shipyard industry since the 1970's, and large scale immigration and emigra-

Table 7. Positive rate of HBV markers by the combination of origin and religion

MALE	NARAO	
	Native	Immigrant
Christian	10/18 (55.6)	3/ 4 (75.0)
non-Christian	19/66 (28.8)	5/12 (41.7)
FEMALE		
Christian	18/ 39 (46.2)	11/18 (61.1)
non-Christian	58/180 (32.2)	17/55 (30.9)
MALE	OSHIMA	
	Native	Immigrant
Christian	10/ 24 (37.5)	4/ 5 (80.0)
non-Christian	32/124 (25.8)	31/104 (29.8)
FEMALE		
Christian	11/ 29 (37.9)	8/ 23 (34.8)
non-Christian	69/191 (36.1)	55/174 (31.6)

Table 8. Relationship of personal seropositivities between anti-HTLV-1 and HBV markers

	Male		Female		Total
	anti-HTLV-1 antibody		antibody		
	(+)	(-)	(+)	(-)	
HBV markers	(+) 53	(-) 222	(+) 118	(-) 388	506
	(-) 91	(+) 437	(-) 185	(+) 744	929
Total	144	659	303	1132	1435
	$\chi^2=0.381$		$\chi^2=2.082$		
	p=0.537		p=0.149		

(+) : positive (-) : negative

tion on each exchange of these major sociocultural impacts.

Female dominance of the seropositivity has been reported and considered as the evidence of male-to-female transmission of HTLV-1 by sexual intercourse^{15, 16)}. However, in this study, we could not find the marked female predominance over male, even HTLV-1 is quite highly endemic in these islands. The data suggested that the efficiency of sexual transmission of HTLV-1 from male to female may not be very efficient to account for the maintenance of the virus in the communities, or female to male transmission may also be fairly efficient than expected.

In this study, we employed the birth place and the religion (Christianity) as parameters of

sociocultural backgrounds. The seroprevalence of residents born in each island was not significantly different from those born outside of the respective island. Since the major transmission pathway of HTLV-1 is vertical¹⁷⁾, the data suggested immigrants into each island did not affect the prevalence significantly. In Mishima and Narao, because the prevalence was extraordinarily high, the immigrants probably originated from a neighboring community where HTLV-1 has also been endemic. On the other hand, in Oshima, the immigrants were not necessarily originating from endemic areas, since they came in by industrial needs rather than by reason of geographical neighborhood. Because the prevalence in Oshima has not been high enough, the immigration did not affect the prevalence significantly.

Since Christians in these areas had been historically discriminated, and they tend to live in isolated areas and to intermarry within small communities. In Oshima, male Christians were significantly more prevalent than non-Christians. When we analyzed this in combination with birth place, the difference became more pronounced. The results suggested that the Christians on the island had an effect of isolated life cycles in at least several generations to keep HTLV-1 highly endemic in the community. Since female Christians did not reveal the significantly higher prevalence, significant number of wives of male Christians might not have been born as Christians. We could not see a significant difference between Christians and non-Christians in Narao. Historically, Christians in the Kami-Goto immigrated some 400 years ago. Christians and non-Christians might have cohabitated long enough to have a similar prevalence to each other. In Mishima, we could not find any Christians. These results suggested that although the closed community effect on the maintenance of HTLV-1 is obvious, the length of cohabitation in a small area was made indistinguishable between two apparently separated communities even in a small island. Oshima was exceptional, probably because of recent large scale immigration by industrial pressure.

The prevalence of HTLV-1 carriers increased with age in Mishima and Narao regardless of

sex. On the other hand, we did not see this profile in Oshima where HTLV-1 is less endemic. The combined analysis with birth place did not change the profile in Oshima. The result suggested that the apparent increase of the prevalence on age is not dependent on the horizontal infections in adulthood, but rather due to the cohort effect. The rather flat curve at Oshima may be dependent on the earlier exposure to a contemporary life style than other islands.

HBV was also highly endemic in these islands. However, the difference in the prevalence among these islands were smaller than that of HTLV-1, 55.8, 35.1 and 31.7% in Mishima, Narao and Oshima, respectively. In Oshima, male Christians were more prevalent than non-Christians as in the case of HTLV-1. However, the birth place effect was not seen in HBV markers. The result suggested that cohabitation might effect much sooner in case of HBV than of HTLV-1.

The age dependent increase of the prevalence of HBV markers was not apparent in each island. In contemporary Japan, the transmission pathway of HBV is considered mainly maternal. However, in rural situations, such as Africa and Southeast Asia, the main pathway of HBV is considered as horizontal rather than maternal^{18, 19, 20)}. Most HBV carriers are infected in childhood by horizontal transmission via skin damage or insect bites in these areas. At the time when these people were born and in early childhood, these islands might have such effect. The smaller difference of prevalence among islands, the absence of birth place effect, and rather indifferent curve of prevalence by age all fit with this conjecture.

We studied seroprevalences of anti-HTLV-1 and HBV markers in residents of three islands in Nagasaki Prefecture. These 2 viruses are currently thought transmissible mainly via the maternal route, and therefore behaving similarly. Although these two viruses were endemic in all islands we tested, their epidemiological attitudes were slightly different from each other. The behavior of HTLV-1 was more compatible with vertical transmission as the major factor than that of HBV. However, the mode of HBV transmission in rural areas seems to have been

more horizontal. The lack of age effect in the prevalence of HBV markers suggested that the change of life to a contemporary style developed earlier in Oshima than that in Mishima or Narao. Inversely, the endemicity of HTLV-1 and HBV is not solely determined by the nature of virus, but strongly associated with human factors, such as hygienic status, life style, immigration/emigration, etc.

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REFERENCES

- 1) The T-and B-cell Malignancy Study Group: Statistical analysis of clinico-pathological, virological and epidemiological data on lymphoid malignancies with special reference to adult T-cell leukemia/lymphoma. The second nation wide study of Japan. : *Jpn. J. Clin. Oncol.* **15** : 517-538, 1985.
- 2) Kohakura, M., Nakada, K., Yonahara, M., Komoda, H., Imai, J., and Hinuma, Y.: Sero-epidemiology of the human retrovirus (HTLV/ATLV) in Okinawa where adult T-cell leukemia is highly endemic. *Gann*, **77**, 21-23, 1986.
- 3) Tominaga, S. Kato, I. and Tajima, K.: Adult T-cell leukemia. *Gann Monograph on Cancer Reseach* **33**, 1987.
- 4) Blattner, W. A., Nomura, A., Clark, J. W., Ho, G. Y. F., Nakao, Y., Gallo, R. C.: Modes of transmission and evidence for viral latency from studies of human T-cell lymphotropic virus type 1 in Japanese migrant populations in Hawaii. *Proc. Natl. Acad. Sci. USA* Vol. **83** : 4895-4898, 1986.
- 5) Yanagihara, Eugene, T., Nakamura, Jeffrey, Kimura, Lucille, and Oishi, N.: Retrovirus-associated adult T-cell leukemia-lymphoma: An epidemiologic study of five cases among Hawaii-born offspring of migrant Japanese. *Hematological oncology*, Vol. **7**, 181-188, 1989.

- 6) Gallo, R. C., Sliski, A., Wong-Stall, F.: Origin of human T-cell leukemia-lymphoma virus. *Lancet* October 22, 962-963, 1983.
- 7) Hinuma, Y.: Seroepidemiology of adult T-cell leukemia virus (HTLV-1/ATLV): Origin of virus carriers in Japan. *AIDSRES*. Vol. 2: 17-22, 1986.
- 8) Tajima, K., Tominaga, S., Suchi, T., Kawagoe, T. Epidemiological analysis of the distribution of antibody to adult T-cell leukemia-virus-associated antigen: Possible horizontal transmission of adult T-cell leukemia virus. *Gann*, 73, 893-901, 1982.
- 9) Takemoto, T., Suzuki, T., Miyamoto, T., Moji, K., Izumi, T., Ohkubo, H., Gotoh, H., Fujita, K.: The impact of changing environment of the human settlement in islands of western part of Japan. *Nissan Science Foundation Research Projects in Reviews*; 81-88, 1989 (in Japanese).
- 10) Hin P. L.: Surveillance of viral hepatitis and liver cancer in Singapore. *Acta Med. Nagasaki* 30: 300-303, 1986.
- 11) Gotoh, H., Takemoto, T., Shigeto, K., Miyamoto, T.: A human ecological study on epidemics of HBV and HTLV-1 among islands in western Japan. *Acta Med. Nagasaki* 35: 28-31, 1989.
- 12) Hinuma, Y., Komoda, H., Chosa, T., Kondo, T., Kohakura, M., Takenaka, T., Kikuchi, M., Ichimaru, M., Yunoki, K., Sato, I., Matsuo, R., Takiuchi, Y., Uchino, H., Hanaoka, M.: Antibodies to adult T-cell leukemia-virus-associated antigen (ATLA) in sera from patients with ATL and controls in Japan: A nation-wide sero-epidemiologic study. *Int. J. Cancer*: 29: 631-635, 1982.
- 13) Momita, S.: Detection of anti-ATLA (adult T-cell leukemia cell associated antigen) antibody in Nagasaki district, ATL endemic area. *J. Jpn. Soc. Intern. Med.* 73: 309-315, 1984 (in Japanese).
- 14) Kitamura, T.: Relationship between ATLL and anti-ATLA antibody in Nagasaki prefecture. *J. Jpn. Soc. Blood Transfusion* Vol. 30. No. 4: 305-308, 1984.
- 15) Sanada, I., Yamaguchi, K., Yoshida, M., Ishii, T., Tsukamoto, A., Sato, M., Obata, S., Shido, T.: Adult T-cell leukemia in spouses. *Jpn. J. Cancer Res.* 80, 401-404, 1989.
- 16) Sakuma, T., Satoh, T., Satodate, R., Madarame, T., Onodera, I., Suzuki, Z., Ito, C.: Adult T-cell leukemia by probable horizontal transmission from husband to wife. *Jpn. J. Clin. Oncol.* 18(1) 75-79, 1988.
- 17) Hino, S., Yamaguchi, K., Katamine, S., Sugiyama, H., Amagasaki, T., Kinoshita, K., Yoshida, Y., Doi, H., Tsuji, Y., and Miyamoto, T.: Mother-to-child transmission of human T-cell leukemia virus type 1. *Jpn. J. Cancer Res.* 76: 474-480, 1985.
- 18) Igarashi, H., Suzuyama, J., Yamanouchi, K. and Miyamoto, T.: Epidemiological study of hepatitis B virus in Nagasaki area of Japan. *Medical postgraduate* Vol. 20 No. 3: 43-48, 1982 (in Japanese).
- 19) Kusumoto, Y.: Epidemiological and clinical studies of hepatitis B antigen on latent liver disease in Tomie-town, Goto island, Nagasaki prefecture. *Nippon syoukakibyouto gakkai zasshi* Vol. 76. No. 9: 1782-1792, 1979.
- 20) Okushin, H., Yamada, G., Manabe, K., Kinoyama, S., Kunitomi, T., Eguchi, K., and Nagashima, H.: Transmission of hepatitis B virus (HBV) from HBsAg-positive females with positive e antigen to their husbands. *Kanzou* Vol. 27. No. 2: 160-164, 1986.