Epidemiological Explanation on Cholera Epidemics (and Others) by the Weekly Report in Diarrhea and the Result of Bacteriological Examination in North Sumatra, and the Survey Referring to the Role of Rivers

Osamu Sakamoto
JICA Expert

Dr. F. E. Munthe, M. Sc.
Cholera Section,
Provincial Health Service

Mr. S. Sinulingga
Subsection of Bacteriology,
Medan Health Laboratory

Dr. R. Takai
Leader of JICA Experts

August 3, 1984

Japan International Cooperation Agency

Epidemiological Explanation on Cholera Epidemics (and Others) by the Weekly Report in Diarrhea and the Result of Bacteriological Examination in North Sumatra, and the Survey Referring to the Role of Rivers

Osamu Sakamoto
JICA Expert

Dr. F. E. Munthe, M. Sc.
Cholera Section,
Provincial Health Service

Mr. S. Sinulingga
Subsection of Bacteriology,
Medan Health Laboratory

Dr. R. Takai
Leader of JICA Experts

August 3, 1984

Japan International Cooperation Agency

C O N T E N T S

「北スマトラ下痢週報と細菌検査によるコレラの疫学的検討，及び川の役割に関する調査」

北スマトラ州に最初にコレラが侵入したのは1962年のことであった。

当初マラッカ海峡側の沿岸地域に広がっていたコレラはやがて各地に浸透し，1975年までには北スマトラ州内のすべての県や主要都市が被害を受けるまでになった。

1978年から1979年にかけ未曽有のコレラ流行が北スマトラ州全土をおおい，その被害は患者数21,919人，死者数1,024人にも達した。

北スマトラではコレラは今日においても致死率（約3％）が非常に高いことから，下痢症の中で最も重要な位置をしめている。

〔1978年から1979年にかけてのコレラ流行〕

1978年3月，インド洋に浮かぶニアス島で始まったコレラ（小川型）の大流行は海を渡り，対岸のスマトラ島シボルガを経由して，その主流は国道沿いに北上し，ブマタン・シアンタールを経て直接州都メダンに達し，さらに国道を逆行してデリ・スルダンに定着，翌年の大流行への基地となったと思われる。1978年の流行は6～7月頃に一服状態が見られ，デリ・スルダンに達するまで半年以上の歳月を要している。

1979年に入るとデリ・スルダンのコレラはメダンへの再侵入をくわだて，もう一つの流れはティビン・ティンギを経て国道を南下，ブマタン・シアンタール，シマルングンに達したようである。1979年の流行は，1978年と比較して一層速く，1～2ヶ月で北スマトラ州のすみずみに拡がっていったようである。

1978年12月には稲葉型によるコレラ流行がデリ・スルダンで始まり，その主流は国道を南下，タパヌリ・ウタラでその勢力を強め，シボルガからインド洋を渡ってニアス島に至り，そこでかなりの流行を見たようである。

デリ・スルダンで始まった稲葉型による流行がニアス島に達するまでに要した時間は1～2ヶ月だったと思われる。

稲葉型の流行は小川型に比較し，その規模はかなり小さかったようである。

〔1980年から1983年にかけてのコレラ流行〕

1980年以後のコレラ流行はほとんどすべてが小川型によるものであった。

1980年タパヌリ・スラタンで始まった小川型によるコレラ流行は，タパヌリ・ウタラを経由して国道を北上し，デリ・スルダンに至ってそこに居座ったようである。

1980年末，流行の主力はメダンに移り定着した。

1981年上半期末，流行はさらに拡がる様相を示し，国道を南下，ブマタン・シアンタール，シボルガを経てタパヌリ・スラタンに達したようである。

1980年のタパヌリ・スラタンからデリ・スルダンへ，1981年のメダンからタパヌリ・スラタンへ流行が移動するのに要した時間はそれぞれ2ヶ月前後であったと思われる。

1980年以後のコレラ流行は1978年～1979年の大流行と比較すると，その規模はかなり小さい。

1981年9月以降になると下痢症の週報システムが変わり，それまで報告されていたコレラ患者数が，一括して下痢患者数の中に含まれるようになり区別できなくなってしまったため，コレラ流行の伝播経路をつかむことが困難となった。

〔コレラ流行における川の役割に関する調査〕

コレラと水との関係は非常に密接なものがある。

過去において，川とコレラの流行との関係を述べた論文も少なくない。

今回の報告は，1983年4～5月にアサハン県メダン・デラス郡ナナシウム村でみられた下痢症（コレラ）と川とのかかわりについて言及した。

北スマトラの下痢症週報は特別緊急の場合を除き，発生から1ヶ月以上して報告が州衛生部に届くことが少なくない。さらに流行があっても細菌検査がなされないことが少なくないため，適切な対策がなされないこともある。こうした事情から州衛生部は週報より先に新聞の記事によって流行の発生を知ることがまれでない。メダン・デラスのコレラ流行はまさにこの一例であった。

地方新聞からメダン・デラスでコレラと思われる下痢症の流行を察知，調査にのりだした。

当時その流行の中心であったナナシウム村の村民と，ナナシウム村に接して流れているバクラワン川の川の水が今回の調査対象であった。

その結果，村民から小川型のコレラ菌が検出され，川の水からも同型のコレラ菌が検出されたことから，川とナナシウム村でのコレラ流行との関係が強く疑われた。

薬剤感受性の結果は，村民から検出された菌と川から検出された菌が同一パターンであった（CP，TC，NAに感受性，KMに耐性）。

コレラ菌陽性の村民は河口近くに集中しており，そこでは掘り抜き井戸が1年半も前から水が枯渇していたため飲料水に川の水を使っていた。

さらに河口のため，海水と混じりあい水が塩からいために十分沸とうさせずに飲んでいた。

ナナシウム村でのコレラ流行はこうした悪条件が重なって起きたものであることが判明した。

(I) Introduction

North Sumatra Province seems to have been the settled region of cholera since 1962.

The first cholera in North Sumatra in 1962 seems to have had the origin in Makassar (Ujung Pandang) of Selebes Island where 7th worldwide cholera pandemic since 1961 originated from.

According to the report 'CHOLERA TODAY IN NORTH SUMATRA PROVINCE, INDONESIA' of Dr. F. E. Munthe (the chief of the Cholera Section of the Provincial Health Service of North Sumatra), cholera had been already perceived in a few regencies and municipalities along the eastern coast of North Sumatra in 1962, and it had invaded all the regencies and municipalities of North Sumatra by 1975. It has been remaining in North Sumatra since 1962.

An unparalleled cholera epidemic occurred in North Sumatra in 1978 - 1979, and it seriously damaged almost all the regencies and municipalities. The patients were over 14,000 and the dead reached a total of 593 in 1979.

Cholera is the most important disease in diarrhea in North Sumatra because the fatal rate is now still high (about 3%).

The reporting system of the weekly report of the Provincial Health Service of North Sumatra in diarrhea was changed in September of 1981, that is, only suspected cholera in diarrheal diseases had been reported in the period before September of 1981, but all diarrheal diseases collectively have become to be reported since September of 1981. After the change, the number of diarrheal cases increased with a big leap and reached a total of 78,011 in 1982.

This report was chiefly written with the aim of the epidemiological explanation for the actual state of cholera.

This report also referred to the survey concerning the role of rivers in a cholera epidemic.

Some difficulties arose at the stage making out the report, for example, incomplete or no descriptions of patients' dwelling places (streets, villages, districts and regencies or municipalities) were not a few and the dates on which specimens were taken were not often described in the both reports of the Provincial Health Service and Medan Health Laboratory.

It will be one of the most important elements for the epidemiological investigation in a diarrheal disease that the check of patients' dwelling places and the dates on which specimens were taken is certainly executed.

It must be also very important to do cholera survey that another column for the suspected cholera cases number will be newly prepared in the weekly report.

(II) Epidemiological Examination of Diarrheal Diseases Including Cholera in North Sumatra by the Weekly Report of the Provincial Health Service of North Sumatra and the Report of Medan Health Laboratory

The actual state of diarrheal diseases including cholera in North Sumatra can be roughly explained by the weekly report of the Provincial Health Service of North Sumatra and the report of Medan Health Laboratory. Before September of 1981, only suspected cholera was reported from each regency and municipality to the Provincial Health Service in the weekly report. The word of 'suspected cholera' is used in the sense that a bacteriological examination was not done or the result of a bacteriological examination was not ascertained at the moment when a weekly report was sent to the Provincial Health Service, but the symptoms were clinically like cholera. All diarrheal diseases collectively have become to be reported since September of 1981.

The change of reporting system brought the merit that the general aspect of the total cases number of diarrheal diseases became to be able to be grasped, but on the other hand, it brought the fault that the actual state of cholera was hidden in whole diarrheal diseases.

It is very important for drawing up preventive measures against epidemics in future that the investigation of the actual condition on a mass outbreak in diarrhea is done.

It is often difficult to differenciate cholera from other diarrheal diseases only by the symptoms of the illness, and especially in a mild case.

The most reliable means to prove each diarrheal disease including cholera is laboratory diagnosis.

It is very important to do bacteriological examinations on the epidemic in a diarrheal disease, and also important to do it even if the outbreak is sporadic. The result often gives a big clue to the whole aspect of an epidemic.

(1) General aspect of diarrheal diseases including cholera in North Sumatra in the past 13 years (1970 - 1982)

North Sumatra is near Malaysia and Singapore (about one hour by plane), and located in the northwestern part of Sumatra Island in Map 1. It consists of 11 regencies and 6 municipalities in Map 2, and the seat of the provincial government is Medan. The inland area has some scenic spots like the Lake Toba and high mountains over 2,000 meters above the sea. The climate in the interior is comparatively mild and often cool. On the contrary, the climate in the flat area along the coastline is considerably hot and generally humid.

Figure 1 shows the change of diarrheal cases number in North Sumatra in April of 1970 - March of 1982 (Fiscal Year).

The diarrheal cases number before September of 1981 means the number of cholera/suspected cholera cases. The number suddenly incrased after August of 1981, but it was caused by the change of reporting system as stated before.

Figure 2 shows the change of V. cholera positive number by bacteriological examinations in North Sumatra in 1978 - 1982. The number remarkably increased in 1978 - 1979 and it shows that there was a big cholera epidemic in North Sumatra in 1978 - 1979. The number of V. cholera positive roughly corresponds to the number of diarrheal cases in Figure 1 and Figure 2.

Table 1 shows the mortality of cholera/suspected cholera in North Sumatra in 1970 - 1981 (Fiscal Year). The mortality was over 30% in 1970, but it rapidly declined till about 3% in 1981 by the improvement of living environment, the establishment and increase of rehydration centers, and others. The mortality in 1973 was very low, but it was mainly due to the extraordinary increase of diarrheal cases number in Tapanuli Selatan, and the low mortalities in some other regencies and municipalities. The mortality in Tapanuli Selatan was only 1.6% (22/1,339). It is guessed that there was a big epidemic by some diarrheal disease besides cholera in a few regencies and municipalities including Tapanuli Selatan at that time.

Table 2 shows the change of diarrheal cases number, bacteriological examinations number and V. cholera positive number in North Sumatra in 1978 - 1983. The rate of number examined to patients number was 13.0% in 1979, and the rate rose to 36.2% in 1980 right after the provincewide

cholera epidemic. In 1982 - 1983, the rate suddenly declined into 1.5 - 1.7% because of the big increase of diarrheal cases number by the change of reporting system.

The rate of V. cholera positive number to number examined was over 50% in 1979. On the other hand, the rates were between about 20 - 30% in 1980 - 1983 after the provincewide cholera epidemic.

Table 3 and Table 4 show the rate of bacteriological examinations number to diarrheal cases number in each regency or municipality of North Sumatra in 1978 - 1983. The rate is considerably different in each regency (or municipality) and Year. In some regencies and municipality, bacteriological examinations number exceeded the number of diarrheal cases, and it seems the inconsistency means that there were the ommissions in the reports of diarrheal cases number.

The population in each regency or municipality of North Sumatra in 1980 is shown in Table 5.

Table 6 shows the morbidity of cholera/suspected cholera (1979 - 1980) and diarrheal diseases (1982) in each regency or municipality of North Sumatra. The morbidity of Tanjung Balai was the highest of all regencies and municipalities. Almost all the regencies and municipalities were more or less damaged by the big epidemic in 1978 - 1979. On the contrary, no cholera/suspected cholera cases were reported in Tanah Karo in 1978 - 1979 but the morbidity of diarrheal diseases in 1982 was over 10% there.

(2) Epidemiological explanation on cholera epidemics in North Sumatra in 1978 - 1983

Figure 3 shows the change of diarrheal cases number and the number of V. cholera positive in 1978 - 1983. In 1978 - 1979, a big cholera epidemic was observed in North Sumatra, and the epidemic spread like wildfire to almost all the regencies and municipalities in North Sumatra.

According to the weekly report of the Provincial Health Service, the number of the dead in 1978 - 1979 reached a total of 1,024 (431 in 1978 and 593 in 1979), and the number of diarrheal cases reached a total of 21,919 (7,634 in 1978 and 14,285 in 1979).

Since 1980, there have been some cholera epidemics whose beginnings and ends were not so clear and scales were far smaller than that of the epidemic in 1978 - 1979.

Figure 4.1 - 4.5 show the change of the number of V. cholera positive in each regency and municipality in the past 6 years (1978 - 1983). The wavy patterns of V. cholera positive number in 1978 - 1983 are different in each regency and municipality. Deli Serdang, Simalungun and Pematang Siantar have the peaks in 1978. Nias, Tapanuli Utara and Tanjung Balai have the peaks in 1979. Medan and Asahan have the 2 peaks in 1979 and 1981. Tapanuli Selatan has the 2 peaks in 1980 and 1982. Langkat and Binjai have the peaks in 1982. In Tapanuli Selatan, Langkat and Binjai, the peaks were the most in 1982 a few years after the provincewide cholera epidemic. However, the data in some regencies and municipalities are lacking for judging the tendency.

Figure 5.1 - 5.17 show the change of diarrheal cases number and the number of bacteriological examinations in each regency and municipality of North Sumatra in 1978 - 1983. All the regencies and municipalities of North Sumatra were more or less damaged by cholera epidemics between January of 1978 and August of 1983.

(i) Cholera epidemics in 1978 - 1979

Referring to the cholera epidemics in 1978 - 1979, Dr. R. Takai and Dr. N. Kumazawa (JICA Experts) described the details of the epidemics in their report 'SOME STATISTICAL CONSIDERATION ON CHOLERA EPIDEMICS IN 1978 - 1979' (29th October, 1980).

The following contents were written with reference to the above mentioned report in the epidemics of 1978 - 1979.

Table 7 shows the change of each number of 2 Types of V. cholera in the provincewide cholera epidemic of 1978 - 1979. The figure in parentheses in each regency or municipality shows the date on which V. cholera was detected first. Type Ogawa was confirmed first in August of 1978, and Type Inaba was confirmed first in December of 1978.

In the first outbreak (the peak in April) of the cholera epidemic in 1978 in Figure 3, it seems that Nias played an important role as Figure 6.1 shows.

In the second outbreak (the peak in August) of the cholera epidemic in 1978 in Figure 3, it seems that Pematang Siantar and Simalungun played an important role as Figure 6.1 shows.

In the third outbreak (the peak in November) of the cholera epidemic in 1978 in Figure 3, it seems that Medan and Deli Serdang played an important role, and the epidemic in Medan preceded the

epidemic in Deli Serdang as Figure 6.1 shows. It seems that the cholera epidemic in 1978 was caused by Type Ogawa because Type Inaba was detected for the first more than four months after Type Ogawa was detected first in August.

In the fourth outbreak (the peak in February and March) of the cholera epidemics in 1979 in Figure 3, the each period of the epidemics by Type Ogawa and Type Inaba overlapped in some regencies and municipalities but it seems that the epidemic by Type Ogawa was far bigger than that by Type Inaba as Figure 7 shows.

In the epidemic by Type Ogawa in 1979, it seems that Deli Serdang and Tapanuli Utara played an important role as Figure 6.2 shows.

The provincewide cholera epidemic by Type Ogawa in 1978 - 1979 seems to have lost the power in Tapanuli Selatan or Asahan at last in around October.

In the epidemic by Type Inaba in December of 1978 - May of 1979, Deli Serdang was just the place from where the epidemic began as Table 8 shows. The epidemic in Nias was remarkably different from the epidemics in the other regencies and municipalities in that it was caused by only Type Inaba.

Map 3.1 and Map 3.2 show the estimated transmission route of the cholera epidemic by Type Ogawa in 1978 - 1979. These maps were made on the basis of Figure 6.1 and Figure 6.2 showing the change of suspected cholera cases number in each regency and municipality in 1978 - 1979, and the report of Medan Health Laboratory recording the districts on cholera epidemics and the dates of bacteriological examinations.

Map 3.3 shows the estimated transmission route of the cholera epidemic by Type Inaba in 1979. This map was also made on the basis of Table 8 and the report of Medan Health Laboratory.

It seems that: (A) the main stream of the epidemic by Type Ogawa in 1978 which began in Nias Island crossed the sea to Sibolga, regained its power in Pematang Siantar and Simalungun along a national road, reached Medan without a rest, and further returned the national road to Deli Serdang; (B) the branch stream of the epidemic which divided in Sibolga passed Tapanuli Tengah, and reached Tapanuli Selatan; and (C) the epidemic which divided in Pematang Siantar had 2 branch streams ① to Simalungun and Tapanuli Utara and ② to Bandar (in Simalungun), Asahan and Tanjung Balai.

It seems that: (D) the main stream of the epidemic by Type Ogawa in 1979 started from Deli Serdang had 3 streams (1) to Medan, Binjai and Langkat, (2) to Tebing Tinggi, Pematang Siantar and Simalungun and (3) to Silau Kahean (in Simalungun); (E) the other epidemic which started from Tapanuli Utara passed Sibolga and Tapanuli Tengah, and reached Tapanuli Selatan; and (F) the epidemic which started from Tanjung Balai reached Labuhan Batu.

It seems that: (G) the main stream of the epidemic by Type Inaba in 1979 which began in Deli Serdang passed Tapanuli Utara, and reached Nias Island; and (H) the other streams from Deli Serdang were those (1) to Medan, (2) to Asahan, Tanjung Balai and Labuhan Batu and (3) to Silau Kahean (in Simalungun).

It has the possibility that the cholera epidemic in Tanjung Balai in the beginning of 1979 was carried and spread through the Asahan River from Tapanuli Utara. A big cholera epidemic was occurring around Porsea (in Tapanuli Utara) at that time.

(ii) Cholera epidemics in 1980 - 1983

In 1978 - 1979, the number of V. cholera positive was directly proportional to the number of diarrheal cases on the whole in Figure 3. But since 1980, the correlation between the number of V. cholera positive and the number of diarrheal cases has not always become to be clear, especially after August of 1981.

In the first half of 1980 - August of 1983, it seems that there were three waves of the cholera epidemic by Type Ogawa in Figure 3: the first wave in 1980; the second wave in the first half of 1981 - the first half of 1982; and the third wave in the latter half of 1982.

The 9 shows the change of the number of V. cholera positive in December of 1979 - June of 1982. Several numbers of cases by Type Inaba were detected in Medan in 1980, in Deli Serdang, Asahan and Labuhan Batu in 1981.

In the first wave (1980), it seems that Tapanuli Selatan played an important role as Figure 6.3 shows.

It seems that the second wave (the first half of 1981 - the first half of 1982) was bigger than the first wave (1980) in Figure 3. In the beginning of the second wave (the first half of 1981) in Figure 3, it seems that Medan played an important role as Figure 6.3 shows.

Map 3.4 and Map 3.5 show the estimated transmission route of the cholera epidemic by Type Ogawa in January of 1980 - Aug. of 1981. These maps were made on the basis of Figure 6.3 and the report of Medan Health Laboratory.

It seems that: (I) the cholera epidemic in 1980 began in Tapanuli Selatan and spread like the arrow of Map 1.4; and (J) the cholera epidemic in Medan in the first half of 1981 spread like the arrow of Map 1.5.

Since September of 1981, it has become very difficult to guess the transmission route of cholera epidemic because the reporting system in diarrhea had changed as stated before.

In December of 1981, a cholera epidemic was observed in Sinunukan (Natal of Tapanuli Selatan), and it shows the possibility that the epidemic was brought by the immigrants from Java. There was a cholera epidemic in Belawan (seaport) of Medan in Nov. of 1981. The immigrants to North Sumatra usually settle in various places (including Natal) of North Sumatra through Belawan.

In the first half of 1982, some cholera epidemics were seen in Tapanuli Utara, Medan, Deli Serdang and Langkat in Table 9.

In the beginning of the third wave (August of 1982), a sudden cholera broke out in Air Joman of Asahan. The outline of this epidemic will be explained later.

In the latter half of 1982, cholera epidemics were mainly seen in Tapanuli Selatan, Deli Serdang, Binjai and Langkat except Asahan.

In 1983, the epidemics seem to have spread to most regencies and municipalities in North Sumatra as Table 10 shows.

It became clear that there was a cholera epidemic in Medang Deras of Asahan in 1983 by the survey whose details will be explained later.

The stream of the transmission of the cholera epidemic in North Sumatra in 1982 - 1983 is not so clear by the reason of the change of the reporting system in diarrhea after August of 1981.

Map 4 roughly shows the area of frequent cholera occurrence (oblique lines) by the weekly report of the Provincial Health Service, the report of Medan Health Laboratory and others in 1978 - 1983.

Examining the cholera epidemics in North Sumatra between 1978 and 1983, trunk roads including a national road seem to have had a very important role in these epidemics.

In the provincewide cholera epidemic (1978 - 1979), the first cholera epidemic in each regency and municipality occurred in the area along/near a trunk road, and it seems to suggest that cholera in North Sumatra was mainly carried and spread to various places by buses, trains and so on.

As the other ways of transmission of cholera, it is guessed that rivers and immigration have had certain roles in epidemics.

On cholera epidemics in North Sumatra, it is desirable that further investigation will be collectively/individually done on the basis of more complete data.

Seasonal tendency in cholera epidemics was hardly recognized in North Sumatra.

(3) Outline of diarrheal diseases in North Sumatra in 1978 - 1983

The actual state of diarrheal diseases is not known so much except cholera in North Sumatra.

In 1978 - 1983, some pathogenic organs causing diarrhea (Shigella, Salmonella, V. parahaemolyticus and others) were detected by the bacteriological examination of Medan Health Laboratory, but the cases number by each pathogenic organ were not so many or zero in each year. These numbers seems not to reflect the actual state of diarrheal diseases in North Sumatra.

According to the rotavirus survey of infants by ELISA which was carried out by Medan Health Laboratory in April - June of 1982, the positive rate was 54.2% (29/54). Judging from the positive rate, it seems that this pathogenic organ is general in infants there.

Since September of 1981, it seems that the imperfection in understanding for the change of reporting system had been seen in a few regencies and municipalities of North Sumatra for a while.

The number of diarrheal cases since December of 1981 regularly has had the peaks every three months as Figure 3 shows. It is not clear whether the peaks in every three months is due to a mere chance or not.

The rainy season in North Sumatra is between September and December, and the dry season is between January and August but small rainy season is sometimes observed in around the middle of the dry season.

In Figure 3, diarrheal cases number were the most in September of 1982 (the beginning of the rainy season).

It is not so clear whether diarrheal cases number is affected by the change of the season. Further observation will be necessary to make sure of it.

(III) Cholera Epidemic in Air Joman District of Asahan in July - August, 1982

Air joman district is located between Tanjung Balai and Kisaran as Map 5 shows. The district is far from a main road, and it partially faced the Malacca Strait. The population of Air Joman is 38,856 as Table 11 shows.

The cholera epidemic in Air Joman began in the village of Silo Bonto at the end of July, and it immediately spread to the village of Silo Lama next to Silo Bonto. The epidemic further expanded to neiboring villages (Kp. Banjar and Psr. Lembu), and came to an end at the end of August.

The result of bacteriological examination in Air Joman is shown in Table 12. Type Ogawa was detected first on the 12th of August, and the positive number reached a total of 18 by the following examination.

Figure 8 shows the number of diarrheal cases and the dead in Air Joman in 1982.

Table 13 shows the aspect of diarrheal cases in some districts of Asahan, Tapanuli Selatan and Medan in April - Sep. of 1982.

In July - August, 188 villagers in the epidemic of Air Joman suffered from cholera and 19 villagers of them died.

In the same time, 22 villagers in Air Putih suffered from diarrhea (cholera), and 1 of them died.

In April - September, about 50 - 100 inhabitants in Tanjung Balai (Bagan Asahan) suffered from diarrhea every month, but it is unknown whether the epidemic was caused by cholera because one case was only examined bacteriologically during the period.

In August, cholera broke out in Tapanuli Selatan and Medan, too. And the cholera epidemic in Tapanuli Selatan was especially tremendous in Table 13, but the details of the epidemic are unknown.

In April - May, 33 villagers in Air Joman suffered from diarrhea, and 4 of them died. In consideration of the high mortality, it is suspected that there was a small cholera epidemic in Air Joman at that time.

They got drink water from shallow wells in the houses of about 50%, and from the Asahan River (near Tg. Balai) in the houses of about 50% in

Silo Bonto of Air Joman at that time. The river water for drinking water was carried by boat through sea.

V. cholera (Type Ogawa) was detected from the shallow well of the first case's house in Silo Bonto by the following bacteriological examination, however, it is unknown whether the Asahan River had been contaminated by Vibrio cholera at that time because the bacteriological examination of the river water was not done.

According to the village headman of Silo Bonto, the first case was a 7 year old girl from Simpang Empat who came to see her relative of Silo Bonto and stayed there till she died. She fell ill on the 26th of July a week after she came to Silo Bonto, and died on the 27th of July.

In consideration of the above mentioned fact, it seems that the first case from Simpang Empat was infected with cholera after she came to Silo Bonto because the incubation time of cholera is generally 1-3 days and there was not a cholera case in Simpang Empat at that time in Table 13. Her main symptoms were vomiting and strong diarrhea.

On the 27th of July that the first case in Air Joman district (Silo Bonto) died, a housewife of Silo Lama went to Silo Bonto and made a call of condolence to the victim. On the 29th, the housewife's child of Silo Lama died in the same symptoms as the victim of Silo Bonto had, so it seems that the housewife infected cholera to her child.

On the 29th, the headman of Silo Bonto went to Silo Lama and made a call of condolence to the second victim. He fell ill at the night. His symptoms were also vomiting and strong diarrhea. Luckily, he recovered from the illness.

According to the headman of Silo Bonto, diarrheal cases in July were only 3 persons. There were seen some differences in the numbers of patients and the dead in July between the official report in Table 13 and the headman's story.

It is not clear what kind of food or drink caused diarrhea to the victims. The headman had only tea at the victim's house of Silo Lama. According to the headman, the total number of patients in Air Joman was 230, and the number of the dead was 23. It is not clear whether omission in the number of official report was or not in Table 13.

It is not clear where the cholera of Air Joman in July - August came from, but it seems that the source of infection was not from Tapanuli Selatan or Medan because the epidemics of Tapanuli Selatan or Medan broke

out after the epidemic in Air Joman and also was not from Air Putih where a cholera epidemic was observed in the same time because the first case in Air Joman had not a contact with a case or a suspect of Air Putih during her stay in Air Joman.

There was no obvious cholera epidemic in North Sumatra in July - August except some districts of Asahan, Tapanuli Selatan and Medan. It seems not to be able to ignore the possibility that the epidemic in Air Joman in April - May had lasted till August in Figure 8, but the truth is unknown.

(IV) Survey Referring to the Role of Rivers in Cholera Epidemic

The ways of spread in cholera epidemic will be various. It has peculiar nature in some parts of a country together with general nature. For example, inhabitants of a region along some river in developing countries often use the river water to wash their clothes and tablewares, to excrete, to bathe and sometimes to drink, so it will be necessary to investigate the role of river water in a cholera epidemic.

(1) Aspect of diarrheal cases in the villages of Medang Deras in January - July, 1983

Map 6 shows the location of each village in Medang Deras of Asahan.

Table 14 shows the aspect of diarrheal cases number in each village of Medang Deras in January - July of 1983. The number of patients in the only two villages of Pangkalan Dodek and Sei Buah Keras along the Pagurawan River are over 50% of total number of patients (296/561) in Medang Deras.

The dead in diarrheal cases of Medang Deras were only seen in April - May.

Figure 9 shows the change of diarrheal cases number treated by intravenous drip infusion of ringer solution. The number also center around April - May.

According to the report of a local newspaper at that time, several villages along the Pagurawan River had many diarrheal cases whose symptoms were vomiting and diarrhea.

As was mentioned above, it was suspected that there was a cholera epidemic in Medang Deras, and the survey to make sure of it was carried out between the 13th and the 16th of May.

(2) Cholera survey in the village of Nanasiam and the Pagurawan River in May 13 - 16, 1983

The villages which were attacked by cholera lie along the mouth of the Pagurawa River. The real cholera epidemic in Nan siamaseems to have started at the beginning of April and ended at the end of May. In April - May, the village of Nanasiam seems to have been one of the main cholera infected villages in Medang Deras. The survey was carried out in both sides of the investigation of the actual state of the epidemic in the villagers of Nanasiam and the bacteriological examination of the river water in the Pagurawan River between the 13th and the 16th of May.

(i) Survey of the river water in the Pagurawan River

The Pagurawan River rises among the mountains of Raya district and Pematang Siantar in Simalungun.

Map 7 shows the sampling spots of the river water (red dots) in the Pagurawan River and the rough houses location (rectangles) in the village of Nanasiam.

Table 15 shows the result of bacteriological examination by Moore method and Direct method of the river water. V. cholera was detected at the 5 of 7 spots in both methods.

The positive rate of V. cholera by Moore method was 100% (4/4) and that by Direct method was 42.9% (3/7).

Positive by both Moore method and Direct method were seen at spot A and spot B. Judging from the number of positive spots, V. cholera density of Pangkalan Dodek side (3/3) seems to have been higher than that of Nanasiam side (2/4) in Table 15 and Map 7.

The result of drug sensitivity test is shown in Table 16. All strains from river water (4 strains) were sensitive to CP (Chloramphenicol), TC (Tetracycline) and NA (Nalidixic acid) but resistant to KM (Kanamycin).

(ii) Cholera survey in the village of Nanasiam

The village of Nanasiam is located in the opposite side of the village of Pangkalan Dodek across the Pagurawan River in Map 7. The population of Nanasiam was 1,265 in 1980 as Table 17 shows.

There were 3 artesian wells in Nanasiam at that time in Map 7, but most of the villagers except Hamlet V were using the river water for drink-

ing water because all of the artesian wells had dried up about 1.5 years before the epidemic broke out.

The result of bacteriological examination in the village of Nanasiam is shown in Table 18. Cholera positive rate was 21.4%. As a result of this survey, it was confirmed that the epidemic in Nanasiam was caused by cholera.

Cases' houses are painted out with red ink (cholera cases in May 13 - 16) or blue ink (suspected cholera cases before May 13). The cases' houses exist along the Pagurawan River, and they especially center around Lr. I (Hamlet I) and Lr. II (Hamlet II) along the mouth of the river affected by sea water.

According to the village headman of Nanasiam, the river water used for drinking water was not boiled enough in Lr. I and Lr. II when being drunk because boiled water was salty and unsavory to drink. The villagers in Lr. V (Hamlet V) usually had their own shallow wells to no wells in other hamlets villagers to be able to use.

The result of drug sensitivity test is shown in Table 16.

All strains from the cholera cases in Nanasiam (6 strains) were sensitive to CP (Chloramphenicol), TC (Tetracycline) and NA (Nalidixic acid) but resistant to KM (Kanamycin) as those from river water are.

In the above mentioned facts, it seems to be certain that the cholera epidemic in the village of Nanasiam was caused by the river water of the Pagurawan River.

(3) Survey of the river water in the rivers flowing into the Malacca Strait through/from Pematang Siantar (August 23 - 27, 1983)

Map 8 shows the rivers in Asahan and Simalungun. The villages on the coast of the Malacca Strait in Medang Deras and Air Putih are made contact with Pematang Siantar in Simalungun by the rivers of the Bah Hapal (Pagurawan River) and the Bah Bolon.

Figure 10 shows the change of diarrheal cases number in Pematang Siantar and Medang Deras in January - July of 1983. The numbers in Pematang Siantar and Medang Deras have the peak between March and May.

There was a cholera epidemic in Medang Deras in about Apr. - May as stated before, but it is not so clear when the cholera epidemic in Pematang Siantar began because bacteriological examinations were not done

all months in Table 19. V. cholera (Type Ogawa) in Pematang Siantar was confirmed for the first at the beginning of April in 1983.

This survey was carried out with such an intention to investigate the influence to the riverside inhabitants of downstream area when the riverside inhabitants of upstream area suffered from diarrhea like cholera.

The rivers which were investigated were the ones flowing into the Malacca Strait through/from Pematang Siantar.

Two teams were organized for the survey of river water.

One team investigated the upstreams of the Bah Hapal and the Bah Bolon in Pematang Siantar (the second largest city in North Sumatra) and the midstream of the Bah Bolon in Perdagangan.

Another team investigated the midstream (in Nagabayu) and the downstream (in Sungai Suka, Pangkalan Dodek, Nanasiam and so on) of the Bah Hapal, the midstream of the Bah Pamujian (in Purbaganda) and the downstream (Gambus, Daludalu, Tanjung and Parepare) of the Bah Bolon (in Air Putih and Lima Puluh of Asahan).

(i) Survey of the river water in the Bah Hapal

The main stream of the Bah Hapal River has the source among the mountains of Raya district in Simalungun and the some streams have the source in Pematang Siantar in Map 8.

The Bah Hapal passes some districts in Simalungun and Asahan, and it empties into the Malacca Strait.

The name of the Bah Hapal replaces those of the Suka River and the Pagurawan River in the downstream.

The survey of river water was carried out in the upstream (Pematang Siantar), the midstream (Nagabayu in Simalungun) and the downstream (Sungai Suka, Sei Buah Keras, Pangkalan Dodek and Nanasiam) of the Bah Hapal.

Map 9, 10 and 11 show the sampling spots of the river water (dots) in Pamatang Siantar, Air Putih and Medang Deras.

Table 20 and Table 21 show the results of bacteriological exmination by Moore method and Direct method of the river water.

V. cholera was not detected, but NAG Vibrio was detected in this survey. In the Pagurawan River, NAG Vibrio was detected only on Nanasiam side.

In the survey of the Pagurawan River in May as stated before, V. cholera density of Pangkalan Dodek side seems to have been higher than that of Nanasiam side. Thus, V. cholera or NAG Vibrio density was different on each side of the river.

It seems to suggest that the contamination of river water near one riverside did not affect so much or rapidly the other riverside in the mouth of the Pagurawan River which is about 150 meters across width and whose stream is slow.

NAG Vibrio was also detected in Sungai Suka of Air Putih pointing to the upstream of the Pagurawn River, and in Purbaganda (the Bah Pamujian) in Bandar of Simalungun pointing to the upstream of the Suka River (Pagurawan River).

The positive rate of NAG Vibrio by Direct method (7/25) was higher than that by Moore method (3/20) in the survey in August 23 - 27 in Table 21.

Positive by both Moore method and Direct method was only seen at spot T.

(ii) Survey of the river water in the Bah Bolon

The Bah Bolon River has the source among the mountains of some districts in Simalungun near the Lake Toba, and it passes Pematang Siantar and branches off to two rivers (Bah Bolon and Bah Pamujian) in Pematang Siantar. The main stream (Bah Bolon) absorbs some rivers on this side of Perdagangan in Bandar of Simalungun, branches off to four rivers (Parepare, Tanjung, Daludalu and Gambus) on this side of Indrapura in Air Putih of Asahan again, and empties into the Malacca Strait.

The branch stream (Bah Pamujian) of the Bah Bolon passes some districts in Simalungun, and is absorbed in the Bah Hapal on this side of Sungai Suka in Air Putih of Asahan.

The survey of river water was carried out in the upstream (Pematang Siantar), the midstream (Perdagangan), the downstream (Indrapura, Tanjung Selamat, Lalang, Cinta Damai in Air Putih of Asahan and Simpang Gambus in Lima Puluh of Asahan) of the Bah Bolon.

Table 20 and Table 21 show the the results of bacteriological examination of the river water.

V. cholera was not detected, but NAG Vibrio was detected in the mouth of the irrigation canal (the Raja River) from the Parepare River.

Thinking of the results of the bacteriological examination of the river water in both the Bah Hapal and the Bah Bolon, it seems that the epidemic of NAG Vibrio spread along the Pagurawan River from Nanasiam to Purbaganda, but it is unknown where the epidemic began and how it spread.

Table 1 Mortality of Cholera / Suspected Cholera in North Sumatra in April of 1970 - Aug. of 1981 (Fiscal Year)

Fiscal Year	No. of Diarrheal Cases	No. of the Dead	Mortality (%)
1970	419	142	33.9
1971	966	219	22.7
1972	2,772	434	15.7
1973	3,149	140	4.4
1974	1,278	132	10.3
1975	2,102	313	14.9
1976	2,050	207	10.1
1977	2,115	143	6.8
1978	14,031	674	4.8
1979	7,929	318	4.0
1980	4,240	145	3.4
1981 (Apr. - Aug.)	2,393	68	2.8

Table 2 Number of Diarrheal Cases, Bacteriological Examinations and V. cholera Positive in North Sumatra in 1978 - 1983

Year	No.of Patients	No.Examined (E/P ※1)	No.of V.cholera Positive (CP/E ※2)
1978	7,634	1,597 (20.9)	616 (38.6)
1979	14,285	1,852 (13.0)	1,000 (54.0)
1980	4,243	1,534 (36.2)	300 (19.6)
1981 (Jan.-Aug.)	3,086	804 (26.1)	219 (27.2)
1981 (Sep.-Dec.)	16,956	1,093 (6.4)	200 (18.3)
1982	78,011	1,360 (1.7)	320 (23.5)
1983 (Jan.-May)	36,866	544 (1.5)	160 (29.4)

※1 Rate of No. examined/ No. of patients

※2 Rate of V. cholera positive number/ No. examined

(Note) Only suspected cholera in diarrheal diseases was reported in the period before September of 1981.

Table 3 Rate of Number of Bacteriological Examinations to Number of Diarrheal Cases in Each Regency or Municipality of North Sumatra in January of 1978 - August of 1981

Regency \ Year	Rate of No. Examined/ No. of Patients									
	1978		1979		1980		1981(Jan.-Aug.)		T o t a l	
Deli Serdang	313/1467	(21.3)	306/2148	(14.2)	448/926	(48.4)	101/235	(43.0)	1172/4772	(24.6)
M e d a n *	247/1250	(19.8)	325/2459	(13.2)	181/402	(45.0)	157/611	(25.7)	906/4726	(19.2)
Teb. Tinggi *	8/82	(9.8)	1/485	(0.2)	0/65	(0)	7/35	(20.0)	16/667	(2.4)
Langkat	2/177	(1.1)	11/228	(4.8)	31/107	(29.0)	43/233	(18.5)	87/745	(11.7)
Binjai *	6/5 **		16/28	(57.1)	5/0 **		54/0 **		81/33 **	
Tanah Karo	8/30	(26.7)	4/0 **		0/0		65/19 **		77/49 **	
D a i r i	6/19	(31.6)	3/76	(3.9)	2/2	(100)	9/91	(9.9)	20/188	(10.6)
A s a h a n	65/562	(11.6)	124/1408	(8.8)	63/492	(12.8)	89/429	(20.7)	341/2891	(11.8)
Tg. Balai *	30/98	(30.6)	101/874	(11.6)	37/196	(18.9)	11/155	(7.1)	179/1323	(13.5)
Simalungun	506/777	(65.1)	270/818	(33.0)	152/54 **		94/230	(40.9)	1022/1879	(54.4)
P. Siantar *	121/278	(43.5)	104/124	(83.9)	63/137	(46.0)	35/248	(14.1)	323/787	(41.0)
L. Batu	10/41	(24.4)	42/1238	(3.4)	77/282	(27.3)	30/155	(19.4)	159/1716	(9.3)
Tap. Utara	12/281	(4.3)	310/917	(33.8)	346/340 **		70/139	(50.4)	738/1677	(44.0)
Tap. Tengah	9/41	(22.0)	19/267	(7.1)	12/54	(22.2)	0/30	(0)	40/392	(10.2)
Sibolga *	30/216	(13.9)	28/176	(15.9)	12/43	(27.9)	10/15	(66.7)	80/450	(17.8)
Tap. Selatan	129/890	(14.5)	98/1836	(5.3)	92/906	(10.2)	18/367	(4.9)	337/3999	(8.4)
N i a s	50/1420	(3.5)	79/1203	(6.6)	5/235	(2.1)	13/93	(14.0)	147/2951	(5.0)

* Municipality

** The omission in diarrheal cases number is guessed in the weekly report.

Table 4 Rate of Number of Bacteriological Examinations to Number of Diarrheal Cases in Each Regency or Municipality of North Sumatra in September of 1981 - May of 1983

Year / Regency	Rate of No. Examined/ No. of Patients			
	1981 (Sep.-Dec.)	1982	1983 (Jan.-May)	T o t a l
Deli Serdang	273/4002 (6.8)	148/23302 (0.6)	107/6518 (1.6)	528/33822 (1.6)
M e d a n *	386/760 (50.8)	214/2995 (7.1)	88/2857 (3.1)	688/6612 (10.4)
Teb. Tinggi *	0/66 (0)	0/719 (0)	0/307 (0)	0/1092 (0)
Langkat	178/510 (34.9)	294/2272 (12.9)	50/1491 (3.4)	522/4273 (12.2)
B i n j a i *	8/19 (42.1)	51/108 (47.2)	17/12 **	76/139 (54.7)
Tanah Karo	0/443 (0)	0/2892 (0)	23/1880 (1.2)	23/5215 (0.4)
D a i r i	2/161 (1.2)	26/465 (5.6)	8/225 (3.6)	36/851 (4.2)
A s a h a n	84/1235 (6.8)	120/6160 (1.9)	0/3103 (0)	204/10498 (1.9)
Tg. Balai *	3/764 (0.4)	0/3504 (0)	1/1128 (0.1)	4/5396 (0.1)
Simalungun	23/33 (69.7)	28/276 (10.1)	45/755 (6.0)	96/1064 (9.0)
P. Siantar *	7/419 (1.7)	14/4257 (0.3)	23/2868 (0.8)	44/7544 (0.6)
L. Batu	1/926 (0.1)	27/3404 (0.8)	76/2831 (2.7)	104/7161 (1.5)
Tap. Utara	6/1321 (0.5)	48/7260 (0.7)	30/2063 (1.5)	84/10644 (0.8)
Tap. Tengah	2/19 (10.5)	2/382 (0.5)	1/209 (0.5)	5/610 (0.8)
Sibolga *	2/184 (1.1)	11/897 (1.2)	0/374 (0)	13/1455 (0.9)
Tap. Selatan	101/4224 (2.4)	349/11871 (2.9)	75/7833 (1.0)	525/23928 (2.2)
N i a s	9/1870 (0.5)	28/7247 (0.4)	0/2412 (0)	37/11529 (0.3)

* Municipality

Table 5 Population in Each Regency or Municipality of North Sumatra (by 1980's Census)

NO.	Regency or Municipality	Male	Female	T o t a l
1.	M e d a n	694,536	679,211	1,373,747
2.	B i n j a i	38,567	37,877	76,444
3.	Tebing Tinggi	46,352	45,716	92,068
4.	Tanjung Balai	20,680	21,096	41,776
5.	Pematang Siantar	74,139	76,157	150,296
6.	S i b o l g a	30,254	29,217	59,471
7.	Deli Serdang	625,771	615,286	1,241,057
8.	L a n g k a t	357,393	343,987	701,380
9.	A s a h a n	391,797	383,183	774,980
10.	Labuhan Batu	277,759	269,412	547,171
11.	Tanah Karo	107,947	111,253	219,200
12.	D a i r i	120,347	121,438	241,785
13.	Simalungun	378,634	381,280	759,914
14.	Tapanuli Utara	331,648	350,764	682,412
15.	Tapanuli Tengah	83,436	83,725	167,161
16.	Tapanuli Selatan	373,087	381,012	754,099
17.	N i a s	237,260	230,648	467,908
18.	Special District	7,959	1,311	9,270
	T o t a l	4,197,566	4,162,573	8,360,139

Table 6 Morbidity of Cholera/ Suspected Cholera (1979 - 1980) and Diarrheal Diseases (1982) in Each Regency or Municipality of North Sumatra (Per 1,000 Population)

Regency or Municipality	Morbidity		
	1979	1980	1982
M e d a n	1.83	0.29	2.10
B i n j a i	0.37	0	1.36
Tebing Tinggi	5.37	0.71	7.54
Tanjung Balai	21.33	4.69	80.94
Pematang Siantar	0.84	0.91	27.33
S i b o l g a	3.02	0.72	14.55
Deli Serdang	1.76	0.75	18.12
L a n g k a t	0.33	0.15	3.13
A s a h a n	1.85	0.64	7.67
Labuhan Batu	2.31	0.52	6.00
Tanah Karo	0	0	12.77
D a i r i	0.32	0.01	1.86
Simalungun	1.10	0.07	0.35
Tapanuli Utara	1.37	0.50	10.27
Tapanuli Tengah	1.63	0.34	2.21
Tapanuli Selatan	2.48	1.20	15.19
N i a s	2.62	0.50	14.95

(Note) The population increase rate of Indonesia in 1979 was 1.9 %.
The population of each regency or municipality of North Sumatra used for the morbidity in 1979 was calculated backward in a businesslike manner on the basis of the population of 1980.
The population increase rate after 1980 is unknown, but the population used for the morbidity in 1982 was calculated on the assumption that the increase rate was 1.8 % per year.

Table 7 Change of 2 Types (Ogawa and Inaba) in Big Cholera Epidemic in North Sumatra (Mar. of 1978 – Nov. of 1979)

REGENCY \ MONTH / TYPE	1978 3	4	5	6	7	8	9	10	11	12	1979 1	2	3	4	5	6	7	8	9	10	11	TOTAL
	CP * O I U	CP O I U	CP O I U	CP O I U	CP O I U	CP O I U	CP O I U	CP O I U	CP O I U	CP O I U	CP O I U	CP O I U	CP O I U	CP O I U	CP O I U	CP O I U	CP O I U	CP O I U	CP O I U	CP O I U	CP O I U	CP O I U
DAIRI					(–)		(–)		3(7th) 3 – –			2 2 – –										5 5 – –
TANAH KARO					(–)						1		3(?) 3 – –									3 3 – –
LANGKAT									1(3rd) 1 – –		(–)	3 3 – –	2 2 – –					1 1 – –				7 7 – –
KRINTJAN		(–)						2(?) 2 – –	1 1 – –			(–)	6 6 – –	1 1 – –	2 2 – –					1 1 – –		13 13 – –
MEDAN		(–)	1(?) – – 1			4 4 – –	2 2 – –	51 51 – –	36 36 – –	26 26 – –	128 16 12 –	28 23 5 –	43 43 – –	12 12 – –	26 26 – –	5 5 – –	3 3 – –	4 4 – –		3 3 – –	11 11 – –	281 263 17 1
DELI SERDANG	(–)		(–)	(–)	(–)	(–)	9(3rd) 9 – –	10 10 – –	106 106 – –	72 70 2 –	93 64 9 –	63 46 17 –	28 27 1 –	3 3 – –	2 2 – –	2 2 – –	4 4 – –	6 6 – –	3 3 – –	3 3 – –	(–)	384 355 29 –
DJUNG KONGO						1(?) 1 – –	1 1 – –		(–)			(–)										2 2 – –
ASAHAN		(–)	(–)	2(?) – – 2		1 1 – –	2 2 – –	3 3 – –	16 16 – –	9 9 – –	9 7 2 –	17 16 1 –	10 10 – –	10 10 – –	5 5 – –				6 6 – –			70 65 3 2
TANJUNG BALAI	1(20th) – – 1	(–)	(–)	(–)	(–)	(–)	(–)	(–)	8 8 – –	(–)	16 15 1 –	31 30 1 –	10 10 – –		2 2 – –					2 2 – –	1 1 – –	71 68 2 1
LABUHAN BATU					(–)	(–)	(–)		2(26th) 2 – –	(–)	1 1 – –	5 5 – –	16 15 1 –				3 3 – –					27 26 1 –
PEMATANG SIANTAR						19(?) 19 – –	26 26 – –	1 1 – –	5 5 – –	7 7 – –	5 5 – –	5 4 1 –	16 16 – –	1 1 – –	9 9 – –					7 7 – –		101 100 1 –
SIMALUNGUN						39(?) 39 – –	26 26 – –	27 27 – –	13 13 – –	(–)	7 3 4 –	35 34 1 –	33 32 1 –	10 10	4 4 – –	2 2 – –	(–)	8 8 – –		(–)	(–)	204 198 6 –
TAPANULI UTARA					(–)	(–)		(–)	(–)	(–)	139(31/12) 102 35 –	53 49 4 –	25 25 – –		1 1 – –				2 2 – –	1 1 – –		219 180 39 –
TAPANULI SELATAN								10(4th) 10 – –				1 1 – –	7 7 – –	5 5 – –	7 7 – –	1 1 – –	(–)	1 1 – –	4 4 – –	1 1 – –		37 37 – –
TAPANULI TENGAH	1(?) – – 1		(–)	1 – – 1			(–)	(–)		1 1 – –	1 1 – –		2 2 – –	2 2 – –	10 10 – –							18 16 – 2
SIBOLGA	4(27th) – – 4	2 – – 2	1 – – 1	3 – – 3	1 – – 1		(–)	(–)		1 1 – –	2 2 – –		1 1 – –	11 11 – –	2 2 – –							23 17 – 11
NIAS	10(21st) – – 10	22 – – 22	9 – – 9								1 – 1 –	9 – 9 –	29 – 29 –	16 – 16 –	2 – 2 –	(–)						98 – 57 41
UNKNOWN						15 15 – –	1 1 – –		1 1 – –	2 2 – –	1 1 – –	1 1 – –	3 3 – –	(–)	3 3 – –							27 27 – –
TOTAL	16 – – 16	24 – – 24	11 – – 11	6 – – 6	1 – – 1	99 71 – –	65 65 – –	104 104 – –	192 192 – –	118 116 2 –	231 217 64 –	253 214 39 –	234 207 32 –	71 55 16 –	75 73 2 –	10 10 – –	10 10 – –	20 20 – –	15 15 – –	18 18 – –	12 12 – –	1615 1482 155 53

* CP : Number of V.cholera positive
O I U: Ogawa Inaba Unknown
(–) Negative as a result of examination
Municipality

(Note) Figure in parentheses shows the date on which V.cholera was detected first.

Table 8 Change of Positive Number in Cholera Epidemic by Type Inaba
(Dec.of 1978 - May of 1979)

MONTH / REGENCY	1978	1979					TOTAL
	12	1	2	3	4	5	
DELI SERDANG	2(26th)	9	17	1	0	0	29
M E D A N ※	0	12(3rd)	5	0	0	0	17
TAPANULI UTARA	0	35(3rd)	4	0	0	0	39
A S H A N	0	2(?)	1	0	0	0	3
TANJUNG BALAI ※	0	1(11th)	1	0	0	0	2
SIMALUNGUN	0	4(15th)	1	1	0	0	6
N I A S	0	1(?)	9	29	16	2	57
P.SIANTAR ※	0	0	1(?)	0	0	0	1
LABUHAN BATU	0	0	0	1(?)	0	0	1
T O T A L	2	64	39	32	16	2	155

※ Municipality

(Note) Figure in parentheses shows the date on which Inaba was detected first.

Table 9 Change of V. cholera Positive Number in Cholera Epidemic in North Sumatra (Dec. of 1979 – June of 1982)

MONTH / REGENCY	1979	1980												1981											1982						TOTAL
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	
DAIRI						(−)								1(27th)		1	1	(−)	(−)				1	(−)			2	(−)				6
TANAH KARO																	4(11th)	2													6
LANGKAT, [redacted]					(−)	(−)			(−)				1(17th)	(−)	(−)	(−)	(−)	(−)	(−)	2	2	20	15	3	1	2	9	17		6		78
[redacted]	(−)	(−)	3(5th) 1*	1		(−)	1	2		2	1	1	26 1*	15	5	16	(−)	(−)	6	5	4	6	9	67	14	18	11	3	(−)	(−)	1	217 2*
D. SERDANG, [redacted]	(−)		(−)	4(?)	3	8	(−)	8	2	9	40	16	3	7	(−)	1	1	7	8	12 1*	9	13	11	4	4	5	10	2	(−)	(−)	(−)	187 1*
ASAHAN, [redacted]		3(23rd)	3 2**	13	7	2	1	4			2	(−)	(−)	2	3	11	14	3	7 1*	5	7	(−)	(−)	6	2	2	1				(−)	98 1*, 2**
LABUHAN BATU				2(?)				1	(−)			8	3			(−)				2 2*	3				(−)		2	1				22 2*
SIMALUNGUN, [redacted]	1(?)	2 1**	1	(−)	1	1	1	(−)		(−)	1		(−)		3	1	3	1		10	6	(−)	6	1	2	(−)	(−)	1	1	(−)		43 1**
TAPANULI UTARA				1(22nd)	8 3**	20	4	2	2		7	2	(−)		(−)	1		(−)		3	6	(−)		(−)		12	20					88 3**
TAPANULI SELATAN	(−)		(−)	5(10th)	6	(−)	3	27	7		3										11	1	2		9			10				84
TAP. TENGAH, [redacted]					(−)	3(14th)	(−)	1		1	(−)					1	(−)	1			2	(−)		(−)	(−)	(−)	(−)				(−)	9
NIAS					(−)				(−)	(−)					(−)		(−)			(−)		(−)	(−)	(−)	3(15th)	5			(−)	(−)		8
UNKNOWN						(−)		(−)			3												(−)									3
TOTAL	1	5 1**	7 1*2**	26	25 3**	34	10	45	11	12	57	27	33 1*	25	11	32	23	14	21 1*	39 3*	50	40	44	81	35	44	55	24	11	6	1	849 6*, 6**

Upper row : Type Ogawa
Lower row * Type Inaba
** Type Unknown
(−) Negative as a result of examination
[redacted] Municipality

(Note) Figure in parentheses shows the date on which Type Ogawa was detected first in Dec. of 1979 – Dec. of 1981.

Table 10 Change of V. cholera Positive Number in Cholera Epidemic by Type Ogawa (July of 1982 –)

REGENCY \ MONTH	1982						1983								TOTAL
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	
DAIRI	(–)		1(6th)	(–)	(–)			(–)		(–)		(–)			1
TANAH KARO											5(20th)	5	(–)	1	11
LANGKAT	(–)	(–)		1(20th)	18	(–)	(–)	4	(–)	2	4				29
BINJAI*	(–)	(–)	(–)	3(19th)	14	5	2	(–)						1	25
MEDAN*	(–)	6(28th)	1	1	1		5	4	8	6	(–)	2	1	(–)	35
DELI SERDANG	(–)	(–)	(–)	(–)	19(1st)	5	(–)	(–)	2	1	5	21	2	5	60
TEBING TINGGI*														21(10th)	21
ASAHAN		22(11th)													22
TANJUNG BALAI*							(–)								0
LABUHAN BATU							(–)	1(15th)	1	23					25
PEMATANG SIANTAR*	(–)				(–)			(–)		11(?)		4	(–)	2	17
SIMALUNGUN	(–)				(–)			(–)	2(27th)	18	1	9		(–)	30
TAPANULI UTARA	(–)	(–)						12(2nd)	2	5			(–)		19
TAPANULI SELATAN		82(24th)				(–)		21	14	1		22	(–)	14	154
TAPANULI TENGAH						(–)	(–)					8(6th)		4	12
SIBOLGA*														4(21th)	4
NIAS															0
UNKNOWN														11	11
TOTAL	0	110	2	5	52	10	7	42	29	67	15	71	3	63	476

(–) Negative as a result of examination

* Municipality

(Note) Figure in parentheses shows the date on which Type Ogawa was detected first in July of 1982 – Aug. of 1983.

Table 11 Population of each village in Air Joman of Asahan

Village	Population
Silo Bonto	4665
Silo Lama	2529
Kp. Banjar	5776
Psr. Lembu	2817
Air Joman	5187
Punggulan	5000
Lubuk Palas	5145
Binjai Serbangan	7737
T o t a l	38856

Table 12 Result of Bacteriological Examination in Cholera Epidemic in Air Joman in July - August, 1982 (Type Ogawa only)

WEEK No. / VILLAGE	July				August				TOTAL P / D※1 CP/E※2
	27	28	29	30	31	32	33	34	
SILO BONTO					3/29(14th)	0/2		3/3	91 10 6/34
SILO LAMA					5/16(12th)	0/3		5/6	87 7 10/25
Kp. BANJAR					1/2(14th)				8 1 1/2
Psr. LEMBU					1/4(12th)				1 0 1/4
UNKNOWN									1 1
T O T A L					10/51		0/5	8/9	188 19 18/65

※1 No. of patients, No.of the dead

※2 No.of V. cholera positive/No.examined

(Note) Figure in parenthesis shows the date on which Type Ogawa was detected first.

Table 13 Aspect of Diarrheal Cases in Some Districts of Asahan, Tapanuli Selatan, and Medan in April - September, 1982.

REGENCY \ MONTH		4	5	6	7	8	9
		P D※2 CP/E	P D CP/E	P D CP/E	P D CP/E	P D CP/E	P D CP/E
ASAHAN	AIR JOMAN	17 2	16 2	6 0	5 4	183 15 18/65(12th)	
	SIMPANG EMPAT		4 2	8 0			
	TG. BALAI (BAGAN ASAHAN)	91 0	50 0	105 0	92 1	108 0 0/1	82 0
	AIR PUTIH	47 0 1/2	5 0	23 0	15 1	7 0 4/8(11th)	25 0
TAPANULI SELATAN		991 0 10/23	576 0	462 0	330 0	904 6 82/108(24th)	1376 0
M E D A N※1		198 1 0/19	141 1 0/3	257 2 1/7	224 0 0/15	280 0 6/20(28th)	309 0 1/20

※1 Municipality

※2 No.of patients, No.of the dead
No.of V. Cholera positive/No. examined

(Note) Figure in parenthesis shows the date on which Type Ogawa was detected first.

Table 14 Aspect of Diarrheal Cases Number in Each Village of Medang Deras (Jan.-July, 1983)

Week No.	JANUARY				FEBRUARY				MARCH					APRIL				MAY				JUNE					JULY				TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
	P/D* (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)	P/D (R)
PANGKALAN DODEK	12/-	16/- (2)	12/- (1)	7/-	8/-	8/-	2/-	5/- (1)	7/- (1)	4/-	10/-	10/-	4/-	8/- (4)	4/-	8/- (1)	6/- (1)	5/1	2/-	7/- (2)	7/-	5/-	3/-	4/-	6/-	2/- (1)	2/-	2/- (2)	3/-	1/-	120/1 (16)
SEI BUAH KERAS	15/-	15/- (1)	13/-	13/-	3/-	3/-	2/-	2/- (1)	3/- (1)	2/-	6/-	4/-	6/-	7/-	4/- (2)	4/- (1)	2/-	3/- (1)	3/- (1)	2/-	3/-	-	1/-	1/-	-	1/-	-	-	-	-	116/- (8)
SIDOMULYO	16/-	16/-	11/-	5/-	-	2/-	3/-	2/-	-	2/-	2/-	5/-	2/-	-	1/-	-	-	1/- (1)	1/-	3/-	-	3/- (1)	2/- (2)	1/-	1/- (1)	-	1/-	-	-	-	80/- (5)
AEK NAULI	10/-	15/-	5/-	5/-	2/-	2/-	1/-	2/-	1/-	2/-	1/-	1/-	1/-	-	-	1/1 (1)	2/- (1)	-	1/-	1/1 (1)	-	2/-	1/-	-	-	-	-	-	-	-	56/2 (3)
DURIAN	10/-	9/-	6/-	7/-	-	2/-	3/-	1/-	2/-	-	-	-	-	-	-	-	-	1/- (1)	-	-	-	-	-	-	-	-	-	-	-	-	31/- (1)
MEDANG	17/-	15/-	-	9/-	-	-	-	-	-	-	1/- (1)	-	-	-	-	-	-	2/- (2)	-	-	-	-	-	-	-	-	-	-	-	-	44/- (3)
LALANG	10/-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3/-	-	-	-	-	-	-	-	-	-	-	-	-	13/-
NANASIAM	-	-	-	-	-	-	-	-	-	-	3/-	-	-	2/- (2)	4/- (4)	3/-	1/-	3/2 (2)	1/1	2/- (2)	2/-	1/-	-	1/-	-	1/-	-	-	-	1/-	25/3 (10)
SEI RAKYAT	-	-	6/-	-	-	-	-	-	-	1/-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7/-
P.A.K.M.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1/1 (1)	-	-	-	-	-	-	-	-	-	-	-	-	1/1 (1)
T O T A L	90/-	84/- (3)	53/- (1)	46/-	13/-	17/-	11/-	12/- (2)	13/- (2)	13/-	23/- (1)	20/-	13/-	17/- (6)	13/- (6)	16/3 (8)	11/- (2)	17/4 (9)	6/1 (3)	15/1 (5)	12/-	11/- (1)	7/- (2)	7/-	7/- (1)	4/- (1)	3/-	2/- (2)	3/-	2/-	541/7 (47)

* No. of Patients / No. of the Dead

(No. of Patients treated by Intravenous Drip Infusion of Ringer Solution)

Table 15 Result of Bacteriological Examination of River Water in Pagurawan River
(May 13-16, 1983)

Sample	Location	Moore Method (Alkaline Peptone)	Direct Method (Alkaline Peptone)	Moore Method (Selenite Broth)	Date of Sampling
A	Pkl. Dodek	V. cholera (Type Ogawa)	V. cholera (Type Ogawa)	Negative	14-5-1983
B	Pkl. Dodek	V. cholera (Type Ogawa)	V. cholera (Type Ogawa)	Negative	14-5-1983
C	Nanasiam	V. cholera (Type Ogawa)	Negative	Salmonella (Group B)	14-5-1983
D	Nanasiam	V. cholera (Type Ogawa)	Negative	Negative	14-5-1983
E	Nanasiam	Not Examined	Negative	Negative	14-5-1983
F	Nanasiam	Not Examined	Negative	Negative	14-5-1983
G	Pkl. Dodek	Not Examined	V. cholera (Type Ogawa)	Negative	14-5-1983
T o t a l (Positive Rate)		4/4 (100)	3/7 (42.9)	1/7 (14.3)	

Table 16 Result of Drug Sensitivity Test of V. cholera in Cholera Survey in Nanasiam (May 13-16, 1983)

Drug	Case and Contact Person	River Water	T o t a l
	No. sensitive/No. examined (Drug Sensitive Rate)	No. sensitive/No. examined (Drug Sensitive Rate)	
CP	6/6 (100)	4/4 (100)	10/10 (100)
KM	0/6 (0)	0/4 (0)	0/10 (0)
TC	6/6 (100)	4/4 (100)	10/10 (100)
NA	6/6 (100)	4/4 (100)	10/10 (100)

Table 17 Population of Each Village in Medang Deras of Asahan (1980)

Age	0 - 6		7 - 10		11 - 16		17 - 55		56 -		Total		
	M	F	M	F	M	F	M	F	M	F	M	F	Total
Nanasiam	136	121	68	66	96	79	300	323	43	33	643	622	1265
Pkl. Dodek	524	505	293	272	317	383	1216	1144	132	114	2482	2418	4900
Sidomulio	212	150	109	103	115	130	360	376	62	36	858	795	1653
Sei Buah Keras	255	269	114	121	147	156	461	482	47	49	1024	1077	2101
Aek Nauli	103	101	127	119	92	89	204	205	30	23	556	537	1093
Durian	142	166	130	139	125	142	442	475	63	52	902	974	1876
Medang	287	283	159	160	198	202	614	680	190	194	1428	1539	2967
Pakam	178	177	298	292	359	355	641	643	109	105	1585	1572	3157
Lalang	307	208	234	253	276	192	502	295	42	36	1361	984	2345
Pm. Cengkering	200	186	203	168	188	162	590	601	61	51	1242	1168	2410
Sei Rakyat	192	199	94	84	157	139	384	365	54	51	881	839	1720
Tg. Sigoni	96	56	53	37	87	116	219	231	19	26	474	466	940
T o t a l	2632	2421	1882	1815	2157	2145	5933	5820	852	770	13290	13139	26427
(%)	5053 (19.1)		3697 (14.0)		4302 (16.3)		11753 (44.5)		1622 (6.1)				

Table 18 Result of Bacteriological Examination in Cholera Survey in Nanasiam (May 13-16, 1983).

	No. Examined	No.of V. cholera Positive	Positive Rate (%)
Case	10	2	20.0
Contact Person	18	4	22.2
T o t a l	28	6	21.4

(Note) All of the V. cholera was Type Ogawa.

Table 19 Aspect of Diarrheal Cases in Pematang Siantar (Jan. - Aug. , 1983)

Month	No.of Patients/No.of the Dead	No.of V.cholera Positive/No. Examined
1	383/0	Not Examined
2	182/0	0/3
3	862/0	Not Examined
4	809/0	11/20
5	632/2	Not Examined
6	570/0	4/8
7		0/6
8		2/9
T o t a l	3438/2	17/46

Weekly report of Pematang Siantar in July - August had not been sent to the Provincial Health Service of North Sumatra at the moment of the data arrangement yet.

Table 20 Result of Bacteriological Examination of River Water in Upstream and Midstream of Bah Bolon and Bah Pamujian (August 23-27, 1983, By Team 1)

Sample	Name of River	Location	Moore Method (Alkaline Peptone)	Direct Method (Alkaline Peptone)	Moore Method (Selenite Broth)	Date of Sampling
I A	Bah Bolon	Tomuan	Negative	Negative	Negative	24-8-1983
I B	Bah Sorma	"	"	"	"	"
I C	Bah Bolon	"	"	"	"	"
I D	"	Teladan	"	"	"	"
I E	Bah Kadang	"	"	"	"	"
I F	"	"	"	"	"	"
I G	Bah Sigulanggulang	Martoba	"	"	"	"
I H	"	"	"	"	"	"
I I	?	Sukadame	"	"	"	"
I J	Bah Sorma	Tomuan	"	"	"	"
I K	Bah Pamujian	Siantar District	"	"	"	"
I L	"	"	"	"	"	"
I M	?	"	"	"	"	"
I N	Bah Sibatubatu	"	"	"	"	"
I O	Bah Bombongan	"	"	"	"	"
I P	Bah Pamujian	"	"	"	"	26-8-1983
I Q	?	"	"	"	"	"
I R	Bah Sigulanggulang	Bane	"	"	"	"
I S	Bah Sibatubatu	Siantar District	"	"	"	"
I T	Bah Bolon	Perdagangan	"	"	"	25-8-1983
I U	"	"	"	"	"	"
I V	"	"	"	"	"	"
	T o t a l (Positive Rate)		0/22	0/22	0/22	

Table 21 Result of Bacteriological Examination of River Water in Downstream and Midstream of Bah Hapal and Bah Bolon (August 23-27, 1983, By Team 2)

Sample	Name of River	Location	Moore Method (Alkaline Peptone)	Direct Method (Alkaline Peptone)	Moore Method (Selenite Broth)	Date of Sampling
II A	Gambus	Near S. Gambus	Negative	Negative	Negative	24-8-1983
II B	Daludalu	Near C. Damai	"	"	"	"
II C	Tanjung	Indrapura	"	"	"	"
II D	"	"	"	"	"	"
II E	"	"	"	"	"	"
II F	"	"	"	"	"	"
II G	Raja	Tg. Selamat 2	NAG Vibrio	Negative	Negative	"
II H	Parepare	"	Negative	"	"	"
II I	Raja	Tg. Selamat 1	Not Examined	"	Not Examined	"
II J	Parepare	Lalang	Negative	"	Negative	"
II K	Bah Pamujian	Purbaganda	"	NAG Vibrio	"	27-8-1983
II L	"	"	Not Examined	"	Not Examined	"
II M	Bah Hapal	Nagabayu	"	Negative	"	"
II N	"	"	Negative	"	Negative	"
II O	Cempedak	Pkl. Dodek	"	"	"	"
II P	Pagurawan	"	"	"	"	"
II Q	"	S. Buah Keras	"	"	"	"
II R	"	Nanasiam	NAG Vibrio	"	"	"
II S	"	"	Negative	NAG Vibrio	"	"
II T	"	"	NAG Vibrio	"	"	"
II U	Suka	Sungai Suka	Negative	Negative	"	"
II V	"	"	"	NAG Vibrio	"	"
II W	"	"	"	"	"	"
II X	Pagurawan	Pkl. Dodek	Not Examined	Negative	Not Examined	"
II Y	"	Nanasiam	"	NAG Vibrio	"	"
T o t a l (Positive Rate of NAG Vibrio)			3/20 (15.0)	7/25 (28.0)	0/20	

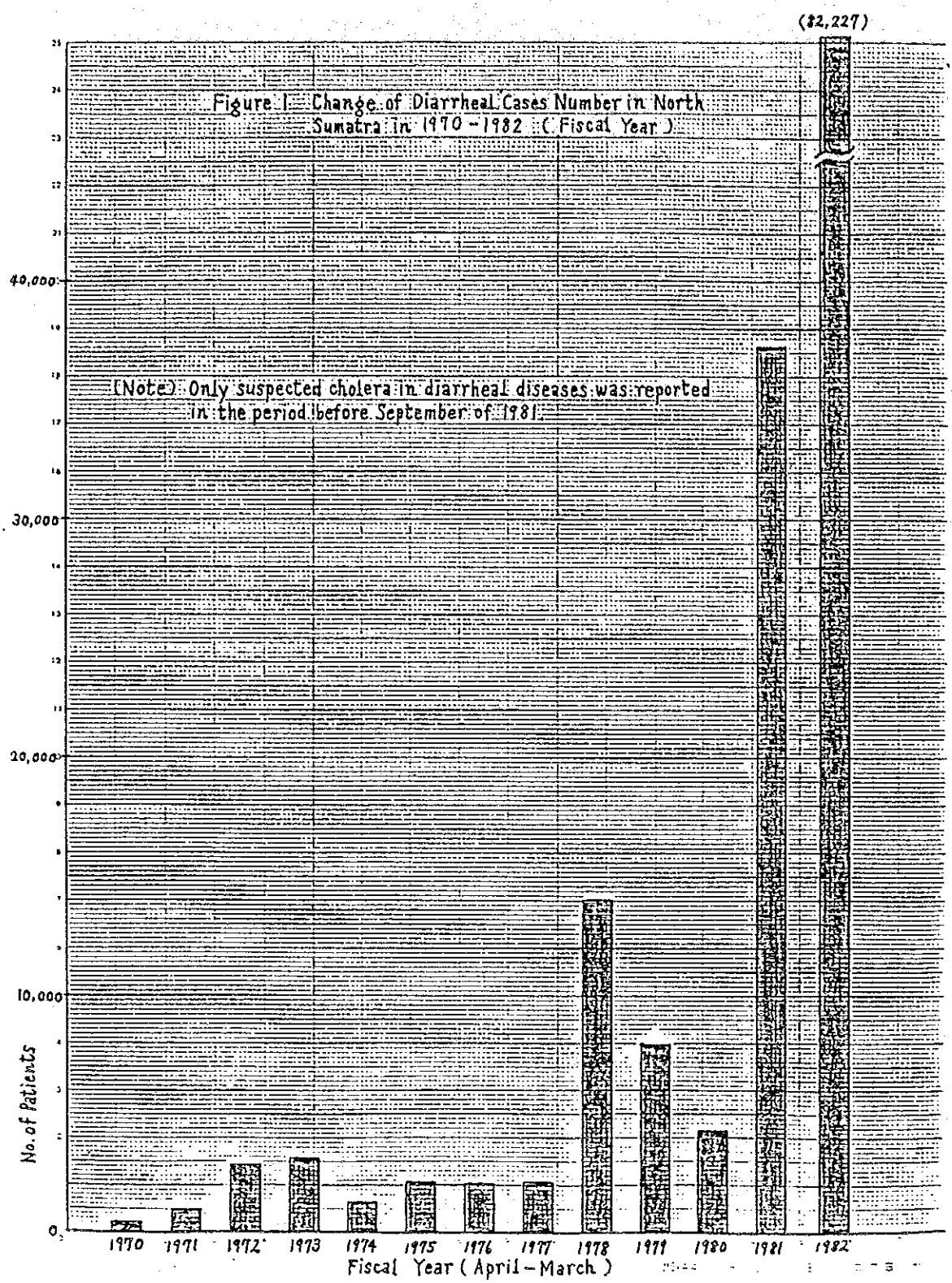
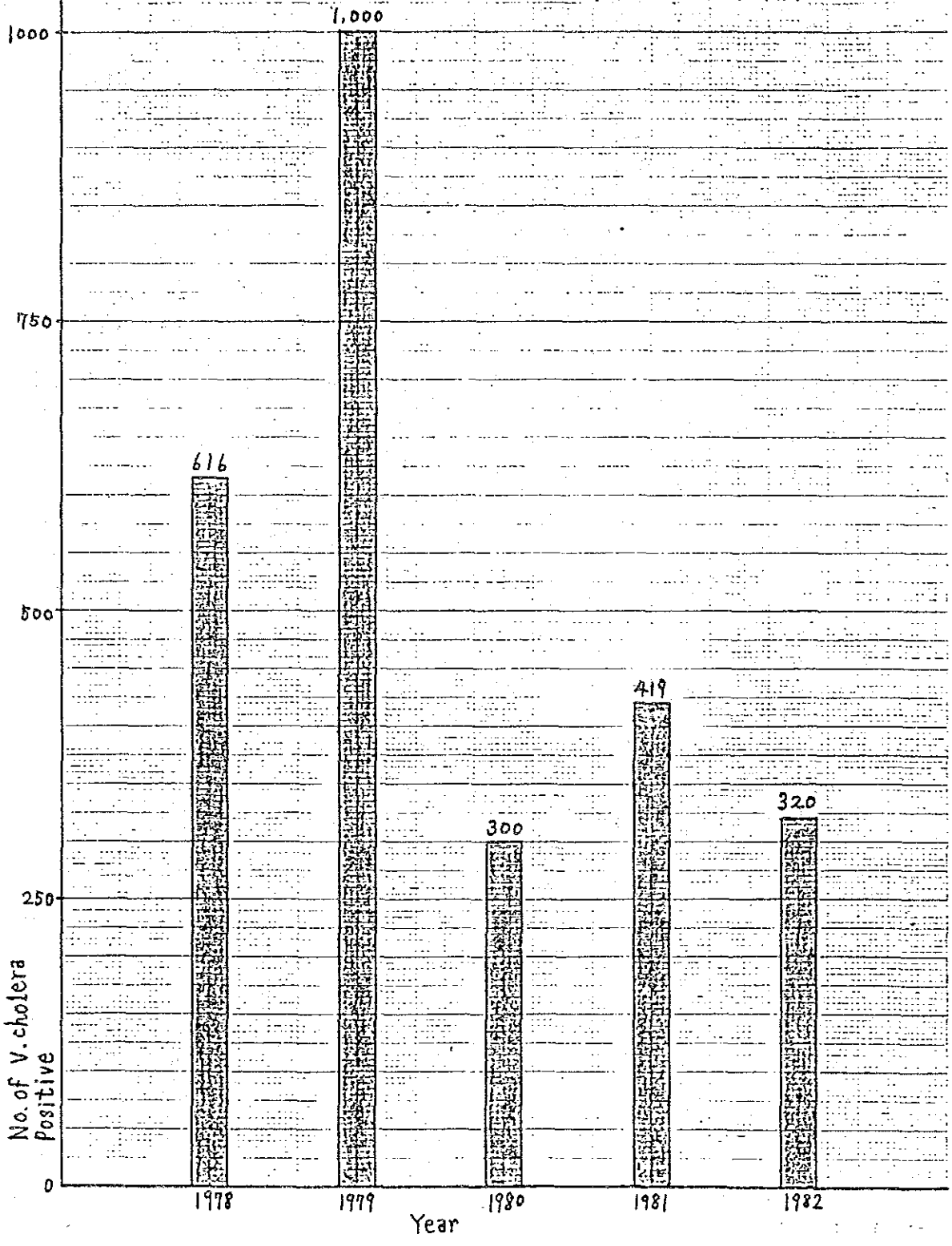
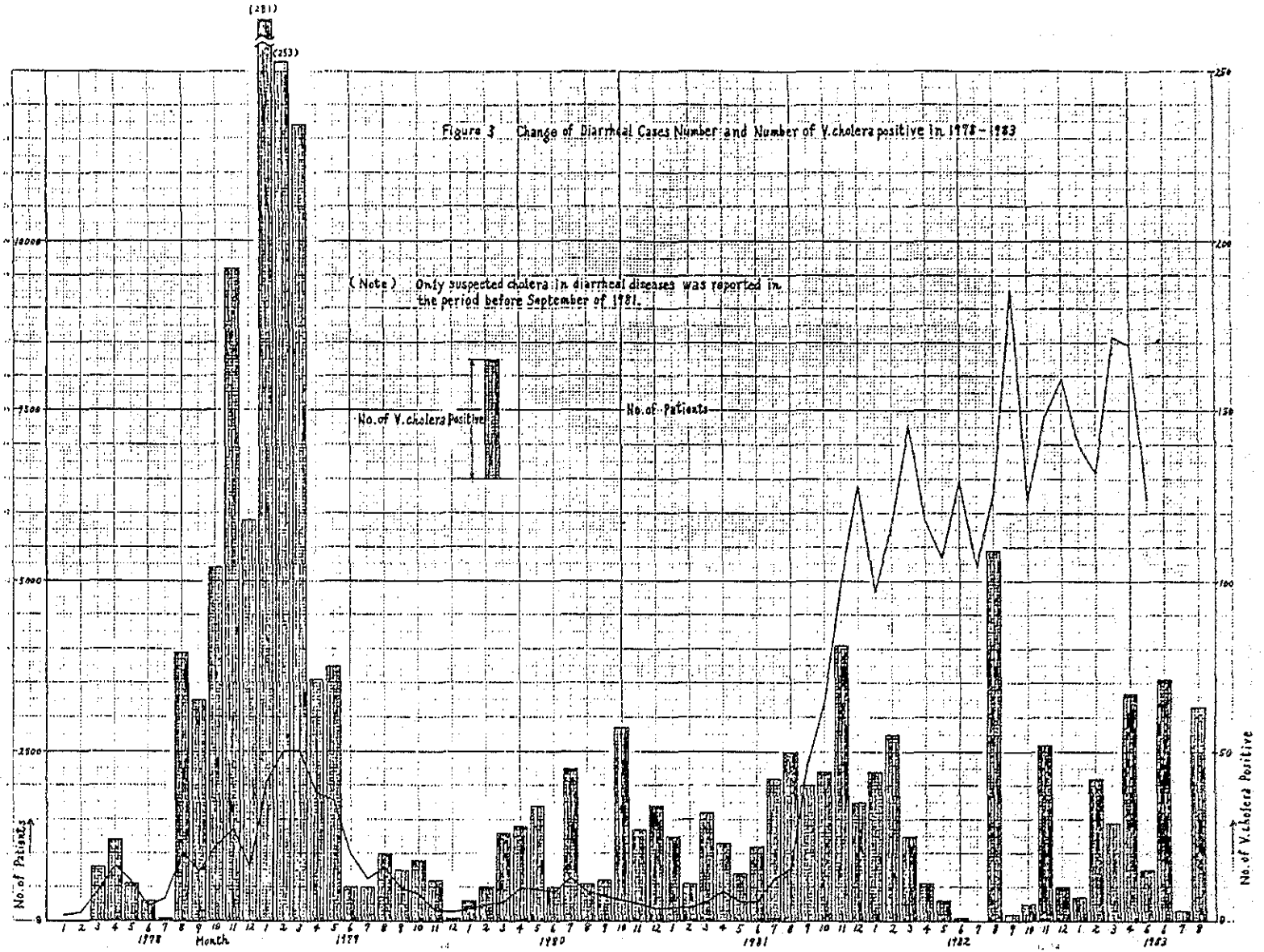


Figure 1 Change of Diarrheal Cases Number in North Sumatra in 1970 – 1982 (Fiscal Year)

(Note) Only suspected cholera in diarrheal diseases was reported in the period before September of 1981.

Figure 2 Change of V.cholera Positive Number by Bacteriological Examinations in 1978-1982 (North Sumatra)




(281)
(253)
Figure 3 Change of Diarrheal Cases Number and Number of V.cholera positive in 1978 – 1983
(Note) Only suspected cholera in diarrheal diseases was reported in the period before September of 1981.
No. of V. cholera Positive
No. of Patients
No. of Patients
No. of V. cholera Positive
Month
1978
1979
1980
1981
1982
1983

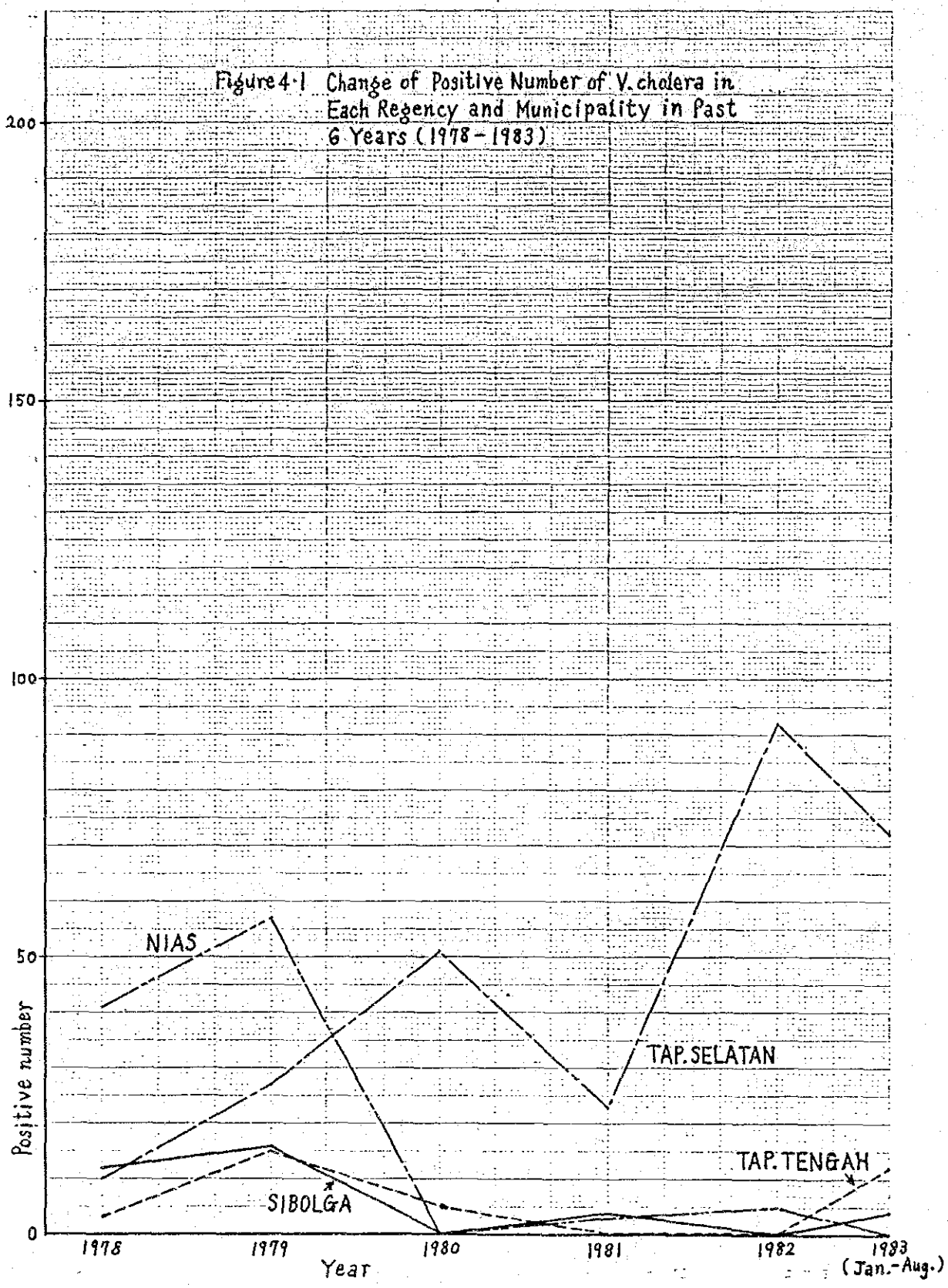


Figure 4-1 Change of Positive Number of V. cholera in Each Regency and Municipality in Past 6 Years (1978 - 1983)
200
150
100
50
0
Positive number
NIAS
TAP. SELATAN
TAP. TENGAH
SIBOLGA
1978
1979
1980
1981
1982
1983 (Jan.-Aug.)
Year

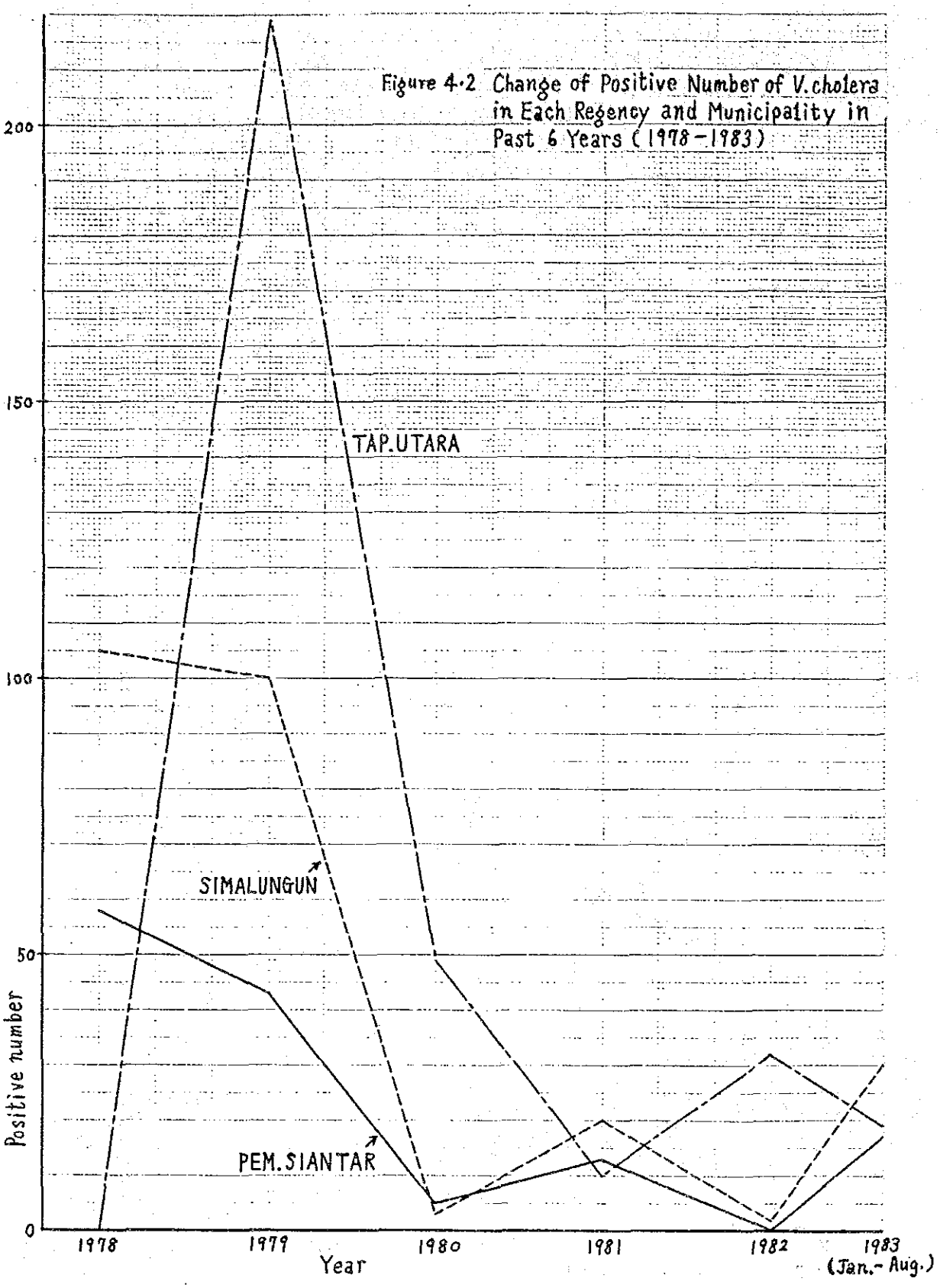


Figure 4-2 Change of Positive Number of V.cholera in Each Regency and Municipality in Past 6 Years (1978-1983)

Figure 4·3 Change of Positive Number of V. cholera in Each Regency and Municipality in Past 6 Years (1978 - 1983)

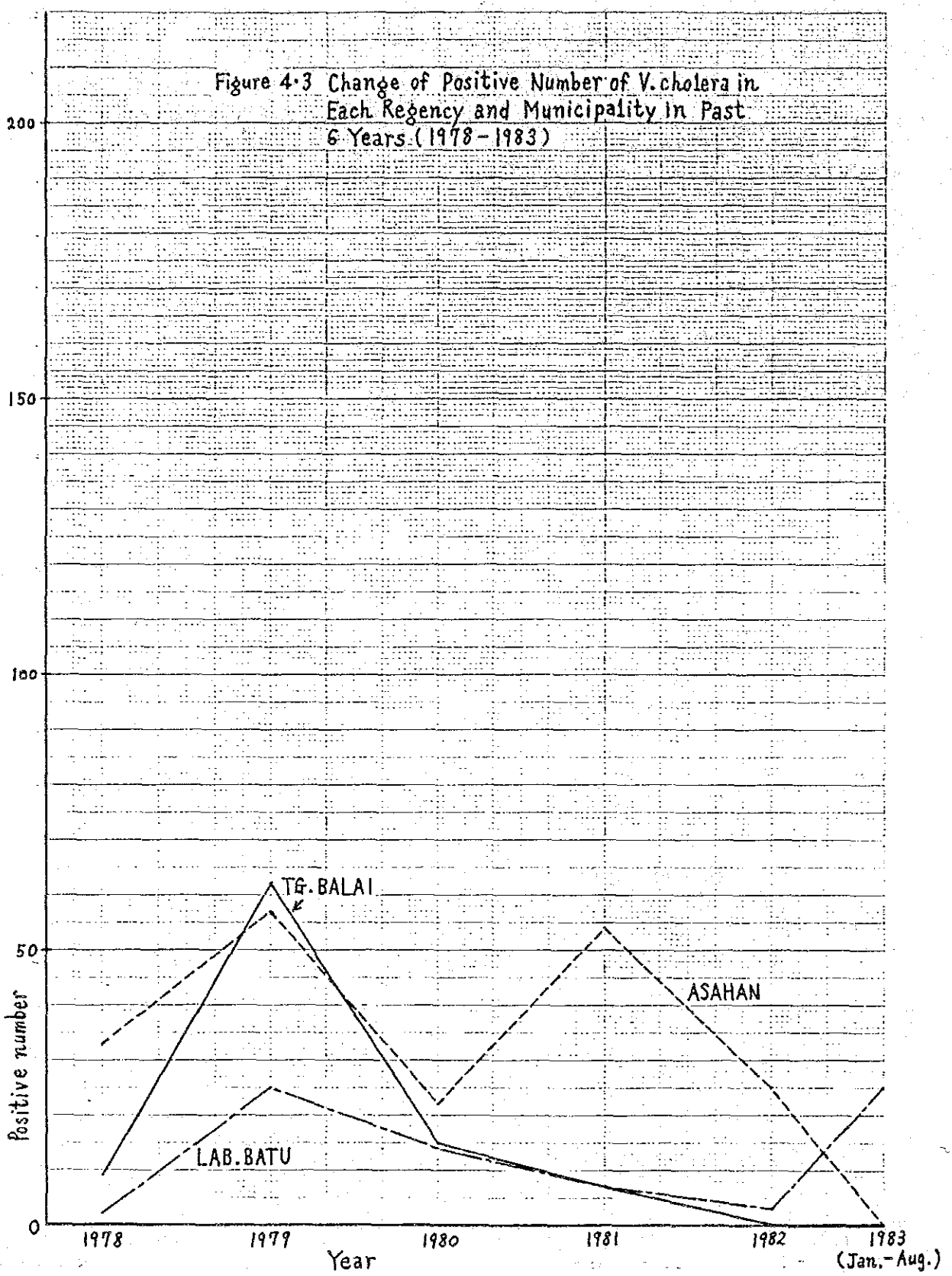


Figure 4·4 Change of Positive Number of V.cholera in Each Regency and Municipality in Past 6 Years (1978-1983)

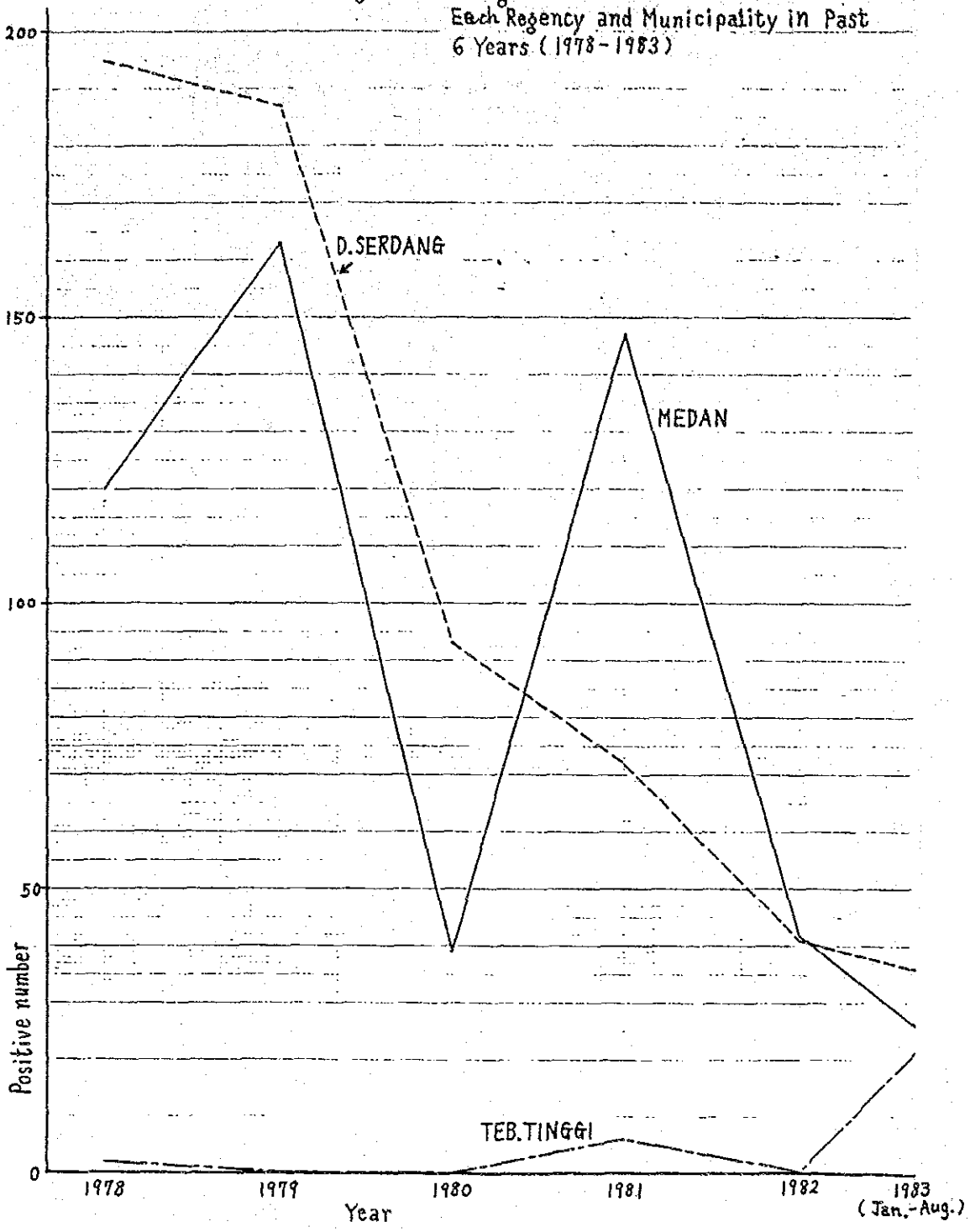
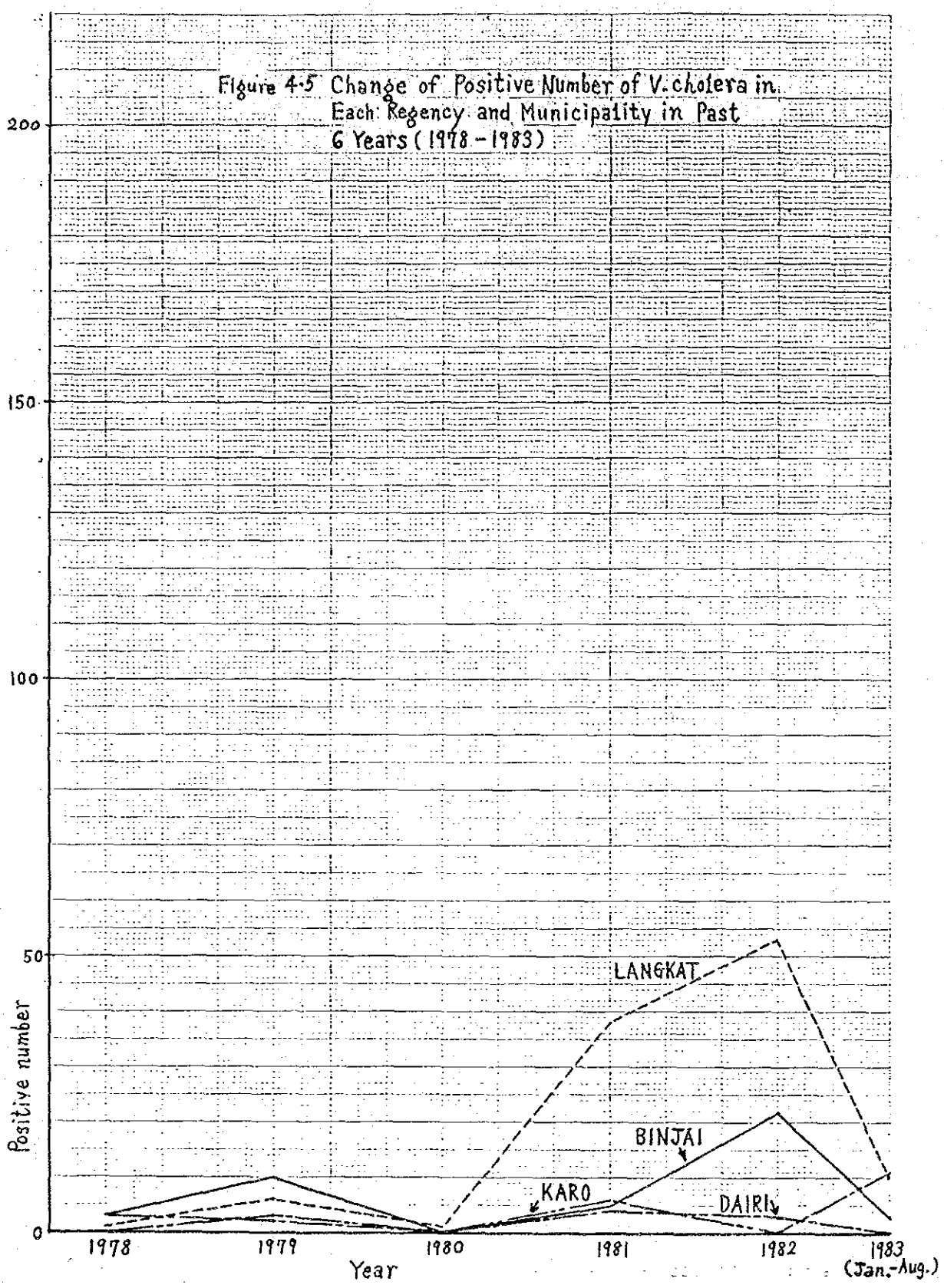


Figure 4-5 Change of Positive Number of V. cholera in Each Regency and Municipality in Past 6 Years (1978 - 1983)



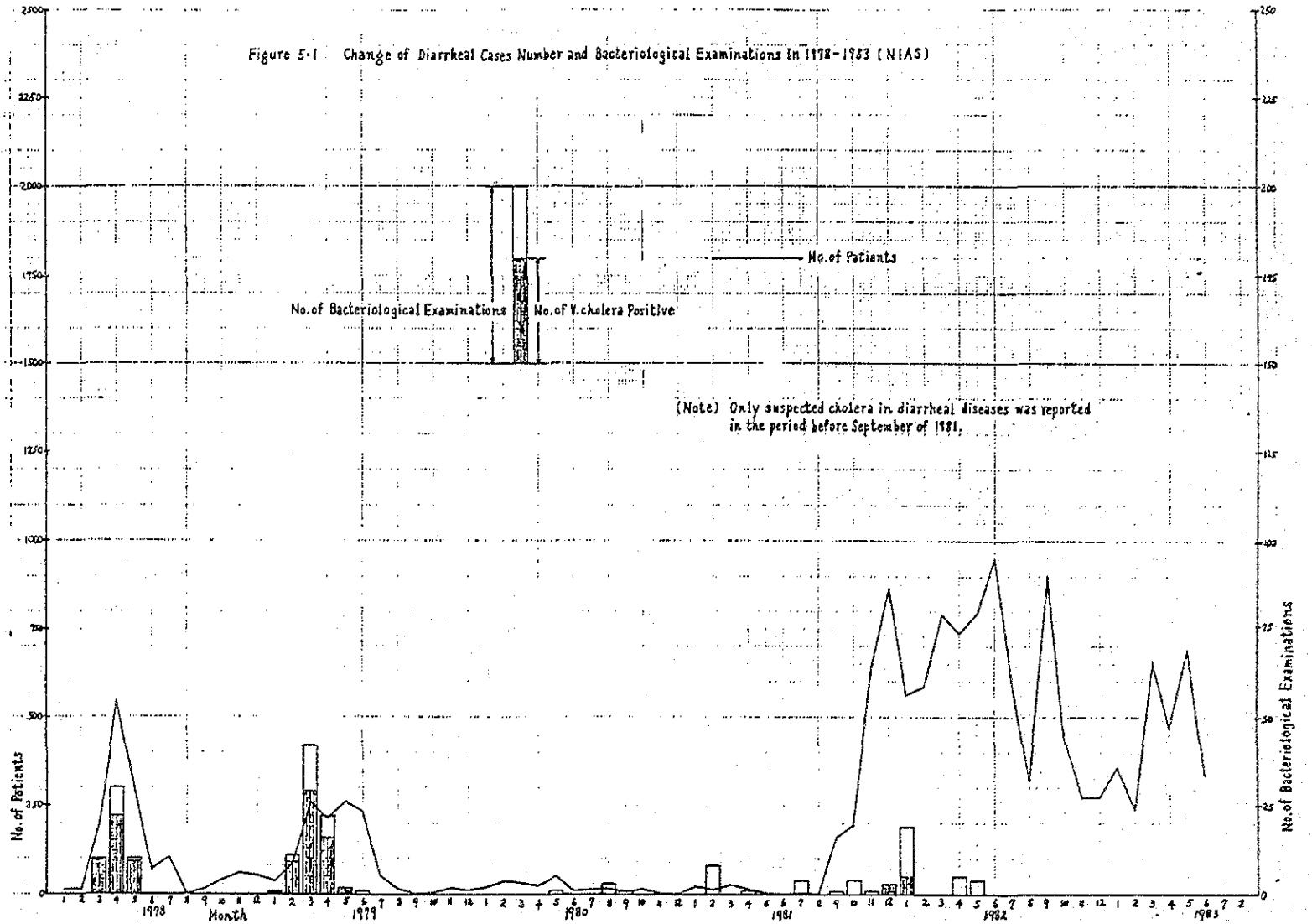


Figure 5-1 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978-1983 (NIAS)

Figure 5-2 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978-1983 (S1 80 L.G.A.)

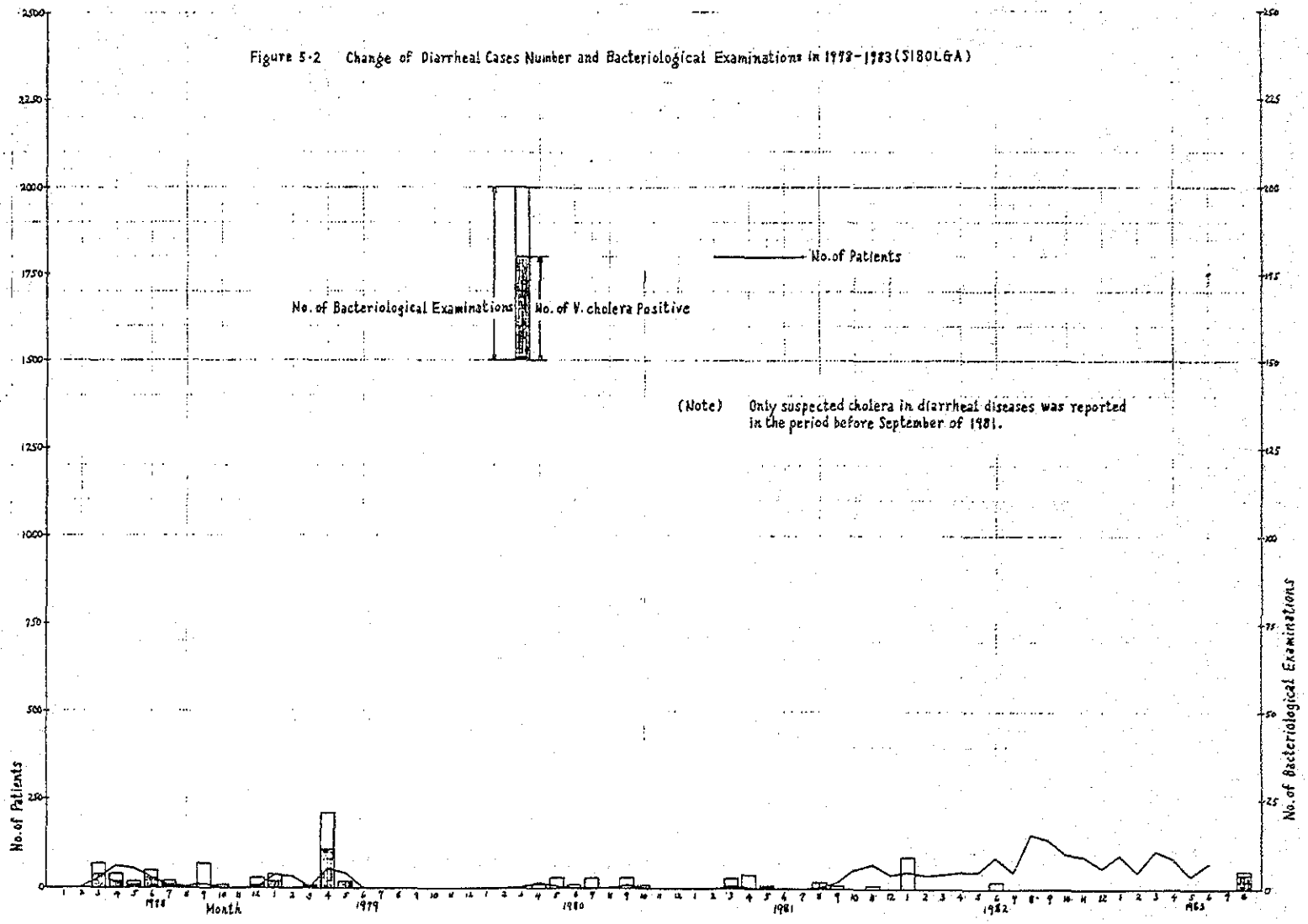


Figure 5-3 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978~1983 (TAPANULI TENGAH)

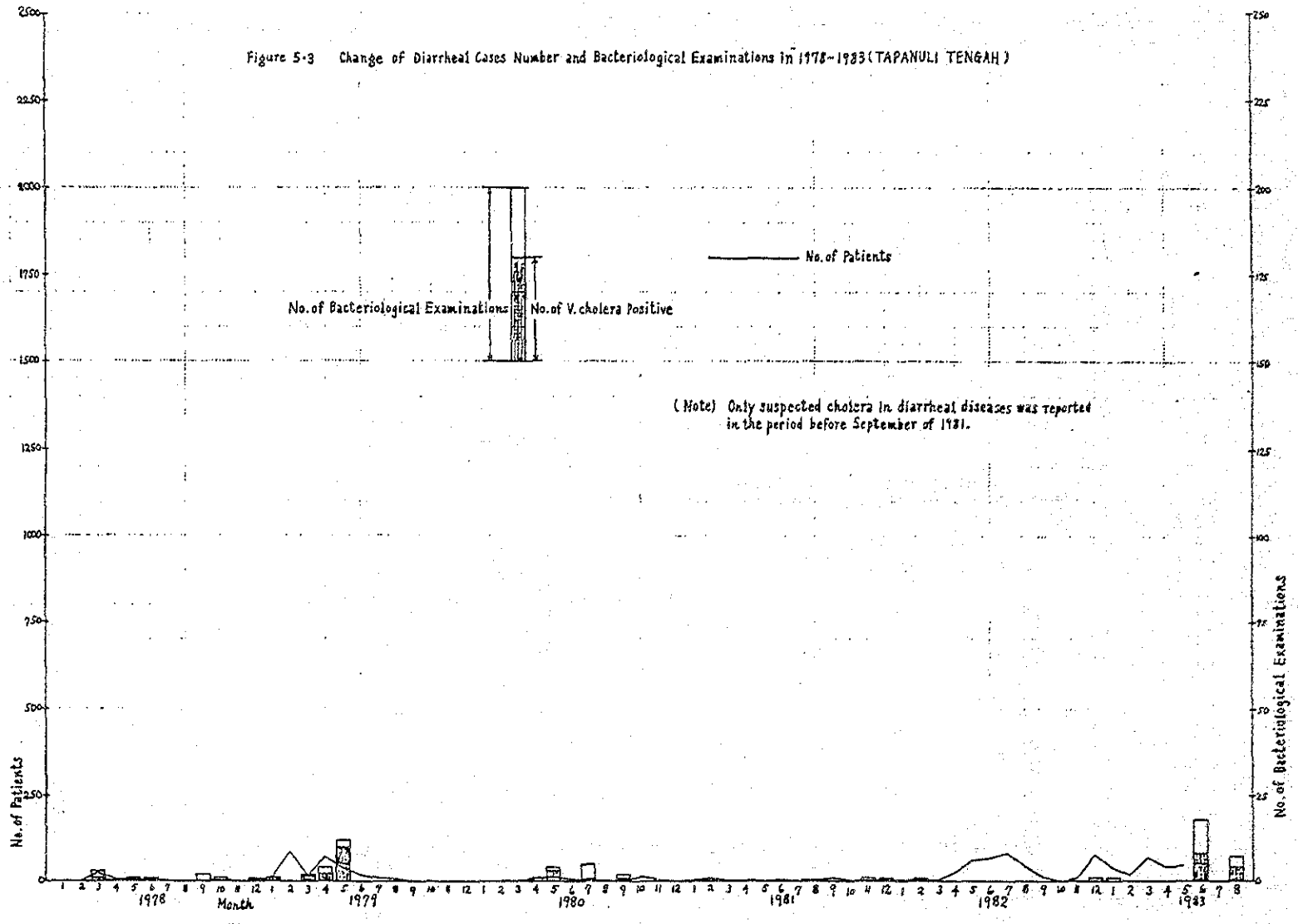


Figure 5-3 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978-1983 (TAPANULI TENGAH)

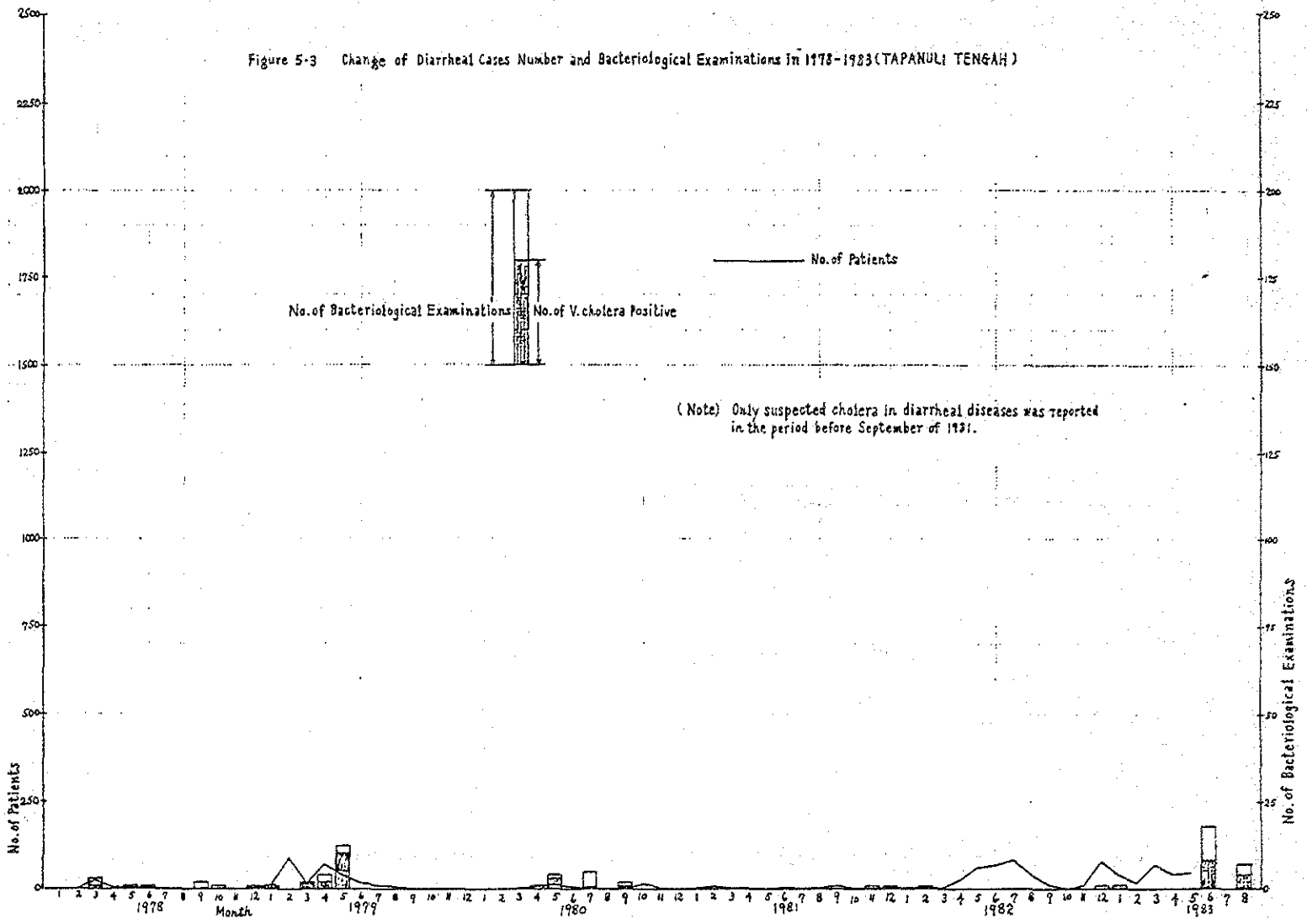
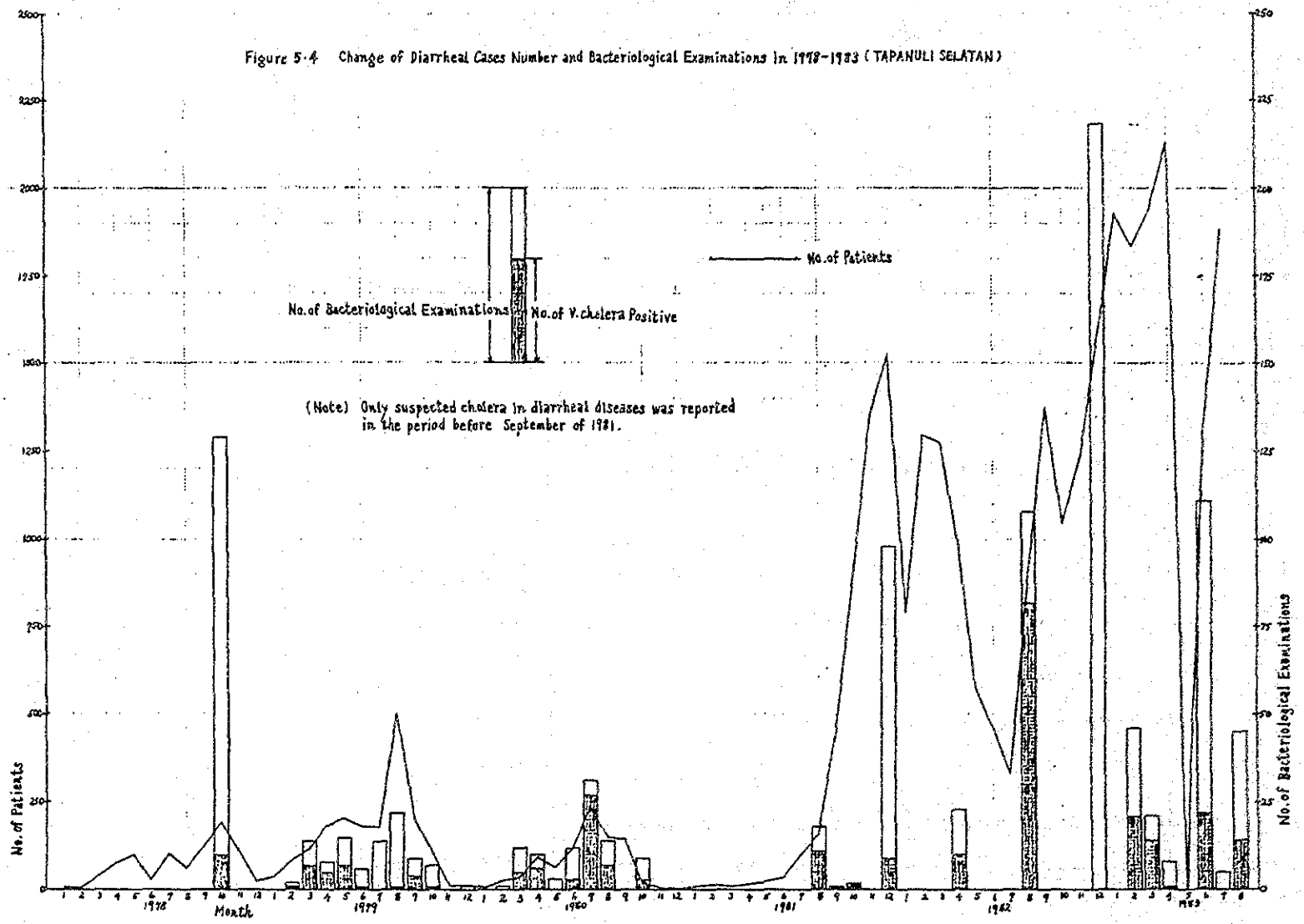


Figure 5-4 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978-1983 (TAPANULI SELATAN)



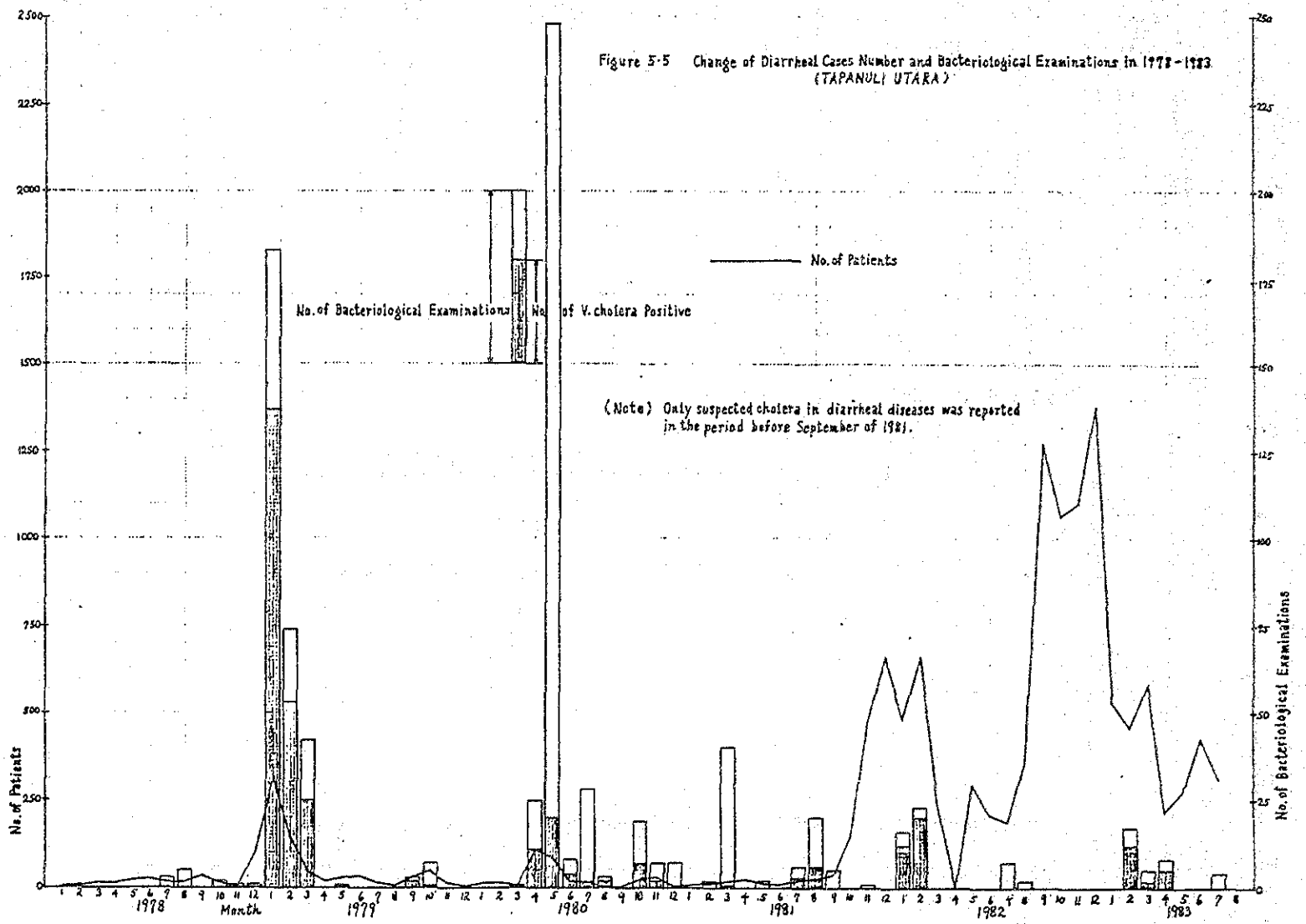


Figure 5-5 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978 - 1983 (TAPANULI UTARA)

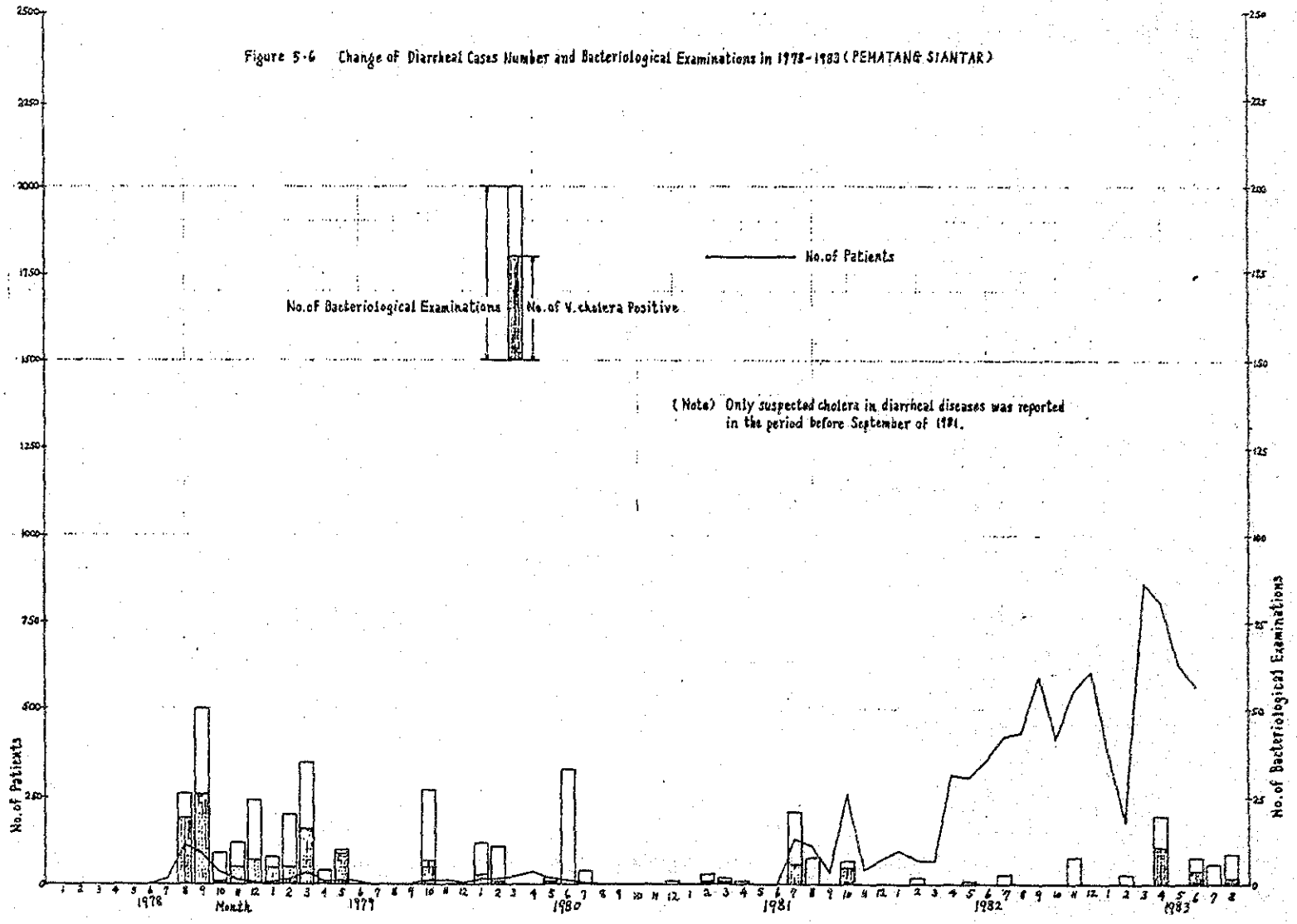


Figure 5-6 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978-1983 (PEMATANG SIANTAR)

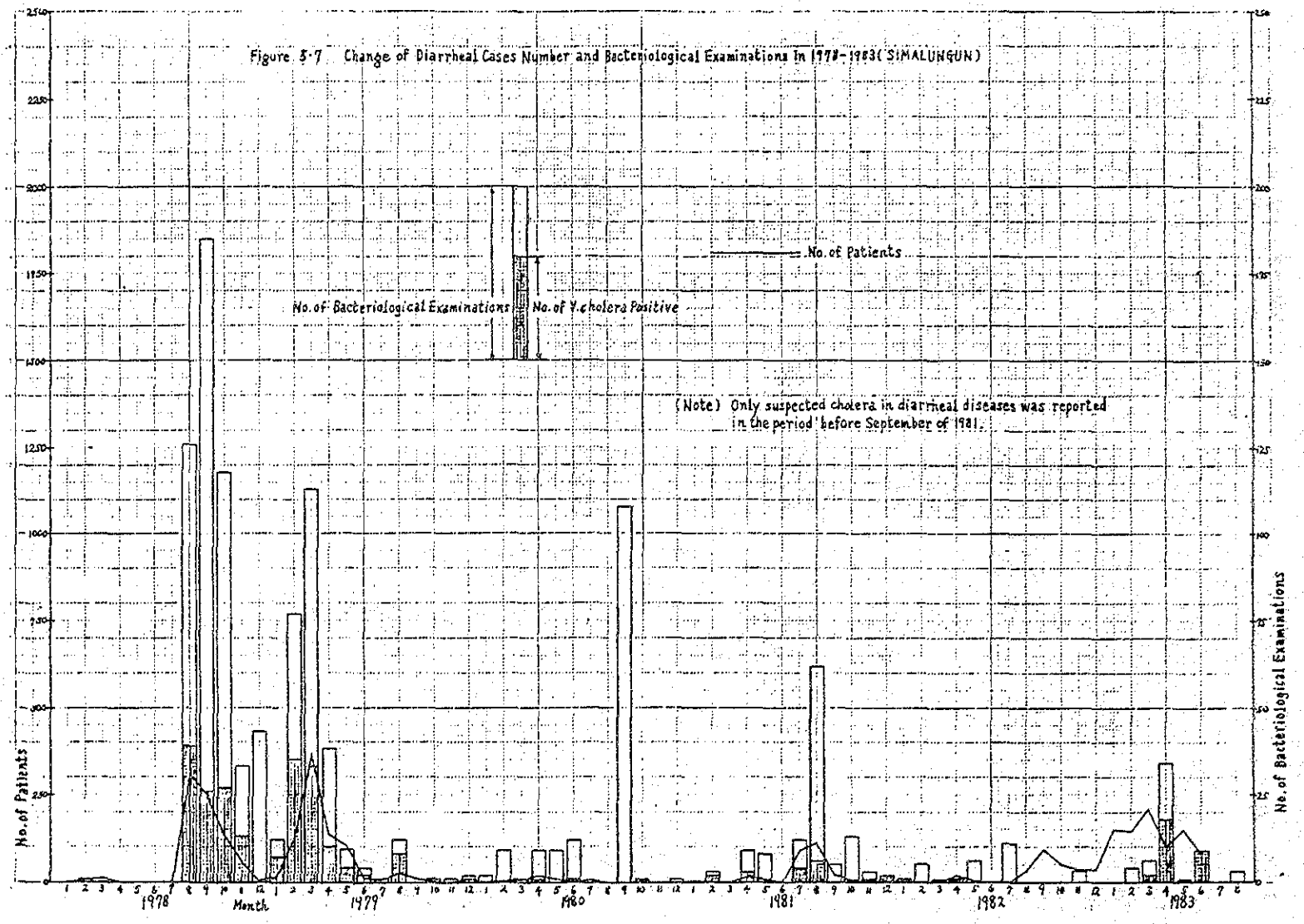


Figure 5·7 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978-1983 (SIMALUNGUN)
No. of Patients
No. of Bacteriological Examinations
No. of V. cholera Positive
(Note) Only suspected cholera in diarrheal diseases was reported in the period before September of 1981.
No. of Patients
No. of Bacteriological Examinations
Month
1978
1979
1980
1981
1982
1983

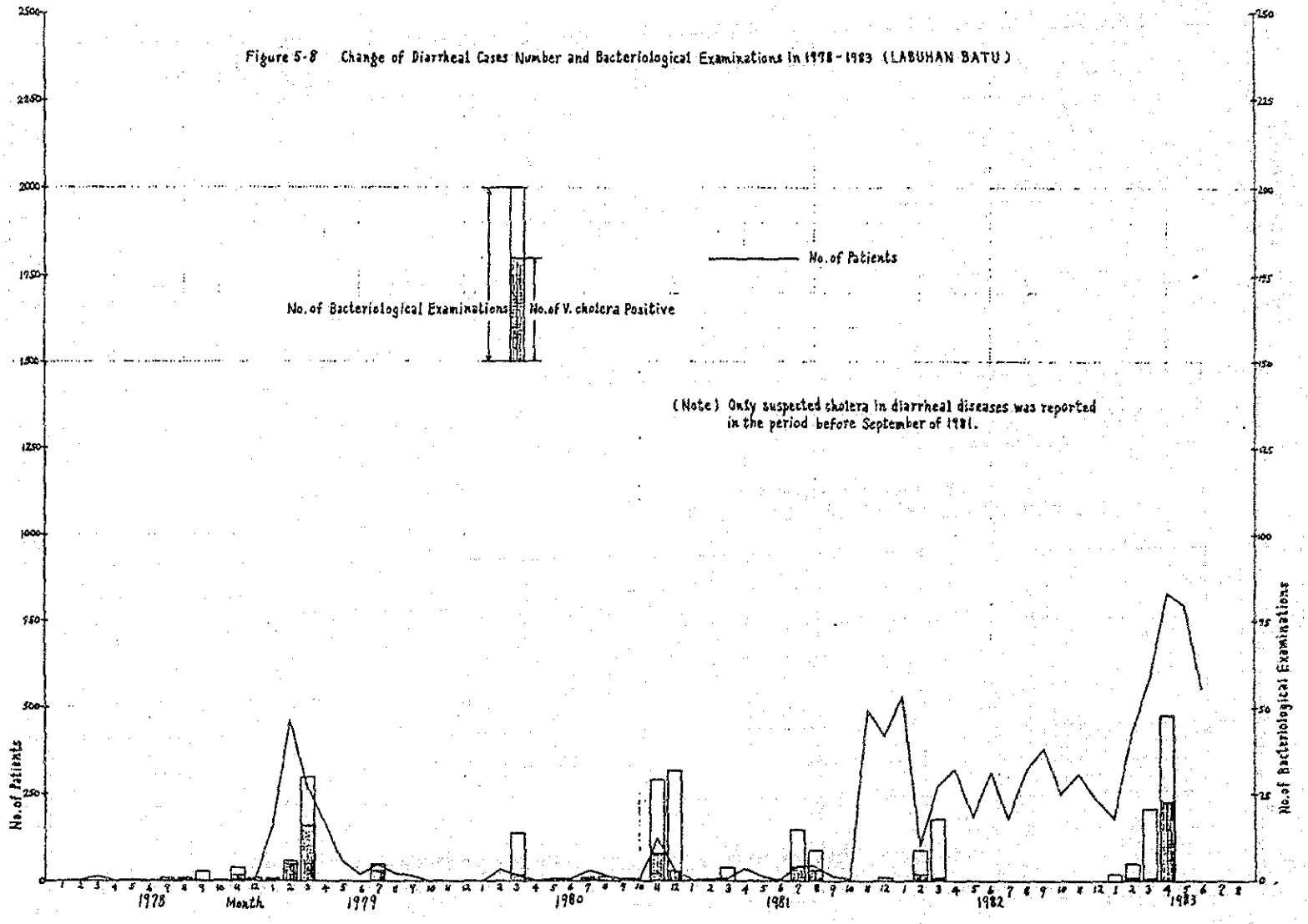


Figure 5-8 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978 - 1983 (LABUHAN BATU)

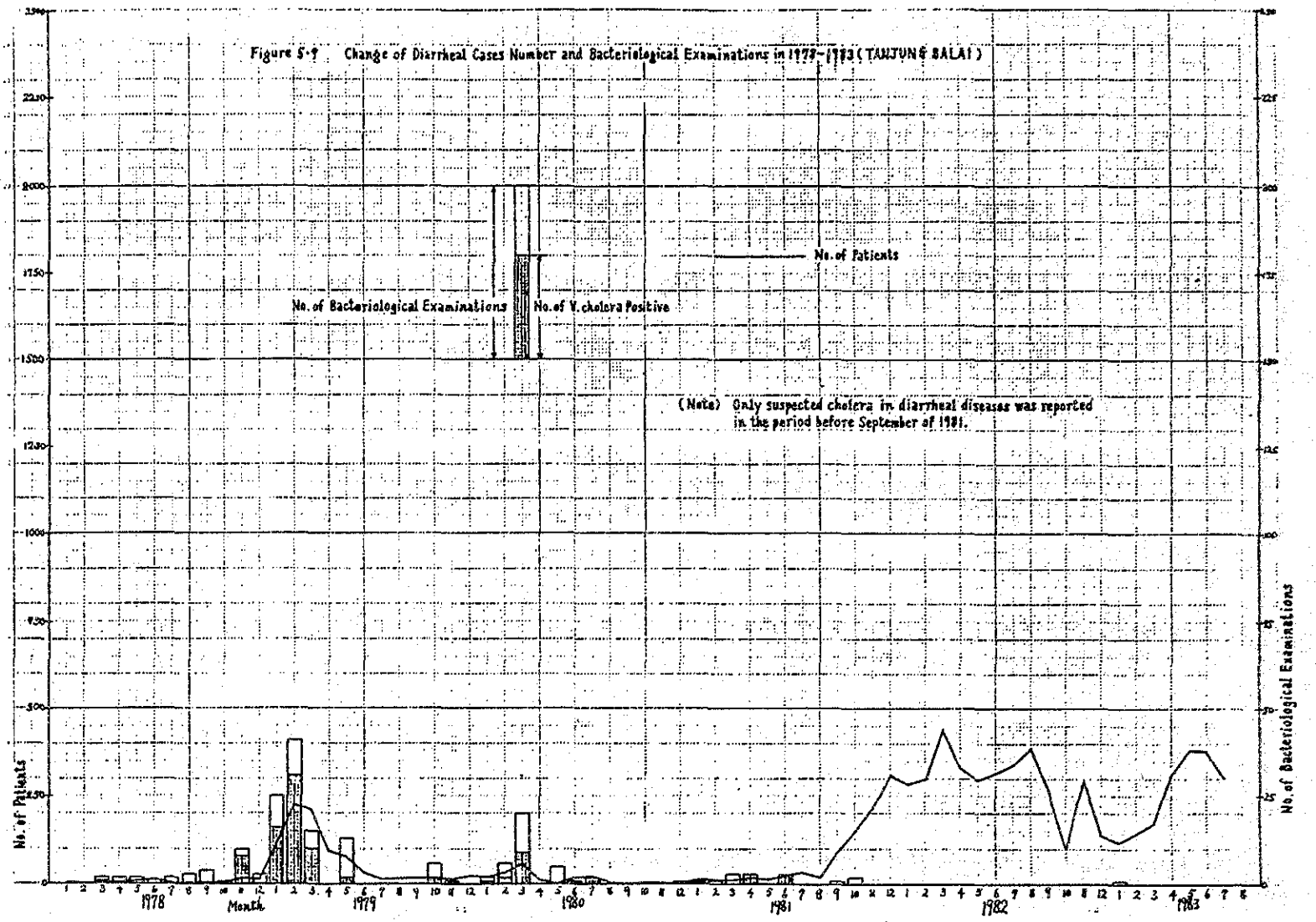


Figure 5-7 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978-1983 (TANJUNG BALAI)

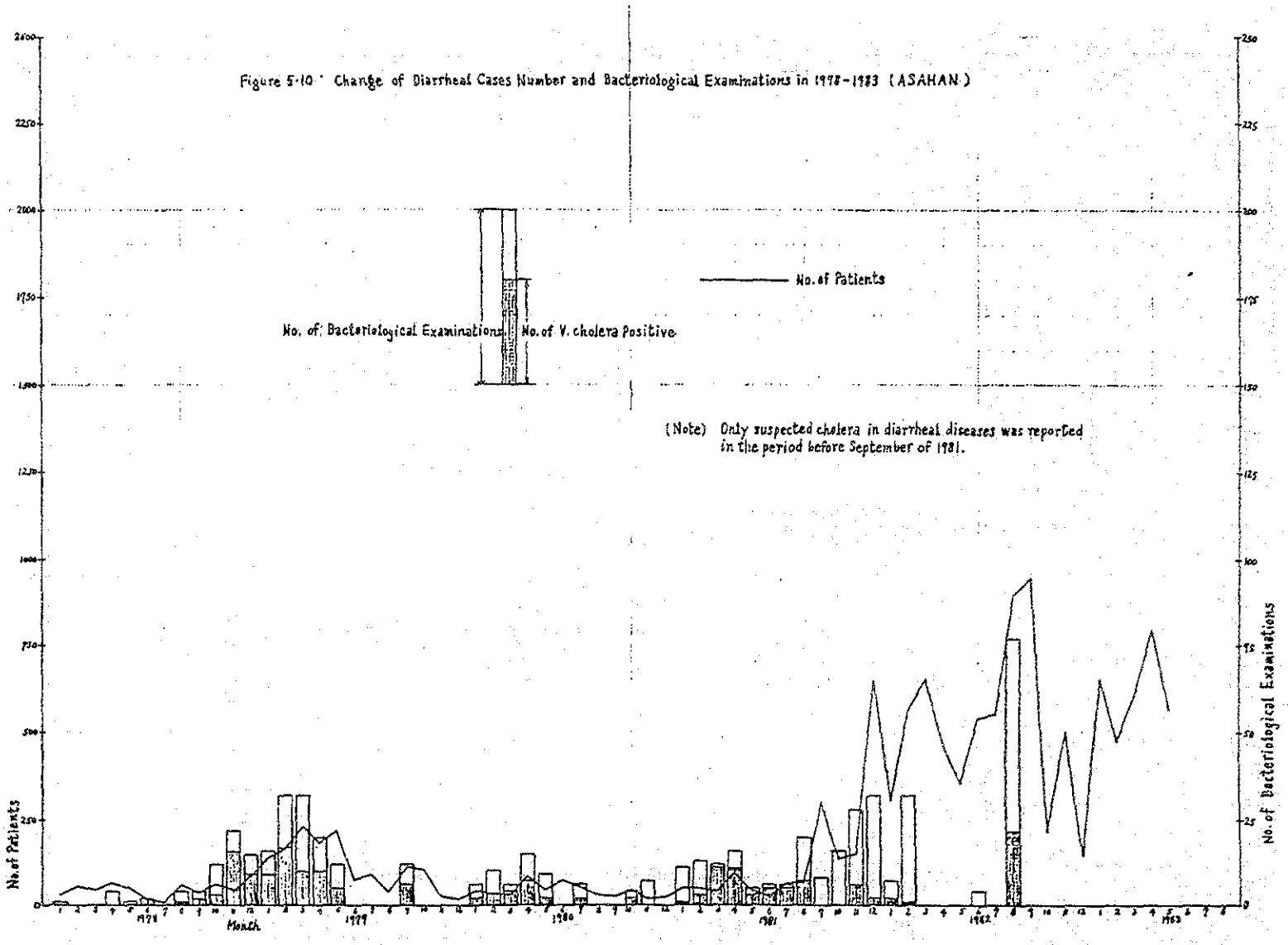


Figure 5-10 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978-1983 (ASAHAN)

Figure 5-11 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978-1983 (TEBING TINGGI)

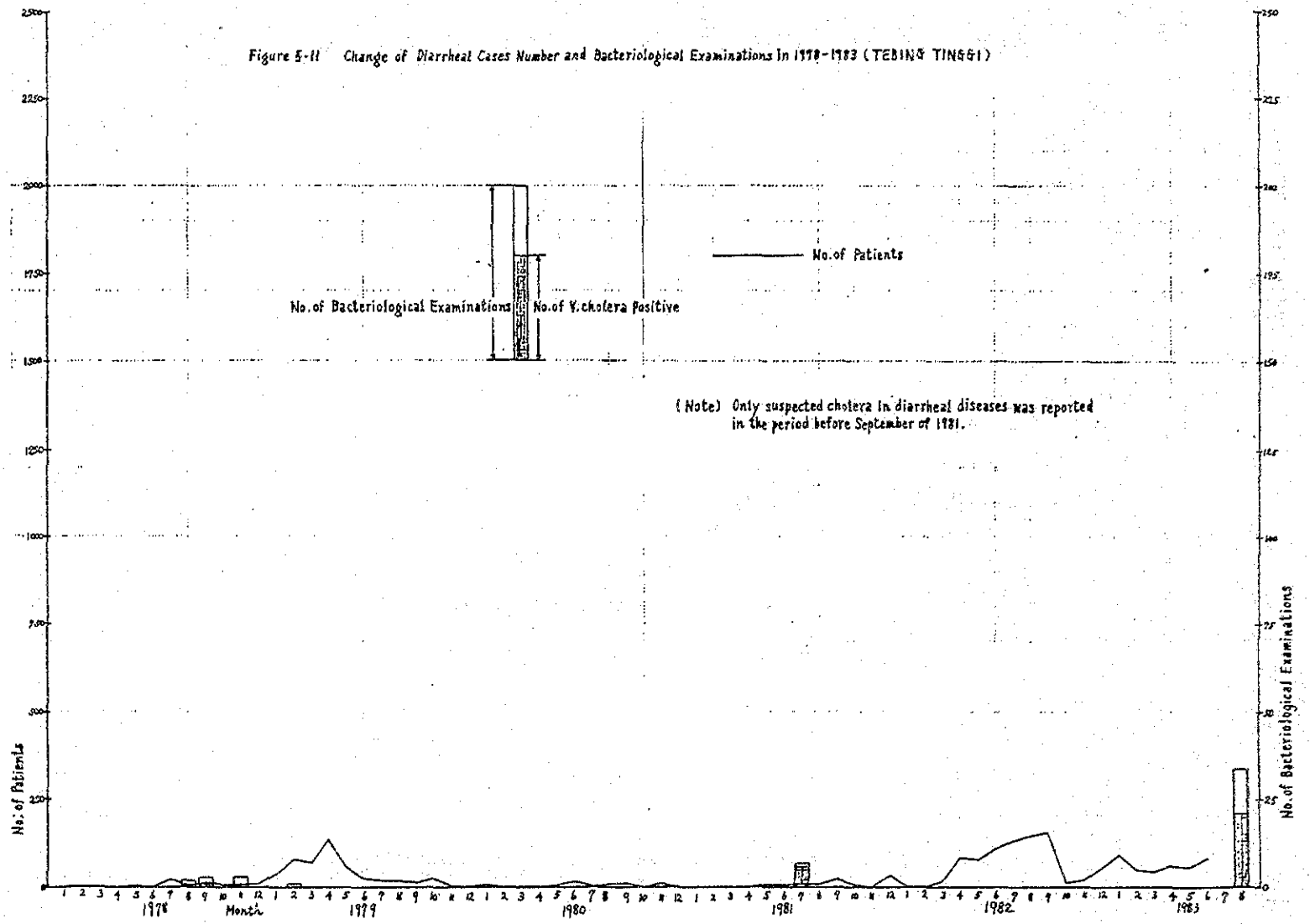
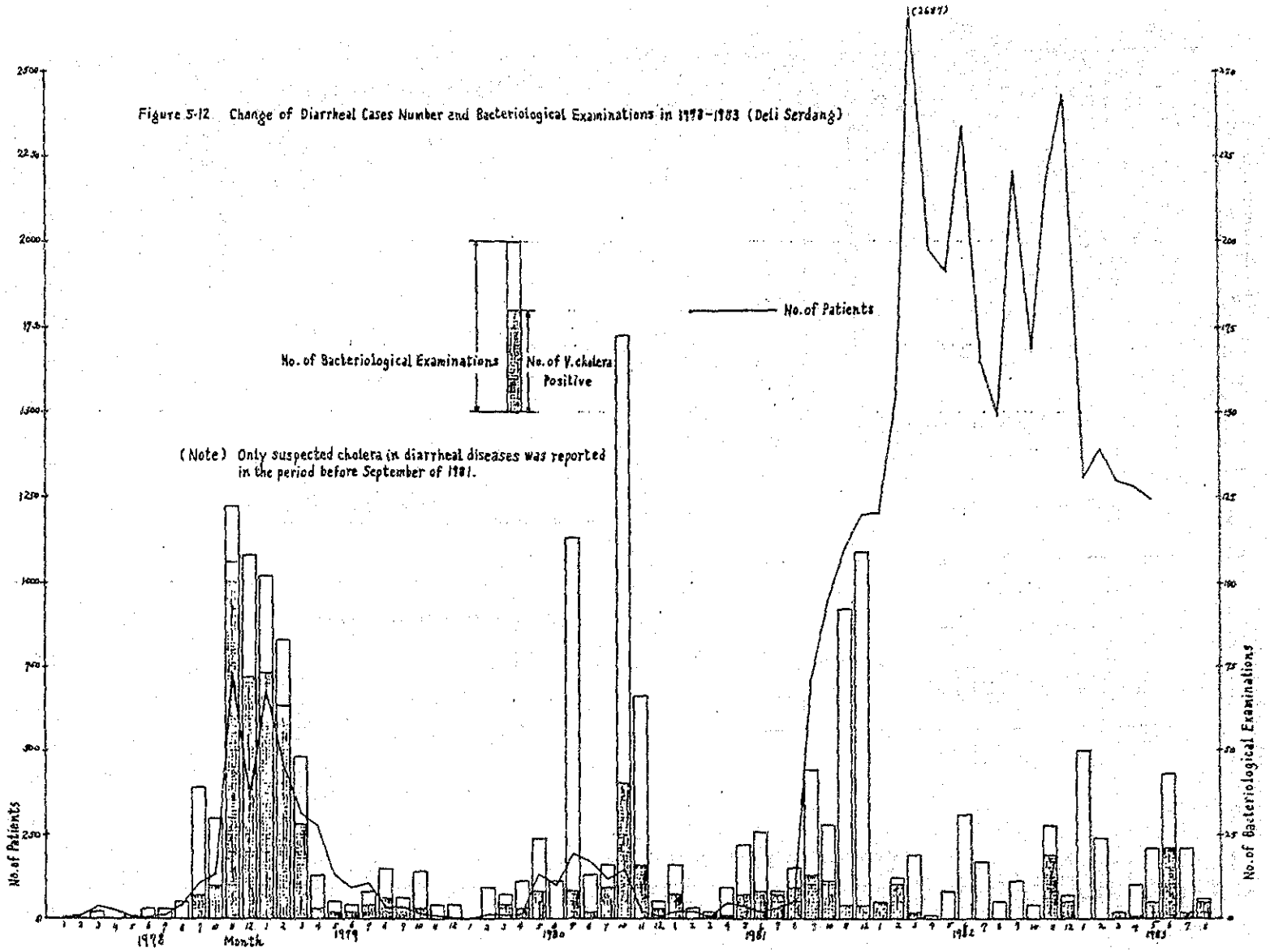


Figure 5-12 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978-1983 (Deli Serdang)



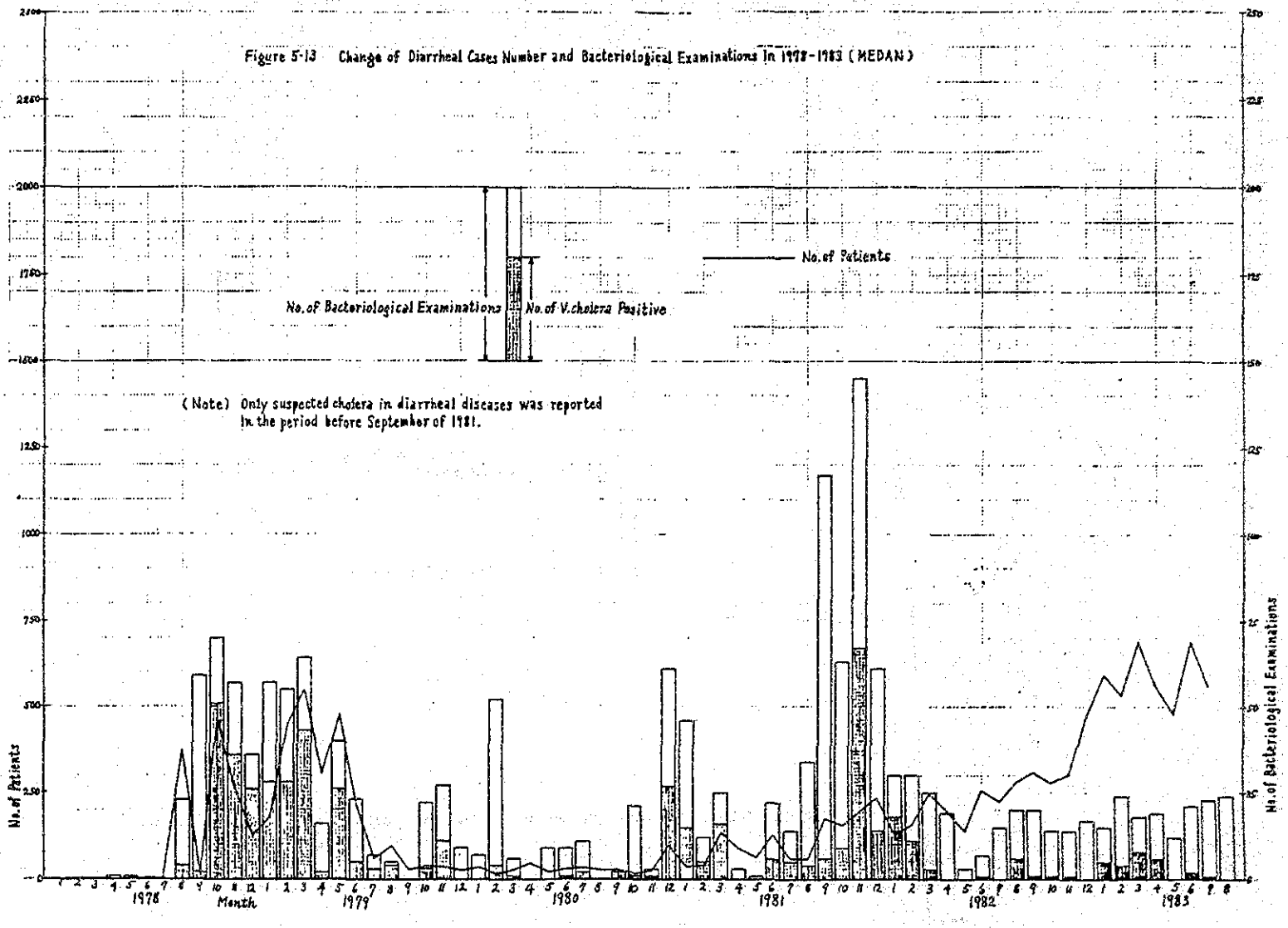


Figure 5-13 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978-1983 (MEDAN)

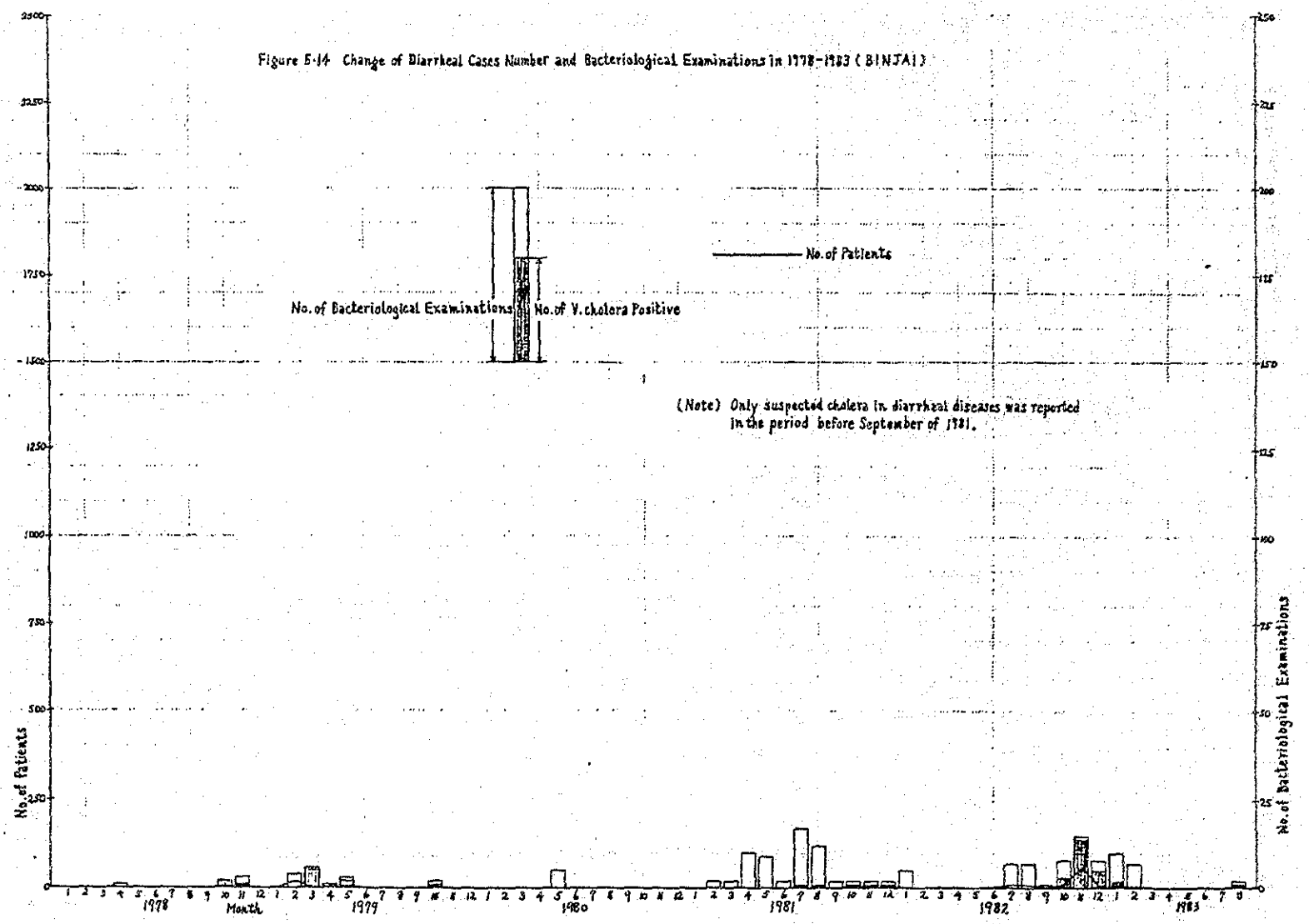


Figure 5-14 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978-1983 (BINJAI)

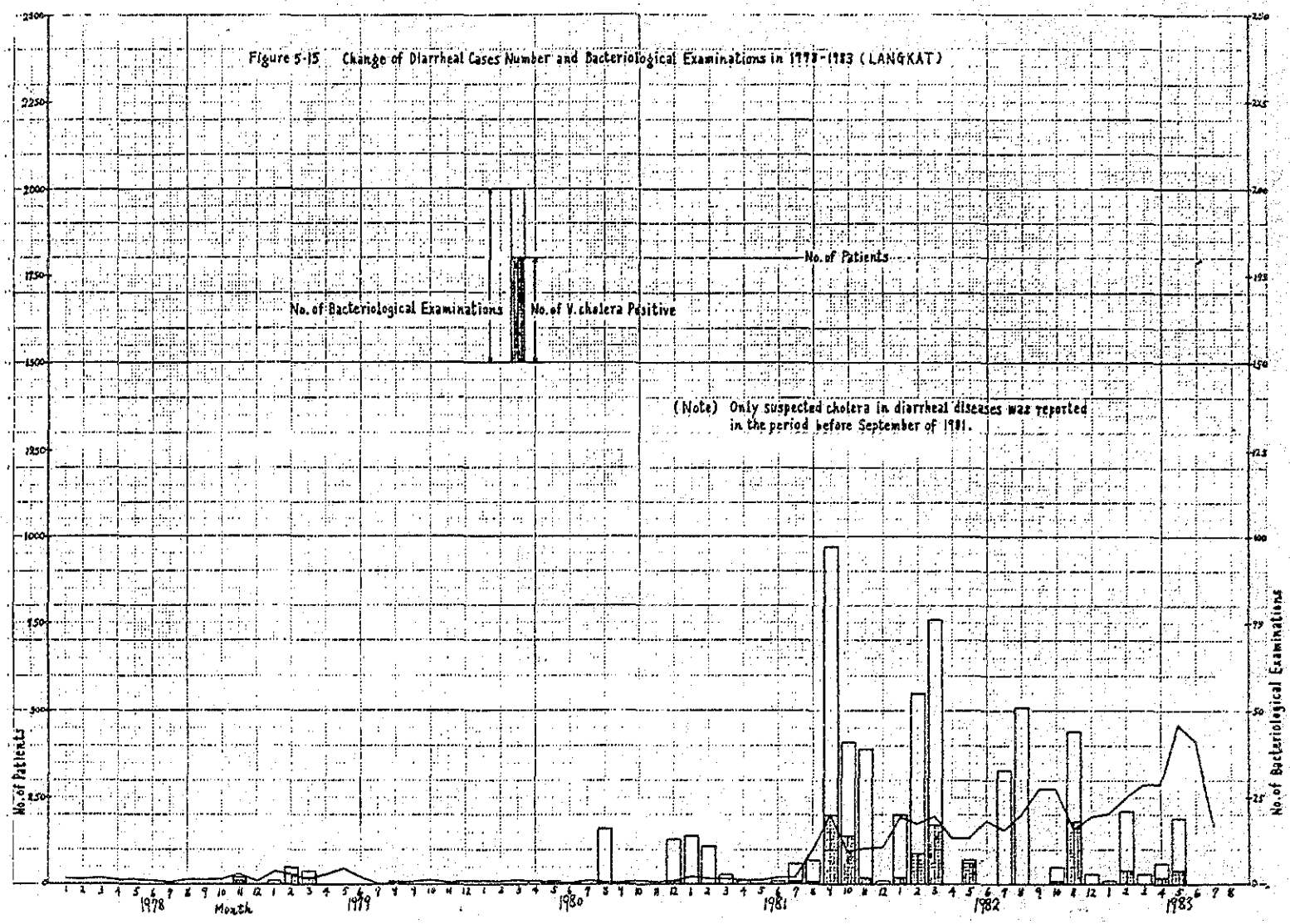
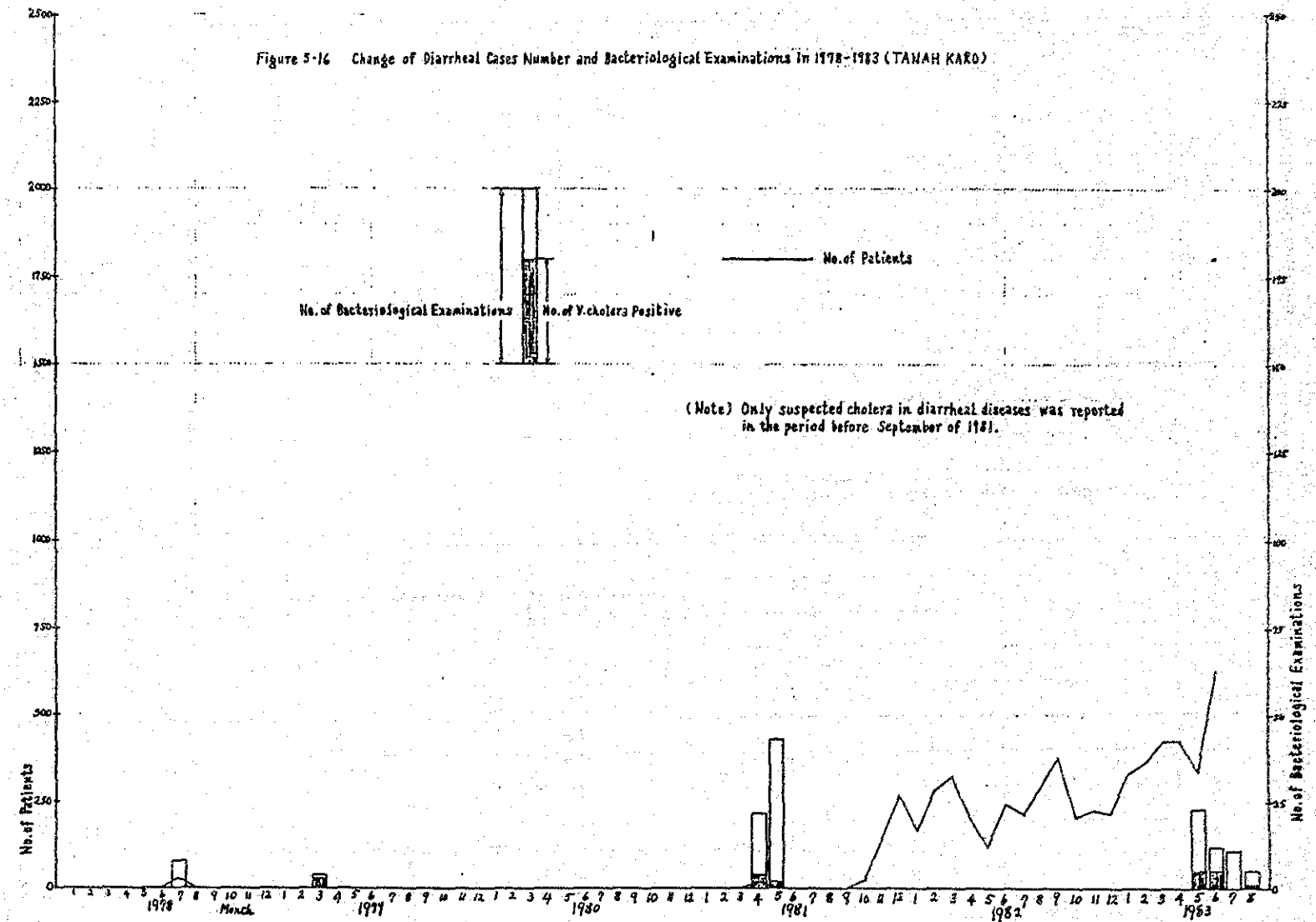


Figure 5-15 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978-1983 (LANGKAT)
No. of Patients
No. of Bacteriological Examinations
No. of V. cholera Positive
(Note) Only suspected cholera in diarrheal diseases was reported in the period before September of 1981.
No. of Patients
No. of Bacteriological Examinations
Month
1978
1979
1980
1981
1982
1983

Figure 5-16 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978-1983 (TANAH KARO)



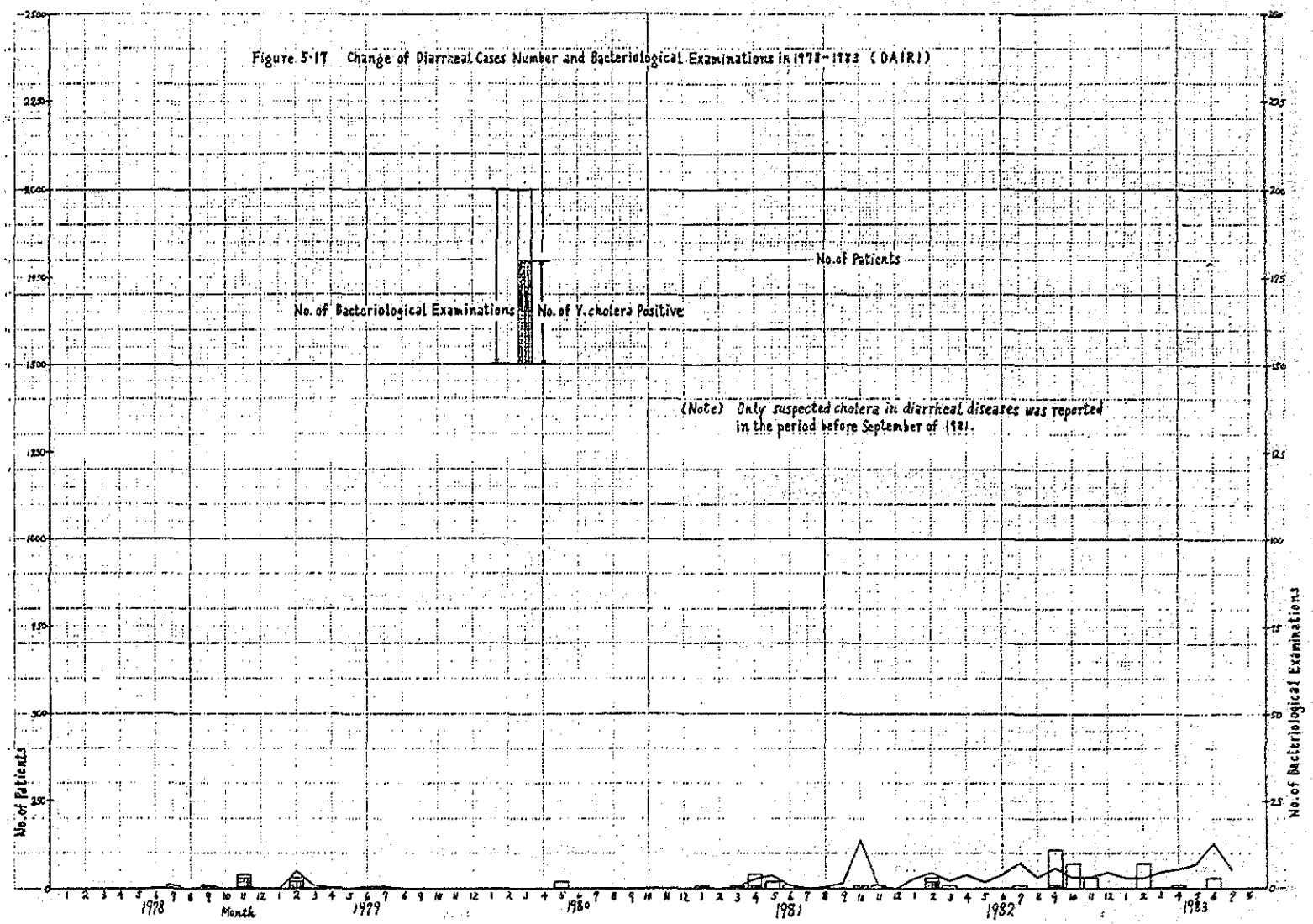


Figure 5-17 Change of Diarrheal Cases Number and Bacteriological Examinations in 1978-1983 (DAIRI)

Figure 6-1 Estimation of Transmission Route by Change Pattern of Suspected Cholera Cases Number in Each Regency and Municipality of North Sumatra in 1978

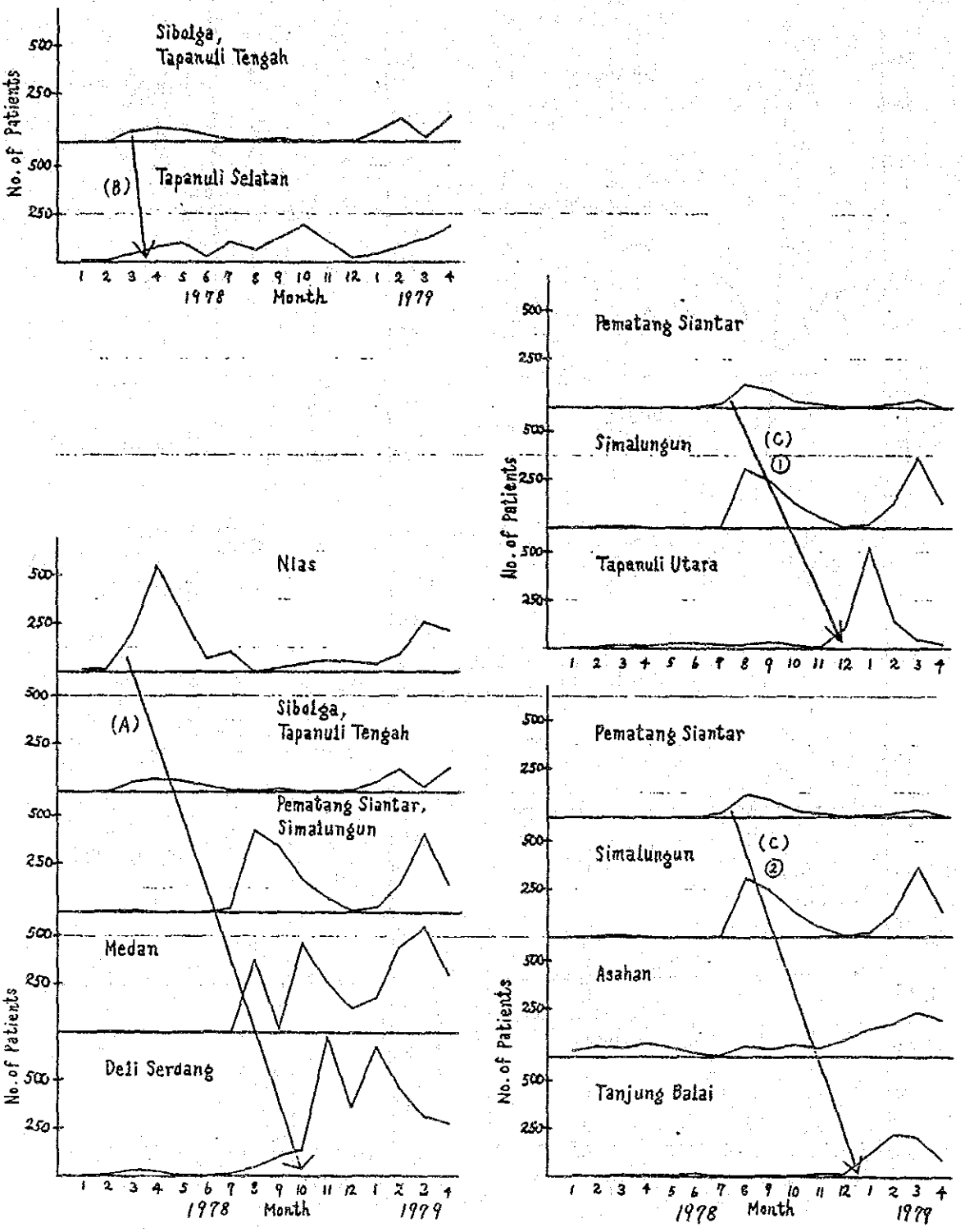


Figure 6.2 Estimation of Transmission Route by Change Pattern of Suspected Cholera Cases Number in Each Regency and Municipality of North Sumatra in 1979

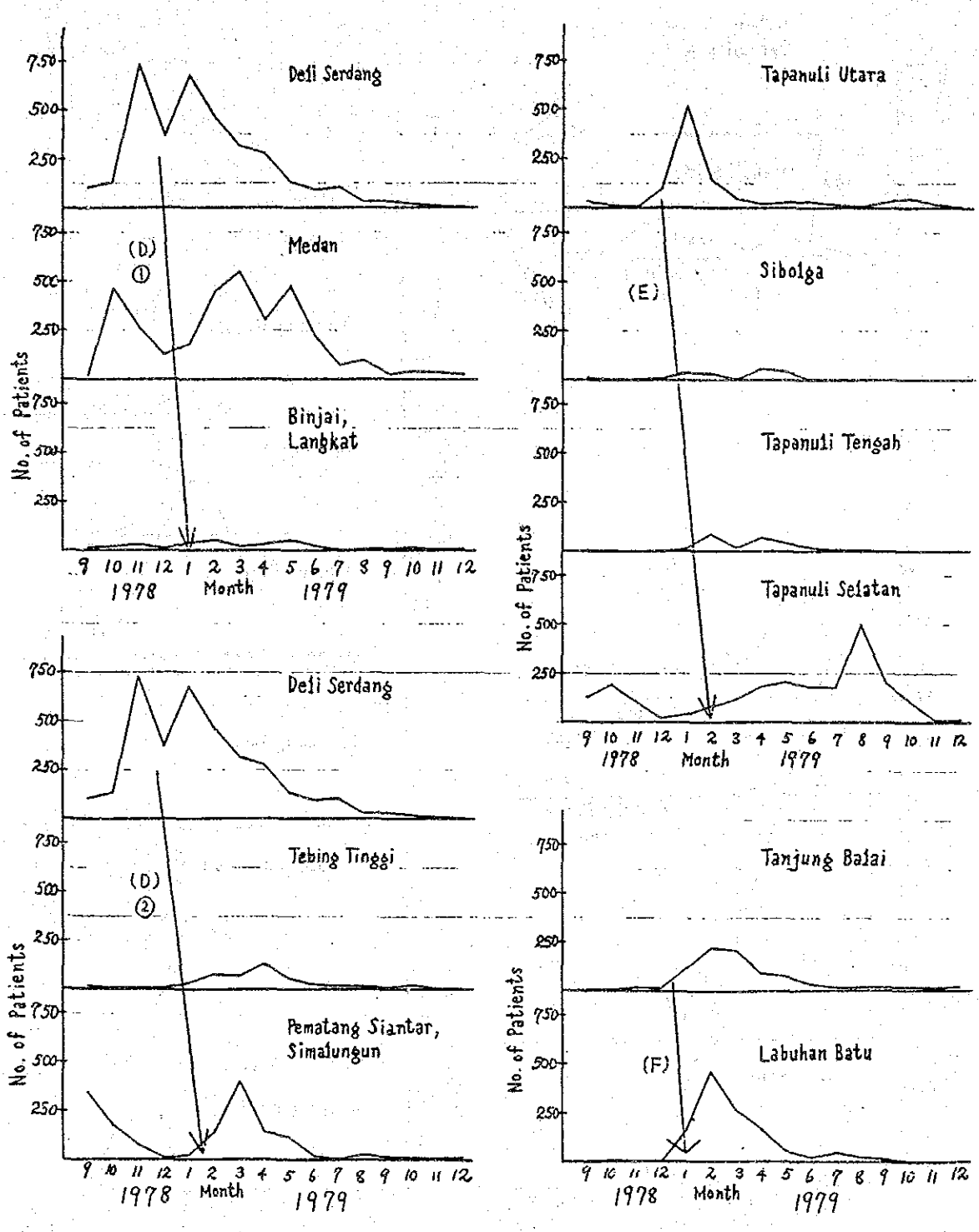


Figure 6-3 Estimation of Transmission Route by Change Pattern of Suspected Cholera Cases Number in Each Regency and Municipality of North Sumatra in 1980-1981

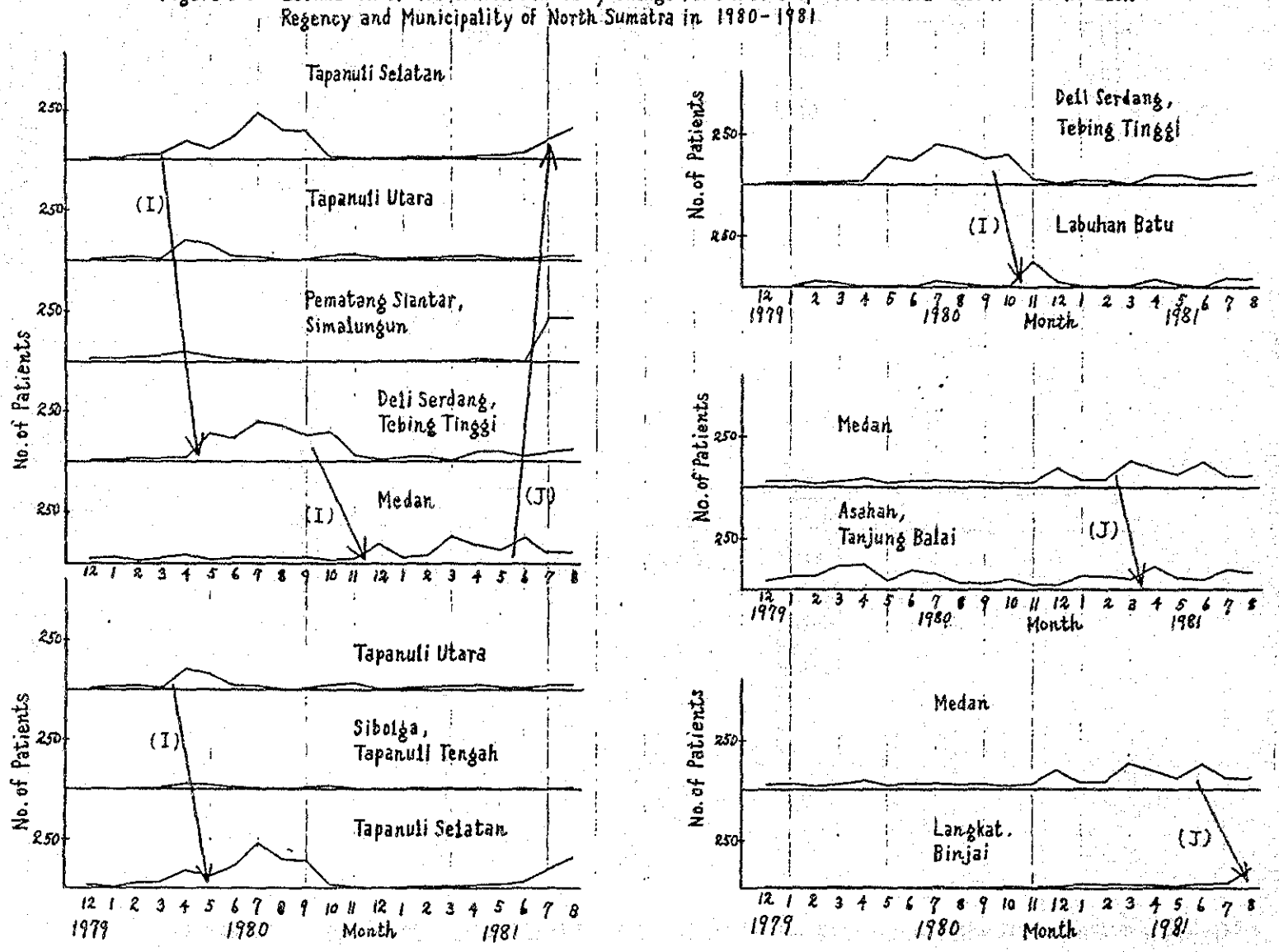


Figure 7 Change of 2 Types (Ogawa and Inaba) in Cholera Epidemic by Type Inaba (Dec. of 1978 – May of 1979)

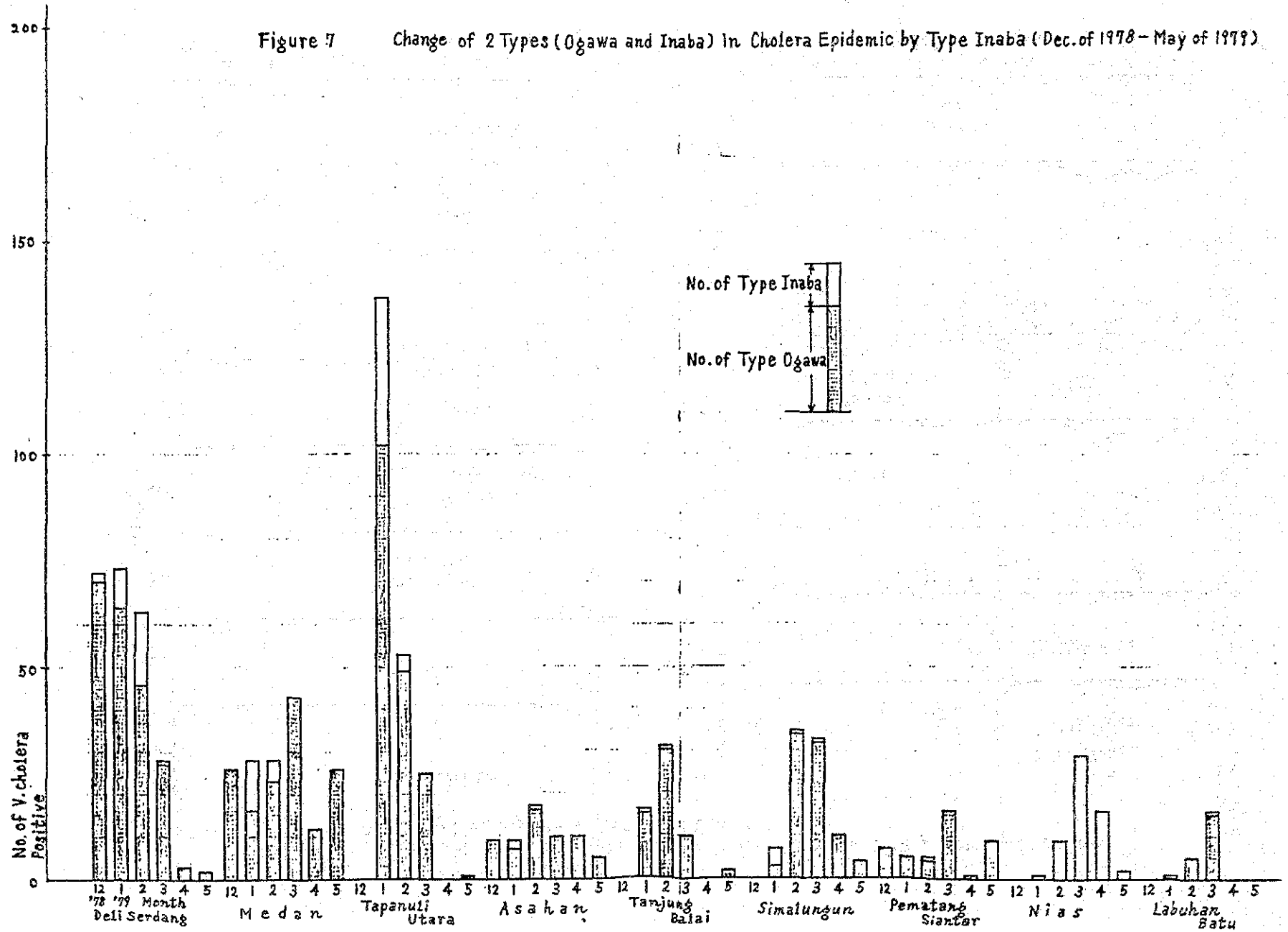


Figure 8 Number of Diarrheal Cases and the Dead in Air Joman (1982)

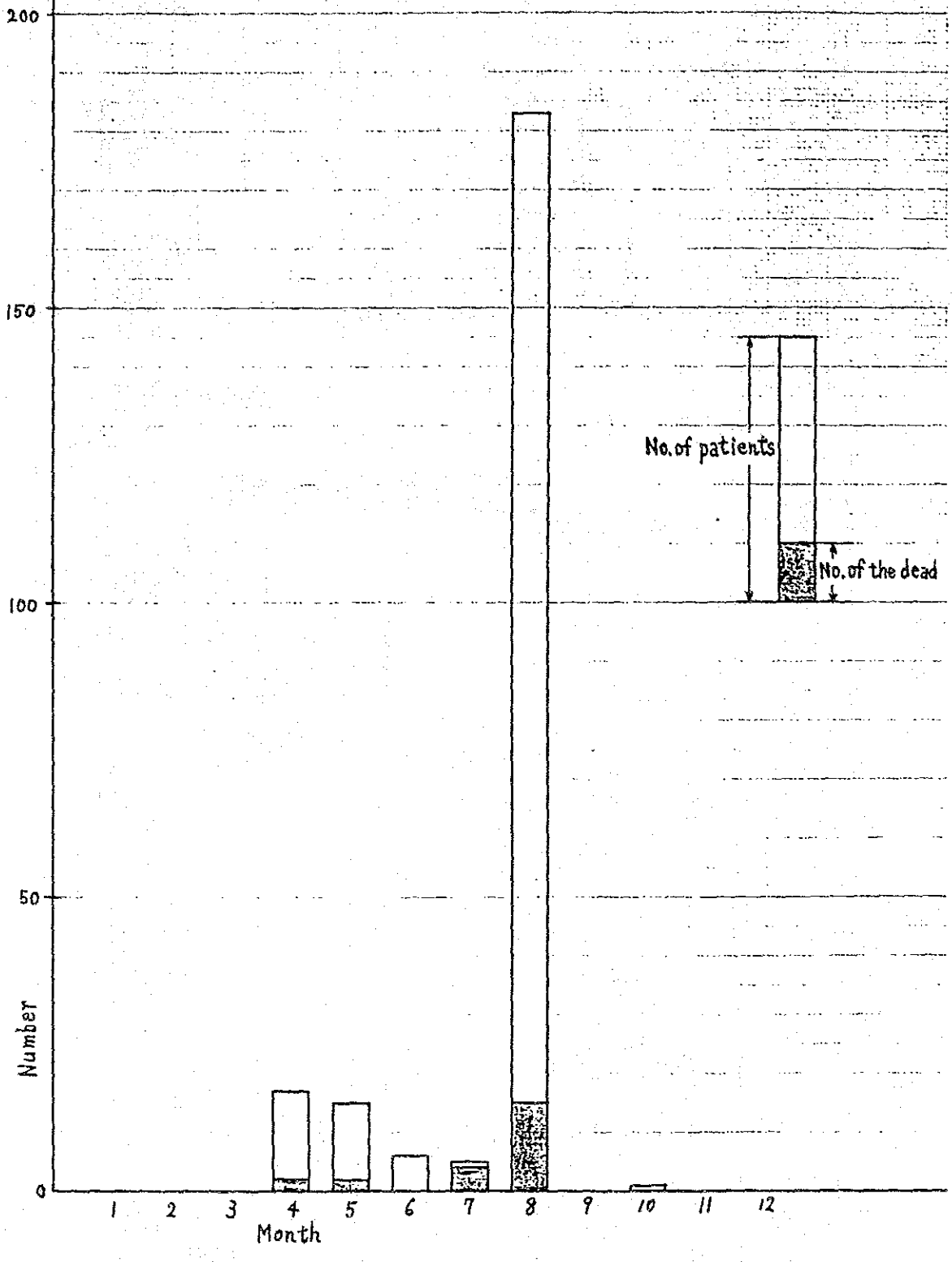


Figure 9 Change of Diarrheal Cases Number treated by Ringer in Medang Deras (Jan.-July, 1983)

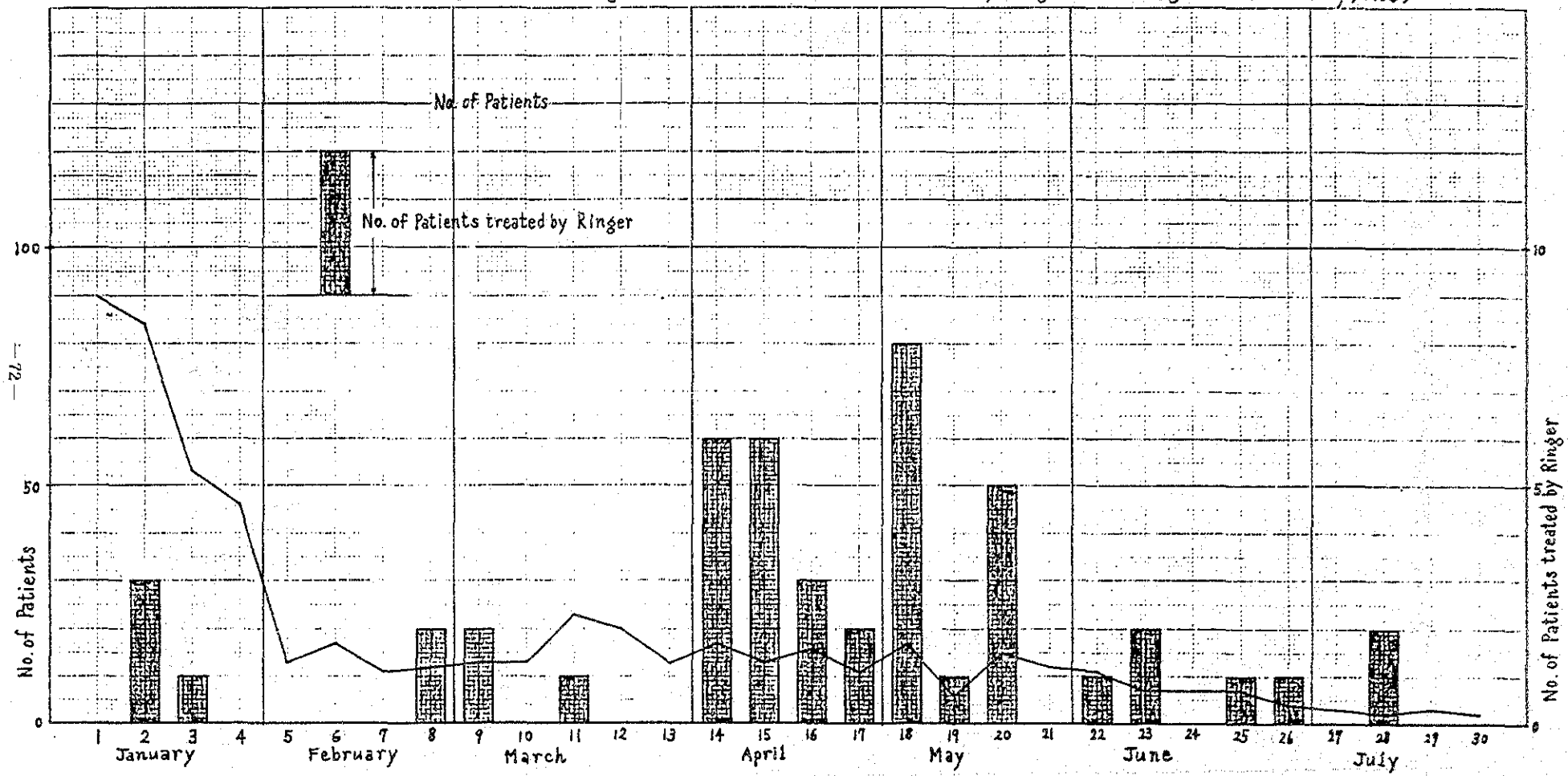
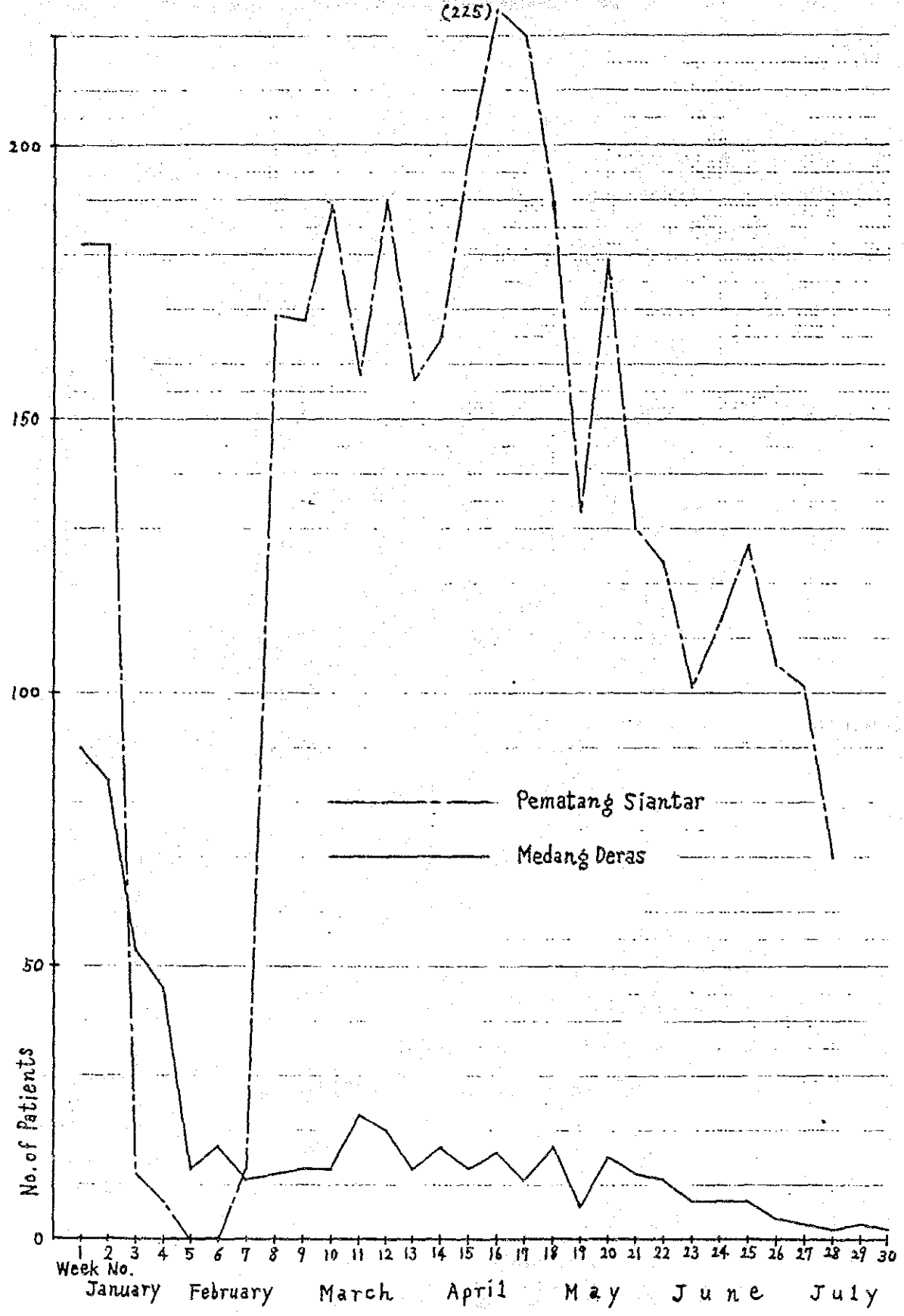
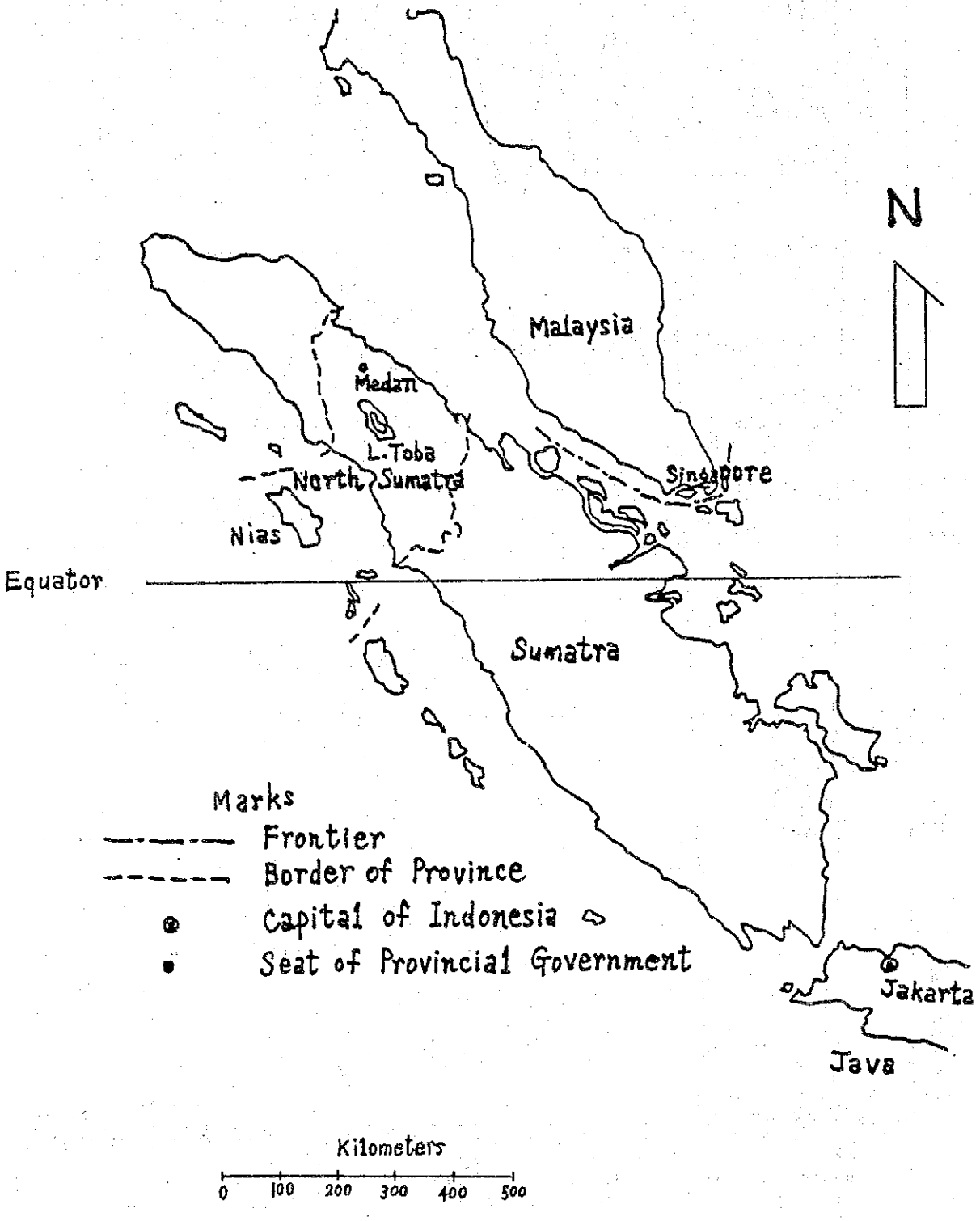


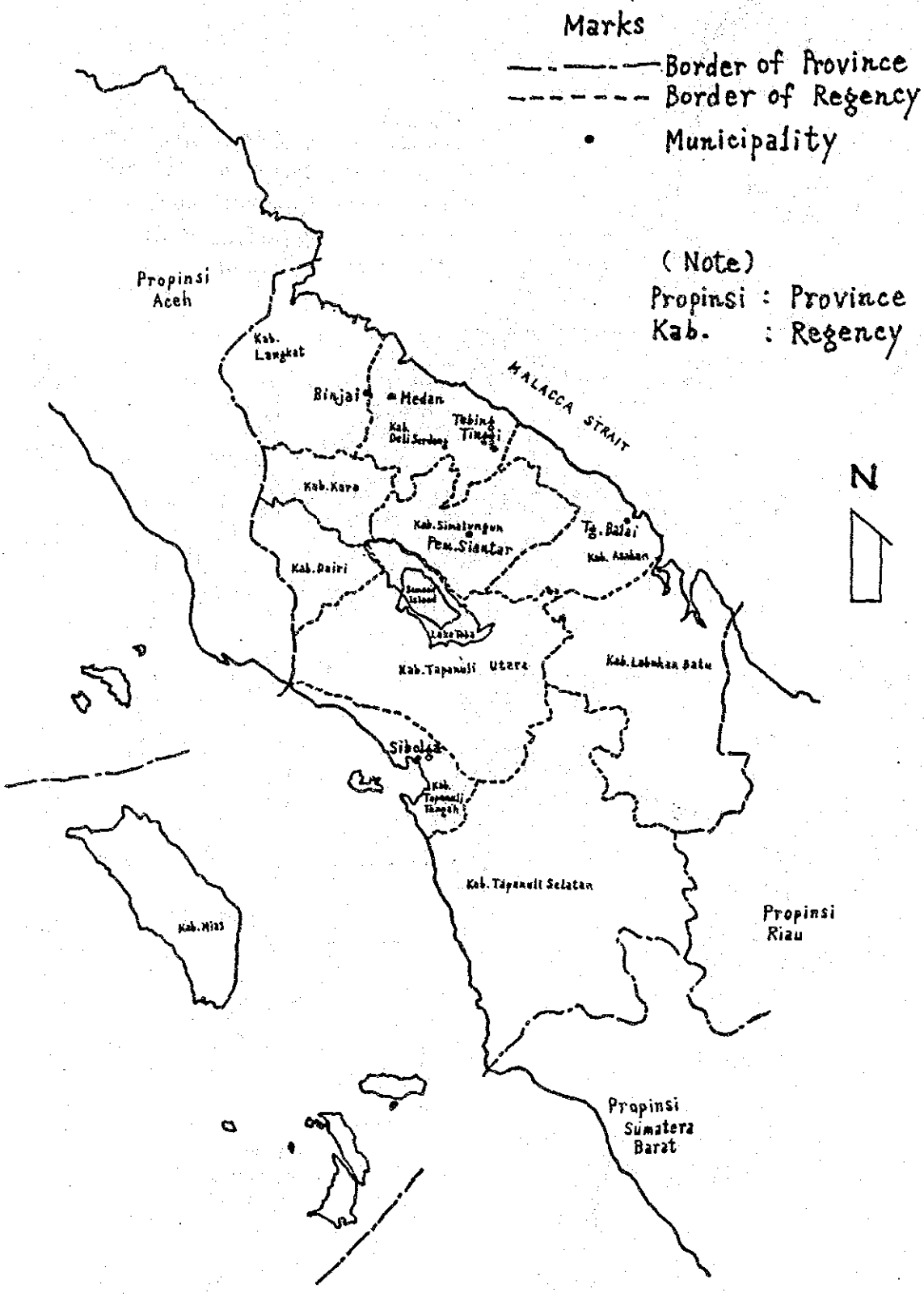
Figure 10 Change of Diarrheal Cases Number in Pem. Siantar and Medang Deras (Jan. – July, 1983)



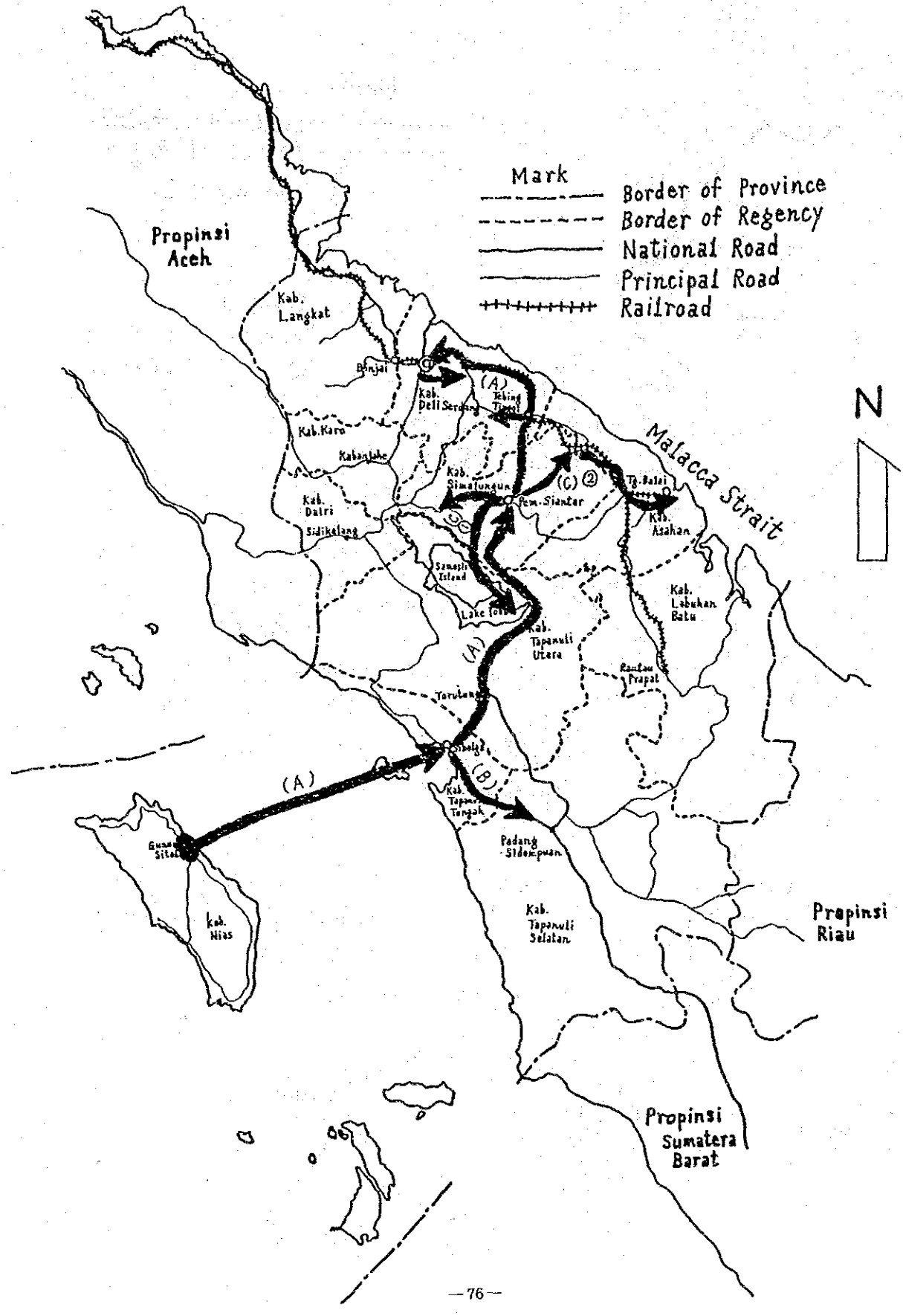
Map 1 Location of North Sumatra



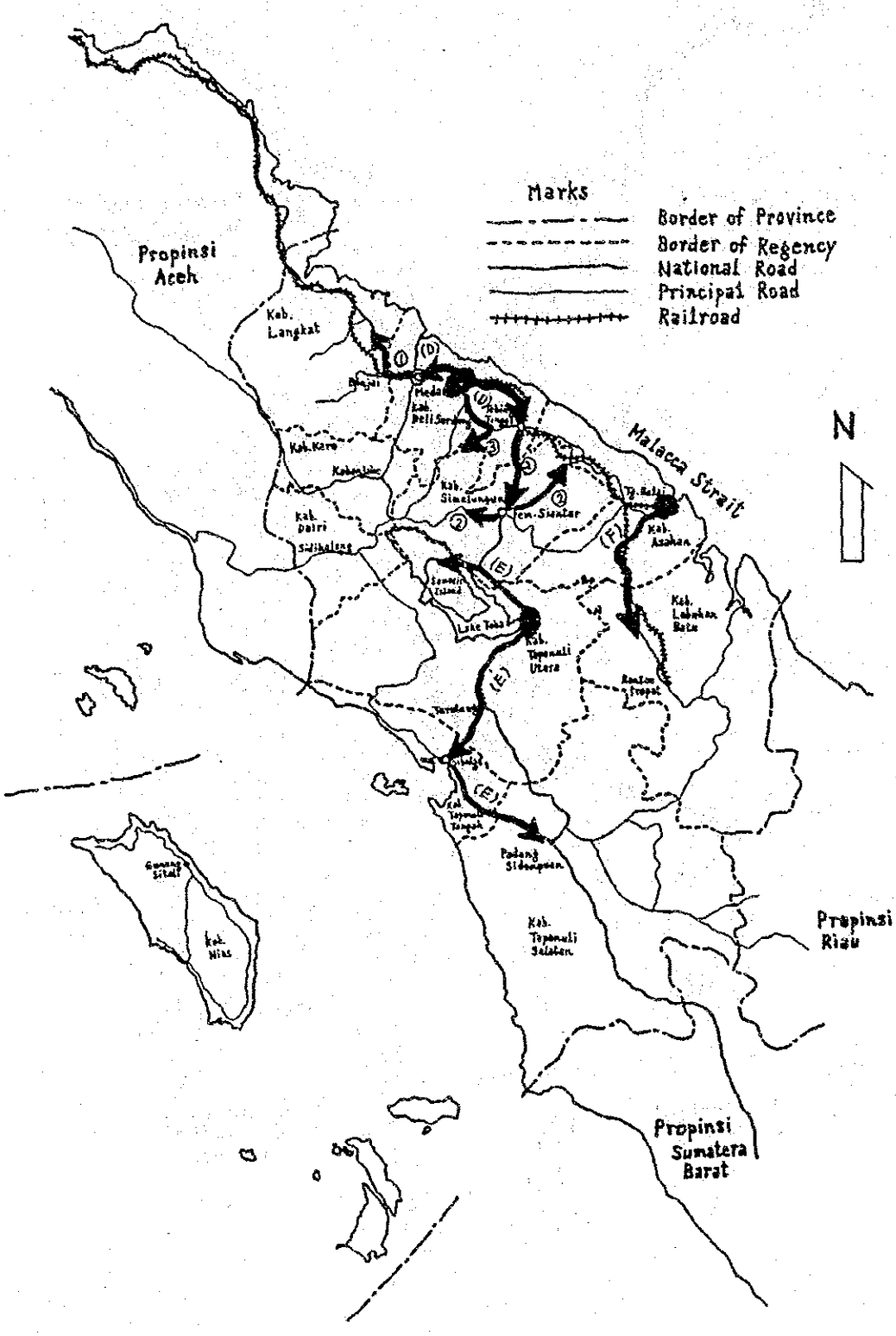
Map 2 Regencies and Municipalities in North Sumatra



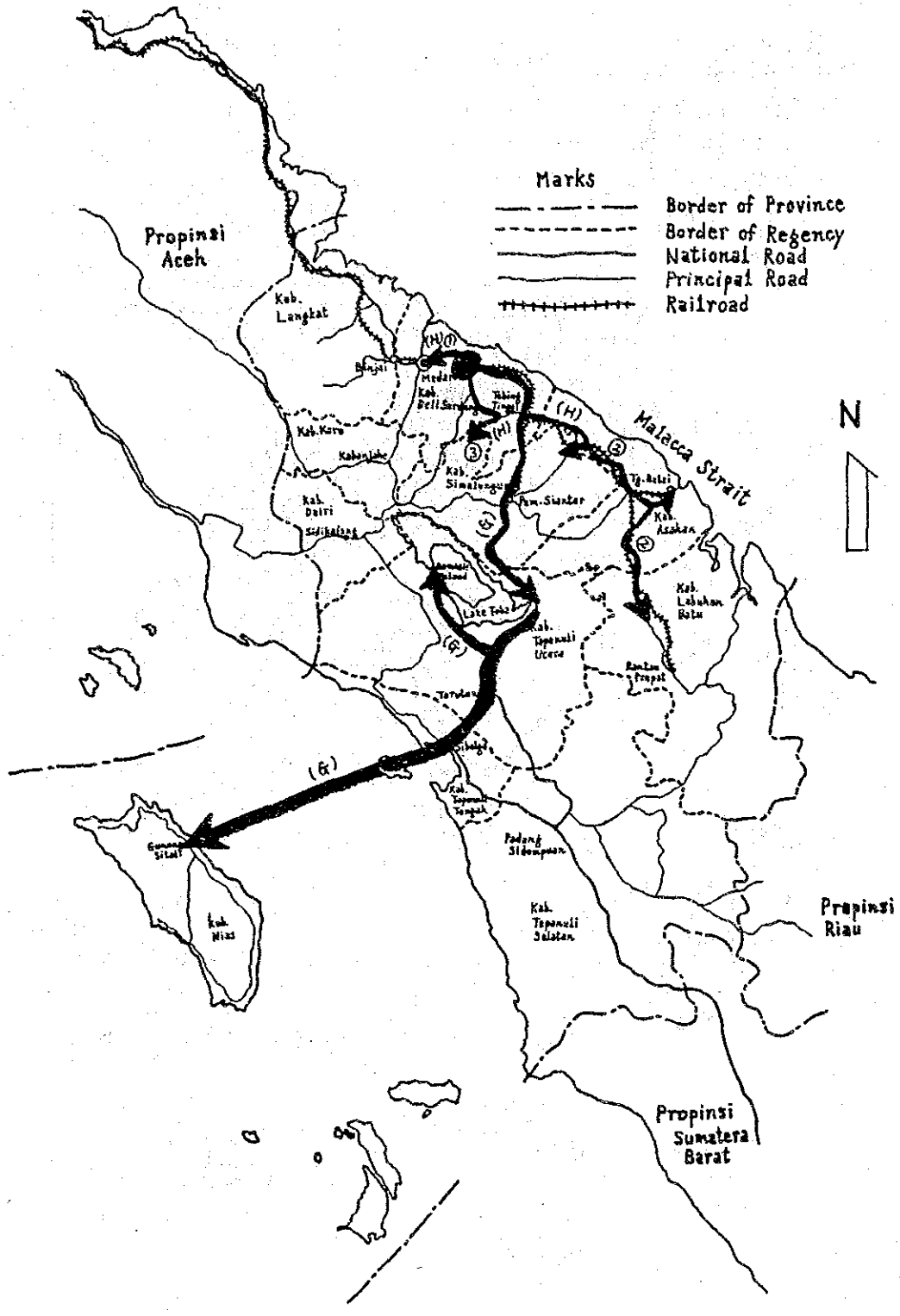
Map 3·1 Estimated Transmission Route in Cholera Epidemic by Type Ogawa in North Sumatra in 1978



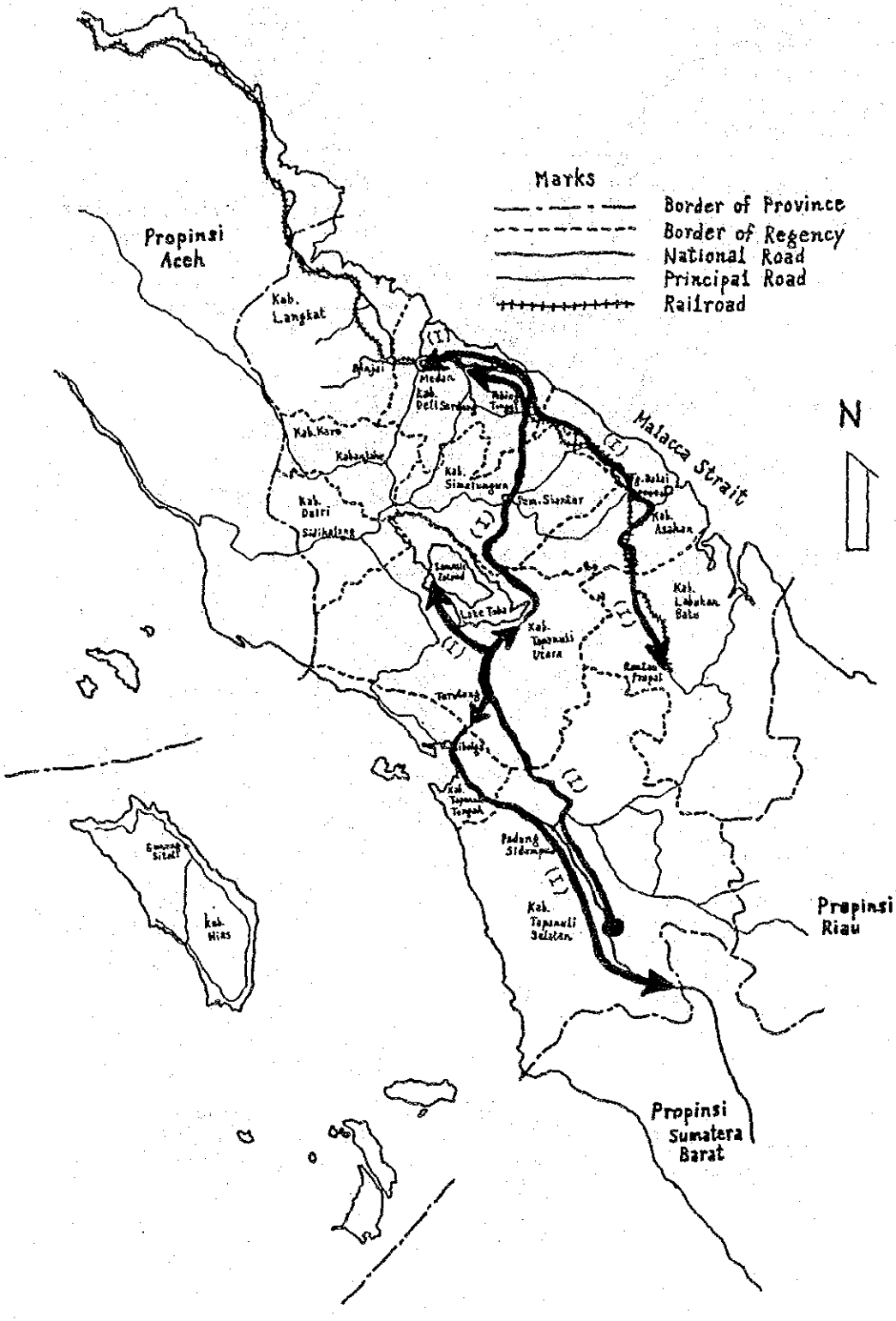
Map 3.2 Estimated Transmission Route in Cholera Epidemic by Type Ogawa in North Sumatra in 1979



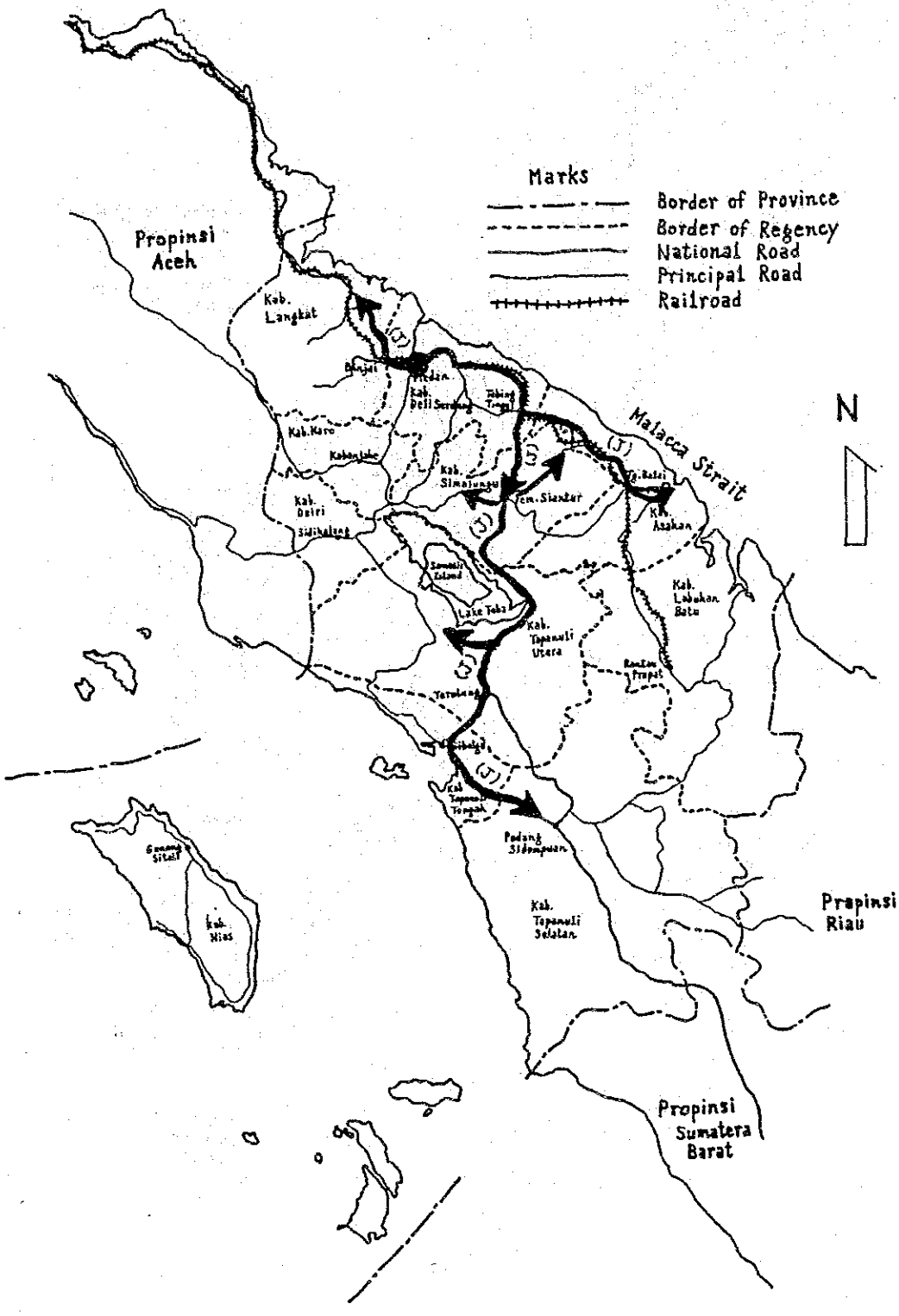
Map 3·3 Estimated Transmission Route in Cholera Epidemic by Type Inaba in North Sumatra in 1979



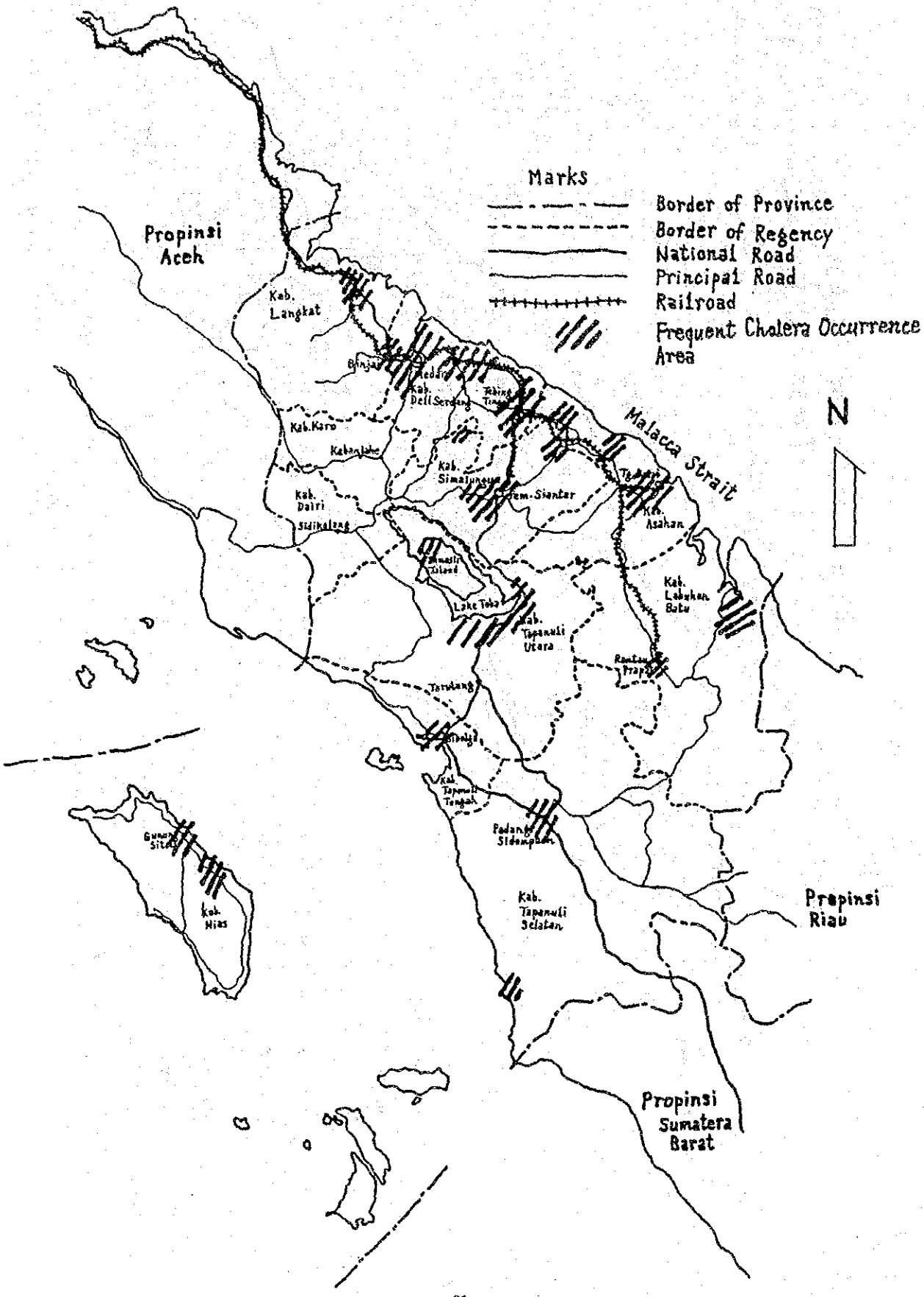
Map 3-4 Estimated Transmission Route in Cholera Epidemic by Type Ogawa in North Sumatra in 1980

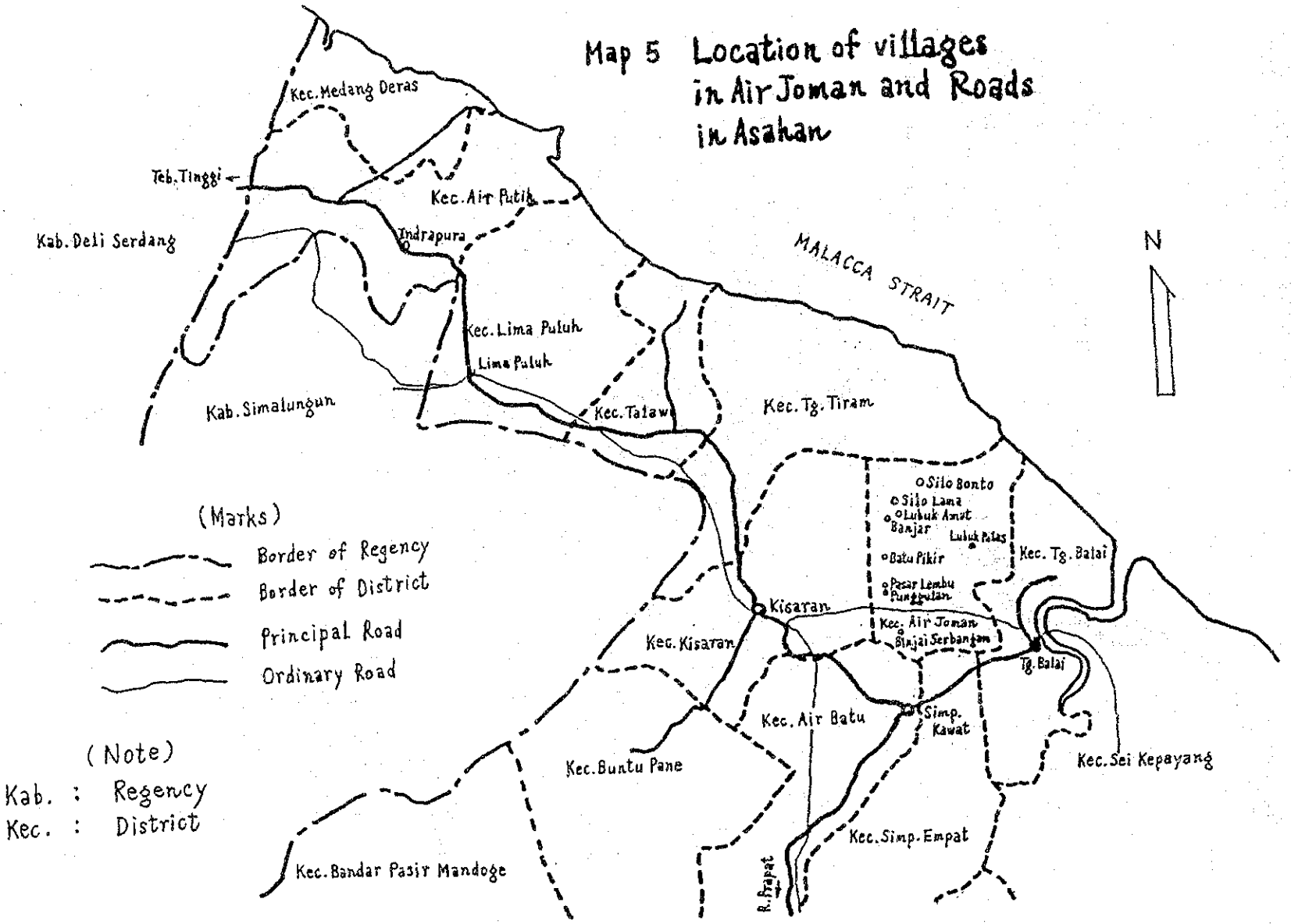


Map 3·5 Estimated Transmission Route in Cholera Epidemic by Type Ogawa in North Sumatra in Jan. of 1981 – Aug. of 1981

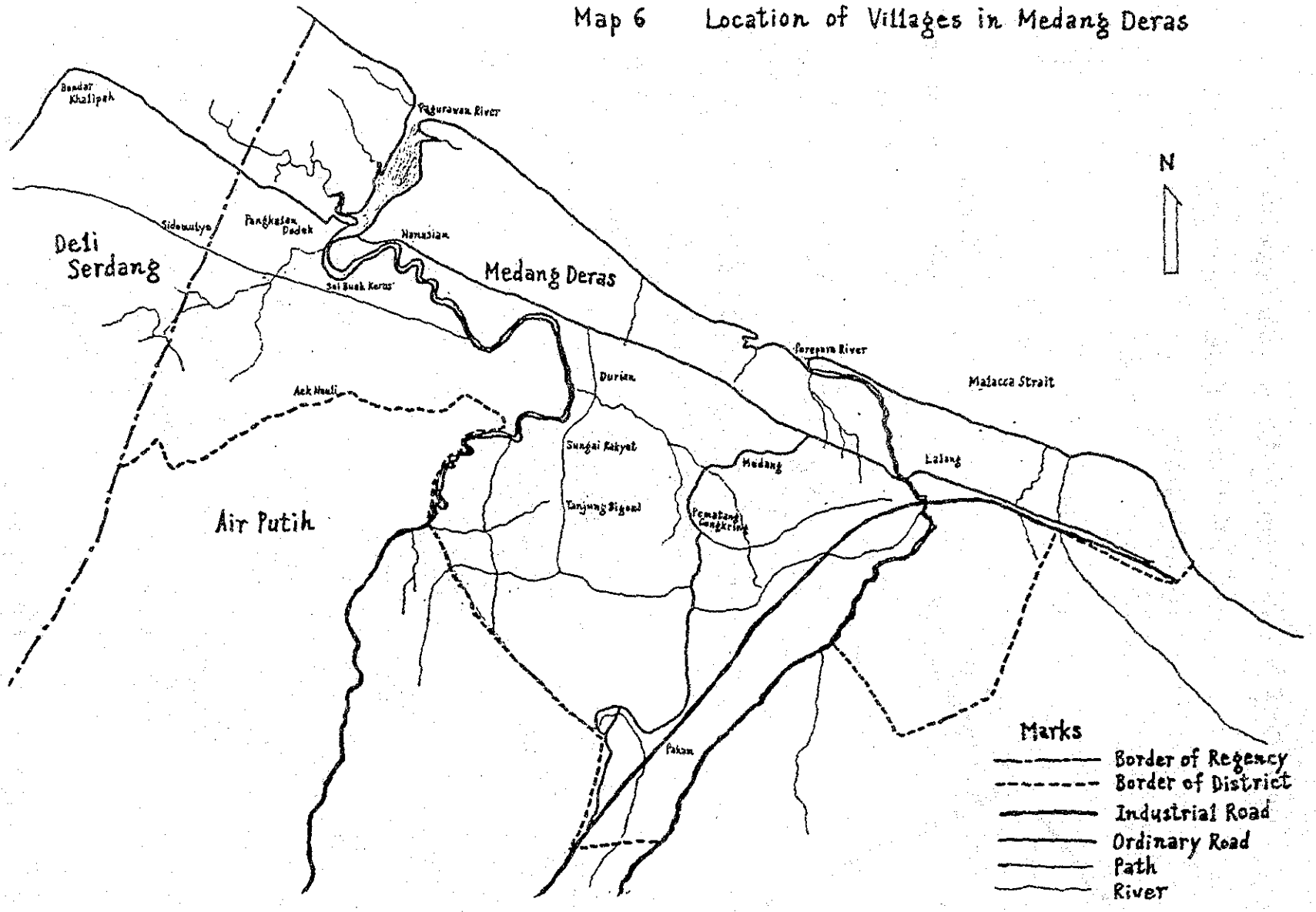


Map 4 Frequent Cholera Occurrence Area in North Sumatra in 1978 - 1983

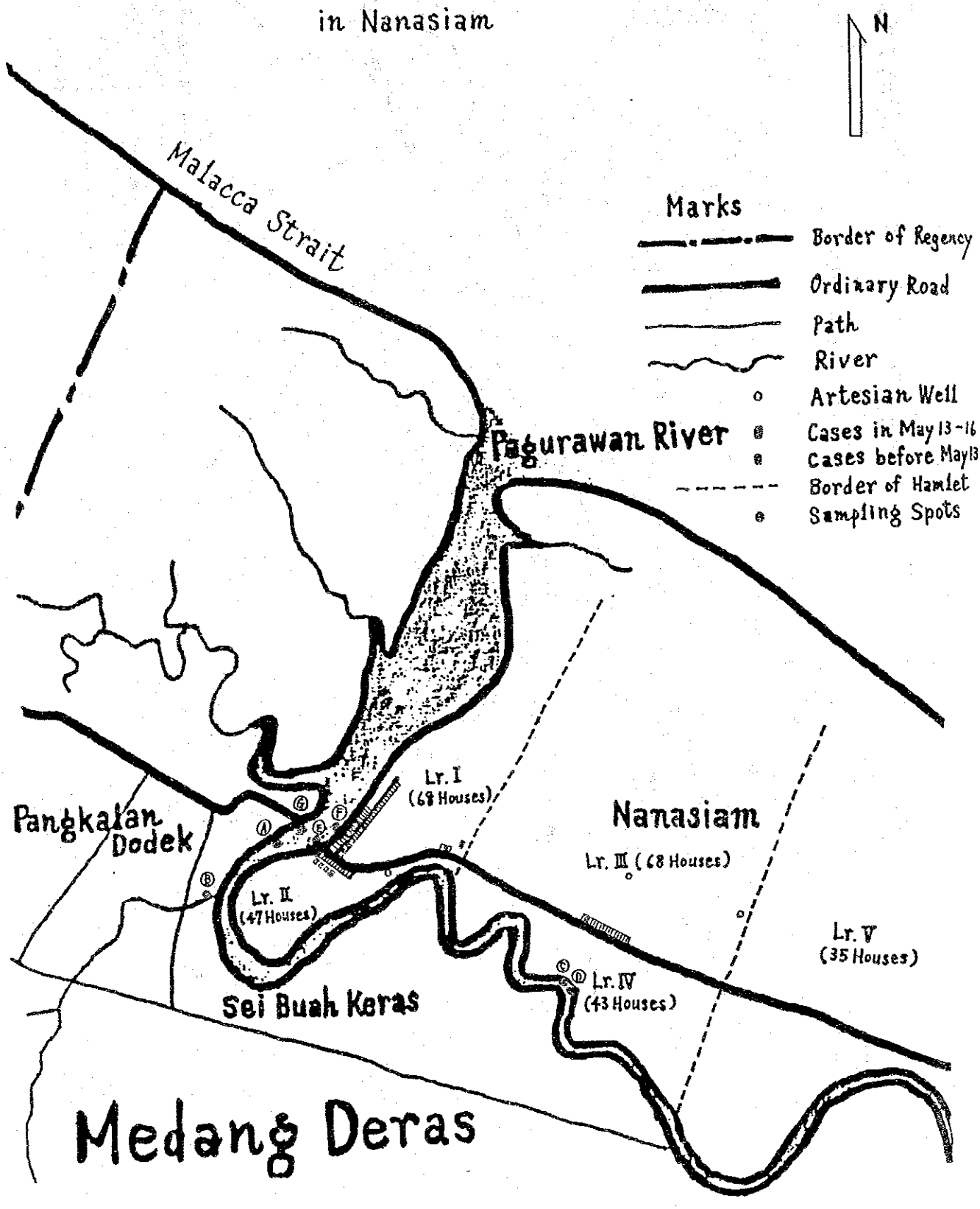



Map 5 Location of villages in Air Joman and Roads in Asahan
Kec. Medang Deras
Teb. Tinggi
Kec. Air Putih
Kab. Deli Serdang
Indrapura
MALACCA STRAIT
N
Kec. Lima Puluh
Lima Puluh
Kab. Simalungun
Kec. Tg. Tiram
Silo Bonto
Silo Lama
Lubuk Amat
Banjar
Lubuk Palas
Batu Pikir
Kec. Tg. Balai
Pasar Lembu Punggulan
Kisaran
Kec. Air Joman
Binjai Serbanjan
Kec. Kisaran
Tg. Balai
Kec. Air Batu
Simp. Kawat
Kec. Buntu Pane
Kec. Sei Kepayang
Kec. Simp. Empat
Kec. Bandar Pasir Mandoge
R. Bingai
(Marks)
Border of Regency
Border of District
Principal Road
Ordinary Road
(Note)
Kab. : Regency
Kec. : District

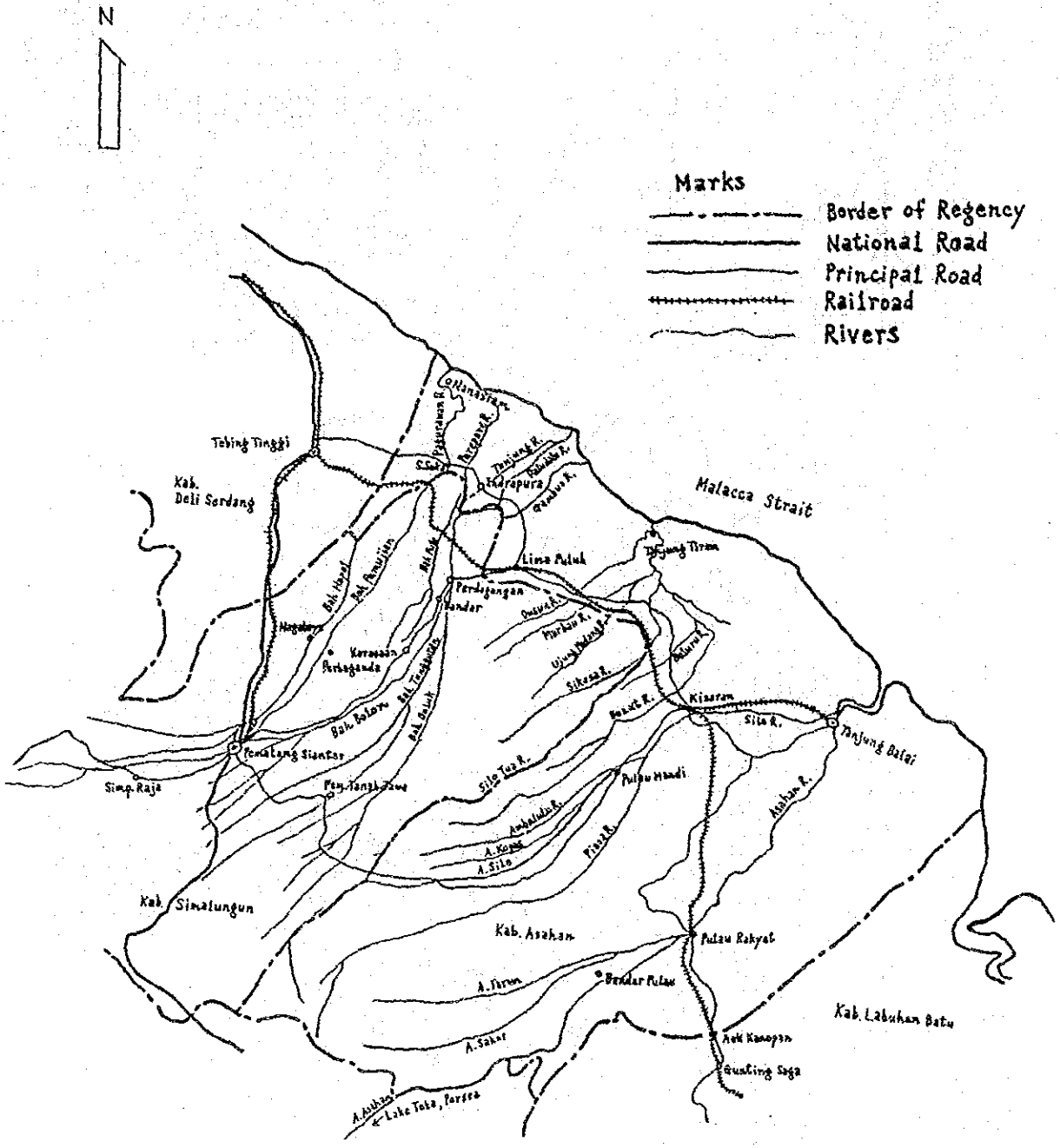
Map 6 Location of Villages in Medang Deras



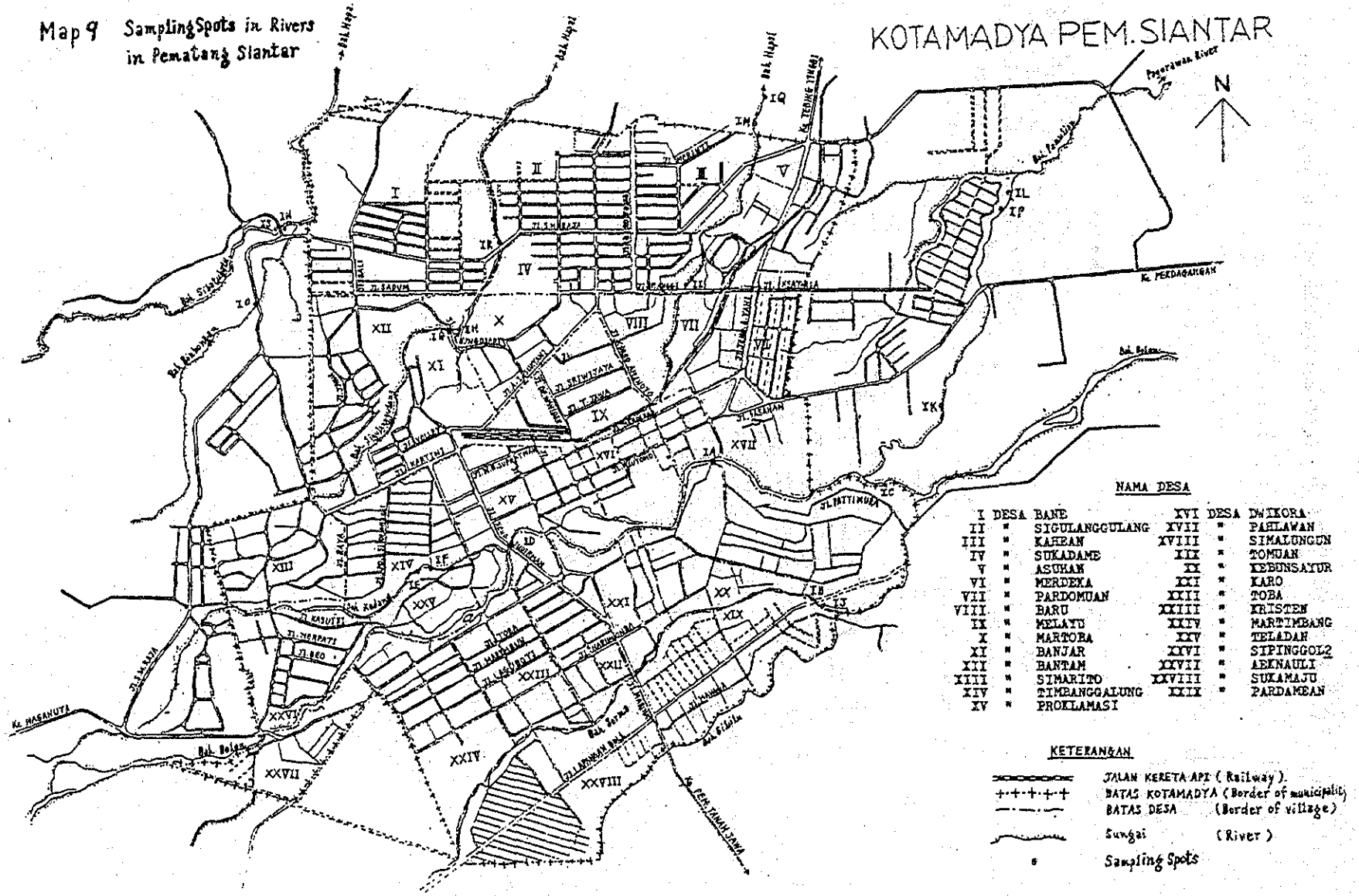
Map. 7 Sampling Spots in Pagurawan River and Location of Cases' Houses in Nanasiam



Map 8 Rivers in Asahan and Simalungun



Map 9 Sampling Spots in Rivers in Pematang Siantar



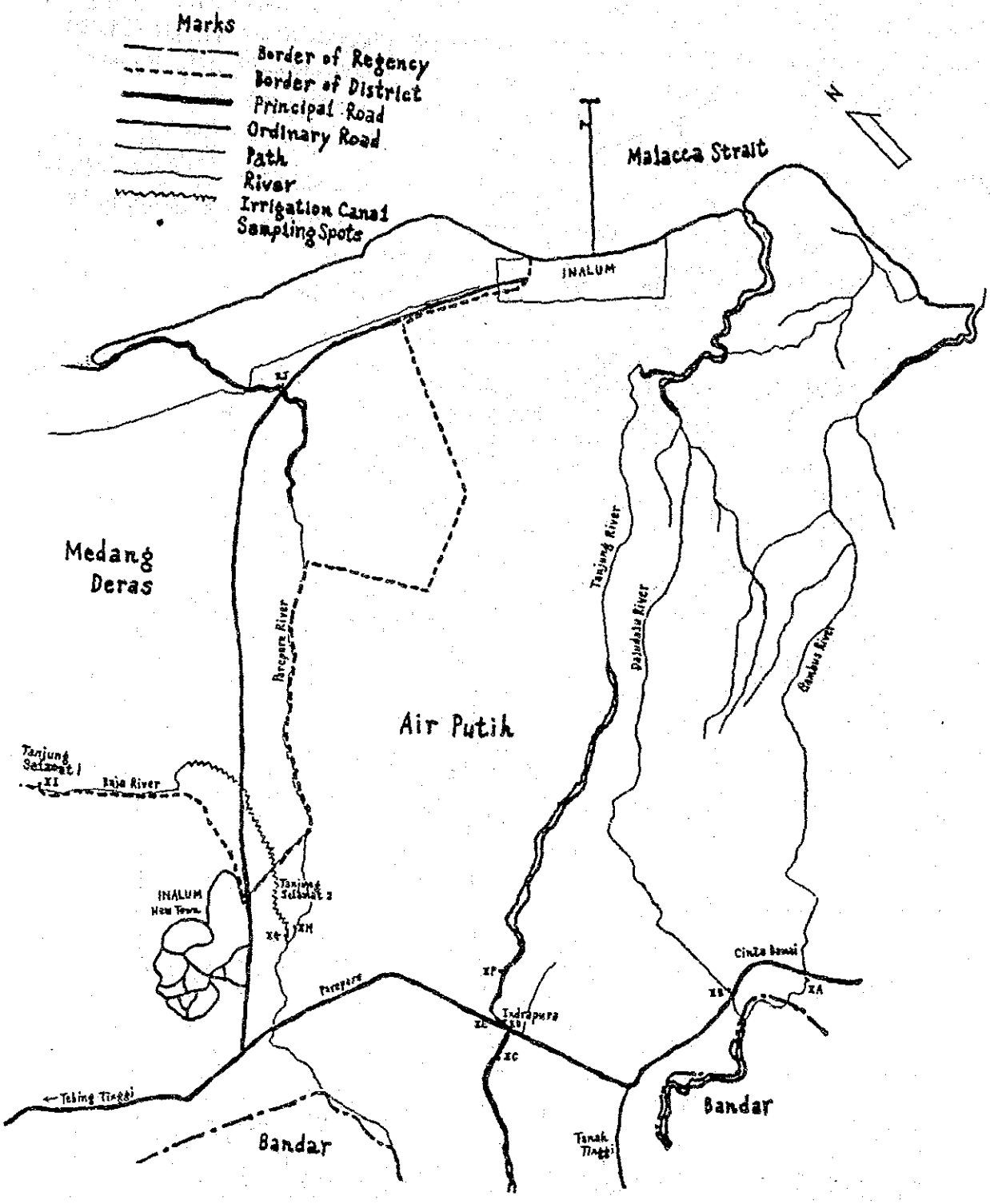
NAMA DESA

I	DESA	BANE	XVI	DESA	DWIKORA
II	"	SIGULANGGULANG	XVII	"	PAHLAWAN
III	"	KAHEAN	XVIII	"	SIMALUNGUN
IV	"	SUKADAME	XIX	"	TOMUAN
V	"	ASUHAN	XX	"	KEBUNSAYUR
VI	"	MERDEKA	XXI	"	KARO
VII	"	PARDOMUAN	XXII	"	TOBA
VIII	"	BARU	XXIII	"	KRISTEN
IX	"	MELAYU	XXIV	"	MARTIMBANG
X	"	MARTOBA	XXV	"	TELADAN
XI	"	BANJAR	XXVI	"	SIPINGGOL2
XII	"	BANTAM	XXVII	"	AEKNAULI
XIII	"	SIMARITO	XXVIII	"	SUKAMAJU
XIV	"	TIMBANGGALUNG	XXIX	"	PARDAMEAN
XV	"	PROKLAMASI			

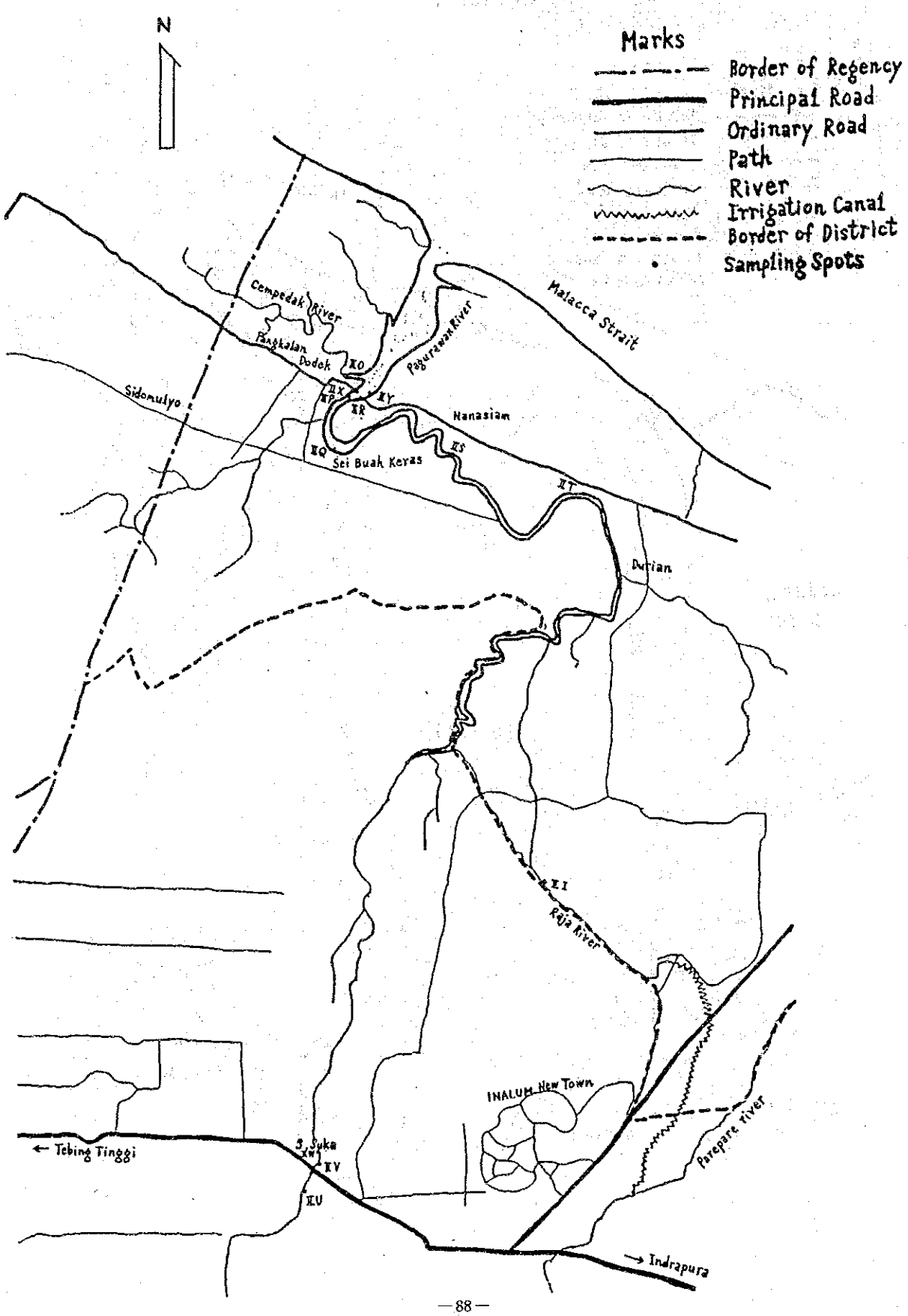
KETERANGAN

- JALAN KERETA API (Railway)
- BATAS KOTAMADYA (Border of municipality)
- BATAS DESA (Border of village)
- Sungai (River)
- Sampling Spots

Map 10 Sampling Spots in Rivers in Air Putih and Lima Puluh



Map 11 Sampling Spots in Pagurawan River (Aug. 23 - 27, 1983)



ACKNOWLEDGEMENT

I firstly apologize to the competent authorities of Indonesia and the persons concerned that the completion of this report was very delayed by my fault and others, and I express my heartfelt thanks to the persons having waited for the completion patiently.

This report will have never been completed without the cooperation of Indonesian counterparts and the persons concerned.

I especially grateful to Mr. Simanjuntak, the Cholera Section of the Provincial Health Service of North Sumatra, who did not spare his energy to the cooperation during my term of office in Indonesia, and also to Mr. Sinulingga's staff, the subsection of the Bacteriology of Medan Health Laboratory, who readily complied with my wishes in the cooperation.

And I appreciate here all the persons who supported directly and indirectly my work in Indonesia.

Finally, I am deeply thankful to Dr. T. Terayama (Tokyo Metropolitan Research Laboratory of Public Health) and Dr. H. Kurata (National Institute of Hygienic Sciences) for the revision or advice to this report.