

The Impact of Malaria on the cognitive performance and Physical Development of School children in a Malaria endemic area of Sri Lanka

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Abstract:

This investigation on the impact of malaria on the cognitive performance of the school child was conducted in four Phases. The first phase of this study was conducted among 542 children at school entry level in two malaria endemic areas, namely Moneragala and Anuradhapura, and in Galle, a malaria non-endemic area. In this phase of the study, it was revealed that children from Galle district performed better in all indices of cognitive performance that were tested. These children were on the average from families of a higher socio-economic status as compared to children from the other two areas as evident from the educational level of the parents, family size and income. The Galle district may have achieved a higher socio-economic standards than Anuradhapura and Moneragala districts which are malaria endemic areas, due to it being free of malaria. The associations observed between indices of cognitive performance and past history of malaria in children from the Anuradha and Moneragala districts collectively revealed that their ability to read letters was compromised by increasing number of malaria attacks. The performance of children who had experienced a greater number of malaria attacks was poorer for the indices of task keeping, concentration, writing skills, reading skills, sentences structure, letter reading, measurement of quantity and identify numbers. The total scores of cognitive performance (writing skills, language and mathematics) declined as the number of malaria attacks increased, both during the child's lifetime and during the immediate past one year. Phase II of the study comprised a historical cohort study in which 571 children aged one to eight years were followed over a period of six years commencing January 1992. At the time of assessment of cognitive performance in November 1997, these children were attending Grades one to seven in schools in Kataragama, situated in the Moneragala District of Sri Lanka. Two instruments were used to assess cognitive performance in two subject areas namely mathematics and Sinhala language. One instrument was a special examination which was constructed with the assistance of the National Institute of Education, Sri Lanka, the premier centre and authority for primary and secondary education in Sri Lanka, the premier centre and authority for primary and secondary education in Sri Lanka. The other instrument was routinely conducted school end of term examination results which ensured that the course content taught in school were tested. Malaria infections in the population were monitored by passive case detection. Both mathematics and language performance were dependent on number of malaria attacks experienced by the children during the past 6 years, parent's education, monthly family income and house type. In multivariate analyses, the number of malaria attacks was a significant predictor of cognitive performance of both mathematics and Sinhala language, in both instruments used i.e. the special examination and the school end of term examination, after controlling for parent's education, monthly family income, house type. If a child did not experience a single attack of malaria

during the six year period, that child scored approximately 25 percent higher in the special examinations and approximately 16 percent higher in school end of term examinations in both mathematics and language as compared to a child who had experienced more than five attacks of malaria during this follow up period. Although weight for age and height for average were significantly associated with repeated attacks of malaria, the relationship was not significant in a multivariate model. The weight for age and height for age among children who had experienced five or less attacks of malaria were better than children who had experienced more than five attacks of malaria. Phase III was a prospective study, where the cognitive performance of 199 children with 303 malaria infections were compared with the performance of 142 children with 162 episodes non-malarial fever and 428 healthy controls at the time of an acute infection and two weeks later. These children were resident in Kataragama and Buttala areas of Moneragala district of Sri Lanka. A special examination in each of mathematics and Sinhala Language comprising five questions each was used. Cognitive performance of children with malaria was poorer than children with non-malarial fever and healthy controls both at the time of the initial visit and at the subsequent visit after two weeks. In the multivariate analysis, at the time of presentation, a child with malaria had on the average a score approximately less than 10-14 percent of control children. After two weeks, although the performance improved, it was still significantly less than that of control children (a deficit of 6-10 percent). In the case of children with non-malarial fevers, the performance at the initial visit was significantly poorer than that of control children and significantly better than that of children with malaria. In these children the performance improved in the next two weeks and was not significantly different to that of the control children. When children with malaria and non-malarial fevers were considered, children with malaria on the average were absent for a longer duration as compared to children with non-malarial fevers. Phase IV of the comprised a randomized double blind placebo controlled chloroquine prophylaxis trial to determine the impact of malaria prevention on the cognitive performance of the school child. Five hundred and eighty seven children resident in Kataragama and Buttala areas and attending schools in the area were randomly assigned to either chloroquine or placebo arms using computer generated random numbers and followed over a period of nine months. Cognitive performance of children was assessed using school end of term examinations in mathematics and Sinhala language and absenteeism was monitored during a seven month period prior to the intervention and the 9 month period of the intervention. At the commencement of the trial, there were no differences in cognitive performance or absenteeism between the two groups of children. At the end of the trial, the performance of children on chloroquine was significantly greater than children on placebo ($p < 0.001$ for both mathematics and language). The improvement in scores (i.e., difference between scores at the end of the trial and at the commencement of the trial) of children receiving chloroquine is significant considering the decline in scores of children who received placebo. Children who received chloroquine were absent a fewer number of days during the intervention. In the multivariate models, being on chloroquine prophylaxis, absenteeism due to malaria and not absenteeism due to health causes other than malaria and other causes were significant predictors of cognitive performance. In the case of language scores, the number of malaria attacks was also a significant predictor. The results of the different phases of this study clearly demonstrate that malaria per se has an adverse impact on the cognitive performance of the school child. The exact mechanisms by which malaria affects cognitive performance cannot be elucidated from this study. The importance of the findings of this study and the need for controlling malaria in this population group are discussed.

Key Words : Cognition Disorders-diagnosis / Cognition Disorders-etiology / Cognition Disorders-Epidemiology / Malaria-epidemiology / Malaria-psychology / Child / Case-Control Studies