

## **Outbreak of measles in the National Capital District, Papua New Guinea in 2001**

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### **SUMMARY**

Documentation in the past has shown that measles outbreaks occurred in the National Capital District every 3-4 years, with the last outbreak in 1997. In 2001 another outbreak of measles occurred in the National Capital District. A total of 492 cases of measles were recorded during the 6 months (April-September) of a study conducted at the Children's Outpatients Department and the Paediatric Ward of the Port Moresby General Hospital (PMGH). The highest number was recorded in July. 44% of patients were infants less than 12 months of age. 9% of children with measles were under 6 months, the recommended age for vaccination. Only 35% of the children with measles had had their first inoculation and only 11% had received their second inoculation of measles vaccine. During this epidemic, 14.5% of the total attendance of 38,323 children received measles vaccine in the children's outpatients. 72% of children seen with measles at PMGH were admitted to the paediatric ward. Most were admitted because of complications, including severe pneumonia and/or diarrhoea. There were 19 deaths recorded during the 6 months study, a case fatality rate of 4%.

### **Introduction**

Measles is one of the many preventable diseases affecting children in Papua New Guinea (PNG). It is easily prevented by immunization of children under 1 year old. It is an acute, highly contagious viral infection caused by the measles virus (morbillivirus) transmitted by respiratory droplets. It has an incubation period of 10 days but may range between 7 and 18 days (1). In developing countries, death associated with measles is common in children under 5 years old, due to complications such as pneumonia and diarrhoea (2).

The measles vaccine is a freeze-dried preparation containing live attenuated measles virus and is stored at a temperature between 2 and 8°C in a refrigerator. The vaccine is reconstituted with sterile water immediately before use and the dose of 0.5 ml is given by subcutaneous injection. The vaccine should provide about 95% protection when given to

children at 9 months or older (3). The live attenuated virus (Schwarz strain) vaccine is used in Papua New Guinea.

According to the National Health Plan for 1974-1978, measles immunization was not done because measles was "not an important health problem and the cost of vaccines when considered against benefits did not warrant their routine use" (4). That view was changed drastically in the Eastern Highlands Province where measles became the major cause of mortality in children admitted to hospital (5). In 1982 measles vaccine was introduced as a routine immunization in PNG with the vaccine given at 9 months of age. In 1988 the policy was reviewed and modified, so that in epidemics all children aged 6 months and above must be immunized. This policy was adopted nationally in 1990 (5). Inoculation with measles vaccine is recommended for children at 6 and 9 months of age (6).

In the National Capital District (NCD), the

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measles immunization coverage (second dose) is 66% while the national target is 76% (7).

This paper describes a recent outbreak of measles in the National Capital District. The aims of the study were to examine the relationship between the risk factors causing morbidity and mortality, analyze complications and describe hospital morbidity and mortality.

### Methods

Structured questionnaires were administered to the parents/guardians of children with measles in the Children's Outpatients Department (COPD) and those admitted to the Paediatric Ward of the Port Moresby General Hospital (PMGH). The information collected included gender, age, date of birth, immunization status, place of residence, province of origin, number of siblings, number of other relatives living in the same house, days of illness before presenting to children's clinic, presenting symptoms and signs and clinical manifestations. The children's health record books were examined for date of birth, number of siblings and record of measles vaccination.

The inpatient records of measles patients, including those who developed measles in the ward, were examined for details of signs and symptoms and types of complications of measles, number of days in hospital and treatment outcomes: number of those discharged, absconded or died. The measles cases presenting to urban clinics were not included in this study, except when they were subsequently referred to the children's outpatients.

The severity of the disease was classified on clinical assessment of the symptoms and signs such as the severity of diarrhoea, oral thrush and conjunctivitis. Moderate to severe pneumonia was diagnosed when a child had shortness of breath with a respiratory rate of more than 40 per minute, pulse rate of 160 or more per minute, in-drawing of ribs, cyanosis and/ or not feeding well. Such children were admitted to the paediatric ward. Children with mild pneumonia and diarrhoea were treated in outpatients and sent home on medications. Hospital records were examined for the number of measles cases in the last 4 years.

We conducted the interviews with the parents/guardians. The data were entered into the computer and analyzed by Epi Info version 6.04.

### Results

A total of 492 children with measles were recorded; there were 260 (53%) males and 232 (47%) females. Mean age of these children was 28 months. 44% of them were infants under 12 months of age. Nearly 27% of the children were of families having 4 or more children. 65% of the children were not vaccinated.

Over 34% of the children came from homes with 11 or more people including children living in the house. The average or mean household size in this study was 9.7 persons (the median was 9.0). On average, household size in PNG is 5.7 persons, 6.3 for urban and 5.6 for rural areas (8).

The number of measles cases reported to PMGH each month is shown in Figure 1. The highest number of cases was recorded in July. Six children developed measles whilst in the ward with tuberculosis; one had tuberculous meningitis.

In April after a public awareness campaign and announcements through the media, 2437 children (27%) were immunized out of the total of 8946 who attended the children's outpatients. The number of unimmunized children decreased in the subsequent months and by September only 62 (1.1%) of the

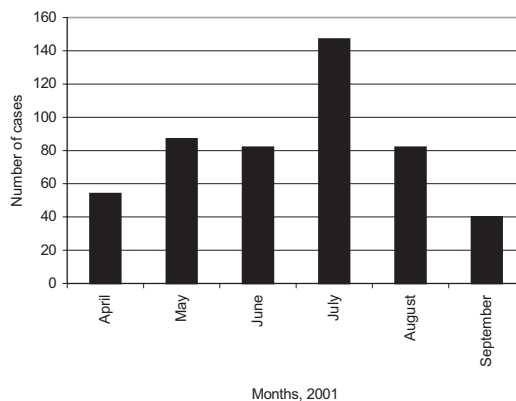


Figure 1. Monthly cases of measles from April to September 2001 at Port Moresby General Hospital.

**TABLE 1**

MEASLES CASES WHO PRESENTED TO THE CHILDREN'S OUTPATIENTS DEPARTMENT (COPD) AND THE PAEDIATRIC WARD OF THE PORT MORESBY GENERAL HOSPITAL (PMGH) IN APRIL-SEPTEMBER 2001

Month	Place of treatment of measles cases in PMGH		No (%) of children who attended OPD who received vaccines	Attendance in Children's Outpatients
	Children's Outpatients	Paediatric Ward		
April	21	33	2437 (27.2)	8946
May	39	48	1041 (13.9)	7499
June	5	77	641 (11.7)	5456
July	44	103	1045 (17.1)	6097
August	15	67	332 (7.1)	4666
September	12	28	62 (1.1)	5659
<b>Total</b>	<b>136</b>	<b>356</b>	<b>5558 (14.5)</b>	<b>38323</b>

children attending outpatients required immunization (Table 1). The decreasing number of children towards the end of the study was not due to shortage of vaccines but because of a progressive increase of fully immunized children who attended the clinics over the months of the epidemic and the immunization campaign. Of the total attendance of 38,323 during the period of the study, 5558 children (14.5%) were immunized in the Children's Outpatients Department. Those children immunized in the urban clinics were not included in this study.

The number of measles cases reported each month, the number of children who received measles vaccination and the total outpatient attendance during the 6-month period are shown in Table 1.

It was not possible to identify the source of the epidemic because the cases came from all the suburbs, villages and settlements in NCD and the villages along the Magi and Hiritano Highways in Central Province. The group with the greatest number of children was that of the villages from Central Province (Figure 2).

Of the 492 patients with measles, 356 (72%) were admitted to the Paediatric Ward of the Port Moresby General Hospital because of severe complications. The complications were moderate to severe pneumonia (33%),

diarrhoea (15%) and both pneumonia and diarrhoea (44%). 136 children (28%), some with mild complications, were treated as outpatients in COPD. 2 patients absconded, 19 died and 335 were discharged home. The main presenting symptoms and signs with varying severity and the main complications are shown in Table 2.

Of the 19 deaths, 8 children had received the first dose of measles vaccine, and 2 were fully immunized. 9 children were not immunized at all. The age groups and the immunization status of these children are shown in Table 3.

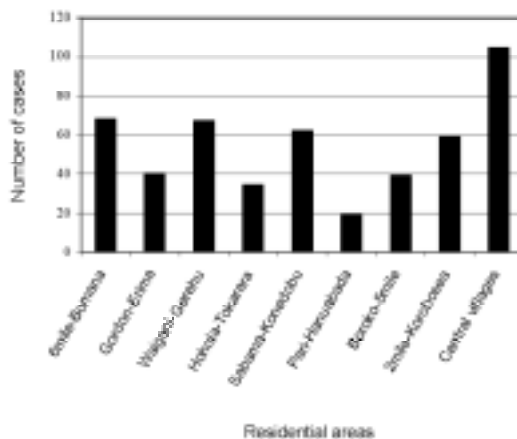


Figure 2. Number of children with measles by residence. The Pari-Hanuabada group includes Kilakila, Vabukori, Baruni and Tatana villages in National Capital District.

**TABLE 2**

PRESENTING SIGNS AND SYMPTOMS AND COMPLICATIONS OF MEASLES

Main presenting signs and symptoms and complications	Observed frequency	%
Children presented with:		
(a) Fever, coryza, cough, measles rash and Koplick's spots	129	26.2
(b) Shortness of breath, conjunctivitis, oral thrush, diarrhoea and those in (a)	363*	73.8
<b>Total</b>	492	100
Complications of measles**:		
(a) Pneumonia	160	32.5
(b) Pneumonia and diarrhoea	218	44.3
(c) Diarrhoea ± vomiting	74	15.0
Nil	40	8.1
<b>Total</b>	492	100

\*Including the 17 children who had stomatitis and 2 that had laryngitis

No case of measles encephalitis was reported

\*\*Of the 452 patients with complications, 356 were severe enough to warrant admission to PMGH

A total of 311 (65%) children were not immunized including 43 of the 46 infants less than 6 months of age who were not eligible to receive routine measles vaccine. Of the 116 children who had had their first dose, 94 had received their vaccination two weeks before developing measles. 55 children (11%) were fully immunized (Table 4). If one excludes the children under 6 months of age (who would not have been routinely immunized), 61% (268/436) of the children had never been immunized against measles and 13% (55/436) were fully immunized.

Two doses of vaccine provided protection by reducing the severity of the disease. Among the immunized children the symptoms were less severe with minimal or no complications and they were likely to be treated as an outpatient (OR 3.63, 95% CI 1.97-6.71 and  $p < 0.001$ ) (Table 5).

The records of the paediatric ward in the last 4 years showed that the highest number of measles cases (283) was recorded in 1997, but from April to September 2001 there were 492 cases of measles compared to 136 recorded between 1998 and 2000 (Figure 3).

## Discussion

In the 3 years since the outbreak of measles in 1997, the number of measles cases had not exceeded 100 in any one year, but in the 6 months between April and September 2001 the number of measles cases was nearly 5 times more. Many of these patients were admitted to the paediatric ward with complications that required further management. No case of measles encephalitis was seen during the period of the study. In the National Capital District over the past 13 years, outbreaks of measles have occurred every 3-4 years (6).

During the study, there were 19 deaths, a case fatality rate of 4%. This included 2 children who were fully immunized, while the rest had none or incomplete measles inoculations. Among the deaths was a child who also had tuberculous meningitis. The others died of severe pneumonia and/or diarrhoea. Although the number of deaths is insufficient for a detailed analysis, some consideration should be given to a booster dose in later childhood because an outbreak of measles occurs every 3-4 years.

**TABLE 3**

AGE GROUPS AND MEASLES IMMUNIZATION STATUS OF THE 19 CHILDREN WHO DIED IN THE HOSPITAL

Age group	Measles immunization status of 19 infants and children who died of measles complications			Number of infants and children
	Fully immunized (2 doses)	First dose only	Not immunized	
<6 months	0	3	1	4
6 to 12 months	0	2	2	4
1 to 4 years	2	3	4	9
5+ years	0	0	2	2*
<b>Total</b>	2	8	9	19

\*These children were 6 and 7 years old

**TABLE 4**

THE IMMUNIZATION STATUS OF INFANTS AND CHILDREN WITH MEASLES

Age group	Fully immunized (2 doses)	First dose only	Not immunized	Total
<6 months	0	3	43	46
6 to 12 months	3	58	107	168
1 to 4 years	36	49	118	203
5+ years	16	6	43	65
<b>Total</b>	55 (11.4%)	116 (24.1%)	311 (64.5%)	482*

\*10 children had no indication of their immunization status

**TABLE 5**

IMMUNIZATION STATUS AND SEVERITY OF DISEASE

Severity of disease as indicated by site of treatment	Immunization status		Total
	Fully immunized (2 doses)	One or no dose (incomplete)	
Outpatient	30	106	136
Ward 2	25	321	346
<b>Total</b>	55	427	482*

\*10 children had no indication of their immunization status

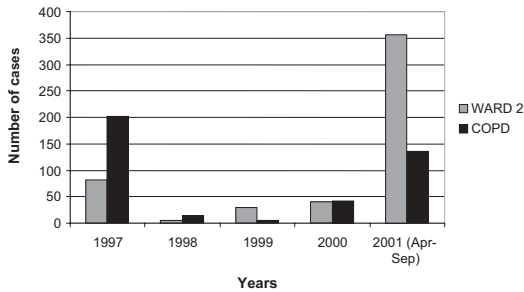


Figure 3. Measles cases who presented to Port Moresby General Hospital from 1997 to 2001. COPD = Children's Outpatients Department.

The large number of children who were not immunized indicated that mothers were not taking their children in for immunization. A study in Port Moresby had shown that many mothers have the knowledge of immunization but this knowledge is not being translated into immunization practice (9).

Although mothers may have the knowledge of immunization and its importance, the decision to bring the child to the clinic often depends on the father, the availability of transport, accessibility and cost of transport to and from the clinic. Poor attitude of the health staff in the clinics can be an important factor contributing to the low immunization rate (10).

During the measles outbreak mothers were encouraged to bring their children for measles vaccination. Children and infants of the age of 3 months and above were given a dose of measles vaccine. A total of 5558 children were immunized during the epidemic. This represented 14.5% of the 38,323 children who attended the Children's Outpatients Department during the 6-month period of the study.

Apart from the children's outpatients of PMGH, there are 7 major urban clinics in the National Capital District that provide maternal and child health services including immunization. Before the outbreak of measles there were no major shortages of vaccines in this district.

The proportion of children who contracted measles despite receiving a second dose of measles vaccine raises two important questions: was there breakdown in the cold chain rendering the vaccines ineffective or

were the vaccines administered incorrectly into the muscle instead of subcutaneous tissue?

However, two doses of the vaccine provided protection by reducing the severity of the disease, the children had less severe symptoms with minimal or no complications of measles and were likely to be treated as an outpatient.

At present the records of measles cases at the hospital are not properly kept so it is difficult to go back to the early 1990s, but according to the National Health Plan 2001-2010 the highest number of measles cases were recorded in 1989, 1993 and 1997. It does appear that outbreaks of measles occur every 3-4 years. The available records showed that there was an outbreak of measles in 1997 when over 283 cases were recorded compared to the 492 cases in 2001.

In the National Capital District the cold chain is adequately maintained at 2-8°C from the medical store, where the vaccines are kept in the refrigerator, to the clinic's vaccine refrigerators. The vaccines are usually transported in the vaccine carrier with ice packs and the health workers are very much aware of the importance of maintaining the cold chain system. However, it is possible for the cold chain to break down during transportation if vaccine carriers are defective.

Health workers are to use every opportunity to immunize eligible children at outpatient clinics, in the ward, at antenatal clinics and on medical patrols, because measles is a very serious illness. The target groups are children from 6 months to 1 year old and any children up 5 years old if they have not been previously immunized. During measles epidemics all children from 6 months to 5 years should be immunized (10).

## Conclusions

In 2001 there was an outbreak of measles in the National Capital District and many of the children had severe complications of measles resulting in 19 deaths (case fatality rate of 4%). 9 of those patients who died were not immunized. The disease was less severe among the children who were fully immunized. The majority of children who contracted

measles were not immunized or had not completed their measles vaccination. Measles outbreaks occur every 3-4 years.

### Recommendations

1. Conduct health awareness and education on the importance of measles immunization in antenatal clinics, postnatal ward, urban clinics, COPD and in the community. These health facilities and services provide opportunities for all categories of health workers to educate parents about the importance and long-term benefits of measles immunization.

2. A measles booster dose to be given at 2-3 years of age.

In view of the fact that measles outbreaks occur every 3-4 years and that many children who had completed their measles immunization still develop measles, perhaps it is reasonable to start thinking about giving a booster dose at 2-3 years of age.

3. Inservice training of our nursing staff in public relations to improve our public image. The community perception of our clinic staff is not good. Unfortunately, some of our health workers are unfriendly and sometimes abusive to mothers and patients, resulting in some mothers' unwillingness to bring their children to the clinics for immunization.

### ACKNOWLEDGEMENTS

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