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Estimation of True Incidence of Polio: Overcoming Misclassification Errors due to Stool Culture Insensitivity

V. Sreenivas and Jacob M. Puliye*

From the Department of Biostatistics, All India Institute of Medical Science, New Delhi; 110 029 and

**Department of Pediatrics, St Stephens Hospital, Delhi 110 054, India.*

Correspondence to: Dr Jacob M. Puliye, Department of Pediatrics, St Stephens Hospital, Tis Hazari, Delhi, India. E mail: puliye@gmail.com

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The diagnosis of polio depends on culturing the virus in stool samples of children with AFP. Using data obtained under the "Right to Information Act" of instances where only one of the two samples was positive for polio, it was possible to estimate the sensitivity of the system to detect cases of polio. The calculations suggest that there were 1625 (95% CI 1528 to 1725) cases of polio in India in 2006 rather than the 674 reported widely!

Key words: *Polio, Stool culture.*

In the past polio was identified as cases of acute flaccid paralysis (AFP) with residual paralysis on follow up after 60 days. Of late we are depending on virological culture of polio virus in stool samples of children with AFP to identify cases of polio. There is concern that some cases of polio may be missed because of imperfect sensitivity of this system of identification. Sensitivity of the system is improved by taking two samples of stools from each case of AFP.

To investigate how many cases are likely to have been missed in the year 2006 we wrote to the Government of India (GOI) under the Right to Information Act. We sought data on instances of

polio AFP where two samples were obtained and culture was positive in only one sample. According to the GOI there were 674 polio cases of 2006 of whom 14 had only one sample received for testing. 643 cases had two samples received for testing and of these 484 had polio virus grown in both samples and 148 had polio virus grown in only one sample. This suggests that in 148 cases of polio one of the two samples did not culture polio virus. Although the figures suggest that there were some missing numbers, we used the data to estimate the sensitivity of the system and to calculate numbers of polio likely to have been missed in the sample of AFP reported in 2006.

What this Study Adds?

- The paper provides an objective method to measure the insensitivity of the polio culture system and the number of polio cases falsely labeled as non-polio AFP.

Calculations and Projections

According to GOI from 643 cases, 1286 samples were sent and of these 148 were falsely negative for polio virus. The chance that one sample was (falsely) negative was 11.51% (95% CI: 9.76% to 13.25%). The chance that both samples would be negative (assuming the both samples results are independent of each other) is given by the formula:

$$n = (148/1286) \times (148/1286) = 1.32\% \text{ (95\% CI: 1.31\% to 1.34\%)}$$

The NPSP web site on 20/4/07 suggests that besides 906 cases with results pending, there were 30209 cases discarded as non polio AFP because the stools were not positive for polio. Two specimens of stool were received from 82% and at least one specimen was received 97% of all AFP cases.

Projecting the sensitivity figures on to this larger sample, 18% of the 30209 (5438 cases) had only a single sample received. 625 cases of polio (95% CI 530 to 720) are likely to have been missed in this group with only one sample received. Of the 24771 cases with two samples received, the chance that both samples were falsely negative was likely in 326 cases (95%CI: 324 to 331). Thus the total number of cases of polio in India in 2006 is likely to be $674 + 625 + 326 = 1625$ (95% CI: 1528 to 1725)

Discussion

Our calculation assumes that collection and transport of stools in AFP cases where polio was cultured, is similar to the group discarded as non-polio AFP. This is not necessarily true. Stools from certain areas may be sent more meticulously than from other areas.

We also know that in the group where polio was cultured, 98% had two samples received. In the non polio group, less than 82% had two samples received. If the samples of non polio AFP came from areas with a problem maintaining the cold chain the sensitivity of the polio culture is likely to be worse.

For each case of paralytic polio it is expected that there are 10 sub-clinical cases of polio in the community. Getting a proper estimate of every case of paralytic polio is crucial to the eradication of the disease. Our revised estimates are important for forward planning of strategy for disease elimination

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