Trends in Non-Polio acute flaccid paralysis incidence in India 2000-2013

N. Vashisht[1] J.M. Puliyel[2] V. Sreenivas[3] 1. Jaypee Hospital, Noida 2. St Stephens Hospital, Delhi 3. All India Institute of Medical Science, Delhi

Background

- India has been polio free since 2011. However there is concern about the increase in incidence of Non- Polio Acute Flaccid Paralysis (NPAFP)) that has gone alongside.
- Nationally, the non- polio AFP rate is twelve fold higher than the WHO accepted norm of 1-2 cases /100,000 (NPAFP rate in 2013 was 11.82/100,000). In 2010, this rate was 25/100,000 in Uttar Pradesh and 35/100,000 in Bihar.
- We established in this study that there is a correlation between the number of oral polio vaccine (OPV) doses used in a region/state and the incidence of non -polio AFP.
- A fall in incidence of non- polio paralysis in these two states was documented for the first time in 2012,which mirrored the decrease in number of OPV doses administered in that year in the state.This is further corroborative evidence of a causative association between OPV doses and the non- polio AFP rate.
- The NPAFP may be considered as collateral damage in the effort to eradicate polio. It was hoped that after polio eradication the use of OPV could be stopped and it could result in the reduction of NPAFP. However it is realised that this is unlikely to happen in the near future given the economic and logistical hurdles in switching to IPV

Materials and Methods

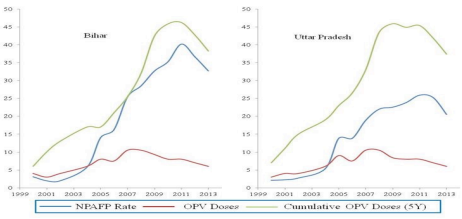
- The data (from the National Polio Surveillance web site) on AFP, polio and non-polio AFP and number of polio rounds were examined in each state in every year from 2000 to 2013.
- We explored whether any correlation exists between the non-polio AFP rate and the number of doses of polio vaccine used in the state in that year. Further, we tried to look for cumulative effect by adding data on vaccine doses from previous years.
- At the time of data analysis, there were 28 states and 7 union territories in India and each region received a variable number of OPV doses in any given year depending on the number of cases of polio reported from the area. When different areas within a state received different numbers of doses, the arithmetic mean of doses was taken as the representative dose for that state.
- There are 525 data points for each characteristic looking at 15 years of data from each of 35 states.
- Normal linear regression analysis was carried out, taking the non-polio AFP rate as the outcome variable and the number of OPV doses as the explanatory variable.
- Multiple linear regression analysis adjusting for region/state, total and female literacy rate, population density and per-capita GDP was performed. Differences between states and changes over time were analysed.

Table 1. Multivariate Regression analysis

Characteristic	Coefficient (95% C.I.)	P
OPV doses	1.31 (1.11 1.52)	< 0.001
State	0.01 (-0.03 0.05)	0.69
Literacy	- 0.05 (-0.25 0.15)	0.64
Female literacy	0.05 (-0.20 0.11)	0.56
Percapita GDP (Rs 10,000 increase)	0.13 (-0.41 0.15)	0.36

- On multiple regression analysis, the number of OPV doses was the only factor that showed a positive correlation with the NPAFP rate. The average increase in the non-polio AFP rate was 1.31 per 100,000 (P<0.001, 95% CI: 1.11-1.52) with each dose of OPV. Per capita income, female literacy and overall literacy did not show significant association with non-polio AFP rate.

Figure 2. Yearly trends in NPAFP Rate with 5-year Cumulative Polio Doses in Bihar and Uttar Pradesh



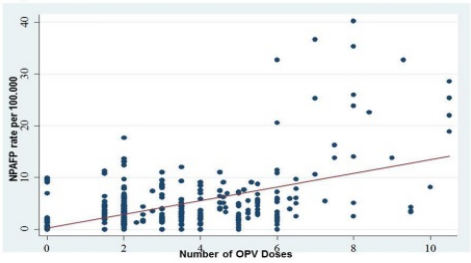
- To examine the trends over time we looked at the relationship of the non-polio AFP rate each year to the number of doses of OPV received in that year separately for UP and Bihar. Figure 3 shows the non-polio AFP over the years in the states of UP and Bihar alongside the 5 year cumulative OPV doses. The fall in NPAFP rate for the first time in 2012 with a decrease in the OPV doses is noted.

Objectives

- The incidence of polio AFP has come down in the country. As a consequence the total AFP rate (which includes polio and non-polio causes of AFP) must come down with the non-polio AFP rate remaining steady.
- Inexplicably however, the non-polio AFP rate has shown a trend to increase over the years from 2000. Nationwide, the NPAFP rate is 11.82/100,000 where the expected rate is 1-2/100,000.
- Follow-up of these cases of non-polio AFP is not done routinely. However a fifth of these cases of non-polio AFP in the state of Uttar Pradesh (UP) were followed-up after 60 days, in 2005. 35.2% were found to have residual paralysis and 8.5% had died (total residual paralysis or death 43.7%).
- This suggests that the pathology in children being registered as non-polio AFP cannot be considered as trivial.
- The objective here was to determine the correlates of NPAFP and discern explanations for the increase.

Results

Figure 1: Trends in Non Polio AFP rate with number of OPV doses



- The non-polio AFP rate (per 100,000) increased with increased number of OPV doses during 2000-2011, irrespective of time and region. The relationship is curvilinear with a more steep increase in non-polio AFP beyond 6 doses of OPV. To demonstrate this association, the Pearson correlation was calculated. This association is statistically highly significant . (R2=25.02%; P<0.001).

Conclusion

- It is paradoxical that while India has become polio free there is a steadily increasing non -polio AFP rate.
- Incidence of non-polio AFP is strongly associated with the number of OPV doses delivered to the area.
- The fall in the NPAFP rate in Bihar and UP for the first time in 2012, with a decrease in the number of OPV doses delivered, is corroborative evidence of a causative association between OPV doses and the NPAFP rate.
- Dosing schedule of OPV needs to be optimised in order to prevent an inadvertent increase in non –polio AFP in the country.
- The NPAFP may be considered as collateral damage in the effort to eradicate polio. It was hoped that after polio eradication the use of OPV could be stopped and it could result in the reduction of NPAFP. However it is realised that this is unlikely to happen in the near future given the economic and logistical hurdles in switching to IPV