ASSESSMENT OF PHASE I OF THE SMALLPOX ERADICATION/ MEASLES CONTROL PROGRAM OF NIGER

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I. INTRODUCTION

The assessment of Phase I of the Smallpox Eradication/Measles Control Program in Niger was undertaken by the Regional Office in January, 1969, as part of a series of assessments being conducted throughout West Africa. Their general intent has been to provide information concerning the success of the various programs in meeting their stated Phase I goals of smallpox eradication and measles control, and to make recommendations concerning the nature and extent of USAID support for the Maintenance Phase (Phase II).

The assessment was participated in by the "Responsable Nationale" for the Niger Smallpox Eradication/Measles Control Program; the Medical and Operations Officers from the Niger Program; the SMP Medical Officer from Upper Volta; a Medical Officer from the Domestic Smallpox Branch at NCDC; the assistant (Adjoint) to the Director of the Institute of Hygiéne in Abidjan, Ivory Coast, (who had participated in the Smallpox Eradication Program training course in Atlanta in the summer of 1968); and by the Deputy Chief and the Assistant Administrative Officer of the Regional Office. Each of these eight persons acted as team leader, (either part time or full time), for one of six assessment teams which carried out a survey of vaccinated villages described in the following section. Design of the assessment, analysis of the data, and preparation of the report were done by the Deputy Chief of the Regional Office.

II. METHODS

There were two major components to the Phase I assessment of the Niger Program. The first was a review of program activities. This consisted of a review of records which were available in Niamey, supplemented by interviews with officials of the U.S. Embassy and the Ministry of Health of Niger. The surveillance system was evaluated by visiting several reporting sites in the vicinity of Niamey to examine the mechanisms by which reports originating at the Canton and Arrondissement level reached headquarters. Regularity and completeness of reporting were also examined. Ordinarily, an inspection of one or more of the vaccination teams would have been included in this review of program activities. Unfortunately, a series of vehicle breakdowns, and an inability to prolong the time initially scheduled for the assessment did not permit this.

The second component of the assessment was a field survey in which over 3,000 persons were interviewed and examined for the presence or absence of a smallpox vaccination scar, and for scars left either by smallpox itself, or by variolation (a process in which the virus of smallpox is inoculated intentionally into the skin).

Three groups of persons were included in the sample survey:

A. Residents of Villages of Less Than 1,000 Persons ("Village Sample")

Sixty-seven villages were selected at random from a list of all villages of less than 1,000 persons located in areas which had been vaccinated by Smallpox/Measles Program (SMP) teams during Phase I. Figure I shows the area from which the villages were chosen, the "hash marks" indicating the vaccinated areas which had a chance of falling into the sample, and the solid areas indicating those cantons from which one or more villages were actually selected. Ninety percent of Niger's population is thought to reside in villages of less than 1,000 persons.

Persons were selected from the chosen villages in the following manner:

On arrival in the village, the assessment team leader determined whether the village was composed of a single conglomeration of people, or whether it was a "village complex," composed of distinct groups of people, (such as a central village with its surrounding hamlets, or a central village with one or more temporary habitations used by nomadic or semi-nomadic groups on its outskirts).

If composed of a single conglomeration of people, a cluster of 16 persons who had spent the previous night in the village was chosen. If the village was a village complex comprised of more than one conglomeration of people, the name and estimated population of each group within the complex was recorded. A cumulative population of all the groups was made, and a number which fell into the interval one through the cumulative population of the village complex was chosen from a random number table. The group in which the random number fell was the one from which the Cluster I sample was drawn.

In this manner, 67 villages were visited, and 1,118 persons were examined. As noted in Table I, the data on one village was misplaced, and so only 66 villages are included in the analysis. Among these 66 villages, three were selected as alternates, since the village which had been originally listed had either been disbanded, or could not be located by the assessment team.

B. Persons Encountered Outside of Villages ("Roadside Sample")

The second general group included in the sample survey was persons encountered outside of the sampled villages who could be classed into one of the following categories:

Herdsmen

Farmers

Brickmakers

Well-diggers

Hunters

Nomads

On leaving each village, the assessment teams simply examined the first 16 persons encountered who belonged to one of the categories mentioned. The intent in selecting them was to obtain a sample of persons who were not well represented in the village samples, yet who might be important as smallpox vectors. The vast majority of those examined were adult males.

For each individual in the "village" and "roadside" samples, a separate card was used to record the information obtained. These cards, (known as "McBee cards"), were of a type which permitted the information to be coded as a series of punches along their edges, a process which facilitated their being sorted and analyzed by hand. The cards were marked and punched by each of the team leaders, and the analysis was done by one person who was experienced in this type of work.

A detailed set of instructions used by the assessment team leaders in drawing the samples of persons is found in Appendix I, and Appendix II contains the list of villages which were selected to be surveyed.

C. Market Surveys of Peulhs and Bellahs

The third general group of persons included in the sample survey were persons belonging either to the Peulh, (also known as Fulani), or Bellah tribes who were found in two markets which were sampled. The market survey technique was first tested and refined in the cattle market in Niamey, where 39 persons were examined. A few days later a large weekly market in Ayorou, (near the junction of the Upper Volta, Mali, and Niger frontiers), was sampled and 302 persons examined.

Peulhs and Bellahs, (a tribal group once conquered by the Peulhs who currently hold a slave or servant relation to them), were chosen because they were suspected of playing a role in sustaining the transmission of smallpox. They are in large part semi-nomadic peoples who wander with their cattle over large expanses of Northern Nigeria, Niger, Upper Volta, and Mali. They establish intimate relationships with the sedentary populations in these areas in a pattern known as "transhumance," in which the wandering groups cycle year after year through the same sedentary population groups; water and grazing land are exchanged by the sedentary populations for the manure provided by the nomads' cattle and for a levy paid by the nomads to the village head.

Their wandering habits make these tribes difficult to vaccinate, and at the same time provide conditions which would be conducive to the transmission of smallpox throughout the area in which they circulate.

It was hoped that information might be gathered during the market surveys which would add to the information currently available concerning the vaccination status and smallpox immunity of these two tribal groups.

McBee cards were not used in the markets. Instead, a tally form was used which had first been developed for the Phase I assessment of The Gambia, using a recording technique which permitted the presence or absence of vaccination scars, variolation scars, and scars of smallpox to be noted.

In any sample survey, allowance must be made for the chance that the population selected is not truly representative of the target population about which one is seeking information. In this survey, the design was such as to provide results which had a 95 percent chance of being within the "actual" or "true" results, given the condition that the attribute being sampled (such as the presence or absence of a vaccination scar, or the history of vaccination by jet injector) was present in 80 percent or more (or 20 percent or less) of the population. In general, this degree of accuracy only holds when there are 180 or more persons in the particular age and sex group about which information is sought.

III. CHARACTERISTICS OF POPULATION EXAMINED IN THE SAMPLE SURVEY

A. Size and Distance from Vaccination Site of Sampled Villages

Parts II and III of Table I present the size of the villages sampled during the survey, and their distance from the nearest site visited by the vaccination teams during the campaign.

Approximately 50 percent of the villages in the sample had a population of between 101 and 500 persons. Forty percent had populations between 501 and 1,000 persons, and some 10 percent had populations of 100 or less persons. Unfortunately, information concerning the population distribution of all villages in Niger (or of all villages in vaccinated areas in Niger) has not yet been compiled so it is not possible at this time to compare the population distribution of the sampled villages with that of all villages in the country.

Part III of Table I indicates that over 80 percent of the villages were less than one mile from the site visited by the vaccination teams. (In all cases, "less than one mile" indicates that the vaccination teams visited the village itself.) No villages were farther than two miles from the nearest vaccination site.

B. Composition of Surveyed Population by Age, Sex, and Tribe

Table II presents the composition of the population examined in the sample survey by age, sex, and tribe. For comparison, the percentage distribution of the population by age and sex for West Africa as a whole is also presented. The population data available for

Niger comes from a census carried out in 1964, and has not been used in Table II owing to slight differences in the way in which the age groups were divided in the analysis of the census results. The Niger data is presented in Table II-A.

It will be seen that the village sample had somewhat more children under the age of five years than might be expected in a representative sample of the population of Niger, and that it contained a relative lack of adult males and a relative excess of adult females. The roadside sample, on the other hand, was composed in large part of adult males, and had a marked under-representation of children under the age of five years. The combination of these two samples, however, had a population distribution which is quite close to that estimated for West Africa.

Part D of Table II compares the percentage of Hausas and Djermas with the percentage of Touaregs and other tribes who were sampled. Hausas and Djermas are the peoples most frequently found in the area of Niger sampled during the assessment, and the table indicates that these two groups accounted for approximately 65 percent of all the tribal groups examined. Touaregs, a nomadic tribe of the desert found in greatest numbers in the vicinity of Agades, accounted for 5 percent of the sample, with various other tribes (including the Peulhs and Bellahs tabulated separately in Section E) accounting for some 30 percent of the sample.

The percentage distribution of the age and sex of the Peulhs and Bellahs surveyed in the markets has not been calculated, but it can be seen that 230 of the 341 persons sampled (67 percent) were evenly divided between males and females between the ages of 15 and 44. This simply reflects the fact that adults comprise the major portion of market populations.

C. Absentees

Table III presents an analysis of "absentees" recorded during the village surveys. An absentee was defined as a person who had spent the previous night in one of the houses (huts) which fell into the sample, but who was unavailable for examination at the time of the visit of the assessment team. (The techniques used for selecting Cluster III and those used in the markets did not make a determination of absentees possible.)

Absentee rates of approximately 50 percent were recorded in adult males. This was consistent with the lack of adult males seen in the sample populations (Table II). Males between 5 and 14 showed the next highest absentee rates (26 percent) followed by females between 5 and 44 and males of 45 and older, each of whom had rates of about 15 percent. The lowest rates (5 percent) were observed in children 1-4 and in females 45 and older. One presumes that the older females represented grandmothers who tended to remain in the villages to care for their grandchildren. Children of less than one year of age had an absentee rate of 9 percent, presumably

because their smaller size and need for closer care favored their being taken by their mothers when they left the village.

There were many absentees who were not included in the above analysis. These were persons who had been absent from the village for weeks to months. Adult males are particularly prone to leave their villages during the dry season, when there is little or no work that can be done, to seek employment in other countries or in other areas of Niger. This was a population group which was largely missed by this assessment survey.

IV. DESCRIPTION AND EVALUATION OF THE SMALLPOX ERADICATION/MEASLES CONTROL PROGRAM IN NIGER

A. General

Several reports (most notably the two reports presented at the Regional SMP meetings in Accra and Abidjan, the report of Drs. Tchell and Chamorin of April 1968 and the Niger Comprehensive Country Project Report of October 1967) provide general background information about the SMP in Niger to which the reader is referred for details which may be lacking from this document.

Although Niger participated in a USAID-sponsored measles vaccination program in 1965 and 1966, the formal beginning of the Niger Smallpox Eradication/Measles Control Program (SMP) did not occur until late in 1966, when the Medical Officer and the Operations Officer assigned by the U.S. Public Health Service as advisors to the Niger Ministry of Health arrived. The campaign opened in February 1967, when the capital city of Niamey was vaccinated. It was not until May 1967, however, that the full complement of eight vaccination trucks had arrived. Six were used for vaccination teams, and one was assigned to each USAID advisor. Shortly afterwards, the two advisors shared one truck and assigned the other to an assessment team.

An organizational chart of the program is presented in Figure II. The Smallpox/Measles Program is under the "Direction de la Sante Publique et des Affaires Sociales," the division of the Ministry of Health which is involved with providing mobile medical services to the country. These mobile services currently consist of three components: OMNES ("Organization Medicale Nigerienne et D'Education Sanitaire"), with a headquarters in both Niamey and Zinder; the Smallpox/Measles Program, headquartered in Niamey; and the "Centres d'Hygiene et de Medicine Mobile" with units in each of the seven Departements in the country.

OMNES is concerned with running two large polyvalent medical teams whose primary goal is to screen the entire population of Niger, using X-rays in addition to a wide variety of microscopic examinations, to construct a "carte Sanitaire" of the country, outlining the nature and prevalence of existing health problems. The OMNES teams began their work in 1963, and it is anticipated that they will

finish in 1971. In addition to screening the population for a broad spectrum of diseases, the teams administer smallpox, measles, BCG, and yellow fever vaccinations; treat certain of the diseases they diagnose; and train a number of student nurses. OMNES personnel are formed into light mobile epidemic control teams should a health emergency arise which warrants this.

The Smallpox/Measles Program is headed by an "Agent Technique" who has been designated as being the "Responsable Nationale" for the SMP. Although not a physician, he has reached the highest medical grade possible for a non-physician. He is responsible to the Director of Hygiene and Mobile Medicine. In theory, the USAID Medical Officer acts as the advisor to the Director of the Service of Hygiene and Mobile Medicine, and the USAID Operations Officer acts as the advisor to the "Responsable Nationale," who has direct responsibility for the SMP. In practice, both the M.O. and the O.O. act as advisors to the "Responsable Nationale," having much less contact with the Director of Hygiene and Mobile Medicine.

The Responsable Nationale in Niger is filling a position which in both Northern and Western Nigeria was filled by two persons, the Medical Officer in Charge and a Senior Health Superintendent. The latter worked directly under the Medical Officer, and relieved him of a large part of the administrative burden of personnel problems, team scheduling, and general office administration. To a degree, the Responsable Nationale is helped with these duties by the program administrator for OMNES, but this has been a rather informal arrangement made possible by the fact that OMNES administrator is a capable person and has happened to be cooperative in helping the SMP.

The SMP teams generally consist of a team leader, three vaccinators (one of whom acts as recorder) and a chauffeur. An exception to this is the assessment team which has only a team leader, an assistant, and a chauffeur.

The seven existing SMP teams were originally constituted as leprosy treatment teams who traveled on well-defined "leprosy circuits" twice a month. As it was not possible for the Government of Niger to finance the establishment of SMP teams in addition to leprosy teams, a compromise was worked out whereby the teams go out on leprosy circuits on the average of once every three months and devote the remainder of their time to SMP work. Although the circuits consume about one week of time in the field, a second week is required to prepare the teams to be sent out again on vaccination activities, and the total time lost from SMP work for each circuit is thus about two weeks.

The organizational chart shows only five teams, four vaccination teams and one assessment team, under the direct supervision of the SMP. Two teams which had originally been under the SMP have since been assigned to function as part of the Departemental mobile teams in the Departements of Zinder (assigned in May 1967) and Maradi (assigned in February 1968). In this capacity, they are involved

full time in giving smallpox and measles vaccinations in their respective Departements, but are under the direct supervision of the Medecin-Chef of the Departement's Mobile Services rather than the "Responsable Nationale" of the SMP.

As the solid lines drawn between the "Responsable Nationale" and these two Departemental teams are intended to indicate, however, he does continue to act in a supervisory capacity toward them by working in conjunction with the Medecin-Chef of the Departement to outline their vaccination schedules and by carrying out periodic "spot checks" on their activities. The dotted lines which connect the SMP "Responsable Nationale" with the Centers for Hygiene and Mobile Medicine are intended to reflect that although he does relate to the Medecin-Chefs of these unit with regard to the activities of the SMP vaccination teams, this is done on a cooperative basis with neither of the two parties being directly responsible to the other.

When OMNES ceases its activities in 1971, its personnel (numbering some 60 nurses, technicians, and drivers) will be assigned to strengthen the health services of the seven Departements. It is hoped that each Departement will have a fully formed "Centre d'Hygiene et de la Medecine Mobile" consisting of a Medecin-Chef in charge of a fixed health facility who will have one or more mobile teams under his direction. A primary function of these mobile teams will be the vaccination of the Departement with smallpox, measles, BCG, and yellow fever vaccine, and it is hoped that they will be able to complete an entire vaccination cycle at least once every two years. The transfer of the two SMP vaccination teams to the Departements of Zinder and Maradi was a step in the formation and development of the Departemental mobile health units in these two areas. The remaining SMP teams (designated as Niamey Based Project Teams in the organizational chart) will each be given a responsibility in one of the other Departements in which their work will supplement the work of the locally based Departemental team. The chart shows the Departement to which each of these teams will be assigned.

The name of a country appears under the name of each Departement listed under the "Centres d'Hygiene et de Medecine Mobile" in the organizational chart. This signifies that the country shown has assumed a major responsibility in providing funds and personnel for the operation of the medical services of the Departement. In the case of the Departement of Diffa, there is dialogue currently underway between the Peace Corps and the U.S. mission and the Ministry of Health. The Peace Corps has decided to terminate its project of running the Departement, while the Ministry of Health feels that the U.S. Government has committed itself to continue to support Diffa, at least in terms of money, if not in terms of personnel.

Both a Medical Officer and an Operations Officer have been assigned to the Niger SMP, with the exception of five months (June through October 1968) when the original M.O. had returned to the U.S., having completed his tour of duty, and his replacement had not yet

arrived. It is anticipated that a similar lag in coverage may occur in 1969 when the O.O. completes his tour of duty.

B. Vaccination Activities

1. Description

The general strategy of the Niger SMP has been for the teams to visit every village to perform their vaccinations. The smallest administrative subdivision above the village level is the Canton. Several Cantons compose an Arrondissement headed by a Sous-Prefect, and several Arrondissements comprise a Departement headed by a Prefect. There are seven Departements in Niger.

In each Arrondissement, a "Note de Service" is prepared and sent to the Sous-Prefect, informing him of the nature of the teams' activities and enlisting his support. In theory, this is sent well in advance of the teams' arrival, but it often happens in practice that the Sous-Prefect sees the note for the first time when the teams show him their copy. This is caused both by delays in the mail service and by failure of SMP headquarters to prepare the notes sufficiently in advance.

The Sous-Prefect authorizes each of the Chefs du Canton to help with the vaccination activities. It usually happens that one team vaccinates an entire Canton within 20 days (the usual length of time which the teams spend away from Niamey).

When a vaccination team arrives in a Canton, the team leader reviews with the Chef the list of villages which program headquarters in Niamey has prepared to see if any villages should be added or deleted and to see which routes would be the best ones to use in covering the area efficiently. In addition to supplying this information, the Chef du Canton is also charged with providing advance publicity to villages scheduled for vaccination. This is often done with horsemen, which the Chef assigns to work in conjunction with the vaccination team leader, or which the Chef directs the various village chiefs to provide. When employed, these horsemen provide effective advance notification, and the impression of the teams is that most of the village population turns out to be vaccinated when so notified. As can be imagined, however, the various Chefs du Canton vary in their willingness and ability to cooperate with the vaccination team leaders, and the quality of the advance publicity, although said to be generally high, is variable.

Although an overall schedule for the vaccination of Niger had been developed by the SMP by April of 1967, the lack of adequate refrigeration equipment led to preference being given to those areas in which problems with maintaining the "cold chain" for measles vaccine were thought to be minimal, and led to a rather patchwork type of vaccination coverage being achieved within any given Arrondissement. In addition to problems with refrigeration

certain considerations of a political nature abetted the program's tendency to move to new areas without having finished old areas.

More recently, however, the program has been able to fill in unvaccinated segments of Arrondissements, and has been more successful in pursuing an overall strategy of covering the country from West to East. Within the past year, a system has been instituted in which three or four vaccination teams are assigned to the same Arrondissement, and continue working in it until it has been completed. Since August 1968, each team has had a portable refrigerator with which it can conserve measles vaccine.

The teams keep a separate tally record of each village vaccinated, and turn these records in to headquarters in Niamey at the end of the month when they return for their pay.

2. Evaluation

a. Smallpox

(1) Survey Results

Table IV presents the percentage of persons interviewed in the sample survey who gave a history of being vaccinated with the jet injector (POJ). While there is no certainty that persons were able to remember whether or not they were vaccinated by POJ, and no guarantee that they were always willing to give a truthful response if they did remember (particularly if they had not been vaccinated for one reason or another), the impression of the assessors was that these histories were fairly reliable.

(The introduction which the assessment team used was designed to be as neutral as possible, and did not identify the assessors as belonging to the SMP. The interviewers were trained in asking non-directive questions, and were specifically instructed not to mention the POJ in questions concerning the method of vaccination unless this was necessary in clarifying a response. A list of the questions asked of each person is included in Appendix I.)

Section D of Table IV presents the POJ vaccination coverage observed in the village and roadside samples. The group which was apparently best covered was that composed of children between 5 and 14 years of age, 89 percent of whom gave a history of POJ vaccination. The rate fell to 79 percent in the one through four age group, and to 5 percent in those less than a year of age. This fall-off in vaccination coverage in the younger age groups is attributable to children who were born after the vaccination campaign. This was given as the

reason-for-not-having-been-vaccinated for over 90 percent of the unvaccinated children of less than a year of age, and for 46 percent (43 of 93 non-POJ vaccinees) of those between one and four years of age. There are no significant differences in the observed POJ coverage rates between persons sampled in the village and roadside samples in those below 15 years of age.

Seventy-nine percent of persons 15 through 44 years of age, and 58 percent of those older than 44 years of age, gave a history of POJ vaccination.

Analyzed on the basis of tribal group (Section D, Table IV), Hausas and Djermas had the highest POJ coverage, having an overall rate of 82 percent as opposed to a rate of 61 percent observed in all other tribes combined. This difference was not apparent in males and females older than 44 years of age, and in females aged 5 through 14 years. It was most marked in females between 15 and 44 years of age, of whom 97 percent gave a history of POJ vaccination among the Hausas and Djermas, and of whom only 53 percent gave a similar history among the other tribes. A significant difference was also observed in males of the 15 through 44 year age group, and differences which border on statistical significance at the 5 percent level were observed in males 5 through 14 years of age and in children one through four years of age.

Not unexpectedly, only 30 percent of the Peulhs and Bellahs surveyed in the market in Ayorou and in the cattle market in Niamey had a history of POJ vaccination. Unfortunately, the number of persons sampled outside of the 15 through 44 age group is too small to allow many conclusions to be drawn concerning their POJ vaccination coverage, other than it appears to have been quite low. Fifty-three percent of the Peulhs and Bellahs comprising part of the village and roadside samples had a history of POJ vaccination.

Thus the vaccination program appears to have been less effective in reaching nomadic and semi-nomadic tribal groups (such as the Peulhs and Bellahs) than in reaching more sedentary groups (such as the Hausas and Djermas).

When the assessment team leaders had returned to Niamey after completing the field survey, a discussion was held concerning their general impressions of the program and concerning any improvements they might suggest. During these discussions, several of them observed that they had encountered small hamlets which had not been visited by the vaccination teams and that the POJ coverage in these hamlets was low. Part III of Table I

indicates that 12 percent of the villages which had been assessed had not been visited by the teams (i.e. were located more than one mile from the nearest vaccination site).

The reason that most of these villages were missed is certainly understandable: they were of such small size that they were either overlooked by the vaccination team leader or were judged to be not worth the time and effort to vaccinate. Because many of these villages are inhabited by semi-nomadic tribes which are very difficult to vaccinate by other means, however, it would seem that the Niger program policy of vaccinating every village is a sound one and that the vaccination teams might benefit from having this policy reemphasized.

In conjunction with this, the assessment team leaders suggested that improvements might be made in the records being kept on villages which have been vaccinated. Although each team is responsible for turning in vaccination tally sheets on each village it vaccinates, no system has been instituted at present whereby these are systematically reviewed to compile a complete list of vaccinated villages for each Canton. It was suggested that it might be useful to request each vaccination team leader to revise the list of villages with which Niamey had provided him as he conducted vaccinations in the field. At the end of his tour, he would be responsible for providing both the Chef du Canton and Niamey headquarters with a list of all vaccinated villages (which should in effect be a list of all villages in the Canton), their estimated populations, and the total number of vaccinations which had been given in each. This list would not only be helpful in keeping Government records current, but would provide a means of doing "spot check" assessment of the teams' work by visiting randomly selected villages on the "completed" list whenever a trip from headquarters was made to the Canton. This focus on the importance of reaching every village might also be helpful stimulus to the team leaders.

An analysis of persons missed by the vaccination campaign is presented in Table IV-A. Persons who indicated that they had not been vaccinated by POJ were asked why they had not been vaccinated, and their responses were grouped into a number of broad categories. Because this type of questioning had a potential for putting people on the defensive, the reliability of the responses which were given is open to question. The factors most frequently mentioned, however, are probably an indication of at least some of the factors which led to persons not being vaccinated.

Section A of the table is in effect simply the converse of Section C of Table IV (total persons with a history of POJ vaccination) and presents the total persons with no history of POJ vaccination. (The numbers in these sections of the two tables do not match exactly owing to certain McBee cards which had items that had been inadvertently omitted.)

Section B presents the percentage of persons who said that they had not been vaccinated by POJ because of absence from the village at the time of the campaign. Some 30 percent of non-POJ vaccinees gave this as their reason for not having been vaccinated. The fact that approximately 19 percent of persons were found to be absent from the assessed villages at the time of visit of the assessment teams (Table III) agrees with this estimate of absenteeism during the campaign (particularly if allowance is made for those who were absent from the village for more than one day, who were not counted as absentees during the survey).

It was felt that while those who were absent from the village for more than one day represented a population that the teams would find very difficult to vaccinate, the population who were absent only on the day of vaccination should represent a population who might potentially have been vaccinated had better advance publicity-health education measures been used. Only about 14 percent of those giving absenteeism as their excuse for not having been vaccinated stated that they were absent only on the day of the campaign, and only a small number of these persons stated that they had been informed of the vaccination team's arrival prior to their departure from the village. These findings suggest that while improvement in advance notification would benefit some, the majority of those missed by the campaign because of absenteeism were absent for a period of days to weeks and would probably not have been reached in this way.

Section C of the table presents the percentage of persons who indicated that they had not been vaccinated because the teams had missed their village. The figure of 11 percent shown here correlates closely with the 12 percent of villages visited in the survey which were not visited by the vaccination teams, again suggesting that a reemphasis on the need to visit every village might be useful for the teams.

Sections D and E of the table present factors that were apparently not significant in reducing vaccination coverage. Only about 3 percent of non-POJ vaccinees said that they thought the vaccination was not

necessary (owing to having had one or more previous vaccinations or to having had smallpox) and that less than one percent of non-POJ vaccinees said that they were opposed to being vaccinated.

Section F presents the miscellaneous other reasons which people gave for not being vaccinated. In the under five age group, 89 percent of non-POJ vaccinees in the miscellaneous group were said to have been born since the departure of the teams, while in the over 44 age group 74 percent of those in the miscellaneous group said that they were "too old" to be vaccinated. In approximately 8 percent of cases in all age groups, the assessor forgot to ask the individual why he had not been vaccinated. For the remaining percentage of persons, a wide variety of responses were given which, with the exception of the nomads who stated that they had never come into contact with any of the vaccination teams, did not appear to have a general pattern.

Table V presents an analysis of the percentage of persons showing evidence of a smallpox vaccination scar. It differs from Table IV, the percentage of persons with a history of POJ vaccination, in two major regards: the vaccination scar rates in the one through four and in the over 44 age groups are lower than the rates of persons giving a history of POJ vaccination, and these rates are higher in the 15 through 44 age group. (This can be seen most easily by comparing Section C of the two tables.)

The lack of vaccination scars in children aged one through four who had a history of POJ vaccination was a finding that was analyzed in depth. The lack of scars could be explained on the basis of parents alleging that their children had been vaccinated when they had actually not been vaccinated. This does not seem to be wholly satisfactory, however, since parents had no reluctance to admit that their younger children had not been vaccinated (almost 95 percent of children under a year of age had no history of POJ vaccination) and adults, particularly those over the age of 44, also had low enough rates to POJ vaccination to suggest that they had little tendency to be untruthful about not having been vaccinated.

If one accepts the history of POJ vaccination in the one through four age group as being reasonably valid, one is left with the suspicion that a certain number of ineffective vaccinations may have been given by the vaccination teams. This issue would be best resolved by reading "take" rates in primary and revaccinees. This was not feasible during this assessment.

In lieu of reading "take" rates, a calculation was made of the percentage of persons who had no visible vaccination scar although alleging to have been vaccinated by POJ. Persons with a history of smallpox, or persons who had physical evidence of smallpox scarring or of a variolation scar were excluded from the analysis. It would have been ideal to exclude all revaccinees as well, but this information was not available. The effect of including revaccinees is to dull the sensitivity of diagnosing apparently ineffective POJ vaccinations. In the Niger population, the population under five years of age is the only one with few enough revaccinees to make this analysis meaningful.

The data indicate that approximately 13 percent of children aged one through four years who were alleged to have received a POJ smallpox vaccination had no visible vaccination scar when examined by one of the assessment team leaders (Table V-A). While it is true that not every primary vaccination "take" will result in permanent scarring, the expected discrepancy between "take" rates and scar rates is thought to be considerably less than 13 percent. Finding a discrepancy this large leads one to suspect that a proportion of ineffective smallpox vaccinations may have been administered by the vaccination teams. The magnitude of this problem cannot be accurately estimated on the basis of these data, but one can conclude that vaccination effectiveness should be more closely monitored in the future than it has been in the past.

In Section B of Table V-A, a comparison is made between the results found in Niger and those found in Phase I assessments done in Northern Nigeria (Sokoto and Katsina Provinces) and in Western Nigeria. Sokoto Province, where vaccination team supervision was known to be a problem, has rates of non-scarring in POJ vaccinees in the under five age group which most closely resemble those of Niger. Katsina Province, which enjoyed better team supervision during its campaign than did Sokoto Province, has somewhat lower rates and the Western State, thought to have had the best trained teams, had the lowest rates. Unfortunately, these observed differences could also be related to the proportion of primary POJ vaccinees in the one through four age groups in these areas, a variable which is unknown. (Using this method of calculation, the higher the proportion of primary POJ vaccinees, the higher the "no-scar" rates will appear, given the same percentage of ineffective vaccinations administered by the teams.)

The fact that more persons gave a history of POJ vaccination than had a vaccination scar in the 45 and over

age group is probably less related to problems with the vaccination technique than to the fact that vaccination scars tend to become less prominent with the passage of time and can be quite difficult to identify in this age group, particularly if the person has wrinkled skin or had a small scar initially.

More persons in the 15 through 44 age group had vaccination scars than gave a history of POJ vaccination, indicating that past vaccination campaigns have reached a certain proportion of persons not vaccinated during the SMP campaign. This was especially pronounced among the Peulhs and Bellahs in whom a majority of the adults were unvaccinated by POJ although having vaccination scar rates in the 70 to 90 percent range.

Table VI is a refinement of Table V, presenting the percentage of those who not only had a vaccination scar, but who also had a history of vaccination within the past 10 years. Judging effective vaccination coverage on this basis, it can be seen that it is diminished by some 5 percent in the 15 through 44 age group and by about 10 percent in the over 44 age group over what it was using the presence of a vaccination scar alone.

Table VII presents the percentage of persons examined who had evidence of having had smallpox at sometime in the past. The pattern in all the groups analyzed is much the same: very little smallpox scarring was found in children under the age of five; one to two percent scar rates were observed in children 5 through 14; 7 percent scar rates were observed in persons 15 through 44; and 15 percent scar rates were observed in those over the age of 44.

Table VII does not suggest that any of the tribal groups analyzed (Hausas, Djermas, Touaregs, Peulhs, and Bellahs) had experienced an incidence of smallpox which was either markedly above or markedly below the average incidence.

Table VIII presents the percentage of persons who had a variolation scar. A word of explanation is warranted concerning the criteria used in defining such scars. In general, scars which resembled smallpox vaccination scars were accepted as being variolation scars if they were present on the forearm, and if the person in question could either affirm that he had "purchased the disease" (an expression used to mean variolation in these parts, since the person being variolated usually pays someone skilled in the technique to variolate him), or could affirm that the scar in question was not a "bravery mark" (a round burn scar intentionally

induced on the arms of both men and women), or had not been caused by some trauma or accident. The vast majority of those classified in this survey as having a variolation scar gave a clear history of having been variolated, even when the event had occurred many years in the past.

In this analysis, the presence of a variolation scar has been taken as being one evidence of smallpox immunity. While this is probably a reasonable assumption, no firm data exists on the frequency with which "takes" might be expected from this procedure, and the frequency with which superinfection in the absence of a "take" might result in leaving a permanent scar. Firm data is also lacking on the duration of immunity conferred by a successful variolation.

Table VIII shows that the frequency of variolation scarring is slightly above that of smallpox scarring, increasing with age in a pattern similar to that of smallpox scarring. Males show rates which are rather consistently higher than those in females, and the rates among Peulhs and Bellahs are a little higher than those among the other tribal groups. Neither of these differences is statistically significant, although they remain suggestive.

Table IX presents the proportion of persons who were considered to be immune to smallpox. A person was considered to be immune if: (1) he had a smallpox vaccination scar and indicated that he had been most recently vaccinated within the past 10 years; (2) he had scars left by the disease of smallpox itself, (which for the purposes of the assessment were defined as being at least five pock marks on the face, each of which had to be at least two millimeters in diameter) or (3) he had a variolation scar. Table IX differs in few practical respects from Table V, the percentage of persons with a vaccination scar, except that the immunity shown in the age group of over 44 is about 15 percent lower than the vaccination scar rate shown, several of them not having had a vaccination within the past 10 years. The low immunity shown for this age group is particularly striking among the Hausas and Djermas, but it is not known to what degree they constitute a smallpox threat in that they are not a mobile group, and their actual immunity levels are at least somewhat higher than those shown in Table IX, owing to persons who have had smallpox who have lost the scars and to those whose vaccination scars have faded. They remain a group which bears watching, however, and the importance of having the older age groups turn out for vaccination should

be reemphasized to the vaccination team members and to the village chiefs.

The largest pool of susceptibles, however, exists in the children of less than five years of age. Using the immunity rates presented in Section D of Table IX and the percentage distribution of the population of West Africa (from Table II), the figures presented in columns III and IV of Table X were derived. Using the definition of smallpox immunity previously given, 76.4 percent of the surveyed population can be considered to be immune to smallpox, or 23.6 percent of the surveyed population can be considered to be susceptible to smallpox. The under one and the one through four age groups have each contributed 17.4 percent of the total susceptibles in the population, and together they contribute more than any of the older age groups to the total susceptible pool. They are followed in importance by the over 44 age group (contributing 29.7 percent of the total susceptibles) and the 15 through 44 age group (contributing 25 percent of the susceptibles).

Unlike the older age groups, whose immunity levels will not change markedly over the next few years even in the absence of additional vaccination campaigns, the immunity in the under five age group plumets each year as unvaccinated newborns are added to the population. The importance of maintenance phase activities for this group cannot be too strongly emphasized, as they pose a significant threat to smallpox eradication.

The analysis of the occurrence of smallpox by age group provides additional information concerning the probable immunity levels of the population to smallpox. Table XI presents an analysis of investigated cases of smallpox in Niger in 1967 and 1968. (This analysis is taken from cases seen in Tera, Tillabéry, Filingue, and Ouallam in 1967, and from cases seen in Goure, Filingue, Tessoua, and Bouza in 1968. Age specific data on seven additional cases, which were seen in Dosso in March 1967, could not be located at the Regional Office and were excluded from this table. It is known that the oldest case was 24 years old and that most of the remaining cases were younger than 10.)

For the two-year period, 76.6 percent of all the analyzed cases were under 15 years of age, and 30.5 percent were under five years of age. No cases were seen in persons over the age of 44 years. These findings are in general accord with the analysis of smallpox immunity presented in Table IX and reemphasize the importance of the under five age group in smallpox transmission. The lack of cases in the over 44 age group suggests that

their actual immunity rates may be higher than those shown in Table IX. Because the number of analyzed smallpox cases is quite small, however, it would seem wise to continue to regard this age group as a potential threat to smallpox eradication and to continue efforts to vaccinate them.

The analysis of smallpox immunity by tribal group indicates that the Hausas and Djermas enjoy the highest immunity levels, followed by the Peulhs and Bellahs and the Touaregs. There seems little question but that this is a direct reflection of the access which the vaccination teams have had to these groups.

The role of the semi-nomadic tribes, such as the Peulhs and Bellahs, in sustaining smallpox transmission is not known at the present time. The capacity for small groups of persons to sustain transmission for periods of several months has been documented in both Niger and Cameroon, so that there is little doubt that such peoples could potentially play a very important role. The question that has not yet been answered, however, is whether these groups are capable of indefinite transmission of smallpox entirely among themselves, or whether such transmission requires that they come into contact periodically with a susceptible sedentary population who sustain the disease before passing it on again to another semi-nomadic group.

Mounting a vaccination campaign which would be assured of achieving a high coverage in these semi-nomadic tribes would be a formidable undertaking. It would require increases in the number of vaccination teams put into the field, which would naturally result in an increased cost of the program. The vaccination of these groups is at best a highly inefficient process, since much time is required to locate them, and the numbers usually found in any one location are small.

In the light of our currently limited knowledge concerning the threat these peoples pose to smallpox eradication, it would appear to be most reasonable to continue to concentrate program efforts on achieving high vaccination coverage rates in the sedentary population, a task whose importance is unquestionable. At the same time, every effort should be made to define the role the semi-nomadic tribes are playing in smallpox transmission, and no profitable opportunity should be lost in vaccinating them using the resources currently available to the program.

The situation is similar with regard to the true desert nomads, such as the Touaregs. Although only 137 of

them were examined during this assessment survey, additional information is available from a vaccination scar survey done by Dr. Donald Moore in September 1967 as a part of the "Cure Salé" project. The results of this survey are presented in Table XII. While the vaccination scar rate of 62 percent found by Dr. Moore in persons older than 14 correlates closely with the vaccination scar rate of 67 percent found in the assessment survey in the same age group (Table V), Dr. Moore's rates in the under 15 age group were considerably lower than those found in the assessment survey (28 percent in Dr. Moore's study as opposed to 63 percent in the assessment survey).

Although the Touaregs must be regarded as being a tribe quite highly susceptible to smallpox, their actual role as a smallpox vector or as a smallpox reservoir is not known. It is argued that because smallpox has been successfully eradicated from countries north of the Sahara, and because the Touaregs would seem to be capable of reintroducing the disease to these countries periodically if they were serving as important vectors or reservoirs for it, they are probably not serving in either capacity. Although smallpox is certainly known among the Touaregs (witness the pock mark rates presented in Table VII), at present it appears that smallpox eradication may be achieved by pursuing the current strategy, which focuses vaccination activities primarily on the sedentary populations while strengthening the surveillance system and doing complete investigations of all reported cases of smallpox. As with the Peulhs and Bellahs, no profitable opportunity should be lost in vaccinating Touaregs. However, it would be difficult and expensive to mount a vaccination campaign which could be assured of achieving a high level of vaccination coverage, and this is probably not indicated until such time as the evidence is stronger that such a campaign is a requisite for smallpox eradication.

One significant area of Niger which was not examined in the sample survey was the Departement of Diffa, which forms the southeastern frontier of the country, bordering on Nigeria and Chad. This Departement has an American physician as the Medecin-Chef, and has had a vaccination team run by the Peace Corps operating in the area for almost two years. During the first year, most of the Departement was vaccinated, but in the effort to complete the program prior to the departure of the Peace Corps physician who was team leader, it was thought by some that vaccination coverage had been sacrificed to speed. Be that as it may, a mop up campaign has been conducted in the area since June 1968,

and it is expected to be completed by December 1969 (and perhaps earlier barring unforeseen delays).

Because of difficulties in communication and transport, an assessment of Diffa during January 1969 would have been extremely difficult, and it was decided instead to recommend that the Niger SMP assessment team carry out an assessment of the Departement in the fall of 1969, when a majority of the mop up vaccination should have been completed.

(2) Surveillance

The effect which the program has had on the incidence of disease is a measure of program effectiveness which can be used to complement data on history of POJ vaccination and vaccination scar rates.

Figure III (taken from "Current Information on Smallpox Epidemiology in Niger, November 1967" prepared by Atlanta SEP Headquarters) presents the number of smallpox cases reported annually from Niger since 1967. Although this shows that smallpox in 1968 was less frequent than it had been in 1967, the impact of the SMP on smallpox incidence would appear to have been a modest one. Figure IV presents the cases of smallpox reported to the Ministry of Health by month since 1966. In contrast to the general impression given by Figure III, Figure IV suggests that the program's impact has in fact been dramatic. According to the patterns of the previous years, the months of November and December should bring a sharp upswing in the number of reported cases. Since June of 1968, however, smallpox has remained at extraordinarily low levels, and there seems no indication at present that it will return to its more usual levels during 1969. The country, in fact, seems to be witnessing the end of endemic smallpox transmission.

The fact that smallpox incidence appears to have declined in this manner in spite of the fact that high vaccination coverage rates do not appear to have been achieved in the semi-nomadic and nomadic tribes lends weight to the suggestion that no specialized vaccination campaigns, other than those which can be carried out with currently available resources, be directed against these tribal groups until the necessity of such an approach becomes more evident.

b. Measles

(1) Survey Results

No estimation of measles vaccination coverage was undertaken in the Niger assessment survey. Previous assessment surveys had suggested that this information had to be very carefully obtained to be of value, and in Niger where measles vaccination had been given in some villages and withheld in others owing to problems of maintaining the "cold chain," the information which would have been obtained concerning measles vaccination coverage would have been difficult to interpret.

(2) Surveillance

Figure V presents the number of measles cases reported to the Ministry of Health of Niger by year since 1956. The rise in the number of cases which has occurred in 1968 is not reassuring with regard to the efficacy of the measles vaccinations given in 1967 and 1968 in controlling measles in Niger. This impression is strengthened by Figure VI, the number of cases of measles reported to the Ministry of Health by month since 1966. There seems every indication that the sharp rise in the number of cases which occurred in November and December 1968 will continue into 1969, and a possibility exists that 1969 will constitute a major epidemic year for Niger.

Unfortunately, the data obtained during the assessment does not permit a full explanation of what has been responsible for the apparent lack of effect of the measles program. Several factors may be playing a role.

One of the most important is that the data presented in Figure VI and Table XV do not separate measles cases reported from non-vaccinated areas. In this situation, excellent measles control could have been achieved in vaccinated areas, but could have been masked by epidemics of measles occurring in non-vaccinated areas. During the time spent in Niamey, it was not possible to extract from the team records the detailed data which would have been required to make this analysis feasible.

Table XVI presents the total number of smallpox and measles vaccinations which have been reported in 1967 and 1968. Measles vaccinations have totaled some 15 percent of smallpox vaccinations. The measles target group (children aged 6 months through 4 years) is also estimated at 15 percent of the total population. Because measles vaccinations were given in a more limited geographic area than were smallpox vaccinations,

however, the former should have accounted for less than 15 percent of the latter. One suspects from this that either fewer measles vaccinations were given than were reported or that they were given to a proportion of children who exceeded the defined age limits.

At the bottom of Table XVI, an estimation is made of the total number of children in the measles target group for 1967 and 1968. When compared to the total number of measles vaccinations which were reported during this period, it can be seen that the number of measles vaccinations is almost 60 percent of the theoretical number of children in the target group. While this degree of coverage would not be expected to result in tight measles control, some overall effect would be expected, particularly since larger towns and villages (which account for the major proportion of reports of measles cases) have received the major proportion of the measles vaccinations.

One probable reason for the measles program's lack of a more pronounced effect has been the fact that problems in maintaining the cold chain for measles vaccine have undoubtedly led to the administration of ineffective vaccinations. The exact magnitude of this problem is not known, but from the number of incidental reports which have reached SMP headquarters in Niamey concerning measles in vaccinees and concerning measles outbreaks in vaccinated villages (such as the one investigated in Tera by Dr. Moore in March 1968 in which over 80 cases of measles were found in measles vaccinees), one suspects that it has been a significant one.

The city of Niamey itself is currently experiencing a measles epidemic for reasons which appear to be clear cut: no mass measles vaccination campaign has been carried out since the program carried out its first campaign in February 1967. Niamey would seem to be no exception to the general dictum that vaccination campaigns carried out at intervals of longer than six months to one year will have little success in achieving measles control in urban areas.

The available evidence seems unequivocal in suggesting that the measles aspect of the program has been less successful than has the smallpox aspect. There also seems no reason to believe that a good measles control program cannot be carried out in Niger, and specific recommendations concerning this will be presented in the discussion of Phase II activities.

3. Summary

The sample survey of Niger revealed that the POJ vaccination program was successful in reaching approximately 75 percent of the population surveyed (which consisted of persons living in randomly selected villages of less than 1,000 persons in areas vaccinated by the SMP teams; herdsmen, farmers, brickmakers, well-diggers, hunters; and nomads selected along the roadside between the chosen villages). The highest vaccination coverage was observed in the 5 through 14 age group (89.1 percent), and the lowest was observed in the over 44 age group (58.0 percent). Approximately 79 percent of the one through four and of the 15 through 44 age groups gave a history of POJ vaccination. Lower POJ coverage rates were observed in the nomadic and semi-nomadic tribal groups than in the sedentary groups, the former having an overall rate of 61 percent (excluding a special group surveyed in two markets who had a rate of 30 percent) and the latter having a rate of 82 percent.

The survey suggested that some 10 percent of villages in the vaccinated areas had not been visited by the vaccination teams. These generally represented very small hamlets, but their size is not a good reflection of their importance to the program, since many of them are inhabited by nomadic groups who are difficult to vaccinate in any other way. It is suggested that the importance of vaccinating every village might be reemphasized to the teams.

Of those persons who said that they had not been vaccinated by POJ, 31 percent indicated that they had been absent from the village when the teams had visited; 11 percent indicated that the teams had not visited their village; and 4 percent said either that they thought the vaccination was unnecessary owing to their having had a previous vaccination or smallpox (3 percent), or that they were opposed to vaccination (one percent). The remaining 54 percent of persons not vaccinated by POJ gave a variety of explanations. Eighty-nine percent of of the under five age group in the miscellaneous category were alleged to have been born after the departure of the teams, and 74 percent of the over 44 age group said that they were "too old" to be vaccinated. Many in the adult male age group were nomads who stated that they had never come into contact with one of the vaccination teams.

Smallpox immunity, defined as the presence of a vaccination scar in association with a history of vaccination within the past 10 years, the presence of a variolation scar, or the presence of at least five pocks of at least two millimeters in diameter on the face, was also examined in the survey. The lowest immunity levels were found in the under one age group (5.3 percent immune) and in the over 44 age group (49.9 percent immune). Looking at the situation from the point of view of numbers of smallpox susceptibles in the population, the most important age group is

the under five group who account for 34.8 percent of the total susceptibles, followed by the over 44 group (29.7 percent), the 15 through 44 group (25.0 percent), and lastly by the 5 through 14 group (10.6 percent).

Analysis of the investigated cases of smallpox during 1967 and 1968 indicates that 30.5 percent of the cases were less than five years of age and that 76.6 percent were less than 15 years of age. No cases were found in the over 44 age group. These findings emphasize the importance of the young age groups in sustaining smallpox transmission, and indicate the necessity of having a good maintenance program which will assure that the pool of susceptibles (which is constantly being fed by newborns) is kept at a low level.

Immunity analyzed on the basis of tribal group follows much the same pattern found in analyzing POJ vaccination coverage rates: smallpox immunity is highest among the sedentary tribes (Hausas and Djermas who showed an overall rate of 77.8 percent immune) and lowest among the nomadic and semi-nomadic groups (Touaregs, Peulhs, and Bellahs who actually had higher immunity rates in the over 44 age groups, although having lower levels in the younger age groups). Considering the difficulty and expense of mounting a vaccination campaign which would be assured of achieving high vaccination coverage rates in these nomadic groups, it would seem more advisable for the Niger SMP to continue its current vaccination efforts to achieve high coverage in sedentary groups (while not losing any profitable opportunity to vaccinate nomads at known gathering points or in small villages), leaving the question of mounting a special campaign for the nomads until this can be shown to be a requisite for smallpox eradication.

From its effect on the incidence of smallpox in Niger, the program can be judged to have been highly successful. From having been a country with a high incidence of smallpox prior to the start of the SMP campaign, Niger is now witnessing what appears to be the end of endemic smallpox transmission.

The measles aspect of the program has been less successful than the smallpox aspect. Measles cases continue to occur in large numbers, and incidental reports of measles occurring in measles vaccinees leads one to suspect that a fair number of ineffective vaccinations may have been administered in the past. From the beginning of the program, Niger has been plagued with problems in maintaining an adequate cold chain for their measles vaccine, and this had undoubtedly contributed to the problem of vaccine failures and the continuation of measles in vaccinated areas. It seems perfectly possible to achieve good measles control in Niger, however, and specific recommendations concerning this will be presented in the discussion of Phase II activities.

C. Assessment

1. Description

An assessment team consisting of a team leader, an assistant, and a chauffeur was formed in May 1967, and worked under the supervision of the USAID Medical Officer. Using techniques outlined in the SMP manual, the team attempted to sample 15 villages from each Canton they assessed, timing the work so that they would arrive about a week after the villages had been vaccinated. As shown in Table XVII, about 20,000 persons have been assessed in each of the past two years.

2. Evaluation

The work of the assessment team can be criticized on two counts: the procedures used in selecting the villages to be sampled were not random (although the selection of individuals from within the villages does appear to have been random), and the total number of assessments which have been done by the team has been few.

In selecting villages to be assessed in a given Canton, the assessment team leader divided the Canton into four imaginary quadrants, and then selected villages which fell along the quadrant lines until he had sampled about 15. He tried to take equal numbers of villages from each of the quadrants. Unfortunately, this technique facilitated the selection of villages which were easily accessible.

A more serious threat to the applicability of the assessments, however, is the fact that they have been done infrequently and that they have encompassed a small geographic area. In 1967, the assessment team worked only in the months of June and December, examining about 9,000 persons on each occasion. They worked in the months of March, April, May, and December in 1968 averaging some 6,000 persons per month. Approximately 50 villages were visited in each year, but they were concentrated in only a few of the many Cantons which had been vaccinated.

Part of the reason that the assessment team has not worked more regularly is due to its being used to doing smallpox outbreak control and leprosy circuits. In addition, the vaccination teams themselves have not worked during the rainy season, except for some special projects. This involved the months of July through October in 1967 and July, September, and October in 1968.

The assessments done by the Niger team are not strictly comparable to the results reported in Table IV, "Percent with History of Jet Injector Vaccination". All of the Niger team's work was done within a week after the vaccination teams had visited the village being assessed, while the Phase I assessment teams whose work is reported in Table IV visited villages which

had been vaccinated from a minimum of a few weeks to a maximum of almost two years before.

In spite of this, the 1968 results presented in Section B of Table XVII are very similar to the results presented in Table IV, showing high POJ coverage in the under 15 age group and lower coverage in the older age groups. This correlation of assessments done immediately following vaccination with those done weeks to months after vaccination suggests that population movement in villages of under 1,000 persons in Niger is not resulting in a significant reduction in POJ vaccination coverage. This is not to say that significant population movement is not occurring, since this factor could not be judged from the Phase I assessment data. This observation suggests only that movement which is occurring must consist of a flux of persons who have approximately the same vaccination status rather than consisting of an exchange of vaccinated for unvaccinated individuals. (The Phase I assessment of Northern Nigeria also showed no significant reduction in POJ vaccination coverage over time.)

The assessment results reported by the Niger team in 1967 differ from those reported in 1968 showing uniformly high coverage rates in all age groups. While the vaccination teams may have achieved a coverage rate of 93 percent in the over 44 age group in 1967 while achieving a rate of 44 percent in the same age group in 1968 (as indicated by the Niger team's assessments), these results raise the suspicion that the 1967 assessment results were biased in the selection of villages, in the selection of persons to be assessed from within the selected villages, or in the designation of assessed persons as being POJ vaccinees. It has been observed that one of the vaccination teams has been much more successful than the others in its ability to achieve high vaccination coverage in the older age groups, and it is also possible that the 1967 assessment results were only biased in the sense that the work of this one team was over represented in the assessments which were performed.

Niger's assessment program has consisted of more than the activities of its one assessment team. The USAID advisors have been active in making field inspections of the vaccination teams, and have on at least one occasion done a POJ vaccination coverage survey in a vaccinated village. Niger was the first program to institute a check sheet to be used when visiting the teams. The sheet provides space for making comments on specific aspects of team performance, as well as for recording details of commodity use and needs.

While these activities are to be commended, there has been a tendency to make fewer field visits to the teams as the program has progressed. Only one visit has been made since August 1968, and this was one for which the vaccination team inspected was well prepared, since it was made with the American Ambassador to introduce him to the program. Since the Morphy-Richards

refrigerators were first put into use in August, this lack of team inspection has meant that the cold chain has not been inspected since the new equipment was installed, and this is most unfortunate.

A need exists to strengthen the Niger assessment program. The assessment team needs to perform assessments on a regular basis, without fear of interruption except in cases of emergency. Their technique needs to be reviewed to assure that they are working as efficiently as possible and to assure that their results are statistically valid. Their results deserve more attention than they have been given in the past, and a definite program policy of immediate revaccination of areas found to be inadequately covered is needed. The definition of "inadequately covered" will certainly vary according to the epidemiological importance of the area being assessed, but there would seem to be few areas in which the finding of less than 80 percent of the 0-4 age group having been vaccinated would not merit an immediate revaccination program.

A regular schedule of team inspections is also needed, and the check sheet that was initially devised could benefit from being made more detailed about the various aspects of team performance to be inspected. More attention could be given to the evaluation of the cold chain, and it would appear reasonable to include titering samples of measles vaccine carried by the teams as part of this evaluation.

Assessments and team inspections are going to become more difficult to perform as the vaccination programs become established on a Departemental basis. As will be discussed in detail in the section of this report devoted to Phase II activities, it is strongly recommended that a second assessment team be formed and that it be based in Zinder to cover the Departements of Zinder, Maradi, Diffa, and Agadez.

The Phase II recommendation calls for a second national counterpart and a second Operations Officer to be based at Zinder, and the assessment team would function under their supervision.

3. Summary

One assessment team has been working in Niger since May 1967 but has performed relatively few assessments, and these have been limited in geographic area. The results of assessments performed in 1968 are very similar to the results obtained during the Phase I assessment in January 1969, and suggest that whatever population movement is occurring at the village level is not resulting in an overall lowering of the vaccination coverage rates. The assessments performed in 1967 showed high vaccination coverage rates in all age groups, and are for this reason suspected of being biased.

Although frequent trips to inspect teams were made by the USAID advisors at the beginning of the program, this activity has become infrequent recently in spite of a need for close supervision of the cold chain.

A need exists to strengthen the Niger assessment program. The technique being employed by the assessment team can be improved to increase its efficiency and to make its results of greater statistical validity. Regular field trips need to be scheduled for the inspection of the vaccination teams, and the check sheets now in use could be more detailed and specific.

As is detailed in the discussion on recommendations for Phase II, a second assessment team is strongly recommended for the Niger program to be stationed in Zinder under the supervision of a second national counterpart and a second USAID Operations Officer. The team would be responsible for the Departements of Zinder, Maradi, Diffa, and Agadez.

D. Surveillance

1. Description

Each Arrondissement in Niger (of which there are 32) is required to send a weekly telegram to the Ministry of Health in Niamey reporting on the occurrence of certain infectious diseases among which are included smallpox, measles, malaria, and meningitis. The system is a negative reporting system in the sense that a report is to be submitted from each Arrondissement each week regardless of whether or not any of the reportable diseases have occurred. If a specific disease is not mentioned on a report, however, it is assumed that no cases of the disease occurred. The diseases are reported according to a numbered code in the telegrams and not by name.

In the Ministry of Health, there is one man whose task it is to collect the weekly telegrams and to make weekly and monthly reports from them. The weekly reports are mailed to W.H.O. offices in Niamey, Brazzaville, and Geneva and to the SMP office in Niamey. The monthly reports are mailed to W.H.O. and to the countries which border on Niger.

There is no standardized reporting week in Niger. The Ministry of Health makes its weekly reports every Thursday, and includes in them all telegrams received since the last weekly report. The 32 Arrondissements differ in the reporting weeks they use. In several, the week ends on Tuesday permitting them to submit their reports in time for the Ministry's report. In others, however, a variety of different days mark the end of the week.

The reports which are submitted by the Arrondissements are comprised of data gathered at the "Centre Medicale," of which there is one in each Arrondissement, and of data gathered at

dispensaries, of which there are 92 in Niger. There are thus a total of 32 plus 92 or 124 primary reporting units which are represented in the reports submitted from the Arrondissements. In addition to these reports, the country's two hospitals (one located in Niamey, and the other located in Zinder) submit their weekly reports separately as do two outpatient clinics located in Niamey (the PMI and the Caisse de Compensation Nationale).

2. Evaluation

Although each Arrondissement is required to submit a telegram each week, this system is not strictly enforced and frequent lapses occur. Quantitation of this is presented in Table XVIII, in which it can be seen that 58 percent of the expected telegrams were received in the first three months of 1967, and 32 percent of the expected telegrams were received for the five month period of August through December 1968.

The results for 1967 and for 1968 are not exactly comparable, since it is known that reporting practices vary according to the number of personnel who are on vacation, and this may have been greater during months analyzed in 1968 than in those analyzed in 1967. A second difference also exists. The results for 1967 were obtained by actual examination of the telegrams which were on file at the Ministry of Health, while those for 1968 were taken from the monthly reports submitted from the Niger program, which may not have provided data as complete or as accurate as that obtained directly from the files. (It was initially intended to obtain all the data from the Ministry files, but this was found to be so time consuming that it was abandoned after analyzing the first three months of 1967. This was due to the fact that incoming telegrams are filed in chronological order, rather than by Arrondissement, making monitoring of reporting very difficult.) The comparability of the two years aside, Table XVIII clearly suggests the need for improvement in the regularity of reporting from Arrondissements.

It should be noted that it was not until August 1968 that the Niger SMP headquarters began monitoring reporting from the Arrondissements in their monthly reports. In view of the importance of the surveillance system to the eradication of smallpox in Niger, this must be considered to be rather late in the program to initiate this activity.

Visits were made to three Arrondissements in the Departement of Niamey to enquire about the functioning of the surveillance system, and the miscellaneous observations recorded during each visit are presented below:

Filingué: Each "Centre Medicale" is headed by a Medecin Chef. Because of a shortage of physicians, many of the Centres are run by "infirmiers d'etat" (nurses who have usually had many years of experience). The Medecin Chef of the Filingué Centre

Medicale is an infirmier d'etat. There are five dispensaries which fall under the supervision of the Centre. They are asked to send reports to the Centre each week, and they do so using any bits and pieces of paper which they can find, sending the report by means of any conveyance which presents itself. If no report is received from a dispensary, it is assumed that no cases of disease occurred. These reports from the dispensaries are incorporated into the weekly report submitted by the Centre to the Ministry of Health, but they are not saved, and there is no means of reviewing the reporting performances of the dispensaries. If no reportable diseases have been reported during a given week, the Medecin Chef sends in a telegram saying "néant" (nothing).

The Medecin Chef at Filingué makes tours of the dispensaries as often as possible, supplementing the information on disease incidence which he receives by means of the written reports. He estimated that he frequently visits the dispensaries once a week, and that it was rare not to visit them at least once a month.

Ouallam: The Medecin Chef of the Centre Medicale is an infirmier d'etat. There are two dispensaries which are to submit weekly reports. One of these submits its report on Thursdays, taking advantage of the fact that there is a Thursday market and that transportation can always be found to get the report to Ouallam. If no report is received, it is assumed that no cases occurred. There was no indication that the Medecin Chef visited these two dispensaries with any regularity or frequency. As at Filingué, the Medecin Chef stated that he sent reports in each week declaring "néant" if no cases had been reported to him. (This is almost certainly not the case in fact since during January, February and March 1967, he submitted only one report of the 14 expected of him. Filingué, by contrast, submitted 12.)

The Medecin Chef at Ouallam did maintain a book of cases which had been reported weekly from the Centre Medicale and the two dispensaries. For the year of 1968, there were only 30 entries made. Since an entry is made for each week for each disease reported, it becomes apparent that the majority of cases of the various reportable diseases which are occurring are not being reported. (If cases of measles were reported during week one, one entry would be made. If additional cases occurred during week two, an additional entry would be made. If cases of measles, malaria, and meningitis all occurred during the same week, three entries would be made for that week.)

It so happened that the Arrondissement of Ouallam had reported a case of smallpox to the Ministry of Health in Niamey on January 9, 1969, and the review of surveillance procedures was made a few days later in conjunction with the investigation of the report. It appeared that the case (which in fact turned out to be chickenpox) had first been seen and diagnosed as smallpox

at the Centre Medicale on January 1, 1969. The patient was discharged from the Centre in spite of the fact that the rash was only a few days old.

When questioned concerning his smallpox reporting and control procedures, the Medecin Chef stated that he was accustomed to waiting until Monday (the day he sent in his telegrams) to report cases of smallpox, no matter on which day of the week they had occurred although he took control measures immediately. When questioned as to what these control measures might be, he stated that he vaccinated the family contacts of the case, but did not isolate it if he knew the village in which it had occurred had been well vaccinated. It was for this reason that he had not isolated this case which had come from Ouallam itself. On visiting the patient's home it was found that she had a six month old child who had not been vaccinated, and from this it was presumed that no control measures whatsoever had been taken by the Medecin Chef.

Tillabéry: The Centre Medicale of Tillabéry also has an infirmier d'etat as its Medecin Chef. Five dispensaries exist in the Arrondissement of which three usually send in reports. One of the dispensaries reports each week by telephone. The remaining two dispensaries are so isolated that they are unable to send in a report except in an emergency. Tillabéry sends in its telegrams each Tuesday, but the Medecin Chef stated that cases of smallpox or measles which are reported are passed on to the Ministry of Health immediately.

The observations made in these three Arrondissements are consistent with those made in reviewing the receipt of reports in Niamey in suggesting that the present surveillance system could benefit from improvement. Certainly every Medecin Chef should know that he is required to send a weekly telegram to the Ministry of Health whether or not cases of a reportable disease have occurred, and should be stimulated to supervise the dispensaries under him so that their reporting is as regular as possible.

As has been emphasized repeatedly, surveillance is the key to smallpox eradication. A weak system, such as currently exists in Niger, cannot assure that imported cases of the disease will be reported to Niamey (or to the appropriate health officials at the Arrondissement or the Departement level) in time to prevent the disease from spreading. Niger already has the elements of a good surveillance system, and the improvements which are needed to make it realize its potential are relatively minor. The following changes would be particularly helpful.

A standardized reporting week should be in use throughout the country. This would not only make the data more comparable over time, but would also facilitate monitoring the regularity of reporting of the various Arrondissements. It would seem

reasonable for Niger to adopt the standard W.H.O. reporting week which begins and ends at midnight on Saturday. The Ministry could continue to make its weekly report on Thursdays, stating that the week being reported was that which had ended on the previous Saturday. Late reports could be handled as they are being handled now (they are reported for the week in which they are received), but at intervals (which might vary from every month to every year) they could be assigned to their proper week, and corrected figures could be issued.

As previously mentioned, filing the weekly telegrams in chronological order also makes it difficult to monitor the regularity with which the Arrondissements are reporting. A system which has been found to be useful in other countries is to file the reports by reporting center (by Arrondissement in this case) and to maintain a separate file for each center. As each telegram was received, the data would be transferred to a sheet used to sum up all the cases of all the diseases reported for that week, and the telegram itself would be filed in one of 32 Arrondissement folders. Arrondissements for which no report was received by Thursday for a given week would automatically be sent a reminder. (A reminder is being sent from the Ministry at present, but usually only after an Arrondissement has failed to report on several successive weeks.) At the Arrondissement level, each Medecin Chef of the Centres Medicales should maintain a file on the regularity of the reporting of the dispensaries under his supervision. This could be a simple table, listing the name of each dispensary and having a place for each reporting week in which a check mark could be placed to indicate that the report for that week had been received. This system is not only useful for the Medecin Chef, but is useful for persons in Niamey when they make visits to the Centres Medicales, since they can see at a glance how conscientious the Medecin Chef has been in inducing his dispensaries to report.

At the present time, the surveillance system does not report diseases by age and sex. For smallpox, this information is obtained in the investigations which are carried out on each reported case, and for most of the other diseases this information would not be used if it were collected. For measles, however, data is needed on the age and vaccination status of the reported cases. If a measles outbreak is reported from a given Arrondissement, it is of great practical importance to know whether it is occurring in children who were born subsequent to the last vaccination campaign, in which case vaccinations would be restricted to that particular age group, or whether it is occurring as well in older children who should have been vaccinated. If it is occurring in older children, it becomes necessary to know whether these children were vaccinated and remain susceptible because of faults in the teams' vaccination technique, or whether they were missed during the campaign. The remedial action that is taken by the Ministry will depend on the answers to these questions.

It is not essential that the age and vaccination status of measles cases be reported in the weekly telegrams. It is essential that in each Arrondissement one or more centers which can be relied upon collect this information as measles cases are being seen, and that it be forwarded to the Ministry of Health at some reasonable interval of time. During the current evaluation of the Niger SMP, a measles reporting form was designed and distributed to two clinics in Niamey as a trial. If used as intended, it would provide all necessary information on measles cases without imposing an unrealistic work load on the person charged with filling it out. It is suggested that either this form (an example of which is found on the following page), or one which is found to be more suitable on the basis of experience in the clinics, be used as widely as possible so that the necessary information may be obtained.

One final suggestion regarding surveillance: the Ministry of Health might wish to consider changing from a reporting system based on a numerical code to one which, at least for smallpox, uses an abbreviation of the name of the disease. In several of the countries of West Africa, Niger among them, hours and days of valuable time have been spent in tracking down a case of "smallpox," only to find that a secretary has made a typing error and that the disease which had actually occurred was not smallpox at all. "Spox" in English or "var." in French would not significantly increase the cost of the telegram, but would help to minimize typographical errors. (There will still be instances where a case reported as smallpox will be found on investigation to be something else, such as chickenpox or measles, but this type of error is unavoidable.)

3. Summary

A weekly telegraphic report is expected from each of the 32 Arrondissements in Niger giving the number of cases seen of several infectious diseases among which are included smallpox, measles, malaria, and meningitis. A telegram stating "neant" is expected if no cases of a reportable disease are seen in a given week.

Inspection of the records in the Ministry of Health in Niamey and visits to three Centres Medicales in the Departement of Niamey suggested that improvements could be made in the regularity and completeness of reporting. It is suggested that the Ministry of Health might wish to consider adopting a standardized reporting week for the entire country (perhaps using the weekly system recommended by W.H.O.), and might wish to file incoming reports in such a way as to facilitate checking on the completeness of reporting from the Arrondissements. The Arrondissements might similarly maintain their records so that the regularity of reporting of their various dispensaries could be checked on. The age and vaccination status of reported measles cases is needed (although not on the telegraphic report), and a possible

REPUBLIQUE DU NIGER

MINISTERE DE LA SANTE
ET DES AFFAIRES SOCIALES

Direction de l'Hygiène
et
de la Médecine Mobile

Section Variole/Rougeole

R O U G E O L E

RAPPORT HEBDOMADAIRE

Nom du Centre: .....

Semaine se terminant le: .....

.....
(Signature)

AGE	VACCINE CONTRE LA ROUGEOLE (Sur les deux bras par Pistolet)		NON-VACCINE	INCONNU
	Il y a moins de 2 semaines	Il y a plus de 2 semaines		
0 à 5 mois				
6 mois à 2 ans				
2 ans à 4 ans				
5 + ans				

Instructions: Indiquer chaque cas de rougeole avec an trait dans la correcte case ci-dessus. Chaque 5 cas doit être indiqués comme ca:

Ce rapport sera rassemblé tous les .....

mechanism for obtaining this data is suggested. It is also suggested that smallpox not be reported by numerical code, since in several countries of West Africa this practice has led to valuable time being spent in investigating cases of some other disease which a typographical error has transformed into smallpox. "Spox" in English or "var." in French are suggested alternates to the numerical code.

E. Outbreak Investigations

1. Description

Six smallpox outbreak investigations were reported in 1967 and six during 1968. All but one of these were conducted by one and sometimes both of the USAID advisors, usually in the company of the "Responsable Nationale" of the Niger SMP. Appendix III contains the form which the program has devised for these investigations. Since June 1968, all reported cases have been investigated usually within a few days of receipt of the report. (During the assessment, a new investigation form based on that used in Ivory Coast was adopted by the program.)

2. Evaluation

In reviewing the reports which have been made by the Niger SMP on outbreaks of smallpox, it becomes evident that the quality of the reports improves as more experience is gained in doing investigations. Three of the four most recent investigations have been done by the Operations Officer, and are noteworthy in containing scar surveys of the population in which the outbreak occurred in addition to containing information about the age, sex, vaccination status, and probable source of the cases themselves. The work up of the epidemic in Tessaoua in July 1968 was particularly outstanding in this regard.

The importance of outbreak investigations increases, however, in inverse proportion to the number of smallpox cases which are reported. Niger is now at the stage where each investigation must be expertly done. In the first place, specimens should be taken from all suspect cases to have the diagnosis (smallpox or not) verified in the laboratory. Specimens have not been routinely submitted on all outbreaks in the past. In the second place, every effort needs to be made to identify the probable source of the outbreak and to identify geographic areas and specific persons who might be capable of maintaining the outbreak. In this regard, detailed histories of patient contacts are needed, and visits to members of the patient's family should be a routine part of every investigation. If it is not possible to identify the source of the outbreak at the first visit, experience in certain of the other countries has suggested that it is useful to ask local health personnel to remain in the area (for several days if necessary) to be certain that all possible information has been obtained.

It is also important that a nucleus of persons be trained who can carry out competent investigations and who can continue to operate effectively on the departure of the USAID advisors. While this must in large part be done by personal example and instruction, it is suggested that thought might be given to revising the outbreak investigations form now in use to make it more detailed in instructing the investigator in exactly what steps are to be taken so that the form itself becomes a teaching device. It might be possible to award certificates of competence to health personnel who can carry out satisfactory investigations. These certificates could be subject to yearly renewal on the basis of an examination, or could merely be withdrawn if the person in question turned in an unsatisfactory performance.

The experience in investigating the report of smallpox in Ouallam, in which it was learned that the Medecin Chef delayed sending in the report until the end of the reporting week and that the suspected case was sent home from the clinic with no attempt being made at isolation or vaccination of susceptible contacts, also highlights the desirability of formulating a specific set of instructions which the Medecin Chef is to follow on being informed of a smallpox case, and of assuring that these are disseminated and understood by the persons for whom they are intended.

3. Summary

Twelve outbreak investigations have been reported in 1967 and 1968. They have showed improvement as more experience in doing them has been gained. The importance of these investigations, however, increases as the number of reported smallpox cases decreases, and Niger is now at a point where each investigation must be expertly done. It is suggested that emphasis be placed on collecting specimens for laboratory analysis for each case or outbreak investigated and on locating the probable source and most likely areas of future spread of the disease. It is desirable to build up a nucleus of persons who can carry out competent smallpox investigations, and it is suggested that a more detailed smallpox investigation form might be of help in this regard. The awarding of certificates of competence in smallpox investigation might also provide a stimulus to learning the needed skills as well as to maintaining them if the certificate were renewed annually, or were withdrawn if an unsatisfactory investigation was submitted.

F. Health Education

Although the Niger SMP has used posters and has had publicity in radio broadcasts and in newspaper articles, the health education activity which has been of most importance to the program has been the advance notification of the villages. As described in a previous section, this has usually worked well where the Chef du Canton has been able to supply horsemen as "advance men," but has not been so

successful where horsemen have not been available or where the Chef du Canton has not been entirely cooperative.

The program might wish to consider devising materials which would help to enlist the wholehearted support of the Sous-Prefects and Chefs du Canton since so much of the program's success depends upon their cooperation. One might be able to develop an illustrated brochure explaining the need to achieve high levels of vaccination coverage in the population and outlining the steps these officials could take to assure that the highest possible coverage was achieved. Similar materials might be devised which would help to stimulate dispensaries and Arrondissements to send in their reports regularly, and which would instruct the various Medecin Chefs on what steps to take on learning of a case or a suspected case of smallpox in the area. There would seem good reason to hope that the health educator from the Regional Office might be able to offer specific help in these projects and that materials might be developed which would (with minor modifications) have wide applicability throughout the West African region. It is suggested that the Niger program pursue this matter further.

G. Team Training

As described in the Niger document presented at the Accra regional meeting (Report on Niger, January-June 1967), a two-week training course was given to seven teams (consisting of about 20 persons) in early 1967. The majority of the team members had previously worked on leprosy teams, and were familiar with the basic requirements of mobile teamwork in bush areas. The training course emphasized familiarization with the POJ, use and conservation of the vaccines, use and maintenance of the trucks, and techniques of crowd control. As the first vaccination campaign in Niamey demonstrated, more practice was needed before the teams were prepared to handle the crush of people which swarmed upon them, and this practice was provided during the remainder of this campaign. During the first few months of the program, both the O.O. and the M.O. made frequent trips to inspect the teams and kept notes on team performance which they had observed. A review of these indicated that within a short time the teams were working well, their main difficulties relating to the cold chain over which they had no control and to advance publicity (particularly in small villages), a problem which was largely solved by increased use of horsemen for this task. Unfortunately, no inspection of the teams was made during this current assessment so that no further information on the adequacy of their performance is available.

H. Program Management

1. Planning and Organization

Niger has experienced some delays in completing the attack phase of the program. This was initially scheduled to occur in July 1969, and is now expected to occur between October and

December 1969. In a review of program progress made by the Operations Officer in July 1968, a comparison of vaccinations performed with vaccinations actually reported revealed that the program had given approximately 80 percent of the vaccinations (both smallpox and measles) which had been projected for FY 1967 and FY 1968. In view of the delay which occurred in the arrival of many of the program commodities (particularly the trucks, many of which did not arrive until May of 1967) and of the many vehicle breakdowns which have occurred, the ability of the program to keep this closely to its original schedule must be viewed as a tribute to the teams as well as to those who were able to provide them with support from Niamey.

The USAID advisors have done a good job of adjusting to working conditions which were, and in some aspects remain, frustrating. Although the vaccination teams were described in the ProAg as being exclusively SMP teams, it soon appeared that their services were needed to perform a certain number of leprosy circuits each year and that they could also be called upon to do meningitis epidemic control. The advisors were placed in a difficult position since the person who served as their counterpart (the "Responsable Nationale") was not a physician but an "Agent Technique," and this placed him and the program at a disadvantage in trying to assure that the teams' vaccination activities would be compromised as little as possible. It is to the credit of all concerned that in spite of some initial frictions a warm working relationship has been established between the advisors and the Ministry of Health, and team schedules have been agreed to which have permitted the teams to function as more than SMP teams without sacrificing the goals which had initially been set for them.

An additional factor which has made the advisors' work difficult is the fact that the Responsable Nationale is not available full time to the SMP, but is also the official public health education spokesman for the Ministry of Health on Radio Niger. While this position carries certain logical advantages for the SMP, it also accounts for an estimated 15 percent of his working time. He is also the Responsable Nationale for meningitis in Western Niger, meaning that during the epidemic season (usually during December and January) he may be involved with verifying cases and organizing control activities. Happily, 1968 was a light year for meningitis and very little time was taken with this duty. These extra activities which the counterpart performs are not an indication of lack of interest in the SMP by the Ministry of Health, but are rather an indication of the paucity of well-trained health personnel who are to be found in Niger. With the establishment of the Departemental health teams, it is expected that the Medecin Chef of each Departement will be able to take over the meningitis activities now being performed by the Responsable Nationale.

A last frustration being faced by the program is created by the nature and location of their office and warehouse space. Both

are located in the building used by OMNES I and while this has great advantages in that SMP personnel are in direct contact with the OMNES personnel who have responsibility for the SMP, this also creates chaos in the office, particularly when the OMNES team is in town, for the office is continually filled with a variety of persons who make it extremely difficult to concentrate and to work effectively. The warehouse is conveniently located next to the office but is unfortunately so small that many commodities clutter the office for lack of room in the warehouse, and others are left outside where dust during most of the year and rain during some of it take their toll.

While the program deserves credit for the success it has achieved, weak areas also exist and should be mentioned. The measles program does not appear to have been well handled. Measles has returned to Niamey in 1969 simply because no mass campaign has been done since 1967. If the fact that measles would return was not well appreciated by the Ministry of Health, it certainly should have been well appreciated by the USAID advisors. The few measles vaccinations which have been done more or less weekly at the various child health clinics in Niamey have apparently been poorly done, since many cases of measles were being reported in Niamey children who had allegedly received measles vaccine at these clinics. Since the refrigeration facilities in Niamey are excellent, one is lead to suspect that a problem existed with the technique employed by the vaccinators. This suspicion is supported by comments made by physicians and nurses assigned to these health clinics who alleged that the vaccinators who came to give the measles vaccine were not at all conscientious, often arriving several hours after the time they were supposed to begin and many times forgetting to bring either smallpox or measles vaccine so children not infrequently got only one of the two vaccinations intended for them. In addition, it was said that the vaccinators did not always employ the recommended system of giving smallpox in the left arm and measles in the right arm but at times appeared to be vaccinating indiscriminantly. Part of the problem is attributable to the fact that the personnel who were used to giving vaccinations in Niamey were often volunteers sent to the program by the Ministry of Health. Several of these volunteers were such poor workers that the vaccination teams did not wish to have them encumbering them en brousse, and it was these volunteers who remained in Niamey to give the vaccinations at static health facilities.

Outside of Niamey, problems in maintaining the cold chain for measles vaccine have proved to be extremely vexing. The C80 freezers were so large that they could not be carried on the trucks along with the gasoline and equipment needed by the teams. Even where they were placed in a central location, the teams were forced to return to them every two days because the isothermic boxes were of such poor quality that they could not maintain measles vaccine for longer periods. The Operations Officer indicated that prior to the arrival of the Morphy-Richards

refrigerator (August 1968) all the measles vaccinations which had been given could be held suspect. While this may be an overstatement of the seriousness of the problem, it is surprising that the use of measles vaccine was not more sharply curtained until an adequate cold chain could be assured, and surprising that samples of unused vaccine were not frequently taken from the teams to be titered for potency. While the arrival of the Morphy-Richards refrigerator has undoubtedly improved the situation, it would seem mandatory to check on this both by inspecting the teams and by titering samples of their vaccine.

Measles in vaccinees was reported from the Arrondissement of Tera in March 1968. Tera was visited by the M.O. and the Medecin Chef of the Departement of Niamey where they saw eight cases of measles in children who had allegedly been vaccinated against measles when over the age of six months and who had fallen ill two to three months after having been vaccinated. Seventy-five other cases were reported in vaccinees but were not seen. The M.O. ascribed this occurrence to loss of potency of the vaccine secondary to the use of iodine for sterilizing the POJ's. In retrospect, this appears to be too facile an explanation in that even if no flushing of the POJ had been done following iodine sterilization, this number of vaccine failures is much more than would have been expected. Although the refrigeration facilities at Tera are good, it would have been worthwhile to check on the potency of the vaccine used (if any was available that long after the vaccinations had been performed) or at least to check on the potency of vaccine then being carried by the teams. Since these cases in vaccinees may not have been related to either problems in the cold chain or to iodine sterilization, an increase in frequency of inspection of vaccination team activity was warranted at that time.

(As an aside, it should be noted that the practice of iodine sterilization was stopped following the Tera investigations; yet from Niamey and other areas, cases of measles continue to be reported in vaccinees. As mentioned in the report of the Phase I assessment of Western Nigeria, the practical alternative to iodine sterilization is no sterilization since no teams yet inspected in West Africa have conscientiously boiled the injectors following each contamination, and the vast majority of "sterilizations" performed by boiling have been ineffective either because the parts were not boiled for a sufficiently long period or because gross contamination of the injectors occurred when the sterile parts were reassembled. Thus it might be well for Niger to review its policy with regard to this procedure. In this regard, Atlanta has been remiss in not providing additional data and a final recommendation on the status of iodine sterilization, an issue which has been pending since July 1967.)

A second area of program weakness has been the lack of separation of the roles of the M.O. and the O.O. In the beginning of the program, there was little choice in the matter: both USAID

advisors did their utmost to get the vaccination teams fielded, and this involved doing a wide variety of tasks for which both advisors were qualified. Ideally, as the program got underway the overlap in the two roles should have diminished with each person specializing in those areas in which he was expert. In fact, however, the overlap in roles remained fairly constant with the result that neither advisor contributed to the program the full extent of the skills at his command.

The measles program certainly offers a rich field of endeavour for the M.O. An adequate measles maintenance program remains to be developed. Data on measles incidence is available in many of the dispensaries and Centres Medicales in Niger which would be valuable from the point of view of determining the frequency with which epidemics of measles strike localities of varying population density, and which would be valuable in vaccinated areas from the point of view of determining the duration of the protection conferred by the campaign. The upgrading of the surveillance system is a priority need, both to assure that all cases of smallpox are picked up and to assure that data will be available on the age and vaccination status of measles cases which (in combination with the data gathered from dispensaries) will permit better planning of measles vaccination campaigns to be done. Much more could be done in the way of determining the smallpox immunity status of populations in isolated areas. Surveys for vaccination, variolation, and smallpox scars are not difficult to do, and it might be possible to interest the Peace Corps or other groups which might have contact with population groups of special interest (such as the Touareg or the nomads who frequent the shores of Lake Chad) to perform such surveys in villages or markets in which they happen to be. The status of variolation could be further clarified in Niger. (Is it done solely from fresh cases, or are crusts occasionally saved for this purpose? If they are occasionally saved, who would have them? etc.) The technique used for outbreak investigations and the assessment program need to be improved and could merit from the M.O.'s attention.

In the O.O.'s field, much remains to be done in the way of tightening up the record keeping systems so that planning can be made on the basis of past experience. When the inventory system used by SMP Niamey was inspected during this assessment, it was found that certain of the items which were present according to the cardex files could not be located on the shelves. It developed that the inventory records had not been carefully maintained for approximately six months. With the program in its present advanced stage, commodity requests for FY 1970 should be based on usage of parts during FY 1968 and FY 1969, yet the inventory records which were reviewed were not in a state which suggested that this would be done.

Tighter control over the teams might be exercised if data were maintained which permitted a running account to be maintained of

days worked per month per team and of the number of smallpox and measles vaccinations averaged per day per team. The Niger report presented in Abidjan showed an estimate of 20 days worked per month per team. During this assessment, data was reviewed on five of the vaccination teams during variable periods of time between February 1967 and December 1968. It was calculated that the five teams could potentially have worked 2,525 days during this period and that they actually worked (or rather were absent from Niamey, which would include traveling time as well as vaccinating time) 1,209 days. This is approximately 48 percent of the potential time that they could have worked (excluding the months during the rainy season when vaccination activities are halted) which would mean that on the average they would have worked about 14 days out of every 30. This information is needed to make sound estimates for future programs, and is also needed if one wishes to determine what effect the leprosy circuits have had on the vaccination program.

Another example is of vaccine usage. Since the beginning of the SMP in 1967, 2,554,397 smallpox vaccinations were reported during which time 3,275,000 doses of smallpox vaccine were apparently used. This works out to a smallpox vaccine wastage factor of 22 percent, and it would be instructive to learn what factors are playing a major role in this waste. Very similar wastage figures are found for measles vaccine: 394,806 vaccinations were given with 490,000 doses of vaccine, a wastage factor of about 19 percent. From the present information, it is not possible to tell whether this represents large waste by some teams and little or no waste by others, whether this represents vaccine lost because of poor storage, or whether the tally figures themselves are accurate enough to permit any such calculations of vaccine usage. It is noteworthy that in the PlanOps for FY 1969, the amount of vaccine requested matched exactly the number of vaccinations that were projected with no apparent allowance being made for vaccine wastage.

One project which has recently been begun by the Operations Officer and which should have great utility is the keeping of vaccination records by Arrondissement. Along with the number and type of vaccinations performed by village, these records will contain village population estimates and the results of any assessments performed. Up to now the teams' tally sheets have been filed by team in chronological order, and it has been extremely difficult to trace back to find if and when a particular village in a particular Canton was vaccinated. The current system should make this information easily found, and should facilitate the analysis of the effect of the program on measles incidence in various areas.

2. Commodities

Niger's most significant commodity problems have had to do with refrigeration and vehicles. The correspondence on the former

subject has been long and frequently anguished: the C-80 freezers were delayed in their arrival, and found to be unsuitable for Niger when they finally did arrive. The isothermic boxes which were sent from Atlanta were found to be flimsy and not capable of holding ice for more than 24 hours. A Morphy-Richards butane refrigerator was sent to Niger for testing in November 1967 and was found to be satisfactory. On November 27, the Niger program submitted a memo requesting that eight of these refrigerators be purchased. It was not until August 1968 that these refrigerators finally did arrive, and the period between was characterized by increasingly frequent and increasingly forceful demands from Niger that their refrigeration needs be adequately met. This culminated in April and May 1968 when Ambassador Ryan himself became involved, since the issue was by this time causing the U.S. Mission acute embarrassment in their relations with the Ministry of Health.

It is instructive that no specific action was taken on Niger's original request for the Morphy-Richards refrigerators until April 11 when Niger sent a cable specifying their urgent need for them. This lapse of almost five months is attributable to a "communications gap" which has been a very real facet of SMP operations in West Africa since the beginning of the program. It is evident that Atlanta was not aware of the seriousness of Niger's problem until the receipt of the telegram of April 11, and evident that the Niger SMP thought that action was being taken on the basis of their November request. There is little doubt that the original request should have been more direct and more forceful. It read:

> "If purchase can be made, 8 Morphy-Richards butane refrigerators would greatly enhance the operational ability of Niger SEP teams, and enhance team morale."

There is also little doubt that someone in the R.O. and/or in Atlanta should have picked this up and acted upon it when the memo was received in December.

It is also instructive that after work was initiated in April, exerting what must be presumed to be maximum program effort, it took four months to get the refrigerators to Niger of which a few days only were consumed by their shipment by air freight. While there are many instances in which commodities (some as large as axles) have arrived within a few days of the request being made, most field personnel expect that urgent needs can and will be met very quickly. Examples such as the lead time required on these refrigerators should serve as reminders that there is no substitute for good planning and that the commodity orders which are placed each fiscal year are deserving of the most meticulous review by those making them.

A shortage of vehicles has existed since the beginning of the Niger program when one of the USAID advisor's vehicles was given to the assessment team for whom no vehicle had initially been provided. In February 1968, one of the team trucks was "totaled" in a head-on collision, and the USAID advisors' remaining vehicle was used as a replacement. No vehicles have arrived in Niger since the spring of 1967 when the initial shipment was completed. None are anticipated until May 1969 (and possibly later) when three are scheduled to arrive. Thus the program will have been short one vehicle for two years and short two vehicles for over one year. Although the three vehicles which are expected will ameliorate the situation, the Niger roads have taken their toll on the vehicles now in use, and they will be needing replacement in late 1969 or in early 1970. It is suggested that the program anticipate this need in its FY '70 commodity requests, since trucks ordered for FY '70 should not be counted on before the beginning of FY '71.

One commodity which has been in oversupply in Niger is the Honda motor-bikes. Realizing before they arrived that they would be of little use en brousse because of the sandy terrain for which they are not well adapted, the Niger program asked that their shipment be reduced. Although the bikes were physically in Abidjan at the time the request was made, their fate was apparently immutable and they duly arrived in Niger. Once having been accepted by the Ministry of Health, it became difficult to arrange for their transfer to countries which had a demonstrable need for them. After fairly lengthy negotiations, four motor-bikes were transferred to the Upper Volta program leaving eight in Niger. At the present time, one of these is with the Departemental team in Maradi, and the seven others are used in Niamey by the vaccination team leaders and the USAID advisors.

3. Summary

a. Planning and Organization

The Niger SMP is approximately six months behind schedule for the completion of the attack phase. In view of the fact that many of the commodities arrived six months late, and in view of the difficulties of carrying out a vaccination program in a country such as Niger, this delay is smaller than might have been expected. Two major areas of program weakness are: (1) the measles program, in which more attention needs to be devoted to designing adequate maintenance vaccination programs and in clarifying the problem of measles occurring in vaccinated children, and (2) the lack of separation of the roles of the M.O. and O.O. leading to neither advisor contributing as many of the skills which he was in a unique position to offer the program as might otherwise have been possible.

b. Commodities

Niger has had major problems with refrigerators and is currently facing an acute shortage of vehicles. The long lead times which are required to get commodities shipped by sea to the country need to be taken fully into account in placing orders so that commodities are ordered as far in advance as possible and sufficient numbers of parts are provided.

Relationships

Good working relationships have been established with the Ministry of Health in spite of minor frictions which occurred at the beginning of the program. The USAID advisors have worked hard at training others to take over the program on their departure, and have done a good job of stimulating the interest of the Responsable Nationale in the program. The AID Operations Officer felt that he was not being adequately informed about the program, and this has been remedied by circulating a weekly SMP reading file to the Embassy. Niger has felt that the R.O. and Atlanta have not provided the program with the support it could have used. They would prefer that more frequent visits be made in the future so that headquarters personnel could gain an on the spot impression of program problems and review certain aspects of the program in depth at each visit.

I. International Coordination

1. Discussion

The Niger SMP has been one of the most active in West Africa in pursuing the implementation of policies of international coordination. An official report of the Niger SMP had been prepared in April 1968, containing certain specific policy suggestions. This report was read by the President of Niger who complimented the personnel involved with the program and stated that he approved of the suggestions which had been made. In addition, he asked that a series of letters be prepared for his signature proposing joint measures of action to be sent to the countries involved. The original letter was sent by the President on May 31, 1968, but was unfortunately not transmitted to OMNES or to the SMP and therefore remained unanswered until a follow-up letter was sent on July 24, 1968.

On August 5, a reply was made to the President which was drafted by the Responsable Nationale of the SMP. It suggested that the involved countries (Upper Vola, Mali, Dahomey, and Nigeria) cooperate by vaccinating their joint borders at the same time during the attack phase and placing vaccinators at all entry points from neighboring countries. During epidemics, it suggested that vaccinating teams should be permitted to penetrate up to 50 kilometers into bordering countries (after having

notified the administrative authorities) to vaccinate nomadic groups and other susceptibles who otherwise would constitute a threat from the point of view of maintaining the epidemic. In addition, it suggested that all information on outbreaks of either smallpox or measles should be transmitted to the responsible health officers in the concerned countries and that these officers should also be notified of movements of nomadic groups crossing the frontier into their territory.

At present, the Ministry of Health of Upper Volta has approved of these suggestions, but approval has not been forthcoming from the Ministry of the Interior. As far as is known, no other countries have replied to the letter. The major problem appears to be with approving the suggestion of permitting vaccination teams to penetrate up to 50 kilometers into neighboring countries. Since this suggestion is of less critical importance to the achievement of smallpox eradication than is the suggestion concerning cross notification of border outbreaks and nomadic movements, it would seem wise at this time for the Niger SMP to draft another letter to the President of Niger informing him of the progress so far made and suggesting that Niger make an amended proposal which drops the question of mutual border penetration by vaccination teams but which emphasizes the need for an effective cross notification system.

It should be stressed that telegraphic notification should be made officially by the Ministry of Health of the involved country to the Ministry of Health of the threatened country, with a copy of the telegram being sent to the specific medical officer in charge of the affected area. To aid the Ministries in this, it would be helpful for each country to prepare and distribute a list of the telegraphic addresses of the medical authorities to whom such notifications should be sent. Niger could distribute its own list with the President's letter.

The Niger SMP has had several fruitful meetings with health officials from both Upper Volta and Mali to discuss possible approaches to the border control problem, and it is hoped that this kind of activity will be continued. Unfortunately, Niger has thus far had no success in arranging similar meetings with Nigeria whose Northern frontier is Niger's greatest smallpox importation hazard. The first request for such a meeting occurred in March 1968, and was made to the Federal Ministry of Health by the Nigeria SMP acting on the request of the Niger SMP. The Federal Ministry of Health asked that such requests be made instead through the Niger Embassy in Lagos, and as yet no repeat request has been made.

The Niger program did have an opportunity to meet informally with the Northern Nigerian SMP in the fall of 1968. No trip was made, however, since Atlanta did not give the approval necessary to permit international travel. The cost of the trip was negligible since it involved driving to Kaduna from a nearby point in

Niger which needed to be visited in any case, and it is apparent that Atlanta had misinterpreted the purposes of the proposed visit. This can also be attributed to the "communication gap" which has been previously mentioned. It is hoped that the Niger and Nigeria representatives will be able to discuss their border problems productively at a meeting sponsored by W.H.O. in May 1969. Failing that, the Niger program should submit an official request to visit Nigeria through the Niger Embassy in Lagos.

2. Summary

The Niger SMP has been one of the most active in West Africa in pursuing the implementation of policies of international coordination. The President of Niger has given his active support to suggestions made by the program on this subject. There appears to have been reluctance on the part of the Governments of Upper Volta, Mali, Dahomey, and Nigeria to accept the suggestion that vaccination teams be permitted to penetrate up to a distance of 50 kilometers into neighboring countries in doing outbreak control work. It would seem wise at this time for Niger to submit an amended proposal which drops the question of penetration but reemphasizes the importance of cross notification.

J. Cost

Tables XIX through XXI present an analysis of the cost of the Niger SMP and compare it with the costs of the Gambia, Northern Nigeria, and Western Nigeria programs calculated from figures obtained during assessments of these programs made during 1968. As shown in Table XIX, USAID has born the costs of about 78 percent of the Niger program, the Government of Niger contributing about 18 percent and W.H.O. contributing about 4 percent (for gasoline and vehicle maintenance).

Niger's large size and its relatively low population density have made it more expensive to operate than the programs in Nigeria when analyzed on a per capita basis as is done in Table XXI. Niger has spent $141,000 on its own personnel since the beginning of the program. The program staff is similar to that of the Western State of Nigeria, who has spent $136,000 in salaries and technician support of other kinds. Whereas the Western State was able to give over 10,000,000 smallpox vaccinations, the Niger program was able to give only about 2,600,000. Another factor which has increased the cost per vaccinee of the Niger program is that the vaccination teams are engaged in leprosy circuits for a part of their time and are able to perform very few vaccinations during the months of June through September because of the rains, and Niger shares with Northern Nigeria a period of inactivity during Rhamadan, an Islamic month of religious fasting. The Gambia, whose small size has reduced the efficiency of its program, has costs which on a per capita basis are very similar to those of Niger.

V. PHASE II ACTIVITIES

A. Current Plans

Niger is currently in a period of transition with regard to the organization of her health services. The OMNES teams will be disbanded in 1971, and their personnel will be used to strengthen mobile health units which are currently being established in the country's seven Departements. At the present time, these Departemental units are understaffed and are not able to carry out all the functions which should be possible in two years. Phase I vaccination activities have been carried out for the most part by six vaccination teams which were initially based in Niamey. As the Departemental mobile health units were built up in Zinder and Maradi, one of the vaccination teams was permanently assigned to each of these Departements where they have worked to complete Phase I vaccinations.

Maintenance (Phase II) activities are being planned on a Departemental basis. The Departemental mobile teams are expected to vaccinate the entire population of their area against smallpox once every two years, and to vaccinate the measles susceptibles population (children between six months and four years not vaccinated during the last passage of the vaccination teams) "regularly". When these teams are fully formed (hopefully in the fall of 1971), it is anticipated that they will be able to cover their areas in one to two year cycles. At present, some Departements will have difficulty in completing a three year cycle, and the four vaccination teams which are currently stationed in Niamey will be used to supplement the activities of the Departemental teams to assure that a three year cycle is maintained. It is anticipated that each of the Niamey teams will be assigned to assist one Departement with its vaccination program. The Departements of Niamey, Dosso, Tahoua, and Agadez would be covered in this way, the Departements of Zinder and Maradi being covered by the teams already stationed there, and the Departement of Diffa being covered by the Peace Corps mobile team.

Static health facilities are also expected to play a role in the maintenance program. Dispensaries have been issued a supply of multiple pressure smallpox vaccine, and the dispensors have been instructed to assure that all newborns in the area are vaccinated. They are expected to send in monthly tally forms showing the number of vaccinations performed by age and sex. (While the involvement of dispensaries in this way is to be commended, they see only a small fraction of the country's population and the brunt of maintenance activities must fall on the vaccination teams.)

B. Government of Niger Support for Phase I Activities - Potential for Phase II Support

Niger has meagre resources for health. The personnel who were used for the smallpox measles vaccination and assessment teams formerly comprised mobile leprosy diagnostic and treatment teams. As previously mentioned, there were no personnel who took over the leprosy

work, and the only part of their previous work now being done is that which the SMP teams do in addition to their regular vaccination activities. A second example of Niger's limited resources is the fact that they have been unable to pay for the gasoline and vehicle maintenance necessary for the SMP and that these expenses have been taken on by W.H.O. This has amounted to some $32,000 since the beginning of the program. The Ministry of Health has also requested that W.H.O. provide salaries for 15 vaccinators for the vaccination teams. This assistance was needed when the Government of Niger stopped paying the salaries of personnel not officially listed on the Government roles. (At the present time this request has received the approval of the W.R. in Niger, but no word has been received from the Brazzaville Regional Office.)

The Smallpox Measles Program represents Niger's most important activity in preventive medicine, and they have supported it strongly within the limits of their capabilities. The President's desire to help in the establishment of better international coordination is one example of the interest which has been taken in the SMP, and the willingness of the Ministry of Health to finance two trips to Lagos for the SMP Responsable Nationale to attend meetings on smallpox eradication is another. The major emphasis of the Departemental teams will be on vaccination, which is clearly viewed by the Ministry of Health as being one of the most effective and most efficient ways available to improve the overall health standard in the country. The teams will be giving yellow fever and BCG vaccine in addition to smallpox and measles vaccine, and the effort will be made to keep vaccination teams on the road for the maximum possible time by rotating members of the team with members serving in the static portion of the Departemental health unit. The Government has been impressed with the job the program has done with smallpox, and is enthusiastic regarding the potential of the measles program, although disappointed about its modest success to date.

As will be discussed in the recommendations for USAID support of Phase II activities, the Ministry of Health was very receptive to the suggestion that a second senior Nigerien be assigned to the SMP and that a second assessment team be formed (providing some help would be forthcoming from W.H.O. for the team's support). It is believed that they will continue their willing support of the program during Phase II, which they recognized as being more difficult and challenging than was Phase I.

C. Recommendations of USAID Support of Phase II

It is recommended that USAID continue its support of the Niger Smallpox Eradication/Measles Control Program. Niger could not at this juncture continue the program alone, and maintenance phase vaccinations must be carried out if the gains of the past years are not to be lost.

It is suggested that the program establish goals similar to the following for Phase II:

Vaccination Activities: The vaccination of the entire population of Niger against smallpox in a cycle lasting not longer than three years. By far the most important component of this vaccination activity is the vaccination of those born since the last passage of the teams. The Ministry of Health has advised, however, that they predict limited success for a vaccination campaign directed only at children, since it is difficult to convince the village populations to bring certain persons for vaccination if everyone in the village is not asked to turn out. As the Departemental teams become better established, better health education may be feasible, and a selective campaign more successful. The fact that smallpox immunity rates in the over 44 age group are considerably below the desired lower limit of 80 percent also suggests that an additional vaccination cycle directed at the entire population would be useful.

In addition to a vaccination cycle which would assure coverage of the entire country every three years, certain zones in the country should be established as "high priority" zones to be vaccinated every one or two years. These would be areas where the occurrence of smallpox outbreaks in the past or a rapid turnover of population indicated that an increased risk of smallpox introduction was present. Such areas would need to be established for each Departement on the basis of consultations with Departemental health personnel and an analysis of the past behaviour of smallpox in the areas in question. Information on smallpox immunity levels provided by the assessment team would also be relevant in this regard.

Measles vaccination should continue to be given to children between six months and four years of age who have not been vaccinated previously. As with smallpox vaccination, however, certain zones of priority must be established in each Departement within which vaccination cycles of shorter duration of three years can be realized. Major cities should be vaccinated on a six month cycle, and as large a part of the Departement as possible should be vaccinated on a yearly cycle. Zones which are vaccinated less frequently than this will experience only modest reduction in their measles incidence.

Surveillance: Suggestions have been given in the section devoted to the surveillance system on how the system might be improved. It is suggested that the program set for itself the goal of receiving 80 percent of the weekly reports expected from the Arrondissements, with the Arrondissements receiving 80 percent of the reports that they expect to receive from the dispensaries under them. Certain selected health facilities (at least one per Arrondissement) should report measles cases by age and vaccination status, and continual efforts should be made at increasing the number of facilities reporting in this manner. Every case or suspected case of smallpox which is reported should be investigated by the Medecin Chef of the Departement, and specimens should be collected from every case or outbreak in which the patient(s) still have scabs at the time of investigation.

Assessment: A formal assessment of POJ coverage, vaccination scar rate, and overall smallpox immunity (as previously defined in this report) should be made at least once in each Departement each year. The Medecin Chef of each Departement should inspect the vaccination teams under his supervision at least once per month and turn in a vaccination team inspection sheet (on which the results of his visit will be noted) to SMP Headquarters in Niamey (or Zinder). Each Departemental team should be inspected at least every six months by SMP headquarters staff. The frequency of both the Departemental and the headquarters staff inspections should be increased as warranted by the findings of these inspections.

The number of current program staff is not adequate to achieve the goals outlined above, and it is recommended that an SMP unit be established at Zinder consisting of a Zinder Responsable Nationale, an O.O. (USAID), and an assessment team consisting of a team leader, an infirmier, and a chauffeur. In informal discussions, the Ministry of Health agreed to provide an "Agent Technique Sanitaire" as the Responsable Nationale and an "Infirmier Qualifie" as the leader of the assessment team, if USAID could provide an O.O. and two vehicles (and perhaps three if the Responsable Nationale and the O.O. would be impeded in their activities by having to share a vehicle), and if W.H.O. would provide the salaries for the infirmier and the chauffeur for the assessment team. The Zinder unit would be responsible for the Departements of Zinder, Maradi, Diffa, and Agadez, and for providing a liason with Northern Nigeria. More specifically:

They would be responsible for logistic supply and general supervision of the teams operating in the Departements of Zinder, Maradi, Diffa, and Agadez. This would entail the setting up and maintenance of a spare parts and vaccine pool in Zinder and inspection of the vaccination teams as frequently as possible.

They would supervise the Zinder-based assessment team, assuring that they were using random techniques in their selection of persons and villages and deciding on which areas should be assessed. They would be responsible for analyzing the results and for making recommendations concerning changes in vaccination team schedules and tactics on the basis of them.

They would work with the Medecin Chefs of their Departements in designing schedules for the vaccination teams and would assist them in doing smallpox outbreak investigations. In addition, they would work to strengthen surveillance systems in these Departements.

There are several factors which make the next two years critical ones for the SMP, and which make the recommended increase in staff a necessity for the success of the program. As shown by the assessment, a sizable pool of unvaccinated children under the age of five years exists in Niger, and well-run maintenance programs are required to keep this pool small enough to prevent reseeding of smallpox throughout the country from cases which may be introduced from other areas. A sensitive surveillance system coupled with aggressive case and

outbreak investigation and control are needed in addition to an effective maintenance program to assure that such spread does not occur. The need to design an effective maintenance program and to strengthen surveillance and outbreak investigation and control measures is present during a period of transition for Niger's preventive medical services. Although the Departemental health units are being built up, many of the practical details of their functioning are still being worked out, and they are not expected to have an adequate number of personnel until late 1971. Until they are fully developed, the burden of responsibility for these various activities will fall on the SMP. As mentioned in the body of this report, insufficient attention was paid to team inspection, surveillance and assessment in the past, and this was at least in part attributable to a work load which was too heavy for the existing staff. With a decentralization of activities into the seven Departements, the job becomes logistically much more difficult; in addition, the design and assessment of the maintenance programs are theoretically more complicated than were those aspects of the attack phase program.

As mentioned previously, the measles aspect of the past program has not been as successful as has the smallpox aspect. There is a real need to improve this area of operations in the future. The occurrence of measles in vaccinated children and the return of measles outbreaks to vaccinated areas have already brought the program under suspicion in certain quarters, and its continuation as it has run in the past would damage the prestige of both the Ministry of Health and the U.S. Government. There is no question but that good measles control can be achieved within selected areas of Niger given adequate planning and adequate supervision of the teams. For these reasons, it is strongly urged that increases in SMP staff be made.

One additional recommendation is made for the program during Phase II: radios should be purchased which would permit the SMP headquarters to be in contact with their vaccination teams. At present, days of vaccination activity are lost because of delay in getting spare parts to vehicles with breakdowns, and it is often difficult for supervisors to locate a team en brousse when they come for an inspection. There are also occasions when a vehicle breakdown or accident has placed the team or the supervisors in real jeopardy owing to their distance from any habitation and to the severity of the climate of Niger. It would seem reasonable to take any measures possible to increase the efficiency and effectiveness of one of Niger's most precious resources: trained personnel and the purchase of radios would seem to be one measure which would be warranted even without the consideration of the added safety it brings to SMP operations. Radios are currently being employed to link the OMNES teams in Niamey and Zinder, and it is suggested that the Niger SMP prepare a request for equipment which outlines what radio units are presently in the country and where they are located, so that any stationary units requested could be planned to be an extension rather than a duplication of the currently available network. The request should contain all the relevant technical data about the units currently in the country, as well

as specific details concerning the units desired. Formal approval from the Government of Niger will obviously be required before any action can be taken by USAID on it.

D. Summary

Maintenance (Phase II) activities will be carried out on a Departemental basis by vaccination teams being developed as part of a mobile health unit for each of the seven Departements. The established goals have been to vaccinate the entire population against smallpox at least every two years and measles susceptible children "regularly". The mobile health units are at present understaffed and underequipped, and will require assistance from the four SMP vaccination teams stationed in Niamey until late 1971 when it is anticipated that the OMNES teams will terminate their work and their personnel and financial support will be channeled into Departements.

The Government of Niger has willingly supported the Smallpox Measles Program during Phase I, and it is anticipated that such support will continue throughout Phase II. The Ministry of Health is emphasizing vaccination as being one of the most important activities of the mobile health unit teams so that the basic philosophy and goals of the SMP are in accord with those of the Ministry.

It is recommended that USAID continue its support of the SMP though Phase II. Niger could not at this juncture continue the program alone, and the gains of the program would be lost without continuation into the maintenance phase. It is suggested that the vaccination of the entire population against smallpox every two to three years be maintained as a program goal, modified by the establishment of zones within each Departement which would be vaccinated in six month to two year cycles owing to their particular risk of smallpox introduction. It is suggested that similar zones be established for the measles program so that the greatest percentage possible of the population, and certainly that portion of it at most risk from yearly measles epidemics, would be vaccinated in six month to two year cyles. Thus for measles, good control should be established within these defined zones, and the attempt should be made to extend the area included in them as the health resources of each Departement permit.

During Phase II, every effort should be made to have 80 percent of the reports expected from the Arrondissements received on time in Niamey and to have 80 percent of the reports expected by the Arrondissements from the dispensaries received. Measles should be reported by age and vaccination status from at least one health facility in each Arrondissement. Every case or suspected case of smallpox should be investigated by the Medecin Chef of the Departement, and specimens should be collected from every case or outbreak in which the patient(s) still have scabs at the time of investigation.

A formal assessment of POJ coverage, vaccination scar rate, and overall smallpox immunity should be made at least once in each

Departement in each year. The Medecin Chef should inspect the vaccination team(s) at least once per month, and SMP headquarters should inspect all vaccination teams at least every six months. A detailed team inspection sheet should be filled out on each visit and filed in the SMP headquarters office.

The number of current program staff is not adequate to achieve the goals outlined above, and it is recommended that an SMP unit be established at Zinder consisting of a Zinder Responsable Nationale, an O.O. (USAID) and an assessment team consisting of a team leader, an infirmier, and a chauffeur. In informal discussions, the Ministry of Health agreed to provide an "Agent Technique Sanitaire" as the Responsable Nationale and an "Infirmier Qualifie" as the leader of the assessment team, if USAID could provide an O.O. and two vehicles (and perhaps three if the Responsable Nationale and O.O. would be impeded in their activities by having to share a vehicle), and if W.H.O. would provide the salaries for the infirmier and the chauffeur for the assessment team. The Zinder unit would be responsible for the Departements of Zinder, Maradi, Diffa, and Agadez, and for providing a liason with Northern Nigeria.

The fact that the preventive health services of Niger are in a period of transition just at the time that a complicated maintenance program needs to be designed and implemented, and that improvements in surveillance, assessment and outbreak investigations need to be made, means that the increased staff that is proposed for the program is critically needed to assure success.

In addition to the increase in personnel, it is suggested that radios be provided to the teams and supervisors to maximize their efficiency and effectiveness. The Niger SMP should initiate this request, providing information on the radio units currently existing in the country and the technical details of the units which are desired for this program. Approval of the Government of Niger is an obvious requisite for the request to be considered.

Table I

Characteristics of Sites Surveyed

Niger Assessment
January 1969

I. Completion of Assigned Sites

	Sites Assigned	Completed	Percent Completed	Population Interviewed
A. Village Sample	67	66[a]	98.5%	1118
B. Roadside Sample	--	--	--	576
C. Ayorou Market (Survey of Peulhs and Bellahs only)	--	--	--	302
D. Niamey Cattle Market (Survey of Peulhs and Bellahs only)	--	--	--	39
E. Grand Total				2035

(a) The missing site was visited and assessed, but the data was misplaced and is not included in this analysis.

II. Size of Sampled Villages

Population	Number	Percent Distribution
1-100	8	12.3%
101-500	32	49.2%
501-1000	25	38.5%
Sub-total	65	100.0%
Unknown[b]	1	--
Total	66	--

(b) Information not provided by assessor.

Table I (Cont'd)

III. Distance of Village from Vaccination Site

Miles	Number	Percent Distribution
Less than 1	58	87.9%
1-2	8	12.1%
3+	0	0.0%
Total	66	100.0%

Table II

Population Surveyed

Niger Assessment
January 1969

A. VILLAGE SAMPLE

Age	Number of Persons Assessed			Age Distribution of Assessed Population			Age Distribution of Pop. of West Africa[a]		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			62			5.5%			4.3%
1-4			230			20.6%			14.5%
5-14	123	149	272	11.0%	13.3%	24.3%	13.2%	11.9%	25.1%
15-44	113	306	419	10.1%	27.4%	37.5%	19.7%	22.5%	42.0%
45+	59	76	135	5.3%	6.8%	12.1%	7.4%	6.6%	14.0%
Total			1118			100.0%			99.9%

B. ROADSIDE SAMPLE

Age	Number of Persons Assessed			Age Distribution of Assessed Population			Age Distribution of Pop. of West Africa[a]		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			17			3.0%			4.3%
1-4			19			3.3%			14.5%
5-14	66	16	82	11.5%	2.8%	14.2%	13.2%	11.9%	25.1%
15-44	262	105	367	45.5%	18.2%	63.7%	19.7%	22.5%	42.0%
45+	58	33	91	10.1%	5.7%	15.8%	7.4%	6.6%	14.0%
Total			576			100.0%			99.9%

C. TOTAL[b]

Age	Number of Persons Assessed			Age Distribution of Assessed Population			Age Distribution of Pop. of West Africa[a]		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			132			4.8%			4.3%
1-4			450			16.3%			14.5%
5-14	298	317	615	10.8%	11.5%	22.3%	13.2%	11.9%	25.1%
15-44	488	706	1194	17.7%	25.1%	43.2%	19.7%	22.5%	42.0%
45+	179	194	373	6.5%	7.0%	13.5%	7.4%	6.6%	14.0%
Total			2764			100.1%			99.9%

(a) From United Nations Demographic Yearbook, 1965.

(b) Includes 1070 persons not included in sections A and B who were examined as part of a separate village sample. The results from this group differed little from those shown in section A, however, and they have not been presented separately in these tables.

D. ANALYSIS BY TRIBAL GROUP

1. Hausa and Djerma

Age	Number Assessed			Total Persons in Section C			Percent Hausa and Djerma		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			90			132			68.2%
1-4			308			450			68.4%
5-14	194	201	395	298	317	615	65.1%	63.4%	64.2%
15-44	285	468	753	488	706	1194	58.4%	66.3%	63.1%
45+	96	118	214	179	194	373	53.6%	60.8%	57.4%
Total			1760			2764			63.7%

2. Touareg

Age	Number Assessed			Total Persons in Section C			Percent Touareg		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			2			132			1.5%
1-4			17			450			3.8%
5-14	15	11	26	298	317	615	5.0%	3.5%	4.2%
15-44	46	22	68	488	706	1194	9.4%	3.1%	5.7%
45+	17	9	26	179	194	373	9.5%	4.6%	6.8%
Total			139			2764			5.0%

3. Other Tribes

Age	Number Assessed			Total Persons in Section C			Percent Other Tribes		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			40			132			30.3%
1-4			125			450			27.8%
5-14	89	105	194	298	317	615	29.9%	33.1%	31.6%
15-44	157	216	373	488	706	1194	32.2%	30.6%	31.2%
45+	66	67	133	179	194	373	36.9%	34.6%	35.8%
Total			865			2764			31.3%

E. PEULHS (FULANIS) AND BELLAHS

Age	From Ayorou & Niamey Markets (Not Incl. in Sec. D)			Included in "Other Tribes", Section D			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			9			21			30
1-4			16			54			70
5-14	12	17	29	40	50	90	52	67	119
15-44	112	118	230	66	98	164	178	216	394
45+	29	28	57	28	33	61	57	61	118
Total			341			390			731

Table II-A

Age and Sex Distribution of the Population of Niger (1964 Census Data)

Niger Assessment
January 1969

Age	Male	Female	Total
< 1			4.7%
1-3			11.0%
4-15	17.4%	15.1%	32.5%
16-49	19.6%	22.9%	42.5%
50+	4.7%	4.8%	9.5%
Total			100.2%

Table III

Absentees

Niger Assessment
January 1969

Village Sample

Age	Number Absentees			Population of Surveyed Households (including Absentees)			Percent Absentees		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			12			127			9.4%
1-4			20			451			4.4%
5-14	83	54	135	315	355	668	26.3%	15.2%	20.2%
15-44	202	111	307	428	712	1134	47.2%	15.6%	27.1%
45+	22	9	31	147	170	313	15.0%	5.3%	9.9%
Total			505			2693			18.8%

Table IV-A

Reasons Given for NOT Being Vaccinated by Jet Injector (POJ)
(Total of Village and Roadside Samples)

Niger Assessment
January 1969

A. PERCENT WITH NO HISTORY OF POJ VACCINATION

Age	Number with No History of POJ Vaccination			Number Examined			Number with No History of POJ Vaccination		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			125			132			94.7%
1-4			93			442			21.0%
5-14	41	23	64	295	311	606	13.9%	7.4%	10.6%
15-44	123	124	247	485	702	1187	25.4%	17.7%	20.8%
45+	78	77	155	177	192	369	44.1%	40.1%	42.0%
Total			684			2736			25.0%

B. PERCENT NOT VACCINATED BY POJ BECAUSE OF ABSENCE FROM VILLAGE AT TIME OF VACCINATION

Age	Number Absent			Number with No History of POJ Vaccination			Percent Not Vaccinated Because of Absence		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			3			125			2.4%
1-4			21			93			22.6%
5-14	17	5	22	41	23	64	41.5%	21.7%	34.4%
15-44	56	52	108	123	124	247	45.5%	41.9%	43.7%
45+	31	30	61	78	77	155	39.7%	39.0%	39.4%
Total			215			684			31.4%

1. Percent Absent from Village Only on Day of Vaccination

Age	Number Absent Only on Day of Vaccination			Number Absent From Village			Percent Absent Only on Day of Vaccination		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			3			0.0%
1-4			3			21			14.3%
5-14	1	0	1	17	5	22	5.9%	0.0%	4.5%
15-44	9	6	15	56	52	108	16.1%	11.5%	13.9%
45+	6	6	12	31	30	61	19.4%	20.0%	19.7%
Total			31			215			14.4%

Table IV-A (Cont'd)

2. Percent Absent from Village Only on Day of Vaccination who were Informed of Vaccination Team's Arrival

Age	Number Absent from Village, and Informed of Team's Arrival			Number Absent from Village Only on Day of Vaccination			Percent Absent from Village, and Informed of Team's Arrival		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			0			0.0%
1-4			0			3			0.0%
5-14	0	0	0	1	0	1	0.0%	0.0%	0.0%
15-44	2	2	4	9	6	15	22.2%	33.3%	26.7%
45+	2	1	3	6	6	12	33.3%	16.7%	25.0%
Total			7			31			22.6%

C. PERCENT NOT VACCINATED BY POJ WHO ALLEGED THAT VACCINATION TEAMS MISSED THEIR VILLAGE

Age	Number Not Vaccinated Because Teams Missed Village			Number Not Vaccinated by POJ			Percent Not Vaccinated Because Teams Missed Village		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			125			0.0%
1-4			10			93			10.8%
5-14	13	5	18	41	23	64	31.7%	21.7%	28.1%
15-44	10	25	35	123	124	247	8.1%	20.2%	14.2%
45+	10	4	14	78	77	155	12.8%	5.2%	9.0%
Total			77			684			11.3%

D. PERCENT NOT VACCINATED BY POJ BECAUSE THEY FELT A PREVIOUS VACCINATION OR PREVIOUS SMALLPOX MADE IT UNNECESSARY

Age	Number Not Vaccinated Because Thought Unnecessary			Number Not Vaccinated by POJ			Percent Not Vaccinated Because Thought Unnecessary		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			125			0.0%
1-4			0			93			0.0%
5-14	0	0	0	41	23	64	0.0%	0.0%	0.0%
15-44	3	7	10	123	124	247	2.4%	5.6%	4.0%
45+	4	8	12	78	77	155	5.1%	10.4%	7.7%
Total			22			684			3.2%

Table IV-A (Cont'd)

E. PERCENT NOT VACCINATED BY POJ BECAUSE THEY WERE OPPOSED TO VACCINATION

Age	Number Opposed to Vaccination			Number Not Vaccinated by POJ			Percent Opposed to Vaccination		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			125			0.0%
1-4			1			93			1.1%
5-14	1	0	1	41	23	64	2.4%	0.0%	1.6%
15-44	0	1	1	123	124	247	0.0%	0.8%	0.4%
45+	2	0	2	78	77	155	2.6%	0.0%	1.3%
Total			5			684			0.7%

F. PERCENT NOT VACCINATED BY POJ FOR MISCELLANEOUS REASONS (Not Listed in Sections B - E)

Age	Number Not Vaccinated for Miscellaneous Reasons			Number Not Vaccinated by POJ			Percent Not Vaccinated for Miscellaneous Reasons		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			122			125			97.6%
1-4			61			93			65.6%
5-14	10	13	23	41	23	64	24.4%	56.5%	35.9%
15-44	54	39	93	123	124	247	43.9%	31.5%	37.7%
45+	31	35	66	78	77	155	39.7%	45.5%	42.6%
Total			365			684			53.4%

Table IV

Percent with History of Jet Injector Vaccination
(POJ)

Niger Assessment
January 1969

A. VILLAGE SAMPLE

Age	Number with History of POJ Vaccination			Number Examined			Percent with History of POJ Vaccination		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			4			62			6.5%
1-4			183			226			81.0%
5-14	114	137	251	123	148	271	92.7%	92.6%	92.6%
15-44	92	260	352	111	304	415	82.9%	85.5%	84.8%
45+	32	49	81	59	75	134	54.2%	65.3%	60.4%
Total			871			1108			78.6%

B. ROADSIDE SAMPLE

Age	Number with History of POJ Vaccination			Number Examined			Percent with History of POJ Vaccination		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			17			0.0%
1-4			11			18			61.1%
5-14	47	14	61	63	16	79	74.6%	87.5%	77.2%
15-44	184	75	259	260	104	364	70.8%	72.1%	71.2%
45+	26	23	49	56	33	89	46.4%	69.7%	55.1%
Total			380			567			67.0%

C. TOTAL[(a)]

Age	Number with History of POJ Vaccination			Number Examined			Percent with History of POJ Vaccination		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			7			132			5.3%
1-4			350			442			79.2%
5-14	254	285	539	295	310	605	86.1%	91.9%	89.1%
15-44	361	576	937	484	701	1185	74.6%	82.2%	79.1%
45+	99	115	214	177	192	369	55.9%	59.9%	58.0%
Total			2047			2733			74.9%

(a) Includes 1070 persons not included in sections A and B who were examined as part of a separate village sample. The results from this group differed little from those shown in section A, however, and they have not been presented separately in these tables.

D. ANALYSIS BY TRIBAL GROUP

1. Hausa and Djerma

Age	Number with History of POJ Vaccination			Number Examined			Percent with History of POJ Vaccination		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			7			90			7.8%
1-4			257			303			84.8%
5-14	178	185	363	192	197	389	92.7%	93.9%	93.3%
15-44	236	451	687	281	465	746	84.0%	97.0%	92.1%
45+	56	69	125	95	117	212	58.9%	59.0%	59.0%
Total			1439			1760			81.8%

2. Other Tribes (Including Touareg)

Age	Number with History of POJ Vaccination			Number Examined			Percent with History of POJ Vaccination		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			42			0.0%
1-4			93			139			66.9%
5-14	76	100	176	103	113	216	73.8%	88.5%	81.5%
15-44	125	125	250	203	236	439	61.6%	53.0%	56.9%
45+	43	46	89	82	75	157	52.4%	61.3%	56.7%
Total			608			993			61.2%

3. Peulhs (Fulanis) and Bellahs Surveyed in Ayorou and Niamey Markets (Not Included in "Other Tribes")

Age	Number with Vaccination Scar and History of POJ Vaccination (a)			Number Examined			Percent with Vaccination Scar and History of POJ Vaccination		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			9			0.0%
1-4			3			16			18.8%
5-14	4	3	7	12	17	29	33.3%	17.6%	24.1%
15-44	43	31	74	112	118	230	38.4%	26.3%	32.2%
45+	7	11	18	29	28	57	24.1%	39.3%	31.6%
Total			102			341			29.9%

(a) These results are not strictly comparable to those from the village and roadside samples. In the markets, persons without a vaccination scar were not asked if they had been vaccinated by injector. In older age groups this has the effect of showing a lower POJ coverage than where all persons are asked about POJ vaccination, such as was done in the three cluster samples.

Table IV (Cont'd)

4. Peulhs (Fulanis) and Bellahs (Included in "Other Tribes")

Age	Number with Vaccination Scar and History of POJ Vaccination			Number Examined			Percent with Vaccination Scar and History of POJ Vaccination		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			21			0.0%
1-4			32			54			59.3%
5-14	22	41	63	39	50	89	56.4%	82.0%	70.8%
15-44	32	46	78	66	96	162	48.5%	47.9%	48.1%
45+	15	17	32	28	33	61	53.6%	51.5%	52.5%
Total			205			387			53.0%

Table V-A

Percent Apparently Ineffective POJ Smallpox Vaccinations

Niger Assessment
January 1969

A. NIGER

Age	No. of Persons with History POJ Vac. with NO Evidence of Previous Smallpox or Variolation (by history & Exam.) with NO Vac. Scar	No. of Persons Examined with History of POJ Vac. with no Previous Smallpox or Variolation (by History & Exam.)	Percent of POJ Vaccinees with No Vaccination Scar
<1	0	7	0.0%
1-4	45	340	13.2%
5-14	22	479	4.6%
15-44	31	661	4.7%
45+	13	83	15.7%
Total	111	1570	7.1%

B. NIGER COMPARED TO WESTERN STATE AND SOKOTO AND KATSINA PROVINCES, NIGERIA (Data Taken from Regional Office Assessments Completed in 1968)

1. Niger

Age	POJ Vaccinees with No Scar	POJ Vaccinees Examined	Percent POJ Vaccinees with No Scar
<1	0	7	0.0%
1-4	45	340	13.2%
5-14	22	479	4.6%
15-44	31	661	4.7%
45+	13	83	15.7%
Total	111	1570	7.1%

2. Western State, Nigeria

Age	POJ Vaccinees with No Scar	POJ Vaccinees Examined	Percent POJ Vaccinees with No Scar
<1	2	48	4.2%
1-4	9	405	2.2%
5-14	10	449	2.2%
15-44	37	491	7.5%
45+	20	114	17.5%
Total	78	1507	5.2%

Table V-A (Cont'd)

3. Sokoto Province, Nigeria

Age	POJ Vaccinees with No Scar	POJ Vaccinees Examined	Percent POJ Vaccinees with No Scar
<1	8	55	14.5%
1-4	20	176	11.4%
5-14	19	242	7.9%
15-44	13	260	5.0%
45+	5	36	13.9%
Total	65	769	8.5%

4. Katsina Province, Nigeria

Age	POJ Vaccinees with No Scar	POJ Vaccinees Examined	Percent POJ Vaccinees with No Scar
<1	2	53	3.8%
1-4	12	204	5.9%
5-14	19	453	4.2%
15-44	34	390	8.7%
45+	4	34	11.8%
Total	71	1134	6.3%

Table V

Percent of Persons with Smallpox Vaccination Scar

Niger Assessment
January 1969

A. VILLAGE SAMPLE

Age	Number of Persons with Vaccination Scar			Number Examined			Percent of Persons with Vaccination Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			4			62			6.5%
1-4			153			227			67.4%
5-14	110	133	243	121	148	269	90.9%	89.9%	90.3%
15-44	103	262	365	112	305	417	92.0%	85.9%	87.5%
45+	36	51	87	57	73	130	63.2%	69.9%	66.9%
Total			852			1105			77.1%

B. ROADSIDE SAMPLE

Age	Number of Persons with Vaccination Scar			Number Examined			Percent of Persons with Vaccination Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			17			0.0%
1-4			9			18			50.0%
5-14	49	15	64	66	16	82	74.2%	93.8%	78.0%
15-44	212	87	299	260	103	363	81.5%	84.5%	82.4%
45+	40	26	66	55	33	88	72.7%	78.8%	75.0%
Total			438			568			77.1%

C. TOTAL[(a)]

Age	Number of Persons with Vaccination Scar			Number Examined			Percent of Persons with Vaccination Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			7			132			5.3%
1-4			304			445			68.3%
5-14	251	286	537	295	314	609	85.1%	91.1%	88.2%
15-44	410	602	1012	485	702	1187	84.5%	85.8%	85.3%
45+	117	115	232	173	180	353	67.6%	63.9%	65.7%
Total			2092			2726			76.7%

(a) Includes 1070 persons not included in sections A and B who were examined as part of a separate village sample. The results from this group differed little from those shown in section A, however, and they have not been presented separately in these tables.

D. ANALYSIS BY TRIBAL GROUP

1. Hausa and Djerma

Age	Number of Persons with Vaccination Scar			Number Examined			Percent of Persons with Vaccination Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			7			90			7.8%
1-4			222			303			73.3%
5-14	164	184	348	193	200	393	85.0%	92.0%	88.5%
15-44	248	455	703	284	465	749	87.3%	97.8%	93.9%
45+	58	68	126	92	111	203	63.0%	61.3%	62.1%
Total			1406			1738			80.9%

2. Touareg

Age	Number of Persons with Vaccination Scar			Number Examined			Percent of Persons with Vaccination Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			2			0.0%
1-4			7			17			41.2%
5-14	11	9	20	14	10	24	78.6%	90.0%	83.3%
15-44	31	16	47	46	22	68	67.4%	72.7%	69.1%
45+	8	7	15	17	9	26	47.1%	77.8%	57.7%
Total			89			137			65.0%

3. Other Tribes

Age	Number of Persons with Vaccination Scar			Number Examined			Percent of Persons with Vaccination Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			40			0.0%
1-4			75			125			60.0%
5-14	76	93	169	88	104	192	86.4%	89.4%	88.0%
15-44	131	131	262	155	215	370	84.5%	60.9%	70.8%
45+	51	40	91	64	60	124	79.7%	66.7%	73.4%
Total			597			851			70.2%

Table V (Cont'd)

4. Peulhs (Fulanis) and Bellahs Surveyed in Ayorou and Niamey Markets (Not Included in "Other Tribes")

Age	Number of Persons with Vaccination Scar			Number Examined			Percent of Persons with Vaccination Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			9			0.0%
1-4			3			16			18.8%
5-14	9	11	20	12	17	29	75.0%	64.7%	67.0%
15-44	97	105	202	112	118	230	86.6%	89.0%	87.8%
45+	20	27	47	29	28	57	69.0%	96.4%	82.5%
Total			272			341			79.8%

5. Peulhs (Fulanis) and Bellahs (Included in "Other Tribes")

Age	Number of Persons with Vaccination Scar			Number Examined			Percent of Persons with Vaccination Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			21			0.0%
1-4			32			54			59.3%
5-14	29	40	69	39	49	88	74.4%	81.6%	78.4%
15-44	51	72	123	64	97	161	79.7%	74.2%	76.4%
45+	22	17	38	26	28	54	84.6%	60.7%	70.4%
Total			262			378			69.3%

Table VI

Percent of Persons with Smallpox Vaccination
Scar and History of Vaccination within Past 10 Years

Niger Assessment
January 1969

A. VILLAGE SAMPLE

Age	Number of Persons with Vaccination Scar			Number Examined			Percent of Persons with Vaccination Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			4			62			6.5%
1-4			153			227			67.4%
5-14	107	132	239	115	146	261	93.0%	90.4%	91.6%
15-44	92	245	337	107	304	411	86.0%	80.6%	82.0%
45+	25	44	69	57	72	129	43.9%	61.1%	53.5%
Total			802			1090			73.6%

B. ROADSIDE SAMPLE

Age	Number of Persons with Vaccination Scar			Number Examined			Percent of Persons with Vaccination Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			17			0.0%
1-4			9			18			50.0%
5-14	45	15	60	63	16	79	71.4%	93.8%	75.9%
15-44	195	81	276	255	103	358	76.5%	78.6%	77.1%
45+	33	21	54	55	33	88	60.0%	63.6%	61.4%
Total			399			560			71.39%

C. TOTAL[(a)]

Age	Number of Persons with Vaccination Scar			Number Examined			Percent of Persons with Vaccination Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			7			132			5.3%
1-4			304			445			68.3%
5-14	244	281	525	286	309	595	85.3%	90.9%	88.2%
15-44	373	565	938	475	701	1176	78.5%	80.6%	79.8%
45+	92	99	191	173	179	352	53.2%	55.3%	54.3%
Total			1965			2700			72.8%

(a) Includes 1070 persons not included in sections A and B who were examined as part of a separate village sample. The results from this group differed little from those shown in section A, however, and they have not been presented separately in these tables.

Note: Analysis of the presence of a smallpox vaccination scar in association with a history of vaccination within the past 10 years has not been performed by tribal group, although this information is available. This information was not obtained in the Ayorou and Niamey market surveys.

Table VII

Percent of Persons with Smallpox Scarring[a]

Niger Assessment
January 1969

A. VILLAGE SAMPLE

Age	Number of Persons with Smallpox Scarring			Number Examined			Percent of Persons with Smallpox Scarring		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			62			0.0%
1-4			0			227			0.0%
5-14	0	1	1	122	148	270	0.0%	0.7%	0.4%
15-44	13	18	31	113	304	417	11.5%	5.9%	7.4%
45+	6	14	20	57	76	133	10.5%	18.4%	15.0%
Total			52			1109			4.7%

B. ROADSIDE SAMPLE

Age	Number of Persons with Smallpox Scarring			Number Examined			Percent of Persons with Smallpox Scarring		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			17			0.0%
1-4			1			19			5.3%
5-14	0	0	0	65	16	81	0.0%	0.0%	0.0%
15-44	16	7	23	259	104	363	6.2%	6.7%	6.3%
45+	11	4	15	57	33	90	19.3%	12.1%	16.7%
Total			39			570			6.8%

C. TOTAL[b]

Age	Number of Persons with Smallpox Scarring			Number Examined			Percent of Persons with Smallpox Scarring		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			132			0.0%
1-4			2			447			0.4%
5-14	2	6	8	296	316	612	0.7%	1.9%	1.3%
15-44	35	49	84	485	703	1188	7.2%	7.0%	7.1%
45+	26	28	54	176	193	369	14.8%	14.5%	14.6%
Total			148			2748			5.4%

(a) Defined as the presence on the face of not less than five pock marks of at least two millimeters in diameter.

(b) Includes 1070 persons not included in sections A and B who were examined as part of a separate village sample. The results from this group differed little from those shown in section A, however, and they have not been presented separately in these tables.

Table VII (Cont'd)

D. ANALYSIS BY TRIBAL GROUP

1. Hausa and Djerma

Age	Number of Persons with Smallpox Scarring			Number Examined			Percent of Persons with Smallpox Scarring		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			90			0.0%
1-4			1			305			0.3%
5-14	2	3	5	192	200	392	1.0%	1.5%	1.3%
15-44	21	26	47	283	465	748	7.4%	5.6%	6.3%
45+	9	14	23	95	117	212	9.5%	12.0%	10.8%
Total			76			1747			4.4%

2. Touareg

Age	Number of Persons with Smallpox Scarring			Number Examined			Percent of Persons with Smallpox Scarring		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			2			0.0%
1-4			0			17			0.0%
5-14	0	0	0	15	11	26	0.0%	0.0%	0.0%
15-44	1	1	2	46	22	68	2.2%	4.5%	2.9%
45+	2	0	2	17	9	26	11.8%	0.0%	7.7%
Total			4			139			2.9%

3. Other Tribes

Age	Number of Persons with Smallpox Scarring			Number Examined			Percent of Persons with Smallpox Scarring		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			40			0.0%
1-4			1			125			0.8%
5-14	0	3	3	89	105	194	0.0%	2.9%	1.5%
15-44	13	22	35	156	216	372	8.3%	10.2%	9.4%
45+	15	14	29	64	67	131	23.4%	20.9%	22.1%
Total			68			864			7.9%

Table VII (Cont'd)

4. Peulhs (Fulanis) and Bellahs Surveyed in Ayorou and Niamey Markets (Not Included in "Other Tribes")

Age	Number of Persons with Smallpox Scarring			Number Examined			Percent of Persons with Smallpox Scarring		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			9			0.0%
1-4			0			16			0.0%
5-14	0	0	0	12	17	29	0.0%	0.0%	0.0%
15-44	8	7	15	112	118	230	7.1%	5.9%	6.5%
45+	1	1	2	29	28	57	3.4%	3.6%	3.5%
Total			17			341			5.0%

5. Peulhs (Fulanis) and Bellahs (Included in "Other Tribes")

Age	Number of Persons with Smallpox Scarring			Number Examined			Percent of Persons with Smallpox Scarring		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			21			0.0%
1-4			1			54			1.9%
5-14	0	1	1	39	50	89	0.0%	2.0%	1.1%
15-44	4	5	9	65	98	163	6.2%	5.1%	5.5%
45+	4	1	5	28	33	51	14.3%	3.0%	9.8%
Total			16			378			4.2%

Table VIII

Percent of Persons with Variolation Scar

Niger Assessment
January 1969

A. VILLAGE SAMPLE

Age	Number of Persons with Variolation Scar			Number Examined			Percent of Persons with Variolation Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			62			0.0%
1-4			8			230			3.5%
5-14	5	10	15	123	149	272	4.1%	6.7%	5.5%
15-44	12	35	47	113	306	419	10.6%	11.4%	11.2%
45+	14	11	25	59	76	125	23.7%	14.5%	20.0%
Total			95			1108			8.6%

B. ROADSIDE SAMPLE

Age	Number of Persons with Variolation Scar			Number Examined			Percent of Persons with Variolation Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			17			0.0%
1-4			0			19			0.0%
5-14	3	2	5	66	16	82	4.5%	12.5%	6.1%
15-44	38	14	52	262	105	367	14.5%	13.3%	14.2%
45+	15	3	18	58	33	91	25.9%	9.1%	19.8%
Total			78			576			13.5%

C. TOTAL[(a)]

Age	Number of Persons with Variolation Scar			Number Examined			Percent of Persons with Variolation Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			132			0.0%
1-4			17			450			3.8%
5-14	17	17	34	298	317	615	5.7%	5.4%	5.5%
15-44	60	82	142	488	706	1194	12.3%	11.6%	11.9%
45+	39	33	72	179	194	373	21.8%	17.0%	19.3%
Total			265			2764			9.6%

(a) Includes 1070 persons not included in sections A and B who were examined as part of a separate village sample. The results from this group differed little from those shown in section A, however, and they have not been presented separately in these tables.

Table VIII (Cont'd)

D. ANALYSIS BY TRIBAL GROUP

1. Hausa and Djerma

Age	Number of Persons with Variolation Scar			Number Examined			Percent of Persons with Variolation Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			90			0.0%
1-4			15			308			4.9%
5-14	10	11	21	194	201	395	5.2%	5.5%	5.3%
15-44	33	66	99	285	468	753	11.6%	14.1%	13.1%
45+	27	22	49	96	118	214	28.1%	18.6%	22.9%
Total			184			1760			10.5%

2. Touareg

Age	Number of Persons with Variolation Scar			Number Examined			Percent of Persons with Variolation Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			2			0.0%
1-4			0			17			0.0%
5-14	0	0	0	15	11	26	0.0%	0.0%	0.0%
15-44	9	2	11	46	22	68	19.6%	9.1%	16.2%
45+	3	0	3	17	9	26	17.6%	0.0%	11.5%
Total			14			139			10.1%

3. Other Tribes

Age	Number of Persons with Variolation Scar			Number Examined			Percent of Persons with Variolation Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			40			0.0%
1-4			2			125			1.6%
5-14	7	6	13	89	105	194	7.9%	5.7%	6.7%
15-44	18	14	32	157	216	373	11.5%	6.5%	8.6%
45+	9	11	20	66	67	133	13.6%	16.4%	15.0%
Total			67			865			7.7%

Table VIII (Cont'd)

4. Peulhs (Fulanis) and Bellahs Surveyed in Ayorou and Niamey Markets (Not Included in "Other Tribes")

Age	Number of Persons with Variolation Scar			Number Examined			Percent of Persons with Variolation Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			9			0.0%
1-4			0			16			0.0%
5-14	2	0	2	12	17	29	16.7%	0.0%	6.9%
15-44	26	14	40	112	118	230	23.2%	11.9%	17.4%
45+	10	6	16	29	28	57	34.5%	21.4%	28.1%
Total			58			341			17.0%

5. Peulhs (Fulanis) and Bellahs (Included in "Other Tribes")

Age	Number of Persons with Variolation Scar			Number Examined			Percent of Persons with Variolation Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			21			0.0%
1-4			2			54			3.7%
5-14	5	5	10	40	50	90	12.5%	10.0%	11.1%
15-44	12	11	23	66	98	164	18.2%	11.2%	14.0%
45+	6	10	16	28	33	61	21.4%	30.3%	26.2%
Total			51			390			13.1%

Table IX

Percent "Smallpox Immune"[a]

Niger Assessment
January 1969

A. VILLAGE SAMPLE

Age	Number "Smallpox Immune"			Number Examined			Percent "Smallpox Immune"		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			4			62			6.5%
1-4			159			227			70.0%
5-14	109	137	246	121	146	267	90.1%	93.8%	92.1%
15-44	101	264	365	110	304	414	91.8%	86.8%	88.2%
45+	33	53	86	56	74	130	58.9%	71.6%	66.2%
Total			860			1100			78.2%

B. ROADSIDE SAMPLE

Age	Number "Smallpox Immune"			Number Examined			Percent "Smallpox Immune"		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			17			0.0%
1-4			10			18			55.6%
5-14	47	15	62	63	16	79	74.6%	93.8%	78.5%
15-44	211	88	299	255	104	359	82.7%	84.6%	83.3%
45+	42	26	68	56	33	89	75.0%	78.8%	76.4%
Total			439			562			78.1%

C. TOTAL[b]

Age	Number "Smallpox Immune"			Number Examined			Percent "Smallpox Immune"		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			7			132			5.3%
1-4			320			445			71.9%
5-14	253	289	542	292	310	602	86.6%	93.2%	90.0%
15-44	402	614	1016	478	703	1181	84.1%	87.3%	86.0%
45+	77	103	180	174	187	361	44.3%	55.1%	49.9%
Total			2065			2721			75.9%

(a) For the purposes of this assessment a person was considered "Smallpox Immune" if he had a smallpox vaccination scar and a history of vaccination within ten years, a variolation scar, or more than five pock marks on the face of at least two millimeters in diameter.

(b) Includes 1070 persons not included in sections A and B who were examined as part of a separate village sample. The results from this group differed little from those shown in section A, however, and they have not been presented separately in these tables.

Table IX (Cont'd)

D. ANALYSIS BY TRIBAL GROUP

1. Hausa and Djerma

Age	Number "Smallpox Immune"			Number Examined			Percent "Smallpox Immune"		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			7			90			7.8%
1-4			236			303			77.9%
5-14	167	188	355	191	197	388	87.4%	95.4%	91.5%
15-44	257	419	676	277	465	742	92.8%	90.1%	91.1%
45+	22	49	71	94	112	206	23.4%	43.8%	34.5%
Total			1345			1729			77.8%

2. Touareg

Age	Number "Smallpox Immune"			Number Examined			Percent "Smallpox Immune"		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			2			0.0%
1-4			7			17			41.2%
5-14	11	8	19	14	9	23	78.6%	88.9%	82.6%
15-44	34	17	51	46	22	68	73.9%	77.3%	75.0%
45+	9	3	12	17	8	25	52.9%	37.5%	48.0%
Total			89			135			65.9%

3. Other Tribes

Age	Number "Smallpox Immune"			Number Examined			Percent "Smallpox Immune"		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			40			0.0%
1-4			77			125			61.6%
5-14	75	93	168	87	104	191	86.2%	89.4%	88.0%
15-44	111	178	289	155	216	371	71.6%	82.4%	77.9%
45+	46	51	97	63	67	130	73.0%	76.1%	74.6%
Total			631			857			73.6%

Table IX (Cont'd)

4. Peulhs (Fulanis) and Bellahs Surveyed in Ayorou and Niamey Markets[a] (Not Included in "Other Tribes")

Age	Number "Smallpox Immune"			Number Examined			Percent "Smallpox Immune"		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			9			0.0%
1-4			3			16			18.8%
5-14	10	6	16	12	17	29	83.3%	35.3%	55.2%
15-44	105	108	213	112	118	230	93.8%	91.5%	92.6%
45+	26	27	53	29	28	57	89.7%	96.4%	93.0%
Total			285			341			83.6%

5. Peulhs (Fulanis) and Bellahs (Included in "Other Tribes")

Age	Number "Smallpox Immune"			Number Examined			Percent "Smallpox Immune"		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1			0			21			0.0%
1-4			34			54			63.0%
5-14	31	41	72	37	50	87	83.8%	82.0%	82.8%
15-44	52	80	132	65	98	163	80.0%	81.6%	81.0%
45+	23	23	46	28	32	60	82.1%	71.9%	76.7%
Total			284			385			73.8%

(a) In this table, all vaccination scars were counted as conferring immunity, rather than only those in persons giving a history of vaccination within ten years.

Table X

Contribution of Each Age Group to Total Smallpox Susceptible Pool

Niger Assessment
January 1969

Age	I Percentage Distribution of Population of West Africa (From Table II)	II Percent Susceptible to Smallpox (Derived from Table IX, Section D	III Contribution of each Age Group to Total Susceptible Pool (Col. I x II)	IV Percentage Contribution of Each Age Group to Total Susceptible Pool (Contribution of Each Age Group Column III divided by Total Column III x 100.)
<1	4.3%	94.7%	4.1%	17.4%
1-4	14.5	28.1	4.1	17.4
5-14	25.1	10.0	2.5	10.6
15-44	42.0	14.0	5.9	25.0
45+	14.0	50.1	7.0	29.7
Total	99.9%	-	23.6%	100.1%

Table XI

Percent Distribution of Investigated Cases of Smallpox In Niger

1967 - 1968

Niger Assessment
January 1969

A. 1967

Age	Number of Investigated Smallpox Cases Male	Female	Total	Percent Distribution of Investigated Cases Male	Female	Total
0-4	-	-	24	-	-	25.0%
5-14	28	23	51	29.2	24.0	53.1
15-44	10	11	21	10.4	11.5	21.9
45+	0	0	0	0.0	0.0	0.0
Total			96			100.0%

B. 1968

Age	Number of Investigated Smallpox Cases Male	Female	Total	Percent Distribution of Investigated Cases Male	Female	Total
0-4	0	0	19	0.0	0.0	41.3%
5-14	8	6	14	17.4	13.0	30.4
15-44	7	5	13	15.2	10.9	28.3
45+	0	0	0	0.0	0.0	0.0
Total			46			100.0%

C. Total

Age	Number of Investigated Smallpox Cases Male	Female	Total	Percent Distribution of Investigated Cases Male	Female	Total
0-4	0	0	43	0.0	0.0	30.5%
5-14	36	29	65	25.5	20.6	46.1
15-44	17	16	33	12.0	11.3	23.4
45+	0	0	0	0.0	0.0	0.0
Total			141			100.0%

Table XII

Vaccination Scar Survey of Nomads (predominantly Touaregs) on Major Migration Route to Cure Salé - Dr. Donald Moore, September 20, 1967

Niger Assessment
January 1969

Age	Number with Vaccination Scar			Number Examined			Percent with Vaccination Scar		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1	-	-	4	-	-	33	-	-	12.1%
1-4	-	-	10	-	-	52	-	-	19.2
5-14	33	16	49	90	49	139	36.7	32.7	35.3
15+	64	77	141	100	127	227	64.0	60.6	62.1
Total			204			451			45.1%

Table XIII

Smallpox Cases Reported to Niger Ministry of Health by Month

1966 - 1968

Niger Assessment
January 1969

Month	Reported Cases		
	1966	1967	1968
January	146	93	168
February	139	349	65
March	199	222	58
April	167	224	212
May	80	44	69
June	60	37	83
July	57	69	10
August	23	31	0
September	13	18	0
October	22	1	4
November	32	21	1
December	84	63	9
Total	1,022	1,172	679

Table XIV

Measles Cases Reported to the Niger Ministry of Health by Year

1956 - 1968

Niger Assessment
January 1969

Year	Reported Cases
1956	11,114
1957	1,060
1958	5,350
1959	11,374
1960	8,903
1961	11,978
1962	22,856
1963	4,928
1964	14,412
1965	27,547
1966	6,806
1967	5,548
1968	11,259

Table XV

Measles Cases Reported to Niger Ministry of Health by Month

1966 - 1968

Niger Assessment
January 1969

Month	Reported Cases		
	1966	1967	1968
January	242	225	513
February	294	899	524
March	1123	896	1822
April	2269	591	1771
May	1068	1229	1886
June	755	396	1281
July	388	171	791
August	259	234	669
September	163	217	167
October	88	528	180
November	155	356	531
December	93	178	1124
Total	6,897	5,920	11,259

Table XVI

Smallpox and Measles Vaccinations by Year

1967 - 1968

Niger Assessment
January 1969

Year	Smallpox Vaccinations (POJ & M.P. combined)	Measles Vaccinations	Measles Vaccinations / Smallpox Vaccinations
1967	1,574,433	216,346	13.7%
1968	1,137,349	178,460	15.7%
Total	2,711,782	394,806	14.6%

Total Population Niger:	3,400,000
Number 6 months - 4 years (15%):	510,000
Annual Increase (4.7%):	160,000
Measles Target Group 1967-68:	670,000
Measles Vaccinations/Measles Target Group=	394,806/670,000= 58.9%

Table XVII

Niger Program Assessments, 1967 - 1968

Niger Assessment
January 1969

A. 1967

Age	Number with POJ Vaccination Scar	Number Examined	Percent with POJ Vaccination Scar
0-4	3,400	3,879	87.7%
5-14	4,448	4,942	90.0
15-44	6,146	6,830	90.0
45+	2,710	2,925	92.6
Total	16,704	18,576	89.9%

B. 1968

Age	Number with POJ Vaccination Scar	Number Examined	Percent with POJ Vaccination Scar
0-4	3,834	4,363	87.9%
5-14	5,757	6,118	94.1
15-44	9,111	12,181	74.8
45+	406	917	44.3
Total	19,108	23,579	81.0%

C. 1967-1968

Age	Number with POJ Vaccination Scar	Number Examined	Percent with POJ Vaccination Scar
0-4	7,234	8,242	87.8%
5-14	10,205	11,060	92.3
15-44	15,257	19,011	80.3
45+	3,116	3,842	81.1
Total	35,812	42,155	85.0

D. Percentage Distribution of Assessed Population, 1967-1968

Age	Number Assessed	Percentage Distribution Assessed Population	Percentage Distribution Population of West Africa
0-4	8,242	19.6%	18.8%
5-14	11,060	26.2	25.1
15-44	19,011	45.1	42.0
45+	3,842	9.1	14.0
Total	42,155	100.0%	99.9%

Table XVIII

Regularity of Reporting: Percent of Weekly Telegrams Received in Ministry of Health from 32 Arrondissements for Selected Months in 1967 and 1968

Niger Assessment
January 1969

Month		Telegrams Received	Telegrams Expected	Percent Received
January	1967	66	128	52%
February	1967	92	128	72
March	1967	85	160	53
Total	1967	243	416	58%
August	1968	32	160	20%
September	1968	42	128	33
October	1968	44	160	28
November	1968	50	128	39
December	1968	55	128	43
Total	1968	223	704	32%

Table XIX

Expenditures for Vaccination Program, July 1966 - December 1968, (a)

Niger Assessment
January 1969

	Amount	Percent of Total Expenditure
A. Government of the United States		
1. Technician Support	$116,000	14.3%
2. R.O. and Atlanta H.Q.	111,000	13.7
3. Commodities (used or in use)	405,000	49.8
a. Smallpox vaccine and diluent	(72,000)	(8.9)
b. Measles vaccine and diluent	(212,000)	(26.1)
c. Jet Injectors and spare parts	(42,000)	(5.2)
d. Vehicles and spare parts	(50,000)	(6.2)
e. Other	(29,000)	(3.6)
4. Phase I Assessment	5,000	0.6
5. Sub-Total	637,000	78.4%
B. Government of Niger		
1. Technician Support	141,000	17.3%
2. Other	3,000	0.4
3. Sub-Total	144,000	17.7
C. WHO (Gasoline and Vehicle Maintenance)	32,000	3.9%
D. Grand Total	$813,000	100.0%

(a) During this period 2,554,397 smallpox vaccinations and 394,806 measles vaccinations were given.

Table XX

FY 1967-68 Expenditures for Vaccination Program, Northern Nigeria[a] and Western Nigeria[b]

Niger Assessment
January 1969

	Northern Nigeria		Western Nigeria	
	Amount	Percent of Total Expenditure	Amount	Percent of Total Expenditure
A. Government of the United States				
1. Technician support (Housing provided by Government of Nigeria)	$196,000	10.2%	$92,000	8.1%
2. R.O. and Atlanta H.Q.	334,000	17.4	153,000	13.4
3. Commodities (used or in use)	1,150,000	59.7	734,000	64.3
a. Smallpox vaccine and diluent	(313,000)	(16.3)	(282,000)	34.7
b. Measles vaccine and diluent	(440,000)	(22.9)	(308,000)	27.0
c. Jet injectors and spare parts	(127,000)	(6.6)	(45,000)	(3.9)
d. Vehicles and spare parts	(198,000)	(10.3)	(81,000)	(7.1)
e. Other	(72,000)	(3.7)	(18,000)	(1.6)
4. Phase I Assessment	7,000	0.4	4,000	0.4
5. Sub-Total	1,687,000	87.6%	983,000	86.1%
B. Government of Nigeria				
1. Federal and State				
a. Technician Support (permanent staff)	$92,000	4.8%	$136,000	11.9%
b. Daily paid staff and other	57,000	3.0	-	-
c. Gasoline & vehicle maintenance	33,000	1.9	23,000	2.0
d. Total	182,000	9.5	159,000	13.9
2. Native Authority Administrations				
a. Salary of vaccinators	56,000	2.9	-	-
3. Sub-Total	238,000	12.4	-	-

Table XX (Cont'd)

	Northern Nigeria		Western Nigeria	
	Amount	Percent of Total Expenditure	Amount	Percent of Total Expenditure
C. Grand Total	$1,925,000	100.0%	$1,142,000	100.0%

(a) During period attack phase campaigns were completed in Sokoto, Katsina and Kano Provinces, Population 13,000,000.

(b) During this period 11,200,000 smallpox vaccinations and 1,100,000 measles vaccinations were given.

Table XXI

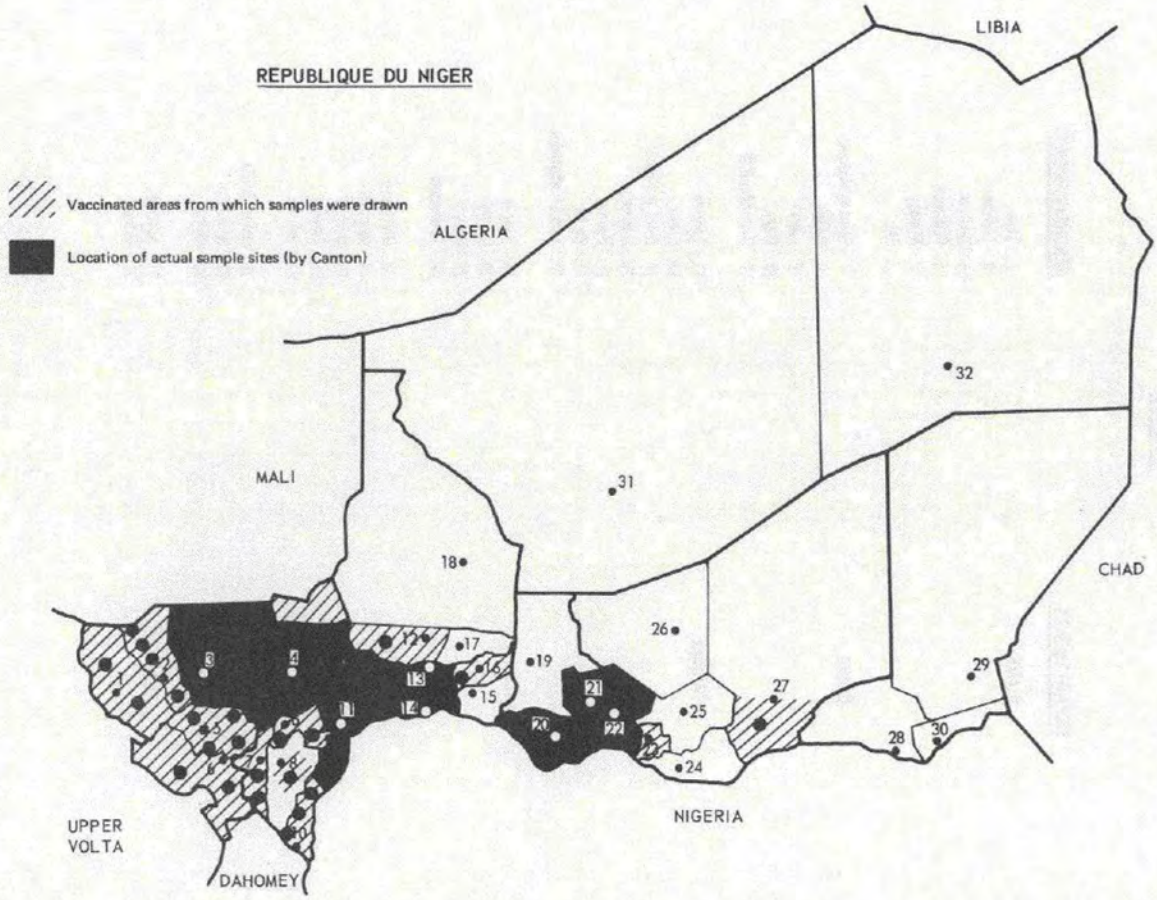
Comparison of Vaccination Program Costs Niger, Northern Nigeria[a] Western State Nigeria[b] and Gambia[c]

Niger Assessment
January 1969

	Niger	Northern Nigeria	Western State	Gambia
1. Total Smallpox Vaccinations	2,554,000	10,200,000	11,200,000	350,000
2. Cost of Program	$ 813,000	$1,925,000	$1,142,000	$102,688
3. Cost per vaccinee	$0.318	$0.189	$0.102	$0.293
4. Cost of smallpox alone[d]	$ 561,000	$1,429,000	$ 799,000	$52,137
5. Cost per smallpox vaccine	$0.220	$0.140	$0.071	$0.149
6. Cost of addition of measles vaccination	$ 252,000	$496,000	$343,000	$50,551
7. Number of measles vaccinees	490,000[e]	1,100,000[e]	734,000[e]	85,000
8. Additional cost per measles vaccinee	$0.514	$0.451	$0.467	$0.595
9. Cost of a smallpox and a measles vaccination per vaccine	$0.734	$0.591	$0.538	$0.744

(a) Data from Phase I Assessment of Northern Nigeria, November 12, 1968, modified by increasing cost of RO and Atlanta support to $334,000.
(b) Data from Phase I Assessment of Western Nigeria, January 17, 1969.
(c) Data from "Evaluation of the Smallpox Eradication/Measles Control Program, The Gambia, June 1968", modified by increasing cost of RO and Atlanta support to $9,550.
(d) Cost of measles vaccine, measles POJ's, and one vaccinator per team deducted from total cost.
(e) This represents the number of doses of measles vaccine issued to the teams, and not the program's estimate of the number of children vaccinated against measles. For the Western and Northern Assessments, this is the most reliable figure, and is used in the Niger assessment to be comparable to the Nigeria assessments.

FIGURE I


REPUBLIQUE DU NIGER
Vaccinated areas from which samples were drawn
Location of actual sample sites (by Canton)
LIBIA
ALGERIA
MALI
CHAD
NIGERIA
UPPER VOLTA
DAHOMEY
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
31
32

LEGEND

DEPARTEMENTS	ARRONDISSEMENTS
NIAMEY	1. Tera
	2. Tillaberi
	3. Ouallam
	4. Filingue
	5. Niamey
	6. Say
DOSSO	7. Birni N'Gaoure
	8. Dosso
	9. Loga
	10. Gaya
	11. Dogondoutchi
TAHOUA	12. Tahoua
	13. Illela
	14. Birni N'Konni
	15. Madaoua
	16. Bouza
	17. Keita
	18. Tchin Tabaraden
MARADI	19. Dakoro
	20. Maradi
	21. Mayahi
	22. Tessaoua
ZINDER	23. Matameye
	24. Magaria
	25. Myrria
	26. Tanout
	27. Goure
DIFFA	28. Maine-Soroa
	29. N'Guigmi
	30. Diffa
AGADEZ	31. Agadez
	32. Bilma

FIGURE II. ORGANIZATIONAL CHART – NATIONAL SERVICE OF HYGIENE AND MOBILE MEDICINE
NIGER – 1969

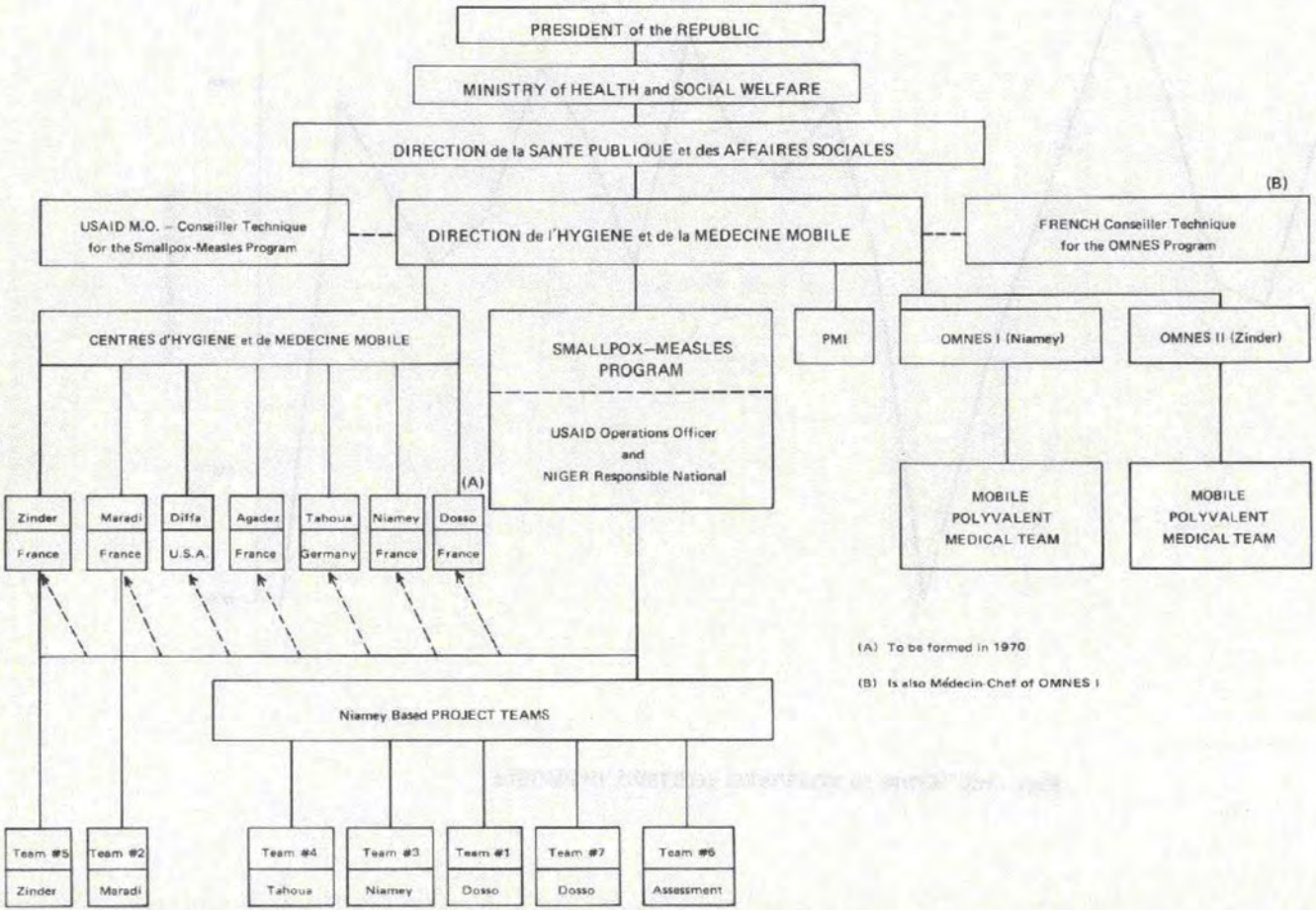


FIGURE III. CASES OF SMALLPOX IN NIGER, 1947-1968

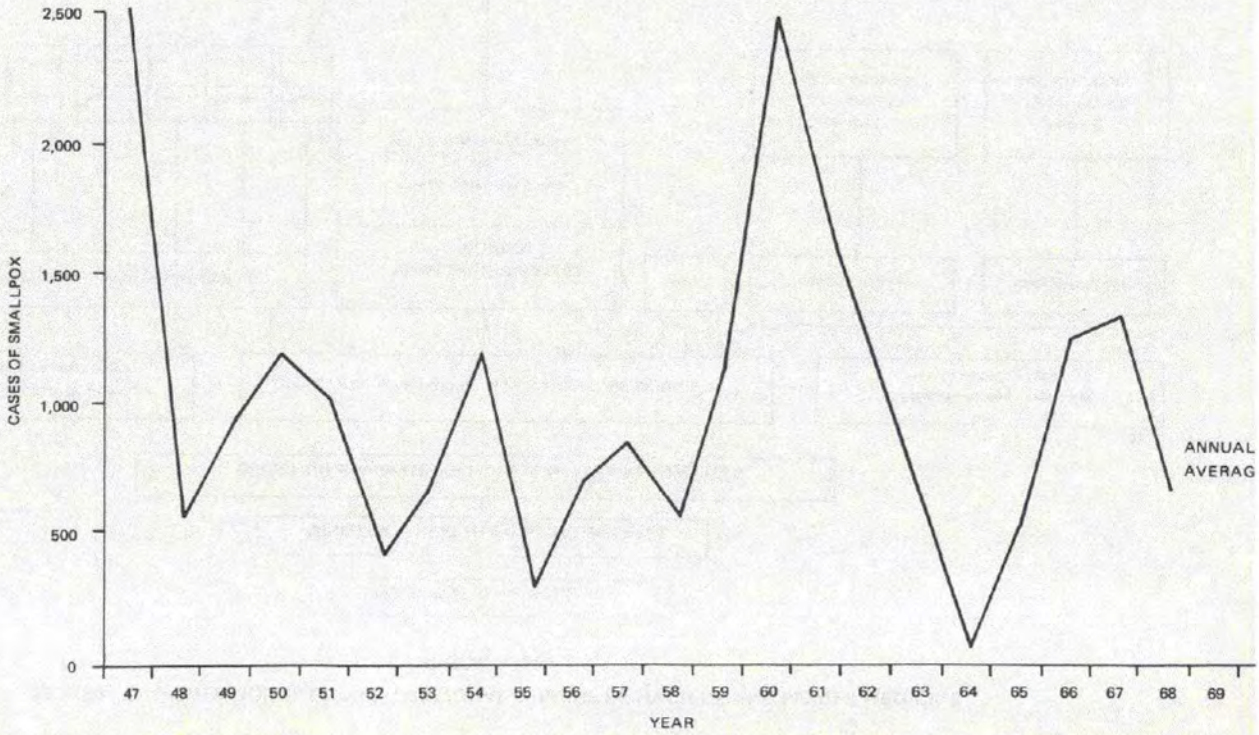


FIGURE IV. SMALLPOX CASES REPORTED TO NIGER MINISTRY OF HEALTH
BY MONTH, 1966-1968

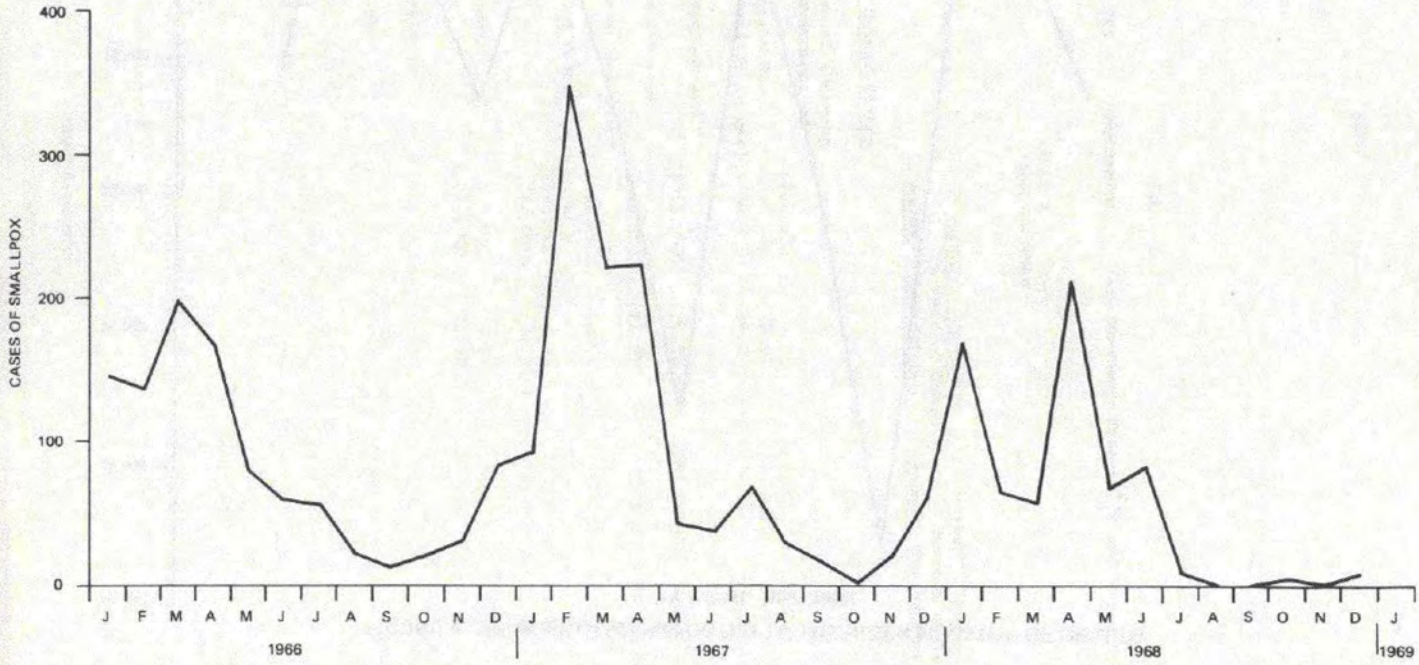


FIGURE V. MEASLES CASES REPORTED TO THE NIGER MINISTRY OF HEALTH BY YEAR, 1956-1968

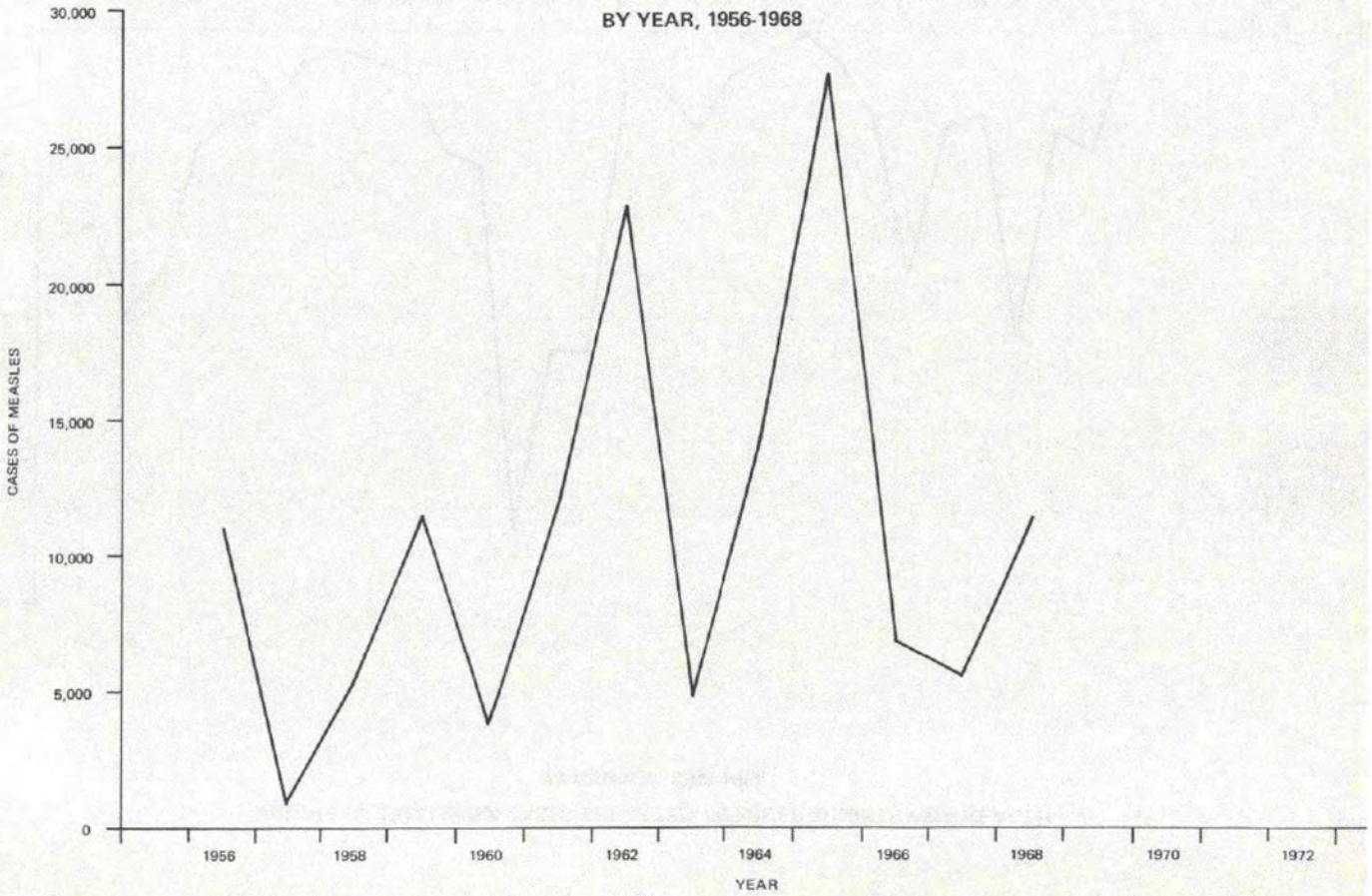


FIGURE VI. MEASLES CASES REPORTED TO NIGER MINISTRY OF HEALTH
BY MONTH, 1966-1968