

■ *Original Article*

## Trends of diphtheria, pertussis and tetanus cases in Nepal

N Jha<sup>1</sup>, SR Niraula<sup>1</sup>, DD Baral<sup>2</sup>, R Bohara<sup>3</sup>

<sup>1</sup>School of Public Health & Community Medicine, <sup>2</sup>Clinical Epidemiology Unit, BPKIHS, Dharan, Nepal

<sup>3</sup>Polio Eradication Office, WHO, Nepal

### Abstract

**Background:** Though, the EPI program has made significant progress over the years, Vaccine Preventable Diseases (VPDs) still cause many children deaths. **Objective:** To study the trends of Diphtheria, Pertussis, and Tetanus cases from 1983 to 2003 (last 20 years) from various health institutions of Nepal. **Methods:** The survey of the 20 various health institutions of Nepal and interview with pediatricians and public health specialists regarding Diphtheria, Pertussis, and Tetanus (DPT) cases in their practice was done. **Objective:** To know the trend of DPT cases in Nepal. **Results:** There were 774 diphtheria, 7285 pertussis and 3636 tetanus cases were found in these 20 surveyed health institutions of Nepal in 20 years. These cases were found between age group of 0-15 years. More or less the numbers of DPT cases were equal in both genders. The overall death rates were 13.4%, 1.4% and 31.0% among the Nepalese children due to DPT cases respectively. Major problems still persist, for example inadequate staffing at the central level, inappropriate training, no authority for decision making, late release of funds, weak system of vaccine logistics and cold chain management, poor supervision, incomplete data and competing priorities (eg. National Immunization Days). **Conclusion:** Currently, incomplete case reporting and inaccurate coverage reporting in Nepal tends to over-estimate the impact and the success of the immunization program. The unnecessary and unsafe injection seems to be common in private sector.

**Keywords:** DPT, diphtheria, immunization coverage, pertussis, surveillance, tetanus, vaccine coverage

### Introduction

Diphtheria, Pertussis and Tetanus (DPT) are the vaccine preventable diseases (VPDs) of childhood. Although there are no conclusive data on the prevalence of Diphtheria and Pertussis in Nepal, it appears from hospital reports that the significance of these diseases for child health has decreased sharply. In year 1983, annual prevalence rate of Diphtheria and Pertussis were 14.5 per and 436 per 100,000 population respectively.<sup>1</sup> Two cases of diphtheria were diagnosed at B.P. Koirala Institute of Health Sciences (BPKIHS), Dharan, Nepal in 1996.<sup>2</sup>

Infant of women have not receive any tetanus vaccination during pregnancy were more likely to die in neonatal period.<sup>3</sup> In Nepal, tetanus immunization during pregnancy is very low as 33% and 24.2% in 2001 and 2002 respectively.<sup>4</sup> A sharp drop in the number of cases reported is also noted in Nepal, giving further evidence of the success of immunization and awareness among the people.

### Methods

The investigating team visited 20 health institutions of Nepal for the collection of data related to Diphtheria, Pertussis and Tetanus. The medical recorder at these places were contacted and interviewed for the data related to Diphtheria, Pertussis and Tetanus (DPT) cases in these health institutions with the help of questionnaire. The data

---

Address for correspondence  
Dr. Nilambar Jha  
Professor, School of Public Health and Community Medicine  
BP Koirala Institute of Health Sciences, Dharan, Nepal  
Email: niljha@yahoo.com

were taken only for age group between 0-15 years of children. The period for study was taken from 1983 to 2003 (20 years). The health institutions were selected on the following basis.

The health institutions were selected from each region like eastern, central, western, mid-western and far-western regions of the country.

The health institutions were also taken topographically like hill and terai. The health institutions from mountain area were not included due to security reason.

The health institutions were included in the survey from different levels of health care delivery system like district, zonal and regional levels. The academic institution like BPKIHS was also taken for the survey. The central hospital for children like KCH was visited for the data collection.

The Child Health Division (CHD), Department of Health Services, Kathmandu was also visited for data collection related to DPT cases.

During the visit to various health institutions, 20 Pediatricians and public health specialists available in these places were interviewed about DPT cases and their prevention and control with the help of questionnaire. The investigating team also looked for special sites related to DPT project but no such sites were found. All above-mentioned data were analyzed with the help of statistician to get the result.

## Results

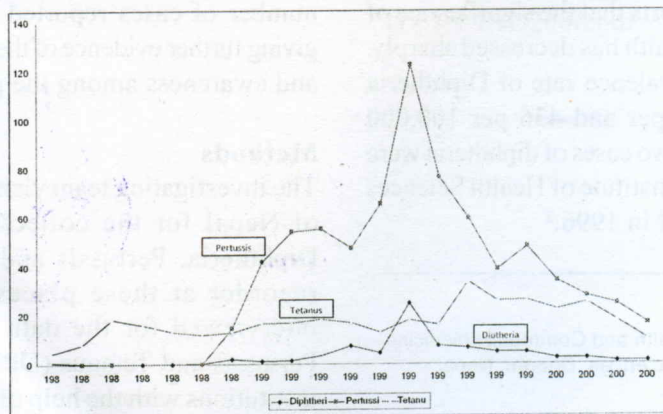
There were 774 diphtheria, 7285 pertussis and 3636 tetanus cases were found from the records of these

20 visited health institutions of Nepal (Table 1) in 20 years. These cases were found between age group of 0-15 years. Among them, 380 (49.1%) and 39 (50.9%) diphtheria cases were present in male and female children respectively. Similarly, 4016 (55.1%) and 3269 (44.9%) Pertussis cases were found among the male and female children. Likewise, 197 (54.3%) and 1660 (45.7%) tetanus cases were seen among male and female children. More or less the numbers of DPT cases are equal in both genders. The overall death rates were 13.4%, 1.4% and 31.0% among the Nepalese children due to DPT case respectively.

Table 2 shows the year wise (1993-2003) distribution of DPT cases among the 20 surveyed health institutions of Nepal. The diphtheria cases were highest (250) in the year 1995 with a death rate of 12.8%. The Pertussis cases were highest (1222) in the year 1995 with a death rate 1.6%. The tetanus cases were highest (340) in the year 1997 with death rate of 29.1%. The death rates of these three diseases do not indicate any increasing or decreasing order. But death rates were less from 1983 to 1993. This may be due to no reporting system or under reporting of these cases. There was increase in death rate after 1993. This may be due to increased reporting. After some years, it looks decreasing, may be due to better vaccine coverage in the country.

The trend of DPT cases in last 20 years from 20 surveyed health institutions of the country is shown in Fig 1. This can be divided into four periods as given below.

**Figure 1: The trend of DPT Cases in last 20 years from 20 surveyed health institutions of Nepal**



1983—1988: - During this early period the DPT cases were reported very less. This may be due to no system of reporting.

1988—1993: - There was an increase in DPT cases but still very less due to under reporting.

1993—1998: - There was increase in number of DPT cases during this period. This may be due to awareness among the people and better and reporting system under Health Management Information System (HMIS).

1998—2003: - During this period DPT cases were reported less. This may be due to good vaccine coverage in the country.

The data related to DPT diseases in each-surveyed health institution of Nepal can be obtained on request.

Demographic Pattern for DPT cases was studied in BPKIHS Dharan. There were 10 diphtheria, 4 pertussis and 282 tetanus reported cases in BPKIHS (Table 1). Among them, the diphtheria cases were more in males (60 %) than females (40 %). These cases were highest (50 %) in age group between 1 to 5 years, followed by 40 % in 5 to 15 years and 10 % in more than 15 years of age.

The death rates were seen more among males (66.7 %) than females (33.3 %). Age wise death rates were observed more in 5 to 15 years (66.7%) and also in age more than 15 years. The pertussis cases were equal (50%) in both genders. These cases were equally (50%) distributed among the age below one year and 1 to 5 years. No death was found for pertussis.

**Table 1: Genderwise distribution of the DPT cases in 20 surveyed health institutions of Nepal**

Name of the Institutions	Diphtheria (N = 774)				Pertussis (N = 7285)				Tetanus (N = 3636)			
	Male	Female	Death	DR	Male	Female	Death	DR	Male	Female	Death	DR
Ilam District Hospital	0	0	0	0.0	0	0	0	0.0	1	0	1	100.0
Mechi Zonal Hospital	0	0	0	0.0	0	0	0	0.0	24	16	16	40.0
BPKIHS	6	4	3	30.0	2	2	0	0.0	192	90	98	34.8
Koshi Zonal Hospital	0	0	0	0.0	0	0	0	0.0	66	47	29	25.7
Sagarmatha Zonal Hospital	0	0	0	0.0	0	0	0	0.0	43	26	10	14.5
Lahan Hospital	0	0	0	0.0	2	1	1	33.3	50	31	11	13.6
Jannakpur Zonal Hospital	4	4	0	0.0	2	4	0	0.0	262	144	97	23.9
Narayani Sub-regional Hospital	15	9	0	0.0	0	0	0	0.0	391	260	162	24.9
Makawanpur District Hospital	0	1	0	0.0	2	2	1	25.0	29	23	3	5.8
Kanti Children Hospital	4	1	0	0.0	77	47	0	0.0	18	10	6	21.4
Patan Hospital	45	44	5	5.6	418	399	12	1.5	12	39	19	37.3
Shukraraj Tropical and Infectious Disease Hospital	2	1	1	33.3	15	17	4	12.5	6	13	7	36.8
Western Regional Hospital	9	9	7	38.9	223	156	0	0.0	1	1	1	50.0
Lumbini Zonal Hospital	3	2	3	60.0	2	2	0	0.0	398	207	259	42.8
Palpa District Hospital	3	2	1	20.0	328	272	0	0.0	18	60	33	42.3
Gularia Hospital	95	109	22	10.8	994	823	10	0.6	144	254	143	35.9
Bheri Zonal Hospital	90	87	43	24.3	890	640	16	1.0	245	278	152	29.1
Seti Zonal Hospital	73	81	19	12.3	650	599	10	0.8	31	67	34	34.7
Mahakali Zonal Hospital	31	40	0	0.0	411	305	50	7.0	45	94	47	33.8
Child Health Division	0	0	0	0.0	0	0	0	0.0	0	0	0	0.0
Total	380	394	104	13.4	4016	3269	104	1.4	1976	1660	1128	31.0

DR = Death Rate, D = Diphtheria, P = Pertussis, T = Tetanus

The tetanus cases were seen more in males (68.1%) than in females (31.9 %). Age wise distribution of these cases were highest in age more than 15 years (57.8%), followed by 5 to 15 years age group (20.6 %), less than one year of age (14.9 %) and 1 to 5 years (6.7 %). The death rates were observed more in males (66.3%) than females (33.7%). The highest death rate was found in age group more than 15 years (60.3 %), followed by below one year of age (20.4 %), 5 to 15 years (15.3 %) and 1 to 5 years (4.0 %).

Laboratory facilities for DPT cases were not available in all surveyed health institutions. Only 4

(20%) health institutions have the laboratory facilities for all three DTP cases. Rest 16 (80%) health institutions do not have such facilities to diagnose DPT cases.

These four institutes are BPKIHS, Sukraraj tropical and infectious disease hospital, Patan hospital, and KCH. Three are in Kathmandu valley.

However, these tests are not done in many places. Because patients report very late and doctor diagnose these cases clinically and also do not feel for the need of laboratory confirmation. Therefore, they do not send specimens.

**Table 2. Year wise distribution of DPT cases among the 20 surveyed health institutions of Nepal**

Years	Diphtheria (N = 774)					Pertussis (N = 7285)					Tetanus (N = 3636)				
	Male	Female	Total	Death	DR	Male	Female	Total	Death	DR	Male	Female	Total	Death	DR
1983	4	5	9	1	11.1	3	4	7	0	0.0	34	13	47	14	29.8
1984	1	1	2	1	50.0	1	0	1	0	0.0	44	37	81	23	28.4
1985	0	0	0	0	0.0	0	0	0	0	0.0	118	66	184	62	33.7
1986	0	0	0	0	0.0	0	0	0	0	0.0	107	54	161	35	21.7
1987	0	0	0	0	0.0	0	0	0	0	0.0	80	53	133	45	33.8
1988	2	1	3	0	0.0	1	0	1	0	0.0	76	45	121	37	30.6
1989	12	7	19	2	10.5	99	49	148	0	0.0	78	52	130	35	26.9
1990	4	8	12	2	16.7	248	173	421	7	1.7	105	62	167	50	29.9
1991	8	6	14	2	14.3	310	231	541	8	1.5	90	79	169	74	43.8
1992	19	16	35	2	5.7	320	231	551	2	0.4	95	89	184	58	31.5
1993	38	38	76	6	7.9	247	226	473	16	3.4	83	87	170	59	34.7
1994	24	23	47	11	23.4	359	296	655	3	0.5	68	62	130	35	26.9
1995	118	132	250	32	12.8	717	505	1222	20	1.6	86	97	183	51	27.9
1996	33	43	76	19	25.0	388	371	759	6	0.8	84	82	166	60	36.1
1997	41	23	64	9	14.1	284	308	592	7	1.2	144	196	340	99	29.1
1998	27	22	49	7	14.3	218	172	390	15	3.8	138	121	259	84	32.4
1999	22	26	48	2	4.2	250	234	484	5	1.0	157	110	267	73	27.3
2000	10	12	22	2	9.1	195	146	341	5	1.5	125	102	227	69	30.4
2001	6	17	23	3	13.0	155	126	281	7	2.5	118	119	237	84	35.4
2002	4	9	13	2	15.4	132	119	251	2	0.8	95	83	178	47	26.4
2003	7	5	12	1	8.3	89	78	167	1	0.6	51	51	102	34	33.3
Total	380	394	774	104	13.4	4016	3269	7285	104	1.4	1976	1660	3636	1128	31.3

DR = Death Rate

### Discussion

The data available for DPT cases from various health Institutions of Nepal are only for admitted cases in the wards. The out-patients cases from these health Institutions were not included due to their unavailability in the medical record sections of these

health Institutions. There is no such system to keep the record for out-patients cases in these hospitals. Most of the health institutions do not have records related to DPT cases from 1983 to 1988. The reason could be no effective reporting system due to under developed infrastructure in these hospitals. Another

reason may be the people were not aware of these diseases. Due to lack of transportation and other factors like going to the faith healers for treatment, people did not come to hospital with their children suffering from these diseases. Therefore, there was also under-reporting. Thus the cases were less reported. The period between 1988 to 1993, there was increase in DPT cases. The possible reason could be implementation of National Health Policy (first time in Nepal) after democracy with more emphasis on HMIS and organized health care system.

Due to decentralization of Health Care system after National Health Policy, Sub Health Post, Health Post and Primary Health Center were established at village level. District health office was made nodal agency for health. This happened in between 1993 to 1998, which could be the reason for the increased case reporting of DPT. Other reason could be due to epidemics of these three diseases especially pertussis in the country (Fig 1). The DPT cases have started coming down from 1998. The possible reason could be better immunization coverage (> 85%) in the country.<sup>4</sup>

Nepal has started EPI in 1979 initially in three districts as a pilot program. This was extended to all 75 districts by 1988 with all six antigens.<sup>5</sup> Since 1990 reported coverage rates for routine immunization have more or less stabilized around 80%.<sup>5</sup> Earlier EPI was not doing well in the country due to geographical situation like hill, mountain and underdeveloped infrastructure of the health care delivery system in Nepal. It was in 1996, due to National Immunization Day for Poliomyelitis, routine EPI program also took momentum for other vaccine preventable diseases. This campaign made people more aware about immunization and people started to reach health facilities with their children for immunization. This is the main reason for dropping of DPT cases 1996/1997 onwards.

The poor immunization coverage may due to poorly developed health care infrastructure, less manpower and security reason. The middle and far-western regions are disturbed since longer times than other parts of the country.

Demographic pattern for DPT cases studied in BPKIHS shows that the diphtheria and tetanus were seen more in males (60 % and 68.1 %) than females (40 % and 39.1 %) respectively. But pertussis cases

were recorded equally (50 %) in both genders in this study.

The highest percentage of diphtheria (50 %) cases and pertussis (100 %) were observed among the age group less than 5 years. But tetanus cases were highest (57.8 %) among the age more than 15 years, followed by 21.6 % in age less than one year as show in the records of BPKIHS. Two cases reported from Nepal were 6 and 9 years.<sup>2</sup>

The diphtheria cases were recorded in other health institutions of Nepal were seen in different age groups. An interesting shift in the age distribution of these diseases was seen in age group of 15 or more. Lack of herd immunity in the population studied with no evidence of booster vaccination doses are thought to be responsible for the disease occurring in adolescents and young adults.

The death rate for diphtheria cases was highest (66.7%) in the age from 5 to 15 years. No deaths were recorded for pertussis. The highest death rate (60.3 %) for tetanus was observed in age more than 15 years, followed by 24.4 % in age less than 5 years. There was 14.9 % death in age less than one year including neonatal tetanus deaths as recorded in BPKIHS.

Age appropriate vaccination, early diagnosis, full treatment of cases and chemoprophylaxis of close contacts of the cases remains the cornerstones of the effective prevention and control of the DPT cases. The laboratory tests for DPT diseases were available in few hospitals of the Country. However, these laboratories are not used adequately for the confirmation of DPT cases. The specimens for laboratory investigations were not sent in adequate number. The records were available only for few years. The DPT cases were diagnosed mainly on clinical ground. Similarly, a series of 606 cases over a period of 5 years (1989-1993) was reported from West Bengal state of India, Where most of the diagnosis was clinical.<sup>6</sup>

The treating physicians do not feel to send the specimens for the laboratory tests. In their opinion, the reason is that the patient reports to the hospital in the last stage of the disease with all distinguished clinical features and toxic manifestations. So there is no need for laboratory test. Another reason is that due to prior use of freely available antibiotics at medicine shops by the patients, and doctors think that laboratory tests will show negative results.

Therefore, there is no need of laboratory test. Third reason is that the patient party has to pay for the tests. But they are very poor to afford such amount and this money can be used for the treatment. In some academic institutions, the throat swab staining, culture and serum antibody test are done for the laboratory confirmation of the DPT diseases. But, generally the results come negative due to prior use of antibiotics. These antibiotics are freely available in the market.

During the visits of various health institutions in the different regions of the country, 20 pediatricians and public health specialists were interviewed about DPT diseases and their prevention and control in Nepal. Among them, 15 (75%) told that they have come across DPT cases every year. Out of 15 health personnel, 6 (40%) have seen more than 4 DPT cases in a year. Equal number 6 (40%) has seen 2 to 3 cases per year. But 3 (20%) of them have diagnosed 1 to 2 DPT cases in previous year. The reasons for appearance of DPT cases in medical practice were given by these health professionals are lack of awareness about these diseases and their vaccines, existence of faulty technique to cut the umbilical cord still in the society, persistence of unhealthy practice to apply some thing (cow dung and ash etc.) on the stump and poor coverage of DPT vaccines specially tetanus toxoid immunization among the pregnant women.

The opinion expressed by the pediatricians and public health specialists about the trends of these DPT diseases in Nepal are as diphtheria is hardly seen now a day, pertussis and tetanus cases are there in the community, but towards declining trends and pertussis appears as epidemic in every 3 to 4 years in Nepal.

The suggestions for control and prevention of DPT diseases given by them are:

Improvement in routine immunization coverage, especially in remote areas, starting of booster doses in the National Immunization Program. This is also recommended by Nepal Paediatric society as optional vaccines.<sup>7</sup>

Motivation of the parents for routine DPT vaccination for their children in proper time.

Awareness program for the people about DPT immunization specially related to the subsequent doses to complete the series.

Improvement of service delivery for immunization by the health workers.

Provision of safe injection for DPT and for other vaccines.

Maintenance of cold chain and proper technique of immunization.

Good surveillance system with proper recording and reporting of DPT cases in the hospitals and follow up with the help of public health office in the district. Each out-break should be reported immediately and controlled in time.

The epidemics should be investigated in detail to get information, which will be helpful to control and prevent such epidemics in future.

There should be ongoing health education program to the mothers about these diseases and their vaccines. This can be arranged in antenatal, family planning clinics and postnatal wards of the hospitals. Similar health education sessions can be conducted in the community during mother meetings and any other social gatherings.

They also suggested in their remarks that the benefits of the DPT vaccines and evaluation of National Immunization Program will require careful cost effective and cost benefit analysis.

### Conclusion

The trend for DPT cases of Nepal in last 20 years shows following features:

There is shift in the age distribution of these diseases and found more in males.

The DPT cases were reported less from 1983 to 1993 in Nepal due to under reporting or no reporting.

The cases were started increasing from 1993 to 1998 due to better infrastructure in health care delivery system including HMIS and increased awareness among the people about the diseases.

The DPT cases were reported less from 1998 onwards due to better immunization coverage in the country.

### Acknowledgements

Thanks to WHO, Polio Eradication, Nepal for financial support. Special thanks to Dr. Thomas F. Weirzba epidemiologist of WHO, Polio Eradication Office, Nepal for his valuable suggestions.

## References

1. Ministry of Health and Population, Nepal, Department of Health Services, Management Division, Kathmandu, 1983/84. Annual Report; 1983/84.
2. Srinivasa H, Parija SC, Upadhyay MP. Diphtheria in eastern Nepal. *Emerg Infect Dis* 1999 Mar-Apr;5(2):304-5.
3. Kartz J, West KP, Khatri SK et al. Risk factors for early infant mortality in Sarlahi district, Nepal. *Bulletin of World Organization* 2003;81(10):717-25.
4. Ministry of Health and Population [Nepal], Department of Health Services, Management Division, Kathmandu, 2001/2002. Annual Report; 2001/2002.
5. Ministry of Health and Population [Nepal], Department of Health Services, Child Health Division, Kathmandu, 2000. Strategic guidelines for National Immunization Program; 2000.
6. Ray SR, Gupta SD, Shaha I. A report of diphtheria surveillance from a rural medical college. *Journal of Indian Medical Association* 1998;96:236-8.
7. Nepal Paediatric Society. Guidelines for childhood Immunization. *JNMA* 2002; 41: 438-40.