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Smallpox quarantine huts in 18th and 19th century Amakusa Islands, Kyushu, Japan.

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1. Introduction

Infectious diseases, especially smallpox is often assumed to have been the main causes of human death in traditional Japan. However, we know of little statistical evidence regarding the death or recovery of individuals who contracted smallpox.

In Takahama of the Amakusa Islands, Kyushu, Japan, 183 people contracted smallpox between December 1807 and April 1808, and 78 of them died. Before the introduction of vaccination, the only way to bring the outbreak under control was to quarantine the people who had contracted the disease. According to historical sources, there were quarantine huts in Amakusa beginning at the start of the 18th century (Higaki, 1952, 7).

Historical sources on the smallpox outbreak in Takahama from 1807 to 1808

show that there were two quarantine huts; one of them, which was called “Yama-goya” (= a mountain hut), was built at that time in a mountainous place, and the other, which was named “Nozoki-goya” (= an exclusion hut), was standing within the village on the way to “Yama-goya”. Those sources list the name, sex, and age of all of the people who suffered from smallpox, and the position of their families.

This paper will investigate the quarantine policy in Takahama. How many people, who moved to those huts, died, and how many recovered? The age structure of the victims of the disease and the causes of death will be analysed according to documents relating to the quarantine huts in combination with demographic and household data derived from the Japanese population register, “Shumon-cho”. I want to acknowledge my gratitude to the Eurasia project funded by the Japanese Ministry of Education, Science, Sports and Culture, and also other projects supported by the Japan Society for the Promotion of Science, as I used the data-base sets produced by these projects.

2. Traditional and modern medical understanding of smallpox disease

Smallpox is a serious, contagious, and sometimes fatal infectious disease. There is no specific treatment for smallpox, and the only prevention is through vaccination. Variola virus is a severe form of smallpox. According to the report of the Centers for Disease Control and Prevention, variola major smallpox historically has an overall fatality rate of about 30%. Smallpox outbreaks have occurred from time to time for thousands of years, but the disease has now been eradicated after a successful worldwide vaccination program. The last case of smallpox in Japan was in 1949.

Generally, direct and fairly prolonged face-to-face contact is required to spread smallpox from one person to another. Smallpox also can be spread through direct contact with infected bodily fluids or contaminated objects such as bedding or clothing. Rarely, smallpox has been spread by a virus carried in the air in enclosed settings such as buildings, buses, and trains. Humans are the only natural hosts of variola. Smallpox is not known to be transmitted by insects or animals.

A person with smallpox is sometimes contagious with the onset of the fever (the prodrome phase), but the person becomes most contagious with the onset of the rash. At this stage the infected person is usually very sick and is not able to move around in the community. The infected person is contagious until the last smallpox scab falls off.

Table 1: Modern medical and traditional understandings of smallpox disease

Day	Modern medical understanding				Traditional understanding in Japan from the 18th century		
	Duration	Phase name	State of contagiousness	Condition of illness	Duration	Phase name	State of contagiousness
	7 to 10 days	Incubation period	Non	Exposure to the virus is followed by an incubation period during which people do not have any symptoms and may feel fine.			Unknown?
1st to 4th	2 to 4 days	Initial Symptom	Sometimes	High fever, malaise, head and body aches, and sometimes vomiting	2 to 3 days	"Jyonetsu"	Unknown
					1 or 2 days	"Kenten"	Unknown
5th to 8th	about 4 days	Early rash	Most contagious: Rash distribution	A rash emerges first as small red spots on the tongue and in the mouth. These spots develop into sores that break open and spread large amounts of the virus into the mouth and throat.	1 or 2 days	"Syusseï"	Unknown
					1 or 2 days	"Kicho"	Unknown
					1 or 2 days	"Yusho"	Unknown
9th to 13th	about 5 days	Pustular Rash	Yes	The bumps become pustules—sharply raised, usually round and firm to the touch as if there is a small round object under the skin.	1 to 2 days	"Kuwannou"	Unknown
					1 to 2 days	"Siuen"	Unknown
14th to 18th	about 5 days	Pustules and Scabs	Yes	The pustules begin to form a crust and then scab. By the end of the second week after the rash appears, most of the sores have scabbed over.	1 to 2 days	"Rakuka"	Unknown
19th to 24th	about 6 days	Resolving Scabs	Yes	The scabs begin to fall off, leaving marks on the skin that eventually become pitted scars. Most scabs will have fallen off three weeks after the rash appears.	At the 15th day: End of Smallpox		
		Scabs resolved		Scabs have fallen off. Person is no longer contagious.			

Sources: www.cdc.gov/smallpox; Rotermund, 1995, 15-17.

Modern medical knowledge has surpassed the traditional understanding of smallpox. However, the symptoms and the changing conditions of smallpox patients were exactly observed in the past. “Toso-Tebiki-Soh” (= Handbook for Smallpox) published in 1778 (Anei 7) shows the symptoms them quite exactly (Rotermund, 1995, 15-17). However, the central problem is the problem of understanding the contagiousness of smallpox. The only way to prevent the spread of smallpox was to keep the patients in quarantine facilities. On the other hand, medicine rites and magic rituals were also customary.

The traditional understanding of the contagiousness of smallpox was clearly different from the modern medical understanding, which insists that the smallpox patients are contagious until their last scab falls off. In the Japanese traditional understanding, the 15th day, on which the scabs begin to fall off, was considered to be the end of smallpox. Also, according to the traditional Japanese medical book, it was believed that the patients died mostly on the 11th and 12th days.

The lack of medical understanding about contagious increased a fear complex against the smallpox.

According to a Japanese contemporary work, “Toso-Mondo”(= Smallpox dialogue) (Higaki, 7), in Amakusa, Kyushu, people abandoned the smallpox patients out of fear of contracting the terrible sickness. Even fathers, mothers and other family relations were ignored. The patients were isolated. Even if they became well again, they could not ever come back to their homes if they had been away for more than one hundred days.

In the case of Takahama, the conditions were different, as a doctor and others cared for the patients in the mountain hut. They were never abandoned. However, the fatality rate of the last smallpox sufferers, who moved to the mountain hut after the doctor returned to his country, was especially high. As will be addressed below, it was also not true that all of the patients were cared for efficiently. Another point to be addressed is that the date of death was not always on the 11th or 12th day after the initial symptoms. Inadequate nutrition, unsuitable care and abandonment would have caused symptoms that could lead to death. (Radtke, 2002).

3. Population change and the influence of smallpox outbreaks in Takahama

The most reliable data on the population of Amakusa is dated 1827 (Bunsei 10). This register gives a total population of 141,797, of which 68,803 are males, 67,910 are females and 5,084 are persons whose gender is unclear. The sex ratio is

101.3. The population increased about fivefold in the Genroku area (Higaki 1951); however, Higaki estimates the population after the rebellion, in the mid-17th century, at around 16,000. If we consider this number to be the minimum population of Amakusa, we see that it increased a little less than 10 times in the following 200 years until the end of the Tokugawa period.

The decrease in population caused by the Shimabara Revolt was rapidly alleviated by government-fostered migration. This population recovery can be particularly observed in the 17th and 18th centuries (Higaki 1951). Table 2 shows an example of this change in population of the four neighboring villages.

Table 2: Population change in four villages in Amakusa

	1691	1808	1816	1817	1827	1856
	<i>Genroku 4</i>	<i>Bunka 5</i>	<i>Bunka 13</i>	<i>Bunka 14</i>	<i>Ansei 10</i>	<i>Ansei 3</i>
<i>Imatomi</i>	407	1,890	1,925	1,939	1,945	1,840
<i>Sakitsu</i>	850	2,466	1,962	1,955	1,865	1,346
<i>Ooe</i>	889	3,179	3,259	3,275	3,290	3,186
<i>Takahama</i>	958	3,336	3,414	3,440	3,629	3,826

In these four villages, the population did not change uniformly. In Takahama, for example, there was a population increase in the late Tokugawa period, while in Sakitsu, the population suddenly decreased during the same period. In Imatomi and Oe, the population has had a tendency to either decrease or remain stagnant. Why are there such differences? Hirata (2001) suggests that, in the case of Sakitsu, smallpox and the economical isolation of Sakitsu from the other villages had a significant impact on its population.

The western shore of Amakusa has few good harbors. Only Sakitsu had a valuable fishing port in this region, and the village also had certain official privileges for port transportation. The inhabitants of Sakitsu had good contact with only one large city outside of Amakusa, Nagasaki, but also suffered dangerous influences because of this contact, for example, the introduction of smallpox, which twice caused epidemics. Sakitsu had no good cultivated areas. The inhabitants of Sakitsu, therefore, had meshed their economy with that of Imatomi, a neighboring agricultural village. The isolation of Sakitsu was exacerbated by the spread of smallpox. In 1808, Sakitsu had its largest population at 2,466 people (Bunka 5), but by 1856 it had decreased in population to only 1,346 (Ansei 3).

According to “Nagasaki-Daikan-Kiroku-Syujyu”, it was reported that in 1834 (Tenpo 5) 507 persons (27 %) out of the population of 1851 persons in Sakitsu contracted smallpox, and of these 338 (18%) died. The fatality rate of 66.7% was

very high. Such statistical data for the smallpox outbreak in 1813 (Bunka 10) were not available, but one record shows that most people took refuge from the village in another region, and that only hundred persons remained there (Hirata, 2001, 223). Most people in the fishing village moved out by ship.

Table 3: Population change in Takahama from 1803 (Kyowa3)to 1813 (Bunka 10)

Year		Population (=A)	Population in <i>Shumon-cho</i> (=B)	Total number of deaths (=C)	C/B in %	Number of sudden deaths (=D)	D/C in %
1803	Kyowa 3	3270	1102	39	3.5	4	10.3
1804	Bunka 1	3301	1086	21	1.9	4	19.0
1805	Bunka 2	3320	1090	15	1.4	3	20.0
1806	Bunka 3	3340	?	?	?	?	?
1807	Bunka 4	3370	2831	103	3.6	19	18.4
1808	Bunka 5	3336	2809	103	3.7	18	17.5
1809	Bunka 6	3307	2778	43	1.5	4	9.3
1810	Bunka 7	3350	2839	54	1.9	14	25.9
1811	Bunka 8	3363	2868	46	1.6	14	30.4
1812	Bunka 9	3400	2900	41	1.4	4	9.8
1813	Bunka 10	3445	2947	98	3.3	21	21.4

For the “Shumon-cho” in Takahama, there were several books for each district. Because some books were lost, we could not derive demographic data for the whole village. In 1803 (Kyowa 3) the population was 3270 persons, for whom the “Shumon-cho” shows only 1102 inhabitants’ households. For 1806 (Bunka 3) no books remained.

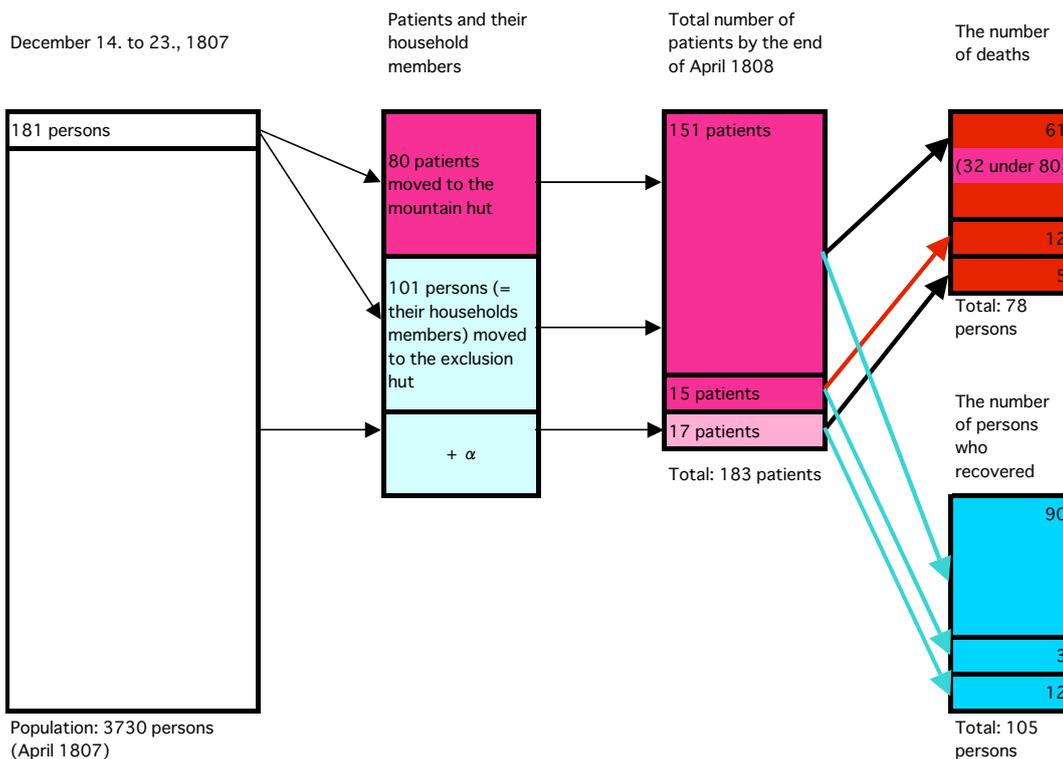
In “Shumon-cho,” the each person who died suddenly was listed as ‘a sudden death’. Such deaths were caused by accidents and also by smallpox. In 1807 (Bunka 4) and 1808 (Bunka 5), the number of deaths was surely high, and also in 1803 (Kyowa 3) and 1813 (Bunka 10). In 1813 there was a smallpox outbreak in Sakitsu.

The fatality rates in 1807 and 1808 were, however, not very high in comparison with the other cases in Amakusa. The quarantine policy was effective in reducing the number of victims. Prompt isolation of the patients with their household members from the other village inhabitants was effective in controlling the unrestricted spread of smallpox. Rice, miso and other foods were sent from Takahama and other neighboring villages. The doctor was effective. On the other hand, some famous Shinto priests were also invited for a mysterious prayer to help eliminate the sickness from the village.

4. Smallpox outbreak and quarantine policy in Takahama

The beginning of the smallpox disease in Takahama of 1807 was the death of Komosuke in December. He lived in “Suwa-no-tori”, one district of the village, which had 122 households with a total of 540 persons. The Komosuke’s cause of death was not known; however, many people who attended his burial and also direct contact with him while he was sick showed the symptoms of smallpox at once. The number of patients increased to 75 by December 14.

Fig. 1: Quarantine policy in Takahama



Takahama’s local governor, “Shoya”, decided to quarantine all of the patients in a mountain hut, and also to quarantine all of their household members in an exclusion hut. Not 75 but 80 patients were moved to the new mountain hut, because five additional persons showed the smallpox symptoms by that time. A doctor, Keiniku Miyata, who visited the village by chance, was begged to care for the patients. Because the patients were mostly quite poor, the village decided to pay the

cost of their medical treatment and food.

Of the 80 patients first diagnosed, 16 had died by December 23, which corresponds to January 20, 1808 on the western calendar. Six of these 16 fatalities were due to a serious illness, and these 6 died before they moved to the mountain hut. The other 10 persons died in the hut. The record of the persons who moved to the huts shows only the death date for those who died before December 23. All the other persons on the list were identified using “Shumon-cho”, and their death dates were confirmed. By the end of January 1808, 16 more persons had died. A total of 32 persons (40.0 %) of the 80 smallpox patients died as a result of the disease.

A total of 101 persons lived in the exclusion hut. They were household members of the 80 patients. If they exhibited symptoms of smallpox, they were moved immediately to the mountain hut.

More than the 80 patients who were quarantined contracted smallpox. Even if only one member of a household was recorded as a patient on the list, it is possible that by January of 1808 all of the household members died. Fukuhei had 6 members in his household. He and all six of his household's members died between December 17 and January 28. Only his daughter, Iwa, who died on December 22, was listed as one of the 80 patients. However, before her death, Fukuhei's brother's daughter, Tama, who was 7 years old (= sai in Japanese), had already died on December 17. This case shows that the list was not perfect, and that there were some village members who were not listed but who died in the early phase of the outbreak.

A total of 166 patients were moved to the mountain hut. Of these, 15 patients were quarantined after the doctor, Miyata, left the village at the end of January. Of these 15 patients only three persons recovered, and 12 (80.0 %) died. When the doctor was caring for the patients, 61 out of 151 patients (40.4 %) died due to smallpox. The significance of this difference is unclear.

After the beginning of April, newfound patients were not quarantined in the mountain hut, but were transported out of the region by ship, while their household members lived for some time in an exclusion ship. A total of 17 patients were shipped in this way. Of these 17 patients, 5 (29.4 %) died. The total number of patients from December 1807 to the end of April 1808 was 183, of whom 78 (42.5 %) died. This rate was not as high as that of Sakitsu in 1834. The quarantine policy in Takahama could be judged to be quite efficient to prevent a greater spread of the disease.

5. Causes of death

Table 4: Age structure of smallpox victims in Takahama, 1807/08

Age	Female	F. pa- tients	in %	Number of deaths	Male	M. pa- tients	in %	Number of deaths	Total	Total patients	in %	Number of deaths	in %
0-5	253	3	1.19	2	185	5	2.70	2	438	8	1.83	4	50.0
-10	133	3	2.26	2	136	6	4.41	2	269	9	3.35	4	44.4
-15	126	8	6.35	1	133	7	5.26	1	259	15	5.79	2	13.3
-20	141	5	3.55	1	110	2	1.82	1	251	7	2.79	2	28.6
-25	116	4	3.45	3	110	4	3.64	0	226	8	3.54	3	37.5
-30	118	3	2.54	1	126	3	2.38	0	244	6	2.46	1	16.7
-35	108	3	2.78	1	89	4	4.49	3	197	7	3.55	4	57.1
-40	74	2	2.70	1	84	1	1.19	0	158	3	1.90	1	33.3
-45	89	2	2.25	1	90	3	3.33	3	179	5	2.79	4	80.0
-50	76	5	6.58	4	73	3	4.11	0	149	8	5.37	4	50.0
-55	68	3	4.41	2	61	1	1.64	1	129	4	3.10	3	75.0
-60	67	0	0.00	0	47	0	0.00	0	114	0	0.00	0	0.0
-65	45	0	0.00	0	31	0	0.00	0	76	0	0.00	0	0.0
-70	34	0	0.00	0	17	0	0.00	0	51	0	0.00	0	0.0
-75	23	0	0.00	0	20	0	0.00	0	43	0	0.00	0	0.0
-80	17	0	0.00	0	12	0	0.00	0	29	0	0.00	0	0.0
-85	7	0	0.00	0	5	0	0.00	0	12	0	0.00	0	0.0
-90	3	0	0.00	0	2	0	0.00	0	5	0	0.00	0	0.0
-95	0	0	-	0	1	0	0.00	0	1	0	0.00	0	0.0
-100	1	0	0.00	0	0	0	-	0	1	0	0.00	0	0.0
	1499	41	2.74	19	1332	39	2.93	13	2831	80	2.83	32	40.0

The age structure of the victims shows that not only the children, but also individuals between forty and fifty years of age became victims more frequently. However, the sample size is too small to draw conclusions from this data.

It is noteworthy that the fatality rate in the period when the doctor was absent was very high. As already mentioned, 15 patients in seven households were sent to the mountain hut after the doctor left the village, and only three of these patients recovered. We know the duration that these 15 patients lived in the mountain hut. The length of their stay in the mountain hut was long, with the end usually occurring on the death date. There was no evidence of the causes of death for those patients. However, smallpox was not usually the decisive cause of death, as with the exception of one patient, Yuki, 11 persons died while in the last phase of smallpox disease.

Table 5: Death and recovery of the last isolated patients in 1808

Number of Household	Name	Male or Female	Age	Date: moved to the mountain hut	Date of death or recovery (=R)
148C	<i>Sangoro</i>	M	27	Feb. 17	R
	<i>San</i>	F	64	Feb. 17	R
	<i>Tatsu</i>	F	29	Feb. 17	Mar. 25
	<i>Jinjiro</i>	M	3	Feb. 17	Mar. 25
161	<i>Tokutaro</i>	M	5	Feb. 20	Mar. 22
	<i>Ichigoro</i>	M	31	Feb. 20	Mar. 15
	<i>San</i>	F	34	Feb. 20	Mar. 17
	<i>Torajiro</i>	M	3	Feb. 20	Mar. 21
160	<i>Kumanosuke</i>	M	35	Feb. 20	Mar. 18
	<i>San</i>	F	23	Feb. 20	Mar. 15
	<i>Yuki</i>	F	35	Feb. 20	Mar. 2
104A	<i>Yoshimatsu</i>	M	31	Feb. 22	Mar. 20
188	<i>Ito</i>	F	59	Mar. 1	Mar. 22
123A	<i>Toramatsu</i>	M	10	Mar. 7	R
192	<i>Tsuma</i>	F	44	April 7	April 15

7. Conclusion

Quarantining the patients and their household members was an efficient way to prevent an even greater spread of smallpox. Takahama was able to avoid a dramatic population decrease. The fatality rate was not as high as in other outbreaks. However, smallpox seems not to have been the only cause of death for the smallpox patients. Often in this situation, the patients would have been abandoned and ignored.

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