

Modified May 25, 2000

PART I

CASE STUDY

MEASLES IN GUAYARAMERÍN.

Prepared by doctors Héctor S. Izurieta, PAHO, Washington, & Dr. Willy Saravia, SEDES Beni, Bolivia.

“ESTO ES EN VERDAD UN MISTERIO,” DIJE YO. “¿QUÉ IMAGINA USTED QUE ELLO SIGNIFICA?”

“NO TENGO DATOS AÚN. ES UN ERROR CAPITAL TEORIZAR ANTES DE TENER DATOS. INSENSIBLEMENTE UNO COMIENZA A TORCER LOS HECHOS PARA QUE ENCAJEN CON SUS TEORÍAS.”

SHERLOCK HOLMES RESPONDIENDO A UNA PREGUNTA DE SU AMIGO EL DR. WATSON, EN “UN ESCÁNDALO EN BOHEMIA”; POR SIR ARTHUR CONAN DOYLE, 1891.

Objectives:

- Familiarize the participants with the procedure to follow during the epidemiological investigation for the measles eradication.
- Introduce the epidemiological data analysis of a measles outbreak and to his use to define risk groups and take decisions about controlling and preventing outbreaks.

Part I: Antecedents and initial investigation [available time: 20 minutes]

Antecedents:

In 1999, Bolivia was the country in the American continent to have the highest measles case number and the most incidence. The age group most affected was the minors of five years. In Beni, the country's tropical zone, was the Department with the mayor incidence. Guayaramerín, a municipality of Beni with 280,000 habitants, frontier with the Brazilian State of Rondonia, was one of the most affected. In Guayará, 63,000 habitants, capital of the municipality, they reported 77 cases (122 for 100,000 habitants). [*Graphics 1 to 4*]

In November and December of 1999, facing the continuation of the transmission, and the continental engagement to eradicate measles,, Bolivia launched a national measles vaccination campaign. The national coverage reported after the campaign was of 98% (99% in Guayaramerín). Guayaramerín has not reported any new case since the end of the campaign in December of 1999.

We are presenting here a study developed from the epidemiological investigation of the outbreak that occurred in Guayará, Guayaramerín. None of the original investigation data has been modified.

Initial Investigation

In January 27 2000, Rosmary B., 30 years of age, and her baby Johnny, of a month of age, consulted in the health center for fever and cough that started three days prior evolution, and y eruption maculopapular. The cases where reported the 29 of January.

Question (1) (a) Is it possible that a month old baby has measles? (b) What would this suggest as of the measles epidemic within that family?

PART I

The 2nd of February, the Dr. Paredes sent the vaccinator Antonio Lenz to the address of the cases. Mr. Lenz took blood samples from the mother (he could not take from the baby) and vaccinated the persons presents in the house and habitants from that street. The blood sample was centrifuged and the serum refrigerated waiting to be sent to the reference laboratory for analysis.

Question (2) The conducted investigation was it sufficient?

[End de Part I]

PART II

Part II: The investigation [Time available: 60 minutes]

The 5th of February, Mr. Melgar and Drs. Paredes, Saravia and Izurieta visited again the dwelling of the suspected cases (family B) and they made a census of the habitants and usual visitors. **[Table 1]** A suspected case was defined as such as the medics consider as possible measles. They found a total of 8 suspected cases, including the original two reported. All had eruption confined to the face, reported high fever and cough. Other symptoms also include conjunctivitis with photophobia, and coriza.

The epidemiological cards of each case were filled, blood samples were taken of three of them and one urine sample from Baby Ortiz, 8 months old, son of Diana B. (23 years). The samples were centrifuged and the serum was kept refrigerated.

Question (3) (a) Why was there taken only a urine sample only from Baby Ortiz? (b) Was the number of taken blood samples appropriate? And why?

Question (4) (a) What usefulness can a census **[Table 1]** of all the house habitants have, even if they don't have any symptoms? (b) What case do you consider confirmed and why?

Question (5) Distributing in three person groups, and using the data from **Table I**, begin a bar graphic that includes the confirmed measles cases from this epidemic by onset date. Use the graphic to fill in. (b) Comment on the usefulness of the graphic to determine the possible infection sources of each case.

Question (6) (a) Using the data from **Table I**; estimate the attack rate only among the vaccinated. For this first select all the vaccinated persons, and among them determine how many cases there has been. The total confirmed vaccinated cases divided between the total vaccinated persons and multiplied by 100 is the attack rate among the vaccinated. (b) Estimate the attack rate between the not vaccinated. For this first select all the persons not vaccinated, and among them determine how many cases there was. The total confirmed cases not vaccinated divided between the total persons not vaccinated and multiplied by 100 is the attack rate in the not vaccinated. (c) What these attack rates suggest by vaccination status about the outbreak cause, could have contributed to it a fault in the vaccine?

Question (7) (a) Using the data from **Table I**, dividing in three persons groups, estimate, first among vaccinated, then among the not vaccinated and last the total of each age group (vaccinated and not vaccinated), **the attack rate by age groups** (percentage of confirmed cases among the total of persons from each age group). (b) Explain what these attack rates by age mean, and the importance that they would have for the measles control in Guayaramerín.

The interviewed did not report social activity out of the family, but visited frequently their property "Las Arenas" in the highway to Riveralta. They indicated being from Santa Ana of Yacuma, a rural area of Beni, and that they has established in Guayaramerín approximately 8 years ago. Interrogated approximately about the activities and visited places for the two weeks (7 to 18 days) prior to the initial symptoms. Sr. Ernesto E. indicated that between the 7 and the 12 of January they had all visited frequently the Roca clinic where the grandmother, that died the 13 of January, had been hospitalized. They were there in contact with a hospitalized patient in the same room with intense cough and eruption similar to measles. Asking about the contacts and visited places from the beginning of the symptoms they only indicated that they frequently visited the property but that Diana y Odali had been hospitalized middle of the month in the Bravo clinic, due to measles.

That same night the investigators realized a monitoring of the coverage in 6 months to 4 years children in that block **[Graph 5, Monitoring File]** and they found that 53 (95%) of the 56 interviewed had been vaccinated against measles at least once. That way they vaccinated all the inhabitants and usual visitors of the house indifferently to their age, and the children of the area.

Question (8) (a) What usefulness can the use of the monitoring file have [see **monitoring file**]? (b) Explain how an epidemic can spread in a neighborhood with 95% coverage of children younger than 5 years.

The Bravo clinic, where there had hospitalized the sisters Diana and Odali B., was visited by the investigators the 6 of February, finding that the measles had been discovered but that the cases had not been reported to the District. They had hospitalized the 23 of January in a private place, isolated from the rest of the clinic. As far as the vaccination status of the personnel, the medic indicated that the nurse had been preventively vaccinated and she was over 50 and had suffered from Measles during her youth. There was no reported contagion among the personnel nor the other patients.

Leza the vaccinator traveled that same day to the “Las Arenas” property, 6 km from Guayar. Did not find cases, but vaccinated a total of 27 persons among them family members and neighbors.

Dr. Saravia moved with a vaccinator team to remote areas of the Guayar-Riveralta highway, organized the vaccination of those habitants and coverage monitoring in one of the communities (Rosario de Yata), finding that 8 of 9 interviewed children were vaccinated.

At noon on the 6 of February, the 4 serum samples (including the previous one taken from Rosmary B.) and the urine sample from the family B investigation. Where taken refrigerated by airplane to the reference laboratory, Cenetrop, where the virology director, Dr. Ana Holzman, and Dr. Marlyn Cruz, analyzed the serum sample and reported their results that same afternoon by electronic mail. The four samples where measles positive [**Table I**]. Due that the other 3 suspected cases without relation with this epidemic had been mailed in the same packet, these too where analyzed immediately. One of these samples, pertaining to Gladys O (22 years) was also found positive. This case had not been yet investigated.

Question (9) (a) What was missing to be investigated? What utility could it have?

PART III

Part III: Visits to the Roca clinic and to family A. [Available Time: 40 minutes]

February 6, the investigators visited the Roca clinic. The senior medic indicated that they had hospitalized a patient with measles (Santo A.) from the 8 to the 12 of January, but he had not reported it nor had he isolated him. He indicated that between the 7 and the 12 of January, family B. visited continuously the clinic to check on their grandmother, who had been hospitalized in the same room than Santo A and was suffering a cerebral-vascular accident. She passed away the 13 of January. He added that the family B. visitors where very curious and they got to close to the measles patient despite the warnings not to. The medic did not cooperate to complete the investigation neither did he furnish any information that will allow to determine if personnel members, or other patients or visitors of the clinic had been infected. The clinic of Santo A. did not had the diagnostic history written down.

Question (10) (a) *What does the visit from the Health professionals contribution to the measles transmission in Guayaramerín?* (b) *What solutions do you propose?*

The Dr. Saravia visited that same day the house of the family of Santo A., discovered that three of his brothers had measles symptoms [**Table III**]. Santo and his brother Julio had been hospitalized in the Roca clinic since the 8 till the 13 of January due to measles. No samples where taken. Family A is originally from Bella Vista, near Río Blanco, place difficult to access (by small airplane), and they referred been in Guayaramerín since approximately 5 years. They indicated that their only social activities where the visits to their relative Darwin M house, whom also had fever.

Question (11) (a) *Observing the data from Table II, what cases do you consider confirmed and why?* (b) *Why do you believe no blood and urine samples where taken from family A?*

Question (12) (a) *Distributing in groups of three persons, and using the data from **Table II**, complete the bar graphic with the confirmed measles cases in this epidemic by initial onset date. Shadow the bars corresponding to the cases of each family with a different pattern.* (b) *What does this graphic suggest about the measles transmission between the different affected families and about the possible places of infection?*

The coverage monitoring of the barrio illustrated that 23 (68%) of the 34 children 6 months to 4 years had been vaccinated against measles. The vaccination in that Area was recommended.

Question (13) *Why was the entire health area recommended for vaccination? Was it justified?*

Question (14) *Has the investigation ended?*

PART IV

PART IV: Visit of the families M. and O. and end of the investigation. [Time available: 50 minutes]

The eight of February, the Dr. Saravia visited the house of Darwin M., whom had been reported as in contact with the cases of the family A.. There he discovered that Darwin, 18 years of age, not vaccinated, had been liberated of the quarter end November 1999 and had compatible symptoms with measles since December 8. His brothers Milton (16 years), Iván (14 years) and Yazmin (13 years), all had not been vaccinated, all had measles symptoms too between 15 and the 22 of December. [**Table III**].

Question (15) *Observing the data from Table III, what cases would you consider as confirmed?*

The 10 of February, Dr. Saravia visited the quarter and conferred with Dr. T., senior medic, who did not help with the required collaboration. Nevertheless, the Health Department indicated that, end November, there had been three confirmed cases in the quarter and, in consequence, the entire quarter had been vaccinated.

The coverage monitoring in two different neighborhoods of the barrio illustrate that firstly 12 (100%) of the children 6 months to 4 years had been vaccinated against measles; secondly 8 (53%) of the 15 children 6 months to 4 years had been vaccinated. The vaccination in that Area was recommended. The case active search was continued.

The 12 of February, due that the laboratory had reported that a sample, belonging to Gladys O. (apparently without relation with this epidemic) was positive, Dr. Saravia visited the patient's address. Despite the fact that Gladys had gone to Brazil for a couple of weeks before and her relatives did not have her actual address, Dr. Saravia was able to question the family and determined that there had not been other cases. [**Table IV**]

Question (16) *Should the possibility that Gladys O could have initiated another epidemic in Brazil be considered?*

Questioned about the possible contacts that Gladys had two weeks prior to her rash, the mother indicated that they were relatives of Darwin and Milton M., whom, from her opinion, previously had fever. Gladys as well as the rest of the family visited frequently to the M..

Question (17) *(a) Distributing in groups of three persons, and based on the data from **Tables III & IV**, complete the bar graphic with the confirmed measles cases of this epidemic by initial onset date. Do not forget to illustrate the corresponding bars from each family case with a different pattern. (b) What does this graph suggest about measles transmission among the different affected families?*

Question (18) *Closely observe **TABLE V [Attack Rate by vaccination status and by age groups, Guayaramerín]**, that includes all the confirmed cases from this epidemic. Interpret these attack rates by age and by vaccination status and indicate if this outbreak is due to a lack in the completion of the national campaign.*

Question (19) *What does this investigation about the young adults that grew up in remote rural areas? What other possible risk groups whose decease could been prevented by the program did you identify during this investigation?*

END OF THE EXERCISE

MEASLES IN GUAYARAMERÍN.

GUIDE NOTEBOOK

(A) GENERAL INSTRUCTIONS

- This case study was designed for 15-30 participants with one or two guides, and will last approximately three hours.
- The study can be freely used for teaching, but must not be altered in any way. You can get our address on the internet (<http://www.paho.org>).
- The text will be distributed to the participants by sections. Part II will be distributed when work on Part I has been completed and response tables and graphics corresponding to that Part have been distributed, and so on. The guide notebook that includes the text, answering tables y graphics of all the questions will be distributed only at the end of the study.
- Each page is marked at the far right with the Part it pertains to.
- The participants will take part each one (clockwise) reading out loud a paragraph.
- Reaching each question each participant, at his turn will read one of them and will answer immediately. Requiring a reply, the question will be discussed briefly with the other participants. Always take in account that time is limited for each question. The monitor must therefor guide the discussion and detain it as long as necessary.
- The practical exercises will be resolved in groups of three (clockwise, each three participant will constitute a group).

The authors want to thank the collaboration of Dr. Edgar Paredes during the investigation, and the commentaries received by the doctors Rosario Quiroga., Oswaldo Barrezueta, Dalia Guris, Rodrigo Rodríguez, Carlos Castillo, Nancy Vásquez & Linda Venczel.

(B) ANSWERS TO THE QUESTIONS AND THE EXERCISES

ANSWERS PART I: Antecedents & initial investigation

(1) *¿It is possible that a month old baby has measles? ¿What does this suggests as to measles epidemic in that family?*

Answer: Most children are protected against measles by antigens transmitted by their mother's placenta. These often decrease during the second semester but persist until the 11th month in many children.¹ To be able to transfer antigens, the mother must have suffered the sickness or must be vaccinated. A sickness immunosuppressive in the mother can impeach the presence, and therefore the transfer of antigens. In the present case, the mother had no vaccination history and is now measles suspected, what suggests that prior she has not suffered of measles. This can be explained by the place where the family lived before is a rural area very low population, faraway from the main urban centers. These places, due to their isolation, can be measles outbreaks free for years, they are frequently not served by health systems, and then their inhabitants are few vaccinated. When measles is introduced after many years without outbreaks, this affects all age groups born after the last outbreak.¹

(2) *¿Was the investigation sufficiently accomplished?*

R. In reality there was no investigation as per say.

Reference:

1 Stephen C. Reed, Lauri E. Markowitz, Samuel L. Katz. *Measles Vaccine. In: S.A. Plotkin and W. Orenstein, Editors, Vaccines. W.B.Saunders Company, Philadelphia 1999: 222-266.*

ANSWERS PART II: The investigation.

(3) (a): ¿Why was a urine sample only taken from Baby Ortiz?

R: He was the only one at the time of the investigation that had at least under 8 days from the outbreak, and therefore the only urine sample was still viable for culture.

(b) ¿Was the numbers of blood sample taken proper? ¿Why?

R: In general one prefers taking approximately 5 samples from each outbreak to ensure that if it is measles at least one will be positive. In this case, the samples taken were proper and all where from people with two or more days without symptoms and within the 30 days prior to the initial onset. Then the possibility of having false-negative results (negative results in someone that really has measles) would be very low. Furthermore, the samples where sent the next day to the laboratory. In those conditions the samples taken would be sufficient to confirm the outbreak.

(4) (a) ¿What use can a full household census be [see table I], having symptoms or not?

R: The census is usually conducted in an age distribution to avoid omitting someone, it allows investigation of all close contacts. Knowing the ones that had symptoms and where they were during the time they could be contagious (the 7-18 days prior to the onset) and the time they could have infected others (from the initial symptoms up to the next following 4 days from the initial onset). That way, it is a guide to investigate those places and for follow-up campaigns. Depending of the outbreak, it can also census other neighborhood dwellings and other close-by communities and/or other communities or establishments (work places, quater, schools, day-care centers, hospitals, etc.).

(b) ¿What cases would you consider confirmed and why?

R: Due to the fact that some cases where laboratory confirmed all the other suspected cases that are close contacts are epidemiological link confirmed. Therefore, all the suspected case of Table 1 are considered confirmed.

(5) (a) Distributing in three person groups, and using the data from Table I, begin a graph with the confirmed measles cases of this epidemic by initial onset date. Use the all ready to fill graph. (b) Comment the usefulness of the graph to determine the possible infection source of each case.

R: See **Response Graph Part II: Measles** by initial onset date, family B. Due that all (except one case) had initial dates very close (23-25 January), it is reasonable to hope that they where all infected by a unique source. This being true, and the initial reported dates correct, the contact of each case with the "initial" case must been 7 to 18 days prior to the initial onset of each case. For this reason these contacts must been made between 18 before the 23rd of January and 7 days before the 25th of January. This is between the 5th and 18th of January. The investigation of visited places and occurred contacts during that period should illustrate who is this "initial" case. The last case (baby Ortiz), that occurred the 5th of February, could be infected from his mother (whom initiated the onset 13 days prior) or from one of his aunts.

(6) (a) Using the data from **Table I**, estimate the attack rate among the vaccinated. In order to select first all the vaccinated persons, and to determine among them how many cases there has been. The total confirmed vaccinated cases divided between the total of vaccinated persons and multiplying by 100 is the attack rate of the vaccinated. Estimating the attack rate among the vaccinated. (b) Estimate an attack rate among the not yet vaccinated. For that first select all the persons not vaccinated, and among them determine how many cases there has been. The total of confirmed cases not vaccinated divided among the total of persons not vaccinated and multiplying by 100 is the attack rate among the not vaccinated.

R: See response table part II: Measles in family B. Table of Attack rates by vaccination status and age groups.

(c) ¿What do these attack rates suggest by vaccination status about the outbreak cause, could a fault in the vaccination contributed?

R: There is no indication that there was a vaccination fault, as there has been no cases among the vaccinated. Even if there would be some case in the vaccinated persons this would not suggest a fault of the vaccine, as this one is not 90 to 95% effective in the one year old vaccinated. Furthermore hypothetically to have an outbreak in a 100% vaccinated community all the cases should inevitably be among vaccinated persons.

(7) (a) Using the date of **Table I**, dividing in groups of three people, estimate, first among the vaccinated, then among the not vaccinated and last in the total of each age group (vaccinated and not vaccinated), **the attack rate by age groups** (percentage of confirmed cases among the total of persons by age groups).

R: See Response to questions part II. Table of attack rate by vaccinated status and by age groups.

(b) Explain what means the attacks rates by age groups and what importance could that have in the measles control in Guayaramerín.

R: There are not a sufficient number of persons in each age group to be conclusive. This analysis if conducted, could expose the high risk age groups and therefore would help define the groups to be vaccinated.

(8) (a) ¿What utility could have the use of a surveillance card [see surveillance card]?

R: In areas where one does not know the reliability of the reported coverage data, the coverage surveillance can be used to estimate (a team of two persons can complete a surveillance of a block in 45 minutes) if the children under 5 years old of the block where the case lives, and other blocks where high risk people live (migrants, poorly served population, etc.). Finding in these high risk blocks that all the children are well vaccinated, one will hope that in the other blocks (presumably at lower risk) the coverage are similar or higher. Finding that in two or three surveillance blocks there is insufficient coverage (under 95%), one should consider vaccinating that area or municipality.

(b) Explain how an epidemic could occur in a block whose coverage among the under 5 years old is of 95%.

R: The epidemic affected mainly age groups that were not vaccinated during the recent campaign, with specific risk factors (coming from isolated rural areas).

(9) ¿What was left to investigate? ¿What utility would be gained in doing it?:

R: The probable infection sources were left to be investigated, who could be infected from it, and other risk factors. The case Gladys O should also be investigated.

RESPONSES PART III: Visits to the Roca clinic and to family A.

(10) (a) *What does this visit from the health professionals suggests to the contribution of the measles transmission in Guayaramerín?*

R: The Roca clinic acted as a multiplying factor of the epidemic. Not only could it not report the case of Santo A, that the clinic medic had reported as measles, nor of his brother, (¿lack of knowledge of the surveillance norms?), but neither was any precaution taken in isolating the infected patients, nor where their contacts vaccinated.

(b) *¿What solutions are proposed?*

R: The instruction of public and private health professionals in surveillance norms and infections control and the regular educative supervision of the public and private clinics to increase the surveillance and the appropriate control of infections could avoid the repetition of these facts.

(11) (a) *From data of Table II, what cases would you consider confirmed cases and why?*

R: All suspected cases, with or without sample, they are confirmed as epidemiological link of confirmed cases.

(b) *In you opinion, what is the reason why they did not take blood or urine samples from family A?*

R: There had been over 30 days from the initial rash, therefor, the probability that the serum analysis was high of a true-false result. Furthermore, the contacted cases where confirmed cases.

(12)(a) *Distributing in three people groups, draw a graphic of measles confirmed cases of this epidemic from the onset date using data from tables I & II.*

R: See **graphic reply part III**: Measles from initial onset dates, families A & B.

(b) *What do these dates suggest about the measles transmission and possible contagion places of each family group?*

R: The contagion place of family B seems to have taken place in the Roca clinic. The key case for the onset for the family B seems to have been Santo A, whose rash had started on January 6, and was hospitalized when the family B visited the clinic. Even if his brother Julio A was also hospitalized during those days, his rash (if the date is properly reported) had started four days prior to his hospitalization, and therefor is more than probable that he was still contagious.

(13) (a) *Why was the vaccination recommended in the entire health area? Was it justified?*

R: Although it cannot be generalized to non monitored blocks, the monitor result suggested that measles vaccination coverage, at least in the monitored blocks, was insufficient to avoid infection dissemination. Due to the necessity of a rapid reply, this area was immediately vaccinated.

(14) *Has the investigation ended?*

R: No, the investigation still has to investigate the infection source of family A. This will allow to identify other factors and risk groups whose vaccination could help prevent future epidemics

RESPONSE PART IV: Visit to the families M. & O. and end of the investigation.

(15) *Observing the data from Table III, what do you consider as confirmed?*

R: As previously discussed, all suspected, as epidemiological link from confirmed cases, will be considered confirmed.

(16) *¿Should the possibility that Gladys O could initiated another epidemic in Brazil be considered?*

R: A measles patient can transmit the virus from the beginning of first symptoms up to 4 days after the rash onset. Gladys had traveled to Brazil well after that period and was therefore not infectious. Nevertheless, she could have traveled to Brazil in other occasions. Furthermore, her contacts and other symptomatic persons could have been in contact with other Brazilians or traveling there. For these reasons, the local authorities in Brazil where contacted so they can investigate probable measles cases.

(17) (a) Distributing in 3 person groups, and based in the **Tables III & IV** data, complete the bar graphic with confirmed measles cases of this epidemic by rash onset date. Do not forget to cover the bars corresponding to the cases of each family with a different pattern.

R: See **Question Answer Graphic part IV**: Measles by initial onset, Families B, A, M & O, Guayaramerín.

(b) What does this graphic suggest about the measles transmission among the different affected families?

R: The initial case of this epidemic (the first detected confirmed case in the investigation) was Darwin M, whom probably contracted it in the quarter. Darwin, could have infected his three brothers, as these, during the 7-18 days prior to the initial onset (15 and 22 December) where frequently exposed to him. Although Gladys O. could have infected either of these three brothers, the onset dates make it more probable that the infection source was Milton or Yazmin M. The rest of the graphic has already been discussed.

(17) Closely Observe **TABLE V [Attack rates by vaccination status and age group, Guayaramerín]**, include all confirmed cases in this epidemic. Interpret these attack rates by age and by vaccination status and indicate if this outbreak was due to a fault in the completion of the national campaign.

R: The only younger than 6 months in the affected families only had symptoms but does not reveal fault in the program, as neither he, or his mother, or aunts (from whom presumably he was infected), were eligible for vaccination. Although the attack rate in the not vaccinated from 6 months to 4 years (target population of this campaign) was 100%, the denominator was only a child. All the others from that age group had been properly vaccinated and did not present cases. In the school age children, the attack rate was moderate and all the cases were among the not vaccinated. The young adults, not eligible for the vaccination program, nor for the campaign, had a high attack rate. This could be explained by (1) they were never vaccinated and-or (2) having been raised in isolated rural areas they were little exposed to measles, as discussed. The over 35 years, as expected due to their long exposure to the wild sickness during the pre-vaccination era, were probably no susceptible and had no cases. In synthesis, the outbreak does not show lack in the campaign implementation as the target groups were not infected.

(18) What does this investigation suggest about young adults that grew up in isolated rural areas? What other high risk groups whose sickness could be prevented by the program have you identified during this investigation?

R: As it has been illustrated in many occasions, keeping a high measles coverage ($\geq 95\%$) in children < 5 years is essential for the eradication. This epidemic in particular, although the vaccination coverage in children has contributed to the moderated number of cases, the transmission lasted at least two months y 4 (25%) of the identified cases were hospitalized. This prolonged transmission can be explained by the contribution to the epidemic of young adults of 15 to 34 years, migrants from rural isolated areas (including a military recruit). This one and other investigations indicate that these groups, in particular if they are in enclosed places (quarters, etc) are at risk to infect and introduce the sickness in the community, their vaccination should be considered. As it has been noted in this and other studies, the health workers are at high risk, as they have a high probability to be in contact with symptomatic cases, and be infected by them, they can disseminate the sickness very quickly to particularly fragile groups.

Final Notes: From this and other investigations, Bolivia, not only continuing efforts to vaccinate children in Areas where official coverage data or the monitoring findings indicate insufficient coverage, and to reinforce the health workers vaccination, recommended vaccination of migrants in rural areas and military recruits. The last epidemic 1998-2000 in Bolivia case occurred in a quarter of Trinidad, Beni, in February 23, 2000. Up to the 27 of Mayo 2000, despite that all the cases have been intensely investigated and that the active search has continued, there has been 12 weeks without confirmed cases in Bolivia. Nevertheless, there still are areas in the country whose coverage are insufficient, and many health workers and other high risk persons have not been vaccinated.

END

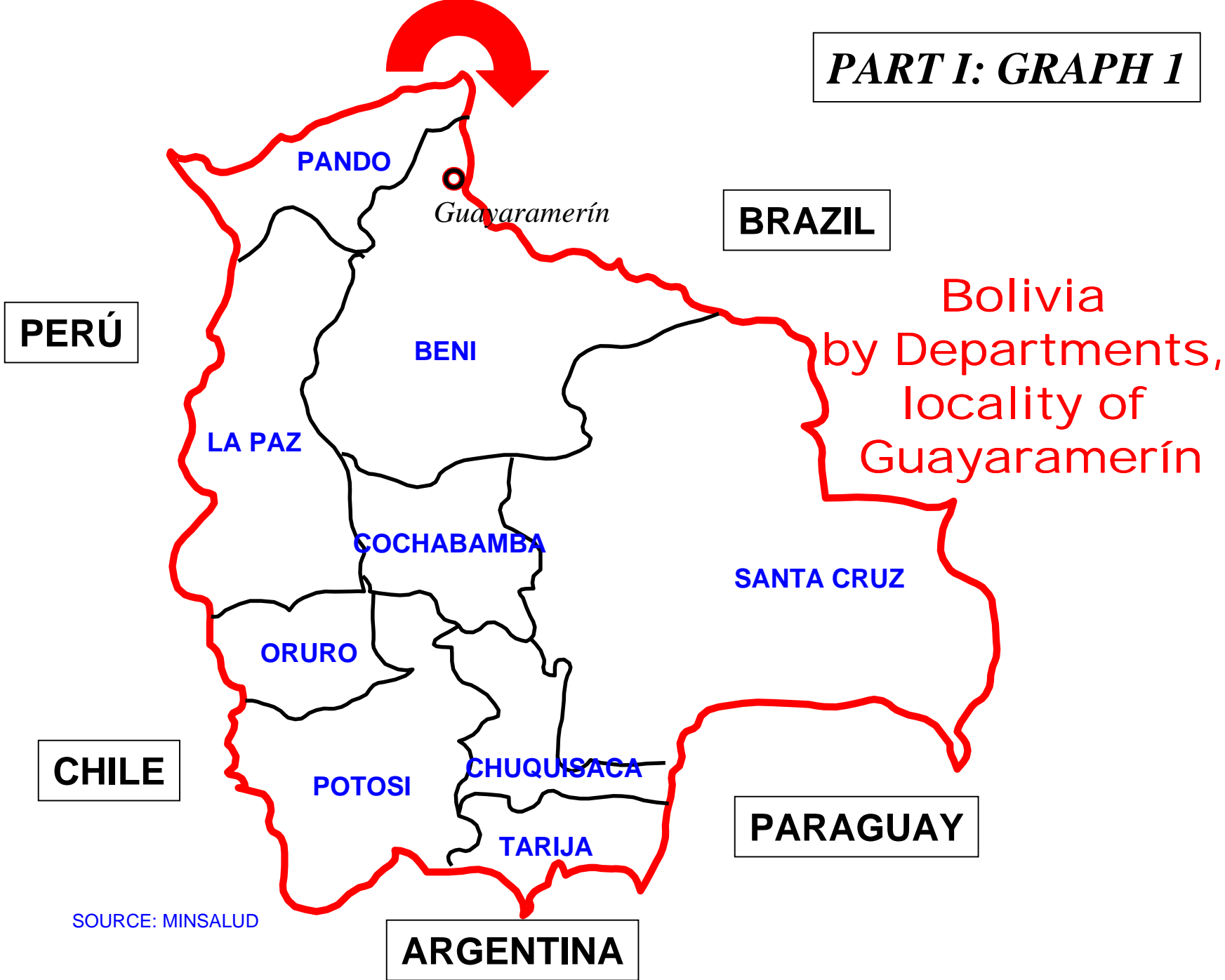
PART II: ANSWERS TO QUESTIONS ABOUT ATTACK RATE
MEALES IN LINE B. - GUAYARAMERIN, JANUARY 1999 TO FEBRUARY 2000
TABLE ATTACK RATE BY VACCINATION STATUS AND BY AGE GROUP

AGE GROUP	VACCINATED			NOT VACCINATED			TOTAL		
	CASES	POPU	Rate x 100	CASES	POPU	Rate x 100	CASES	POPU	Rate x 100
0 - 5 m	0	0	0	1	1	100	1	1	100
6m - 4 y.	0	2	0	1	1	100	1	3	33
5 - 14	0	7	0	0	1	0	0	8	0
15 - 24	0	2	0	3	3	100	3	5	60
25 - 34	0	0	0	3	4	75	3	4	75
35 +	0	0	0	0	2	0	0	2	0
TOTAL	0	11	0	8	12	67	8	23	35

**PART IV: TABLE V (ATTACK RATE BY VACCINATION STATUS AND BY AGE GROUP)
 MEASLES EPIDEMIC - GUAYARAMERIN, DECEMBER 1999 TO FEBRUARY 2000
 ATTACK RATE BY VACCINATION STATUS AND BY AGE GROUPS**

AGE GROUP	VACCINATED			NOT VACCINATED			TOTAL		
	CASES	POPU	Rate x 100	CASES	POPU	Rate x 100	CASES	POPU	Rate x 100
0 - 5 m	0	0	0	1	1	100	1	1	100
6m - 4 y.	0	5	0	1	1	100	1	6	17
5 - 14	0	8	0	3	9	33	3	17	18
15 - 24	0	2	0	8	13	62	8	15	53
25 - 34	0	0	0	3	5	60	3	5	60
35 +	0	2	0	0	6	0	0	8	0
TOTAL	0	17	0	16	35	46	16	52	31

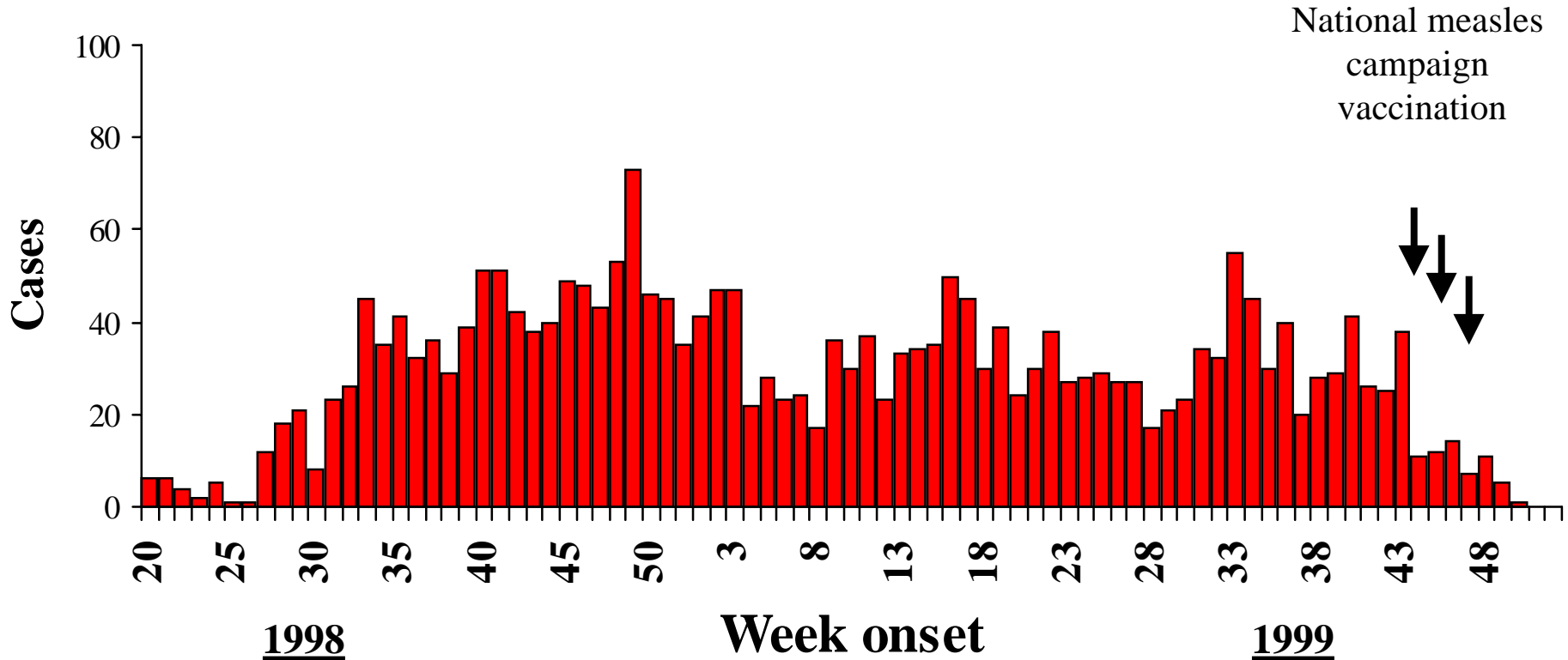
PART I: GRAPH 1



SOURCE: MINSALUD

PART I: GRAPH 2

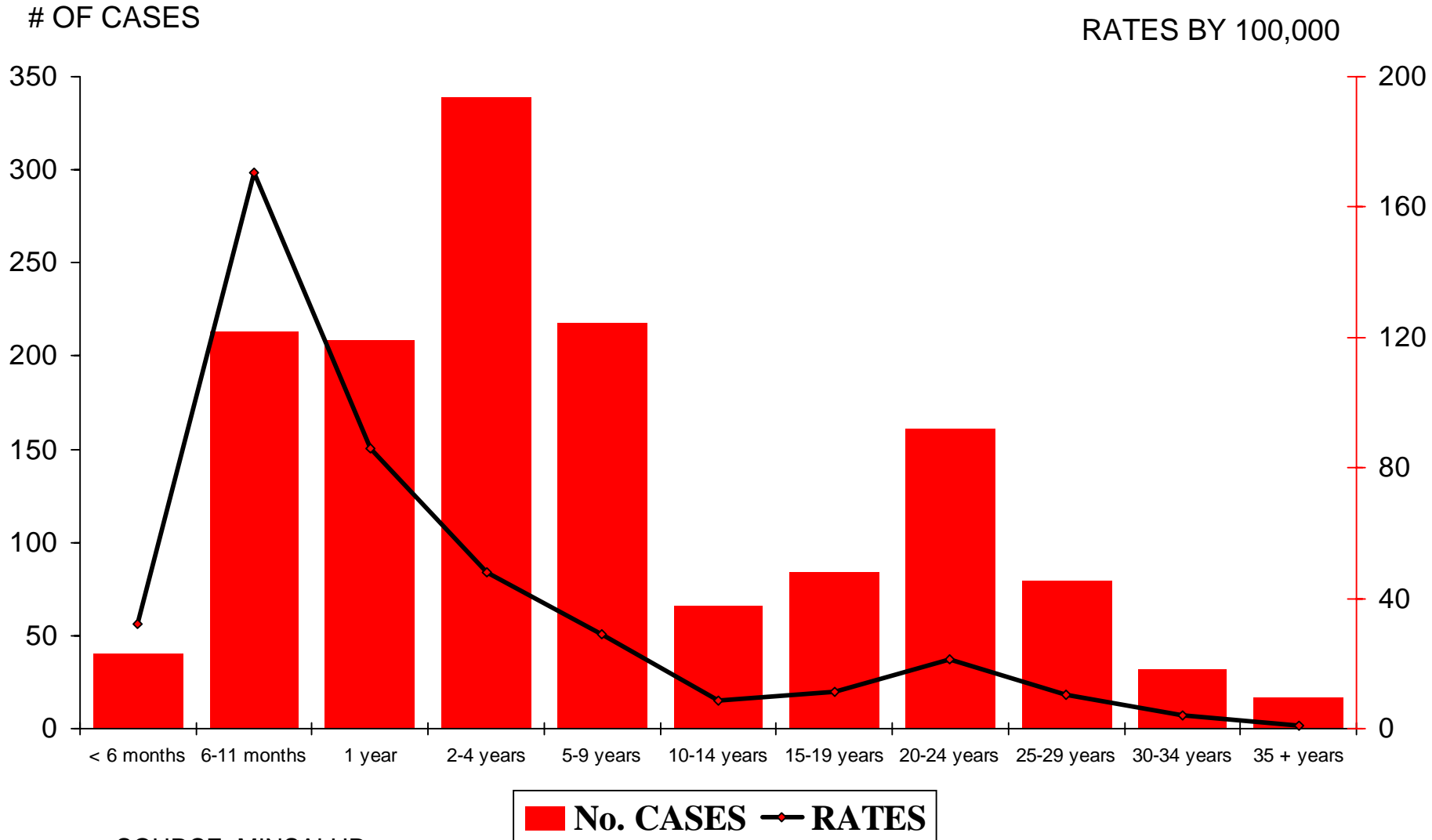
**Measles by initial week,
Bolivia, May 1998- December 1999**



Source: MINSALUD. There was 1004 cases in 1998, and 1441 in 1999.

PART I: GRAPH 3

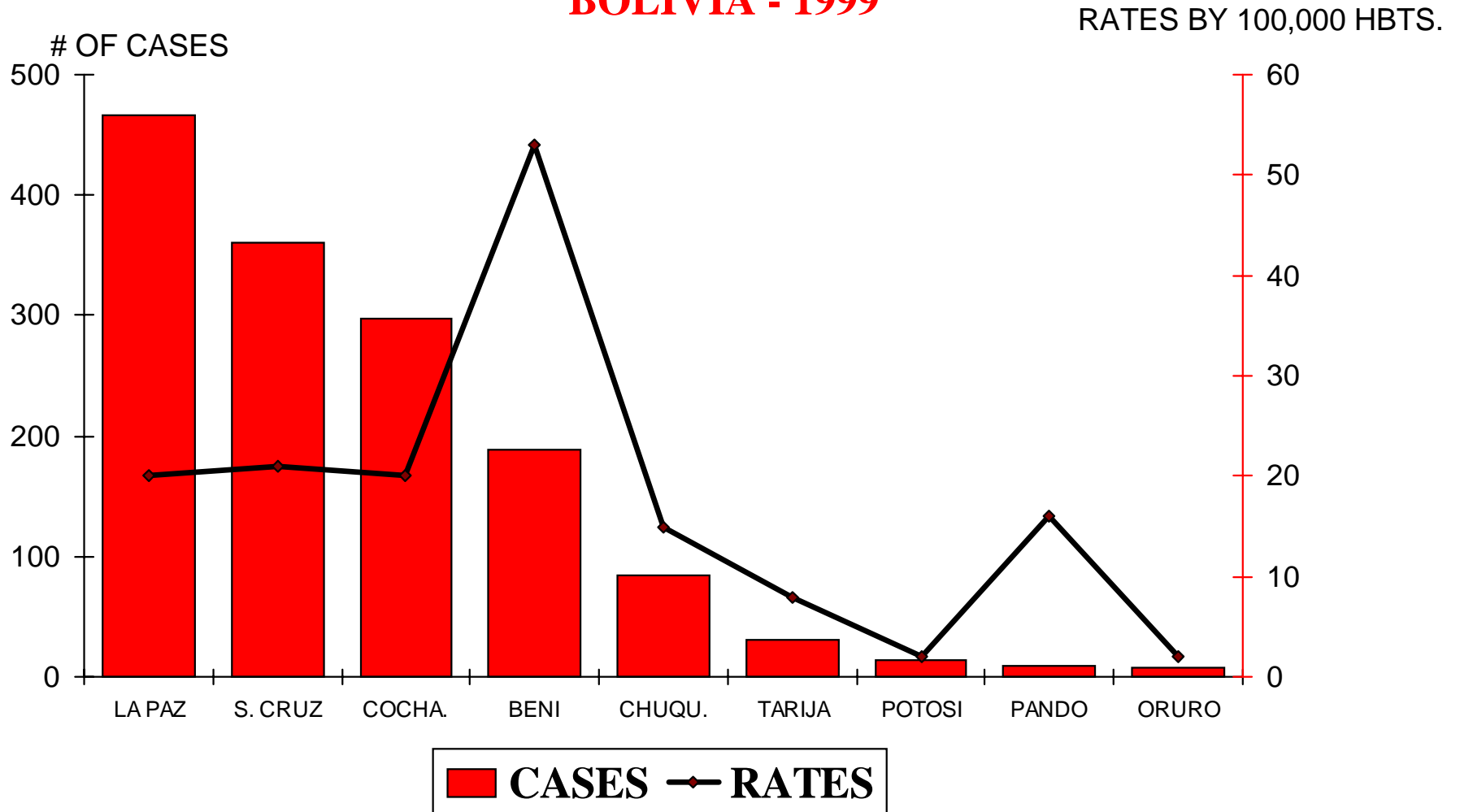
**NUMBER OF MEASLES CASES AND INCIDENCE
BY AGE GROUPS, BOLIVIA, 1999**



SOURCE: MINSALUD

PART I: GRAPH 4

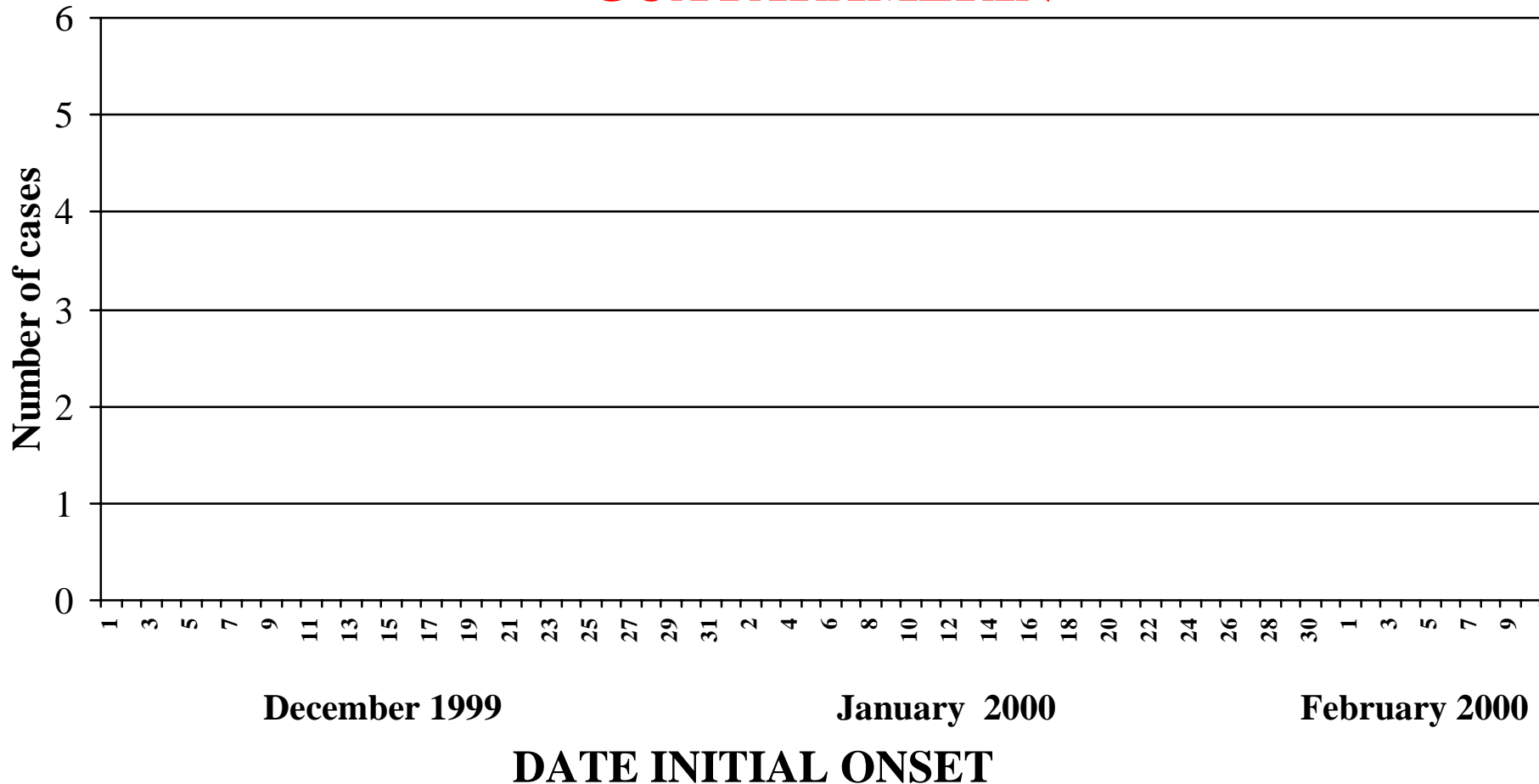
**MEASLES CASES AND
INCIDENCE BY DEPARTMENT
BOLIVIA - 1999**



SOURCE: MINSALUD

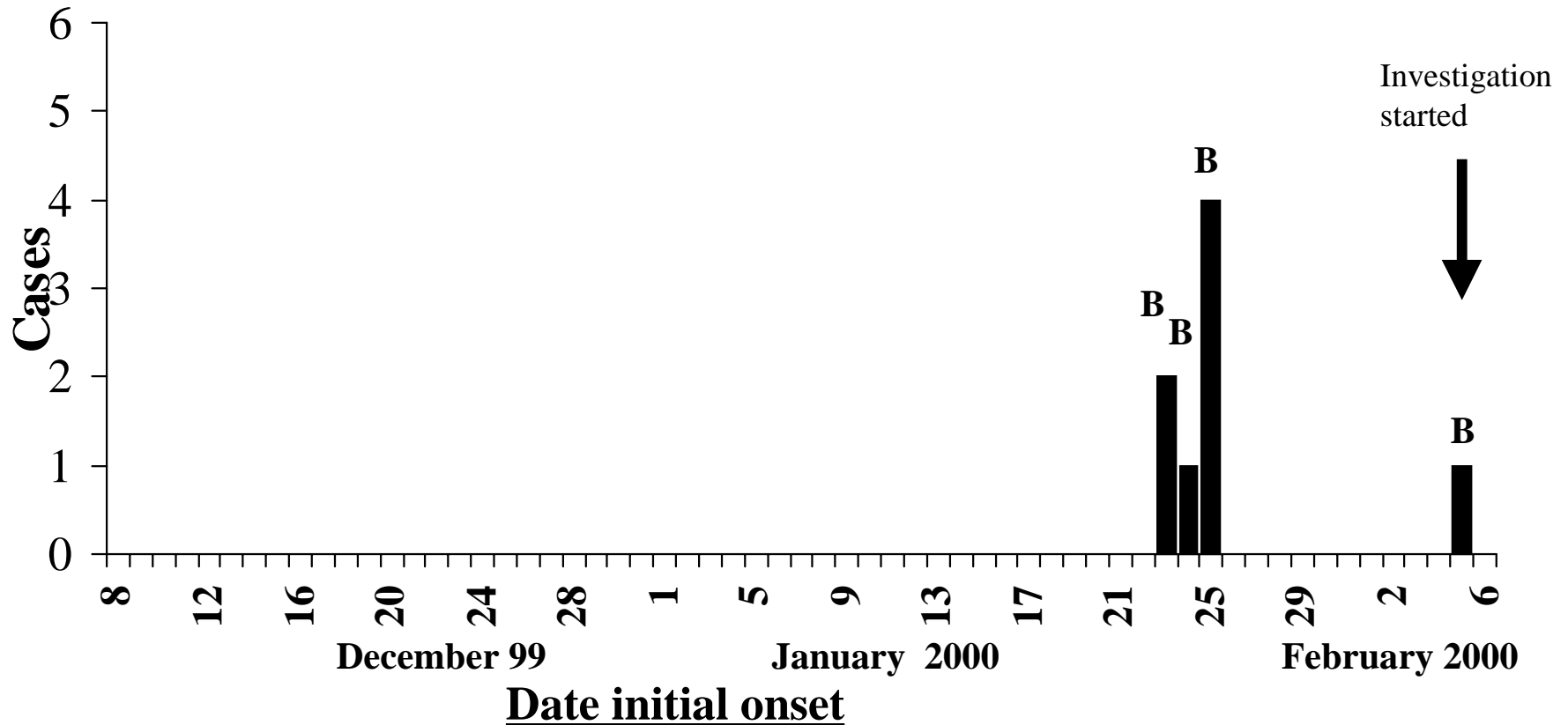
PART II: GRAPHS 6

GRAPH TO FILL IN: QUESTIONS PARTS II, III, IV
MEASLES BY INITIAL ONSET DATE,
GUAYARAMERIN



ANSWERS PART II

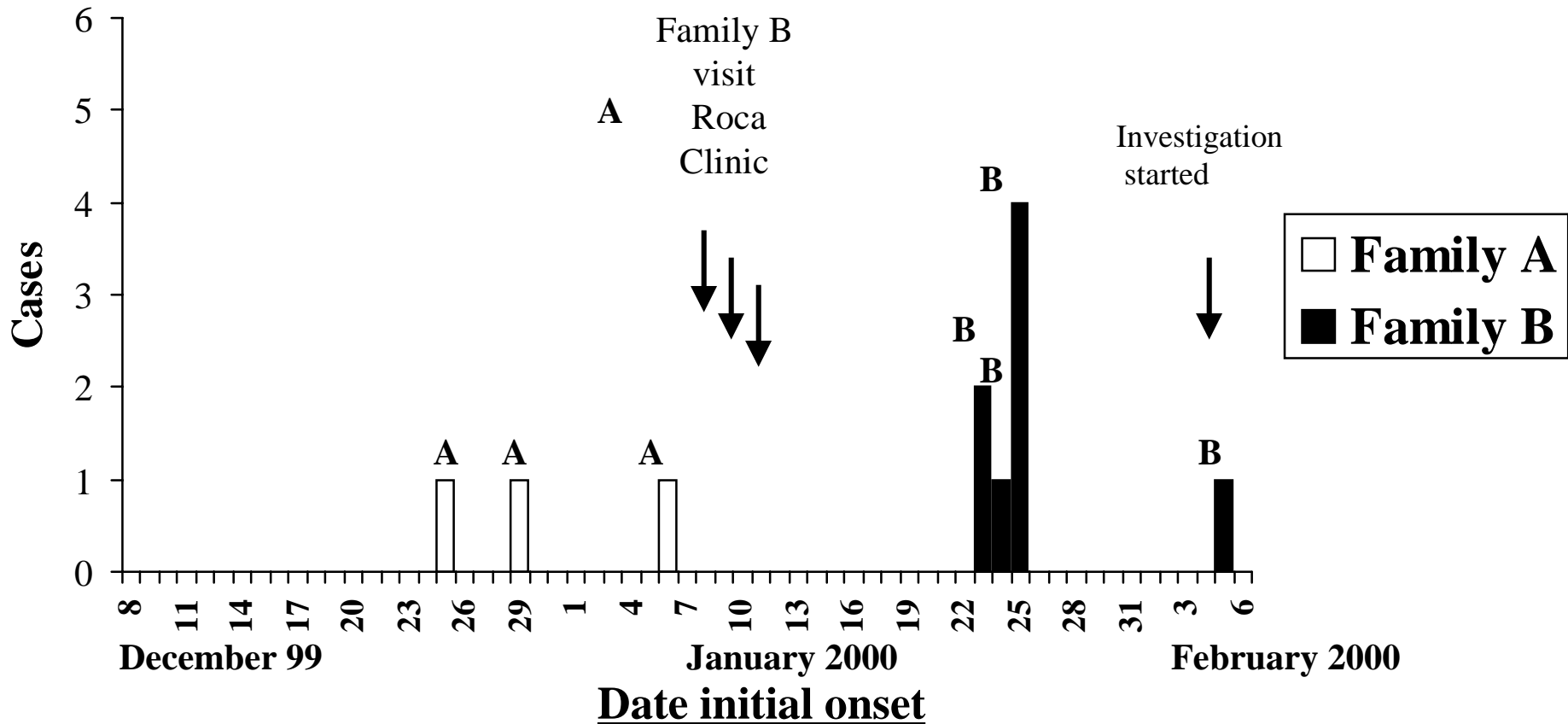
**MEALSE BY INITIAL ONSET DATE,
FAMILY B, January-February 2000***



* The incidence on each family is represented by a corresponding bar

ANSWER GRAPH PART III

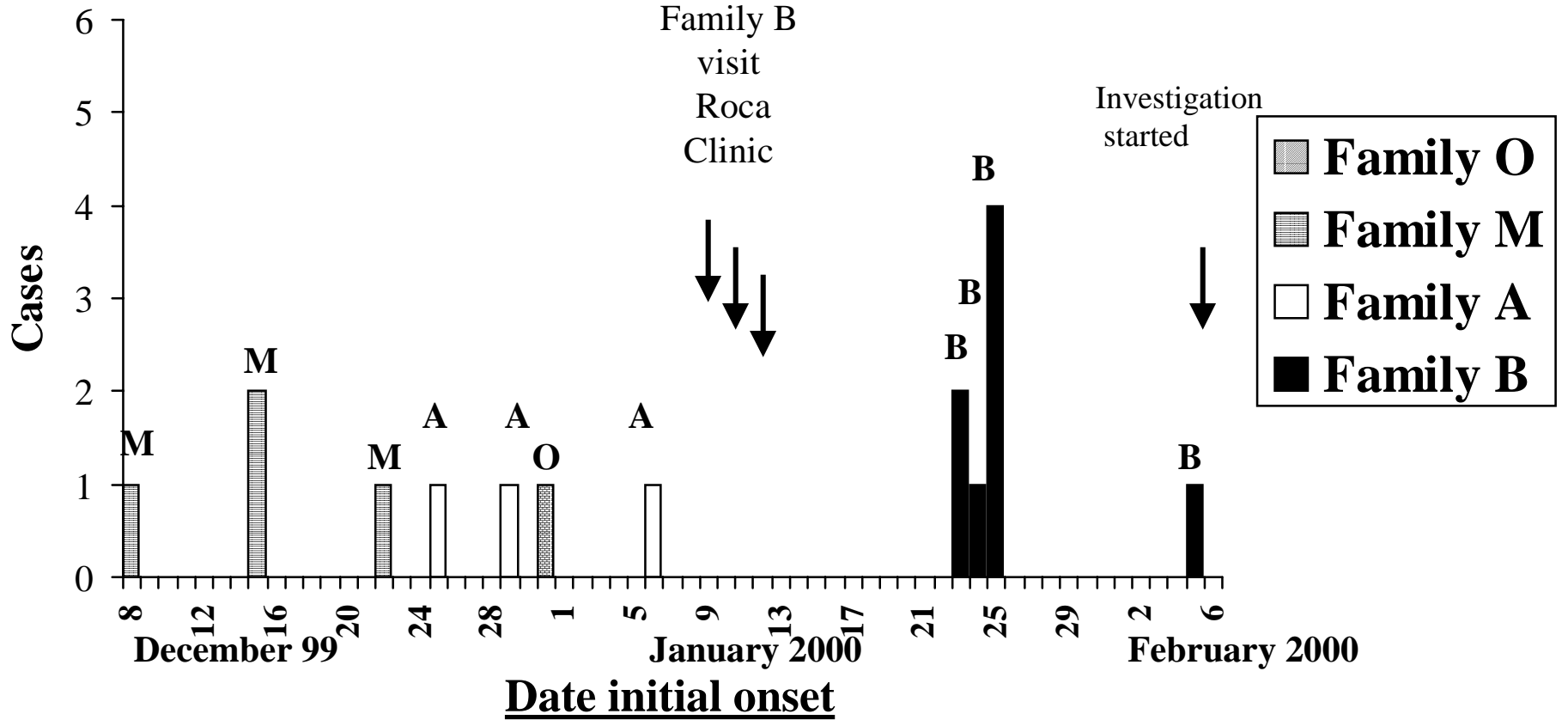
MEASLES BY INITIAL DATE, FAMILIES B & A, GUAYARAMERÍN December 1999 to February 2000*



* The incidence on each family is illustrated on each corresponding bar

GRÁFICO RESPUESTA PARTE IV

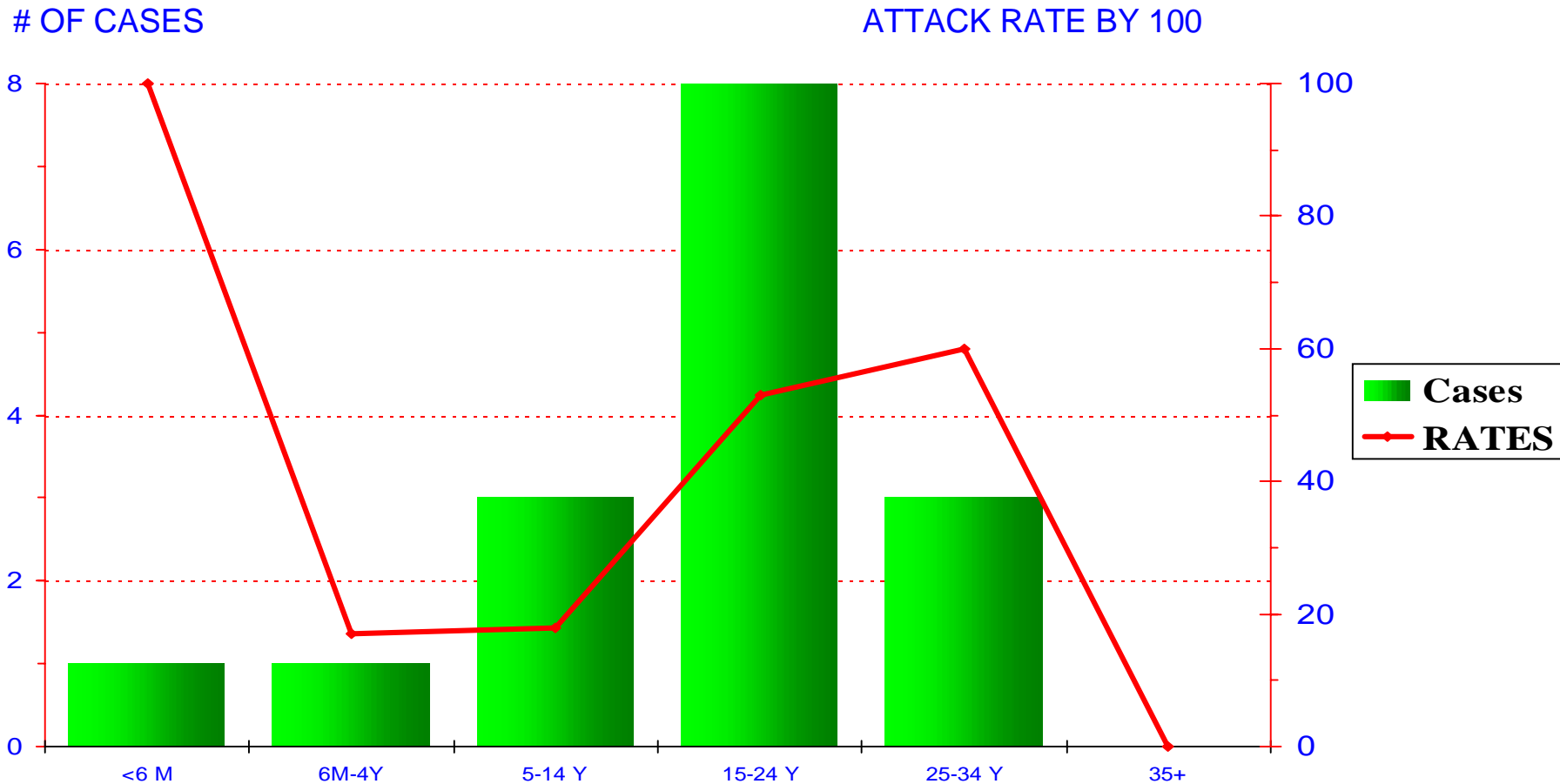
MEASLES BY INITIAL DATE, FAMILIES B, A, M & O, GUAYARAMERÍN December 1999 to February 2000*



* The incidence on each family is illustrated on the corresponding bar

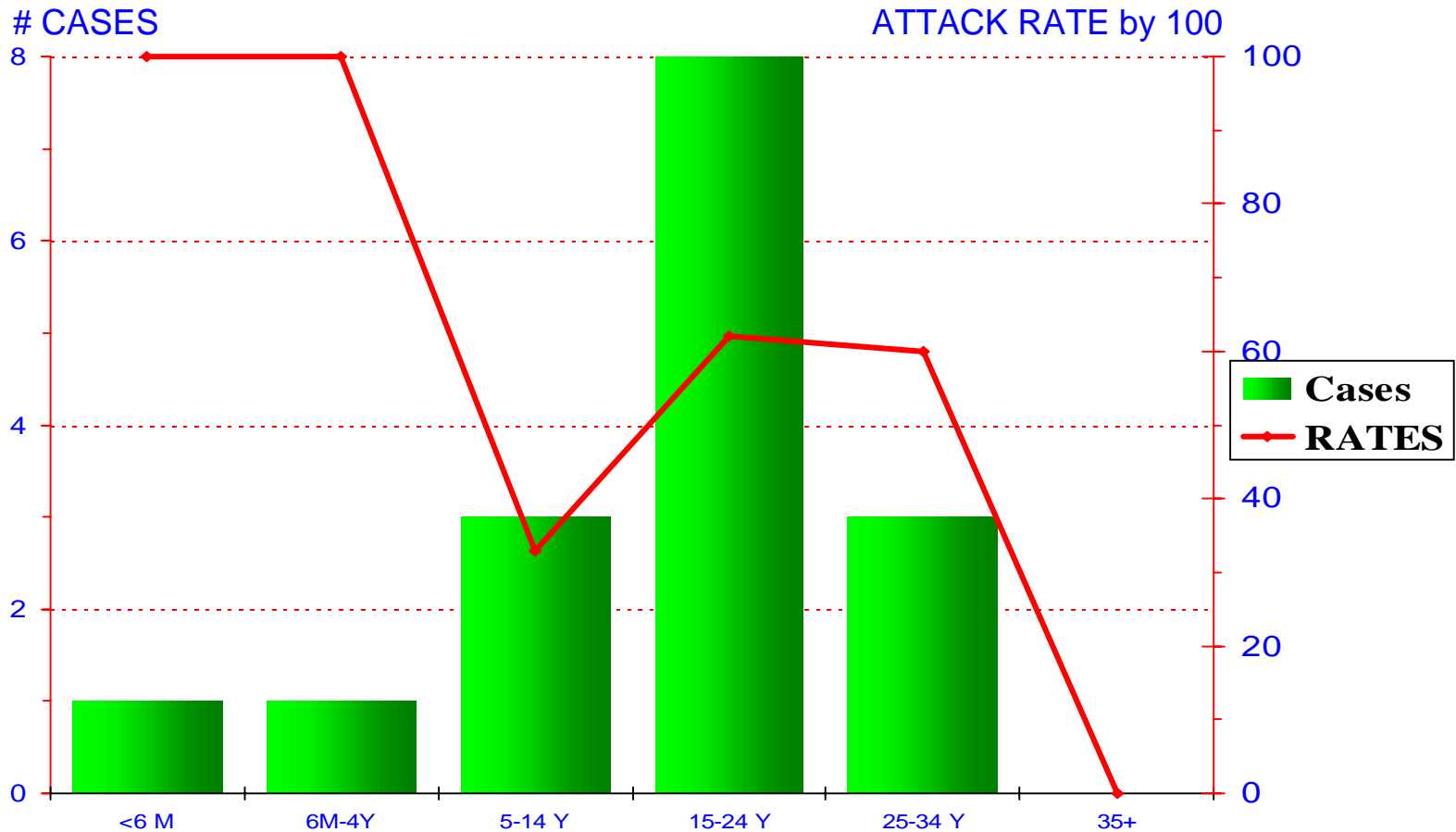
FINAL GRAPH TO PRESENT (PART IV)

MEASLES CASES AND INCIDENCE by AGE Guayaramerín, December 1999-February 2000



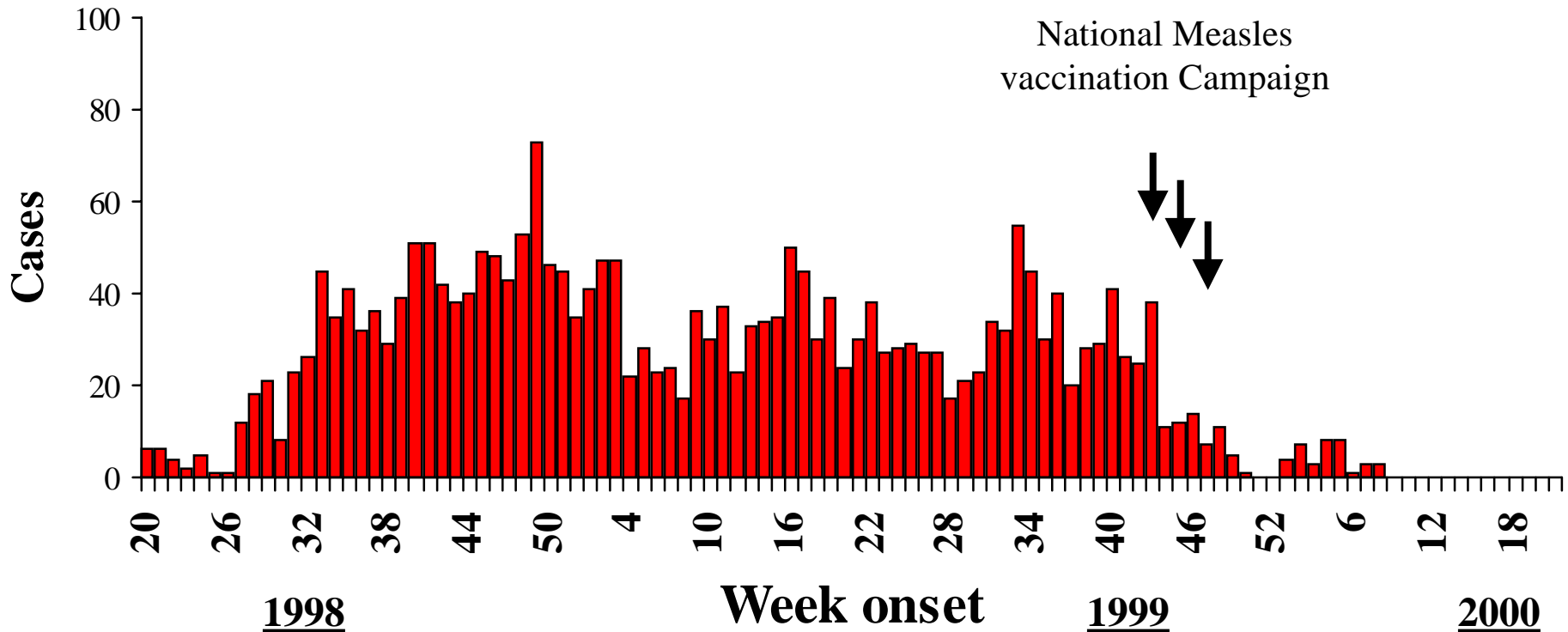
ADDITIONAL GRAPH (PART IV)

MEASLES CASES AND INCIDENCE BY AGE IN THE NOT VACCINATED, Guayaramerín, December 1999-February 2000



ADDITIONAL GRAPH, MEASLES IN BOLIVIA

Measles by initial week, Bolivia, may 1998- may 2000



Source: MINSALUD. Updated May 27, 2000. There were 1004 cases in 1998, 1441 in 1999 and in 2000, as of week 22, there has been a total of 37 confirmed cases. The last confirmed case occurred the 23 of February of 2000 in a quarter of Trinidad (Beni). There is no more active municipalities.

PART II: Table I

Table I

Investigation date: *February 6, 2000*

Investigated Residence or institution: **Family B.**

Inspectors in charge: *Dres. Saravia, Paredes e Izurieta*

Barrio or Area: *Calle Oruro, Area Central*

Name	Age (Y/M)	Sex (M/F)	Vaccinated Against Measles (Yes/No)	Suspected Case* (Yes/No)	Date Initial Onset	Sample taken (Serum; Urine; None taken)	Laboratory Result (Pos/Neg)	Places where there was case approximately two weeks (7-18 days) prior to the beginning of the onset (where there could have been infected)	Dates that they investigated those places	Visited places from the initial symptoms (where other persons could have been infected)	Dates that those places where investigated	Observations or comments
Sr. Balcázar	59 Y	M	No	No		No						
Sr. Espinosa	59 Y	M	No	No		No						
Eida B.	30 Y	F	No	Yes	25/01/00	No		Roca Clinic, Property	07/02/00; 08/02/00	House, property	08/02/00	
Rosmary B.	28 Y	F	No	Yes	25/01/00	Serum	Pos	Roca Clinic, Property	07/02/00; 08/02/00	House, property	08/02/00	Johnny's Mother
Odali B.	26 Y	F	No	Yes	23/01/00	No		Roca Clinic		Bravo Clinic	07/02/00; 08/02/00	Hospitalized
Fanny B.	25 Y	F	No	No		No						Measles History**
Diana B.	23 Y	F	No	Yes	23/01/00	Serum	Pos	Roca Clinic	07/02/00	Bravo Clinic	07/02/00; 08/02/00	Hospitalized, mother Baby Ortiz
Mariela B.	19 Y	F	No	Yes	24/01/00	Serum	Pos	Roca Clinic	07/02/00; 08/02/00	House, property	08/02/00	
Delsa B.	16 Y	F	No	Yes	25/01/00	Serum	Pos	Roca Clinic	07/02/00; 08/02/00	House, property	08/02/00	
Janife	15 Y	F	Yes	No		No						
Donaldo	15 Y	M	Yes	No		No						
Harold	14 Y	M	Yes	No		No						
Luis A.	12 Y	M	Yes	No		No						With card**
Janeline	11 Y	F	Yes	No		No						
Fabiola	10 Y	F	Yes	No		No						
José>	8 Y	M	No	No		No						
Lavive	8 Y	F	Yes	No		No						
Ailton	5 Y	M	Yes	No		No						With card
Carolina	5 Y	F	Yes	No		No						With card
Niñito Ortiz	2 Y	M	Yes	No		No						With card
Brais R.	2 Y	M	Yes	No		No						With card
Baby Ortiz	8 M	M	No	Yes	06/02/00	Urine	Pending.	House, property				
Johnny E..	1 M	M	No	Yes	25/01/00	No		Roca Clinic				

** Measles Diagnostic in Cochabamba 9 years ago.

*** During this investigation, the testimony of the mother about the vaccination status of her children was accepted as valid.

PART III: Table II

Table II

Investigation Date: *February 7, 2000*

Investigated residency or institution: **Flia A.** _____

Inspectors in charge: *Dr. Saravia*

Barrio o Area: 8 of December

Name	Age (Y/M)	Sex (M/F)	Measles Vaccinated (Yes/No)	Suspected case* (Yes/No)	Date initial onset	Sample taken (Serum; Urine; None taken)	Laboratory Result (Pos/Neg)	Places that there was a case approximately two weeks (7-18 days) prior to the beginning of the onset (there could have been infected)	Dates the places where investigated	Visited places from the initial symptoms (where could have infected other persons)	Dates the places where investigated	Observations or comments
Julio A.	52 Y	M	No	No								
Ramona Ch.	42 Y	F	No	No								
Jesús A.	22 Y	M	No	No								
Santo A.	19 Y	M	No	Yes	06/01/00	No		Work as Taxicab		Interned Roca clinic from 8 to 13 of January	07/02/00	
Francisca A.	16 Y	F	No	Yes	25/12/99	No		House.				
Evilenia A.	14 Y	F	No	No								Roommate
Julio A.	13 Y	M	No	Yes	29/12/99	No		House		Interned Roca clinic from 8 to 13 of January	07/02/00	
Yelmi A.	8 Y	F	Yes	No								With card, sister of Julio, Francisca and Santo.
Ariel R.	4 Y	M	Yes	No								With card, child of Evilenia, visited the house frequently
Alvaro R	2 Y	M	Yes	No								With card, son of Evilenia, visited the house frequently

PART IV: Table IV

Table IV

Investigation date: *February 12, 2000*
 Investigated residency or institution: Family O.

Inspectors in charge: *Dr. Saravia.*
 Barrio or Area: The Almendros, Guayaramerín.

Name	Age (Y/M)	Sex (M/F)	Vaccinated against Measles (Yes /No)	Suspected case* (yes /No)	Date initial onset	Sample taken (Serum; Urine; None taken)	Laboratory result (Pos/ Neg)	Places the case visited approximately weeks (7-18 days) prior to the beginning of the onset (where could be infected)	Dates these places where investigated	Places visited since the beginning of the symptoms (where could infected other persons)	Dates these places where investigated	Observations, comments
Mariano O.	43 Y	M	No	No		No						Father of the family.
Josefina M.	44 Y	F	No	No		No						Mother
Gladys O.	22 Y	F	No	Yes	31/12/99	01/01/00	Pos	Visited Riveralta for a week, was in contact with Darwin M.	No	House of Darwin, went to Porto Velho, Brazil the 12 of January.		Nurse Maggie Ch., of Guajarámerim (Rondonia) was informed of this case on the 18 of February.
Ilvia O.	18Y	F	No	No		No						Daughter
Roberto O.	16 Y	M	No	No		No						Son
Saúl O.	15 Y	M	No	No		No						Son
Dany O.	14 Y	M	No	No		No						Son
Aida O.	13 Y	F	No	No		No						Daughter