

The problem of paralytic poliomyelitis in the urban and rural population around Lucknow, India

By U. C. CHATURVEDI, ASHA MATHUR, U. K. SINGH, M. R. S. KUSHWAHA, R. M. L. MEHROTRA, A. K. KAPOOR, SUSHMA RAI AND R. G. GURHA

*Upgraded Department of Pathology and Bacteriology,
K. G. Medical College, Lucknow 226003, India*

(Received 30 November 1977)

SUMMARY

A house to house survey was done from October 1972 to March 1974, covering 52952 individuals of urban population at Lucknow and 50156 individuals of rural population of Unnao district, to find out the incidence of polio-like paralysis in our population. Among 12874 urban children up to 8 years old 8.2/1000 had polio-like paralysis while 4.6/1000 children of the rural population of 13554 children were affected. The incidence was significantly higher in the urban population. In the preschool age group almost 1 out of every 100 children was affected. A higher number of children were affected during 1968-9 and 1971-2, though it did not reach epidemic proportion. The findings show that paralytic polio is a serious problem in our country where poliomyelitis is endemic: this is contrary to the views generally held so far.

INTRODUCTION

Poliomyelitis is endemic in India with isolated epidemics reported from some parts of the country (Dave, 1960; Paul, Gujral & Kapoor, 1964; Gujral *et al.* 1971). The endemicity has been shown by serological studies or by isolation of the virus but such studies are few and scanty (Bhatia & Gupta, 1968; Nair & Kalra, 1969; Feldman *et al.* 1970; John *et al.* 1970; Agarwal *et al.* 1971; Chaturvedi *et al.* 1971; Agarwal *et al.* 1973). From a world-wide study on the incidence of poliomyelitis Cockburn & Drozdov (1970) concluded that the incidence is increasing in 45 out of 71 tropical and semitropical countries. They have further said that in these countries polio vaccination should be started to protect the population from an anticipated polio epidemic. The polio vaccination status in India is also very poor. Only a negligible fraction of the population of some cities have been protected. It has been believed that in tropical countries children get immunity by subclinical infection due to poor hygienic conditions. Before any serious effort is made to vaccinate the population against poliomyelitis, it was considered worthwhile to assess the magnitude of the problem of paralytic polio in our population. About 80% of the population lives in villages, and, to make the study as realistic as possible, a survey was started in October 1972 in the urban population at

Lucknow and the rural population of a neighbouring district, Unnao. It was planned to make personal visits and interrogate a cross section of about 50000 individuals of each population. The survey was completed in March 1974. The present paper describes our findings on cases of paralysis with special reference to paralytic polio.

METHOD AND MATERIALS

Area of study

Lucknow city and villages of Unnao district were selected to represent the urban and rural populations respectively. Lucknow and Unnao are situated in Northern India in the Gangetic plain. The total population of Lucknow city in 1971 was about 820000. The total rainfall is 1014 mm per year. Unnao district is situated about 60 km south-west of Lucknow. The total rural population of Unnao was about 1.5 millions in 1971.

One field team started the work in the urban area (Lucknow) and the other in the rural area simultaneously. Survey areas were randomly selected at both places. The teams visited every house in selected colonies and villages working 5 days a week for about 1½ years from October 1972. They interrogated each member of the families. The data regarding the family composition, sex, age, socio-economic status of population and environmental conditions were studied and recorded on a questionnaire. Any suspected case of muscle weakness or paralysis was carefully recorded and was later subjected to thorough clinical examination by the medical officers. A detailed examination of muscles and neurological functions was done (Chamberlain & Ogilvie, 1967). Among environmental factors of the family, the things emphasized were the type of the house, its roofing, sanitary facilities, source of drinking water and type of milk consumed etc.

An effort was made to obtain realistic estimates of the prevalence of paralytic polio; the cases with paralysis were therefore studied in detail and were grouped as follows:

Paralytic poliomyelitis. In this group those cases were included who had polio-like paralysis involving various parts of the body. From these cases additional history was obtained regarding the onset of the disease, year of attack, the part affected, polio vaccination and course of the disease. These patients were thoroughly examined and assessed clinically for aetiology. Weinstein's (1970) clinical criteria were used to diagnose paralytic poliomyelitis which included acute onset of disease with a spell of fever; asymmetric distribution of paralysis; lower motor neurone type of lesions with muscle wasting; and pure motor involvement with absolute sparing of the sensory system. The laboratory confirmation of the illness could not be done on account of varying length of disease.

Non-polio paralysis. This group consisted of non-polio-like paralytic cases, viz. cerebrovascular episodes, traumatic, cord compression, space occupying lesion, Bell's palsy, cerebral palsy, congenital paraplegia and some cases of unknown aetiology.

Table 1. *Distribution of the study population in the two areas*

Sex	Urban	Rural	Total
Male	27 954	26 945	54 899
Female	24 998	23 211	48 209
Total	52 952	50 156	103 108

Table 2. *Prevalence of paralytic cases in the study areas*

Group	Total population	Polio-like		Non-polio	
		No. of cases	Prevalence per 1000	No. of cases	Prevalence per 1000
Urban	52 952	106	2.0	17	0.32
Rural	50 156	63	1.26	17	0.34
Total	103 108	169	1.6	34	0.33

Table 3. *Prevalence of paralytic cases in the two sexes*

Population	Polio-like				Non-polio			
	Male		Female		Male		Female	
	No. of cases	%*	No. of cases	%*	No. of cases	%*	No. of cases	%*
Urban	65	61	41	39	7	41	10	59
Rural	43	68	20	32	6	35	11	65
Total	108	64	61	36	13	38	21	62

* Per cent of the paralytic cases in each population group.

RESULTS

The population studied consisted of 11 678 families (52 952 persons) in urban areas of Lucknow and 8621 families (50 156 persons) in rural areas of Unnao. Thus a total of 103 108 persons were studied, 25.6 % of whom were children aged 8 years or less. The distribution of the population is presented in Table 1.

Paralytic manifestations were detected in 203 cases during the survey. However, on a detailed study only 169 of them could be clinically categorized as likely to be cases of poliomyelitis. Among them 106 were from urban and 63 from rural areas giving an incidence of 2 and 1.26 per 1000 population respectively (Table 2). On the basis of history and clinical finding 34 cases (0.33/1000) were of paralysis due to other causes, out of which, 17 each were in urban and rural areas (Table 2). Distribution of the paralytic cases between the sexes, summarized in Table 3, shows male preponderance in polio-like cases and a female preponderance in non-polio cases.

Polio-like cases

Age at the time of onset of paralysis was ascertained from the parents. The largest number of children contracted polio-like paralysis during the first year of life both in urban and rural areas viz. 54 out of 106 (51 %) in urban and 34 out of

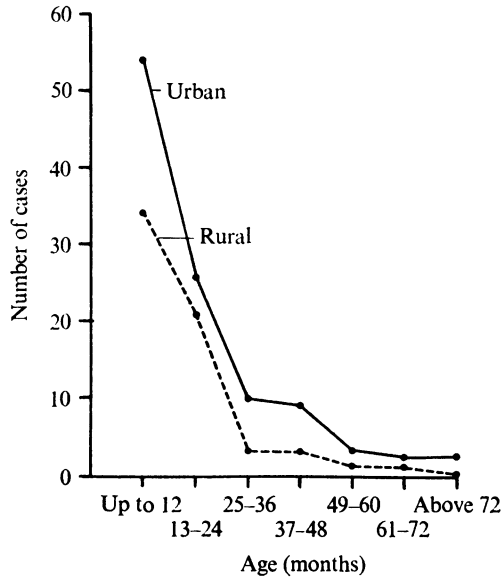


Fig. 1. Distribution of polio-like paralytic cases in various age groups.

Table 4. Age* specific incidence of paralytic polio in children

Age (months)	Urban			Rural			Total		
	No. of children	No. of cases	/1000	No. of children	No. of cases	/1000	No. of children	No. of cases	/1000
0-12	1658	54	32.6	1756	34	19.3	3414	88	25.7
13-24	1704	26	15.2	1694	21	12.4	3398	47	13.8
25-36	1743	10	5.7	1796	3	1.6	3539	13	3.6
37-48	1560	9	5.7	1538	3	1.9	3098	12	3.8
49-60	1693	3	1.7	1798	1	0.5	3491	4	1.1
61-72	1636	2	1.2	1608	1	0.6	3244	3	0.9
73-84	1332	1	0.7	1356	0	0	2688	1	0.3
85-96	1548	1	0.6	2008	0	0	3556	1	0.2
Total	12874	106	8.2	13554	63	4.6	26428	169	6.4

* Age at onset of disease.

63 (54.0%) in rural areas. The next age group affected in order of frequency was 13 to 24 months. As the age advanced the number of children getting polio-like paralysis declined (Fig. 1) and the oldest case to get infection in the present survey was an 8 year old boy in the urban population. However, the youngest case was a 7 month old child from a village.

The age specific incidence summarized in Table 4 shows that 8.2/1000 children aged 8 years or less from the urban area and 4.6/1000 from the rural area were affected by the paralytic polio. The difference was significant ($\chi^2 = > 3.84$). Thus the total figure comes to 6.4/1000 of the population studied.

From the reported age of affected children and length of disease the approximate calendar year was calculated when the child would have contracted the illness. The findings for the years 1966 to 1975 were shown in Fig. 2. Two peaks of

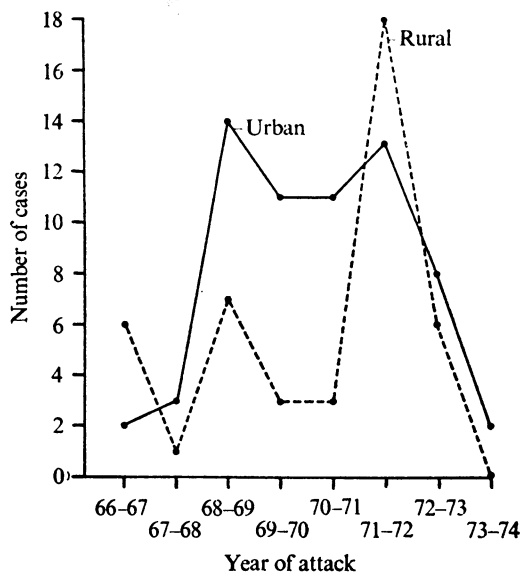


Fig. 2

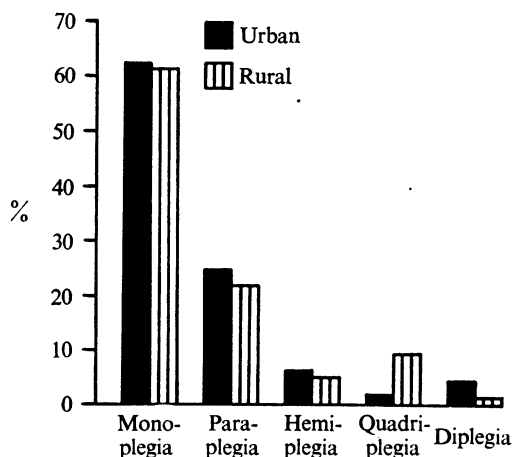


Fig. 3

Fig. 2. Cases of polio-like paralysis occurring in different calendar years.

Fig. 3. Clinical manifestations of polio-like paralysis.

higher incidence were noted in both the population groups simultaneously. The first was in 1968-9 and the second one in 1971-2. Another feature manifested in Fig. 2, is that in the urban area the first peak was higher whereas in the rural area the second peak was higher.

Analysis of physical disability in paralytic polio cases showed largest involvement of one extremity (62%) whereas in another 22% of cases both legs were affected. There were few cases of multiple limb involvement (Fig. 3).

Non-polio paralysis cases

During the survey 34 cases with paralysis were seen which were due to causes other than poliomyelitis. The cases were equally divided in urban and rural populations. Hemiplegias accounted for 38% of illness followed by paraplegia, 11, (33%). The highest number of cases were due to cerebrovascular episodes (10) followed by those with cord compression leading to spastic paraplegia (8) and traumatic paraplegias (6). There were 4 cases of involvement of cranial nerves with paralysis of facial muscles. Paralysis was predominantly seen in individuals below 20 years of age. The approximate age of onset of the paralysis was below 1 year in 4 individuals and 14 (45%) were between 1 and 10 years when they contracted their respective illnesses. Ten persons above 30 years of age suffered a cerebrovascular catastrophe leading to hemiplegia.

Environmental data

The details of environmental data were analysed from 203 families having a paralytic case. Table 5 shows that houses built of mud walls and thatched roofs were predominant among the rural population (39 out of 80) although well built

Table 5. *Comparison of living conditions of the paralytic cases*

	Polio-like		Non-polio	
	Urban (106)*	Rural (63)*	Urban (17)*	Rural (17)*
Latrines				
Water closet	29 (27)	0 (0)	1 (6)	0 (0)
Manual cleaning	55 (52)	26 (41)	10 (59)	7 (41)
None	22 (21)	37 (59)	6 (35)	10 (59)
Water supply				
Private well	8 (8)	1 (2)	0 (0)	0 (0)
Common well	11 (10)	29 (46)	1 (6)	12 (71)
Private tap	54 (51)	16 (26)	10 (59)	1 (6)
Common tap	33 (32)	17 (27)	6 (35)	4 (24)
House wall				
Mud and brick	32 (30)	42 (67)	4 (24)	12 (71)
Cemented	74 (70)	21 (33)	13 (76)	5 (29)
House roof				
Thatch	16 (15)	34 (54)	1 (6)	12 (71)
Tile	7 (6)	1 (2)	2 (12)	0 (0)
Cemented	83 (79)	28 (44)	14 (82)	5 (29)

* Numbers of cases. All other figures in parentheses show percentages.

houses were seen in 26 families of this population. In urban areas well built houses of cemented walls and slab roofs were predominant (87 out of 123).

The sanitary conditions were also widely different in the population (Table 5). More than half (47 out of 80) rural families used open fields for defaecation whereas 25 (31 %) families had private manual cleaning type of latrines. In the urban area, 28 families had no latrines in their houses, 29 families had modern water closet type of latrines and 65 out of 123 families had manual service type of latrines. The cases of paralytic polio were significantly more in families having manual service type of latrines ($\chi^2 = > 3.84$).

The drinking water was obtained from different sources. In the urban areas of Lucknow, the main source of water was the filtered tap water supply accounting for 103 out of 123 families whereas 4 families drew water from bore wells and the rest from open wells. Few families had private wells in their houses (Table 5). Among the rural population the main source of water supply was a hand pump, individual or shared among families. In 41 families, the water was obtained from common wells in different localities. The dietetic interrogation revealed that all but two families living in urban localities were consuming unpasteurized milk. Only unpasteurized milk was available to rural communities.

Interrogation about vaccination revealed that no child in rural areas was vaccinated with polio vaccine. In 67 out of 80 families the parents never knew of such a prophylaxis. In the urban areas the situation was no better. In only three families was prior vaccination against poliomyelitis given and out of these only one child had received a full 3 dose schedule of oral vaccine. In two families one dose alone was fed. The rest of 120 families had no knowledge about polio vaccination ever being given to their children.

DISCUSSION

The findings of the present study demonstrate that paralytic poliomyelitis is a serious problem both in the Lucknow city and in the villages of Unnao district. The incidence was significantly higher in urban children up to 8 years old (8.2/1000) compared with those in rural areas (4.6/1000). Among 16 940 preschool children aged 5 years or less of the study area the incidence was as high as 9.7/1000 children. These figures are higher than the findings of 7/1000 reported from rural areas of Ghana (Nicholas *et al.* 1977). The seriousness of the situation is not realized because of under reporting or no reporting at all of the cases of paralytic polio in our population.

Findings of our previous studies show that poliovirus is endemic in and around Lucknow (Chaturvedi *et al.* 1971; Agarwal *et al.* 1973; Mathur *et al.* 1978). Clustering of the cases in both the populations during 1968-9 and 1971-2 shows a higher circulation of polio virus which did not reach epidemic proportion. This is supported by the higher isolation rate of polioviruses from preschool children of a rural community near Lucknow during 1971 (Mathur *et al.* 1978). This study has further shown that polio viruses are present in the population almost round the year with small peaks.

In an American population whose members lived through many polio epidemics, the incidence of paralytic polio was 4.8/1000 (Collins, 1946). Such reports had led to the belief that the problem of paralytic polio is associated with epidemics only. But the finding of a much higher incidence of paralytic polio in our area where polio had been endemic does not support this view.

In urban families with water closet type of latrines, the incidence of paralytic polio was significantly less. Other environmental factors had no relationship. A higher prevalence in urban children than in rural may be due to overcrowding in the urban population. This assumption is based on isolation of viruses from the throat in a continuous study of the families living in different conditions (Mathur & Chaturvedi, 1977).

The paralytic poliomyelitis was mainly a disease of preschool children in our population as 97 % of children were affected by the age of 5 years. This is similar to findings in Ghana (Nicholas *et al.* 1977) and other tropical countries (Cockburn & Drozdov, 1970). Most of these cases were aged 7 months to 2 years when they got the attack of poliomyelitis. Serological findings have shown that the most susceptible age group is 6 months to 3 years as the incidence of antibodies is lowest during this period of life. Older children get immunity by subclinical infection so that by the age of 4 to 5 years more than 90 % are immune (Agarwal *et al.* 1973).

It has been generally reported that paralytic poliomyelitis is not an important problem in developing countries because children get immunity in early periods of life by subclinical infection due to poor hygienic conditions or are protected by maternal antibodies, breast feeding or other non-specific factors (Nicholas *et al.* 1977). But the findings of our study do not support this view as the magnitude of the problem of paralytic polio is as great as anywhere else if not greater.

We have no data regarding deaths or non-paralytic infection due to polio virus, but it must certainly be there to add to the seriousness of the problem.

The findings further show two peaks of higher incidence which was otherwise not recognized by the physicians as it had not reached epidemic proportions but they may indicate cyclic increased activity of the virus as reported by Nottay & Metselaar (1973) which may lead to a major epidemic. A severe epidemic following sporadic cases has occurred in Israel (Davies *et al.* 1960). These findings clearly show that we must start protecting our population before it is too late. The protection is to be directed not only towards preventing polio epidemics but also for preventing paralysis due to endemic poliomyelitis infection.

The study was carried out as part of a collaborative study financed by the Indian Council of Medical Research.

REFERENCES

- AGARWAL, S. C., BARDOLOI, J. N. S., SEHGAL, S. & GUPTA, A. N. (1971). Placental transmission of neutralizing antibodies to poliomyelitis virus. *Indian Journal of Medical Research* **59**, 1703-7.
- AGARWAL, S. K., KAPOOR, A. K., MATHUR, A., MEHROTRA, R. M. L. & CHATURVEDI, U. C. (1973). Prevalence of antibodies against enteroviruses in the population of Lucknow. *Indian Journal of Medical Research* **61**, 1799-809.
- BHATIA, V. N. & GUPTA, S. P. (1968). Antibodies against enteroviruses in different age groups. *Indian Journal of Medical Research* **56**, 129-36.
- CHATURVEDI, U. C., MATHUR, A., SHARMA, K. L., SHARMA, N. L. & MEHROTRA, R. M. L. (1971). Clinico-virological study of cases of diarrhoea in infancy and childhood. *Indian Journal of Medical Science* **25**, 448-52.
- CHAMBERLAIN, E. N. & OGILVIE, C. N. (1967). *Symptoms and Signs in Clinical Medicine*, 8th ed. Bristol: John Wright and ELBS.
- COCKBURN, W. C. & DROZDOV, S. G. (1970). Poliomyelitis in the World. *Bulletin of World Health Organization* **42**, 405-16.
- COLLINS, S. D. (1946). Incidence of poliomyelitis and its crippling effects, as recorded in family surveys. *Public Health Reports* **61**, 327-55.
- DAVE, K. H. (1960). The background of the epidemic of poliomyelitis in Bombay. *Indian Journal of Paediatrics* **27**, 336-8.
- DAVIES, A. M., MARBERG, K., GOLDBLUM, N., LEVINE, S. & YEKUTIEL, P. (1960). Epidemiology of poliomyelitis in Israel, 1952-9. With evaluation of Salk vaccination during a three-year period. *Bulletin of World Health Organization* **23**, 53-72.
- FELDMAN, R. A., CHRISTOPHER, S., GEORGE, S., KAMATH, K. R. & JOHN, T. J. (1970). Infection and disease in a group of South-Indian families. III. Virological methods and report of the frequency of enteroviral infections in preschool children. *American Journal of Epidemiology* **92**, 357-66.
- GUJRAL, V. V., DHAMIJA, K., SETHI, S. & GANGRADE, S. (1971). A Threat of polio epidemic in Delhi and areas around. *Journal of Communicable Disease*, **3**, 31-38.
- JOHN, T. J., KAMATH, K. R., FELDMAN, R. A. & CHRISTOPHER, S., (1970). Infection and disease in a group of South Indian families. IX. Poliovirus infection among preschool children. *Indian Journal of Medical Research* **58**, 551-5.
- MATHUR, A. & CHATURVEDI, U. C. (1977). Prevalence of viruses in the throat - A one year family study at Lucknow. *Indian Journal of Medical Research* **66**, 544-55.
- MATHUR, A., KAPOOR, A. K., CHATURVEDI, U. C., TANDON, H. O., DAS, S. L. & AGARWAL, S. K. (1978). A continuous one year study for prevalence of enteroviruses in the normal healthy children of a rural community. *Indian Journal of Medical Research* **67**, (In the Press.)
- NAIB, E. & KALRA, S. L. (1969). Cytopathic enteroviruses in Delhi area. I. From cases of diarrhoea and healthy controls. *Indian Journal of Medical Research* **57**, 141-8.

- NICHOLAS, D. D., KRATZER, J. H., OFOSU-AMAAH, S. & BELCHER, D. W. (1977). Is poliomyelitis a serious problem in developing countries? The Danfa experience. *British Medical Journal* *i*, 1009-12.
- NOTTAY, B. K. & METSELAAR, D. (1973). Poliomyelitis: epidemiology and prophylaxis, 1. A longitudinal epidemiological survey of Kenya. *Bulletin of the World Health Organization* **48**, 421-7.
- PAUL, S. S., GUJRAL, V. V. & KAPOOR, D. (1964). Poliomyelitis in Delhi. *Journal of Indian Medical Association* **42**, 428-30.
- WEINSTEIN, L. (1970). In *Principles of Internal Medicine* (Ed. T. R. Harrison), McGraw Hill Inc., 968.