Interdistrict variations in child health status and health services utilization: Lessons for health sector priority setting and planning from a cross-sectional survey in rural India

THE INCLEN PROGRAM EVALUATION NETWORK (IPEN)*

ABSTRACT

Background. There are limited data on interdistrict variations in child health status and health services utilization within the states of India. We conducted this study to identify and understand district-wise variations in child morbidity, mortality, healthcare seeking, and the status of health facilities in India.

Methods. A cross-sectional population-based cluster survey was conducted from April to July 2007 in 16 districts of eight states in India. Two districts with similar demographic profile and health criteria were selected from each study state.

Results. A total of 216,794 households and 24,812 under-5 children were surveyed. There were wide interdistrict variations in the health status of children within the same state and between different states across India. Interdistrict difference of >5 points/1000 live-births was found for infant mortality rate and under-5 mortality rate in all study states, while in six out of eight states this difference was >10 points/1000 live-births. Four states had a difference of >10 points/1000 live-births between respective districts for neonatal mortality rate. The interdistrict differences were also noted in childhood morbidity and health-seeking behaviour. Analysis of proportion of health facilities conforming to Indian public health standards revealed that the difference was ≥10% for availability of vaccines in five states, emergency services in three, laboratory services and logistics in four each, and referral facility in three of the eight study states.

Conclusion. This study underscores an important information gap in the country where planners seem to rely heavily on a few selected national-level databases that may not be adequate at the micro level. The current process of sporadic health surveys also appears inadequate and inappropriate. There is a need for district-specific data for planning, improving quality of service and generating demand for health service utilization to improve child survival in India. The findings of this study may prove useful for child health programme planning in India.

INTRODUCTION

Every year, around 1.83 million children die in India before reaching the age of 5 years.1 The majority of these deaths occur in selected states of India, where mortality rates are high, and delivery and utilization of health services are poor.2,3 Wide variations in child morbidity and mortality rates by regions and place of residence (rural or urban)3,4 are often referred to; however, these have not been measured and quantified in detail with a sufficient sample size.2,3 We intended to analyse the intra- and interstate district-wise variations in child morbidity, mortality, care-seeking and status of healthcare facilities. District-based programme planning is a highlight of the National Rural Health Mission (NRHM). We conducted a study with sufficient sample size to capture the district-specific morbidity and mortality as these data were not available from the existing District Level Household Surveys (DLHS). An important advocacy objective of this study was to provide actionable policy recommendations to policy-makers in India.

METHODS

Study universe and design
This cross-sectional survey was conducted in 16 districts of eight states across India, covering a total population of 17 million.5 These states have a total of 265 districts and a population of about 493 million, which is approximately 45% of all districts and 48% of the total population in India. A total of approximately 6% of the districts and 3.5% of the total population in these states was covered in this study. The study states (Uttar Pradesh, Madhya Pradesh, Rajasthan, Orissa, Karnataka, Haryana, Maharashtra and Meghalaya) were selected to represent different levels of health service systems, in terms of provisioning and performance, health indicators, and sociocultural and geographical locations. To achieve wide representation from these states, a core team of experts reviewed and analysed the available background information, infant mortality rate, health service utilization, and other health service availability and performance-related data for each state. The study was originally nested into baseline evaluation of health indicators in districts where the Integrated Management of Neonatal and Childhood Illnesses (IMNCH) programme was to be rolled out in India. Two districts were selected from each state. One district was supposed to start the IMNCI immediately after the survey and the other after a period of 3 years. This design would have provided an opportunity to assess the impact of the IMNCI intervention. Otherwise, these districts were almost similar in available health indicators.
Study team
The study was coordinated by INCLEN Program Evaluation Network (IPEN), which is a professional and cohesive network of programme management specialists, epidemiologists, health social scientists, biostatisticians, health economists, physicians, anthropologists, behavioural scientists, public health specialists, nutrition and health specialists and health management specialists from 136 medical schools, non-government organizations (NGOs) and public health institutes across India. A total of 58 institutions, including 43 medical colleges, 11 NGOs and four public health institutions were involved in this study (see Appendix 1 at www.nmj.in).

Study period
The study was conducted from January 2006 to July 2007. The data were collected between April and July 2007.

Selection of districts
In all states, the study was conducted in a pair of districts which were planned for the introduction of the IMNCl strategy. Though it was not always possible to select two districts that would represent the rest of the state, all efforts were made and attention paid to select two representative districts based upon the selection and matching criteria. The districts were selected by matching for the following criteria: (i) no IMNCl programme in the district; (ii) demographic profile (sex ratio, proportion of 0–6 years population, proportion of scheduled caste and scheduled tribe, and minority population); (iii) literacy status (men and women); (iv) population density; and (v) health services and status indicators (routine immunization and infant mortality rate).

Sample size calculation and sampling strategy
Mortality estimates. Cluster survey sample size was computed on neonatal mortality rate (NMR) of 40 per 1000 live-births (4% with admissible error of 1%, at 95% CI), considering that this would generate a sample size large enough to capture all other under-5 mortality events that were more common than neonatal mortality. Population proportional to size (PPS) sampling technique was used to select the required number of clusters in each district. A sample size of 1500 live-births was planned for each district. Over 12 800 households (at an estimated average of 6 individuals per household) were expected to be covered per district to capture 1500 live-births (assuming a crude birth-rate of 20–35 per 1000 and covering a population of 45 000–75 000 individuals, from 80 clusters in each district, at the rate of 160 households per cluster). Death being a rare event with unlikely probability of clustering within and between clusters, no design effect was taken into account to estimate this sample size.

Morbidity and healthcare-seeking behaviour. Prevalence of acute respiratory infections (ARIs), as reported in National Family Health Survey (NFHS-2) (8%), was used to calculate the sample size for the morbidity survey. Sample size was estimated to be 923 under-5 children per district (at 95% confidence level and 20% admissible error). This took care of estimating other diseases with a higher prevalence such as diarrhoea and fever. The experts discussed about intra- and intercluster homogeneity and heterogeneity in the study area and a design effect of 1.5 was considered optimal for sample size estimation.

The sample size to estimate the number of children accessing government health facilities was also based on ARI data (from NFHS-2). Thus a sample size of 1600 under-5 children in each district at 20 per cluster was targeted.

A health facility survey was also conducted, covering 40 health facilities (20 each from government and private settings) from each district, to assess the proportion of facilities conforming to Indian public health standards (IPHS). After discussion with the expert group, the number of health facilities was restricted to 40 as it was noticed that it would have been difficult to find even these many health facilities in the study blocks. The government or private primary healthcare facilities nearest to the selected clusters were identified for the survey and a complete list of health facilities was prepared. The private health facilities in cluster numbers divisible by four, and government health facilities in the remaining clusters were selected (see Appendix 2 at www.nmj.in).

Study instruments
A team of programme evaluation experts, paediatricians, social scientists, epidemiologists, biostatisticians and anthropologists conducted several rounds of workshops to develop draft instruments. These were piloted for validity, question framing, relevance and sequencing of all healthcare facilities. Final instruments were prepared with inputs from an International Advisory Board and Partner Medical Colleges/Institutions, and then translated into local languages. The instruments included (i) a household screening form to obtain a family census, information regarding socioeconomic status of the household, details of any under-5 child deaths during the past 2 years and detailed obstetric history of all ever married women (15–49 years of age) for the past 5 years in each household, (ii) a survey form to collect information regarding morbidity among under-5 children, care-seeking behaviour, and the reason for their selection of a particular type of health facility, and (iii) a generic health facility observation instrument to record status of available infrastructure, manpower, services and, other supplies and logistics (gloves, auto-disable syringes, sealed disposable syringes with needles, glass syringes with metal needles, hub cutter, intravenous fluids such as dextrose, ringer, lactate and normal saline, sterilizer/autoclave, sterile water/water for injection) at the health facilities being surveyed.

Quality assurance measures
Emphasis was laid on training of the entire team by conducting 16 workshops to ensure uniformity in data collection skills. A multidisciplinary coordinating team supervised the entire process of data collection and analysis. Assessment of all health facilities was done by the senior investigators and two senior investigators supervised all cluster/household-based data collection. Completeness of all instruments was assured before leaving a cluster site.

Data management and analysis
The data were collated and compiled in the central coordination office (CCO), New Delhi. The instruments were arranged in serial order, family folders were prepared and the entire data-set was checked for completeness. Each instrument was checked for correct transformation of its data on to the corresponding intelligent character reader (ICR) sheets. Subsequently, the data sheets were scanned using ABBY Form Reader 4.0 and transferred to Microsoft Excel 2004 spreadsheets for data cleaning and analysis. A multidisciplinary team led by a biostatistician analysed the data on STATA-10 software using survey command. This was necessary as we did a PPS cluster survey. The mortality rates and prevalence of indicator illnesses (fever, cough and diarrhoea) among under-5 children were calculated for all study districts and study states. The
data were categorized into age group and analysed accordingly. While doing the analysis, experts opined that from the public health point of view, statistical significance may not be the sole parameter and actual difference may also be used for decision-making with regard to programme planning. Therefore, the data presented here are in estimates (percentages/proportions) and 95% CI with calculation of absolute differences; though, these rates were not standardized. Design effect was also generated for each value but has not been presented in the tables. Data from health facility observation were analysed to obtain available manpower, infrastructure, equipment/logistics and referral services. This was then compared with standards set by IPHS to identify the gaps. A number of measures were taken to ensure data quality. The data collection was completed in a span of 2–4 months from all the eight states. Data collectors were trained and familiarized with the process of collecting data using all the survey forms in the field. The completed forms were reviewed and edited daily by the superiors in the field.

RESULTS

A total of 216,794 households were screened during household screening. In the household survey, 24,812 children (12,425 boys and 12,387 girls) under 5 years of age were visited; approximately 1600 in each district or 20 per cluster in each of the 80 clusters.

In all eight states, difference between the two districts of same states was exceeding 5 points (per thousand live-births) for infant mortality rate (IMR) and under-5 mortality rate (U5MR). These interdistrict differences were more than 10 points in six (75%) of the eight states for IMR and U5MR. For neonatal mortality rate (NMR), four states had a difference of more than 10 points between the respective districts. The difference in the period prevalence (two weeks reference) in under-5 morbidity, between the two districts within the same state was 5% or more for three of eight (38%) study states. In one state (Karnataka) this difference was more than 10% between the respective districts (Table I).

Table II shows the interdistrict variations in the proportion of under-5 sick children with any illness and with any specific symptom (fever, cough or diarrhoea) taken to a health facility. While the health service utilization for illnesses ranged from 17% to 49%, the proportion of those attending government health facilities ranged from a low 2% in Kannauj (Uttar Pradesh) to a high 67% in Sonpur (Orissa). In six of the eight (75%) states, the interdistrict difference for health-seeking was 5% or more in case of fever, cough, or diarrhoea. The caregivers cited quality and prescriber characteristics (64%; 95% CI 59.2–68.7), felt urgency (33%; CI 28.5–38.5), accessibility (20%; 95% CI 17.1–23.1) and affordability (13%; 95%; CI 10.7–16.1) as the criteria for choosing a particular health facility (data not presented).

All the states had interdistrict variations in the services available at the government/public health facilities (Table III). For example in Haryana and Meghalaya, the interdistrict difference in the proportion of health facility-based laboratory services conforming to IPHS was in the range of 0% to 16.7% and 0% to 43.8%, respectively. The interdistrict difference was 10% or more for availability of vaccines in five of the eight states (62.5%). The analysis of proportion of health facilities qualifying for IPHS revealed that the difference between the two districts within the same state was 10% or more for availability of vaccines in five states, emergency services in three, both laboratory services and logistics in four, referral facility in three, infrastructure in two, manpower deficit in one; and availability of medicines in one of the eight states (Table III).

DISCUSSION

Our study captures the interdistrict differences in child morbidity and mortality in selected districts of eight states of India. The sample used in this study was 12–18 times more than the sample size for districts in the DLHS; which is a major strength of our study. Our study reveals wide differences in child mortality and morbidity between districts with a similar demographic profile and a common governance. The fact that these differences exist in even those districts that had been selected based upon otherwise similar health parameters suggests that DLHS may not be a large enough survey to capture differences in child mortality and morbidity; and, hence, may not help health programme planners and managers to take informed decisions on operational public health issues. These findings necessitate the need for generation of valid, reliable and good-quality district-level data in India.

We noted differences of a substantial magnitude in various domains (child morbidity, mortality, care-seeking, status of health facilities, etc.) which were consistent across the states and less likely to have any bias. Moreover, the trends in the findings of this study and that of DLHS-3 are similar. We would like to emphasize that the magnitude of these differences translates into a substantial alteration from a public health perspective. These district-wise variations strengthen the need and demand for policy interventions in India by district-level or decentralized planning, based upon local data. Decentralization has been discussed for almost a decade in India. However, there have been limited efforts at actual district-level planning. The NRHM has brought the focus back on decentralized district-level planning, and our study provides evidence to support and further strengthen this approach.

Health service utilization in our study population was low with only one-sixth to half of sick children attending any health facility. Utilization of public health facilities ranged between 2% and 67% among rural populations of these districts. In Kannauj district of Uttar Pradesh, only 2% of sick children reaching any health facility were taken to a government health facility. The health service utilization in these settings, some of which have a very high mortality, is a cause of major concern and requires policy intervention. We noted that the prescriber characteristics and perception of the caregivers were more important than accessibility and affordability while choosing prescribers. Though, generally, distance is the first criteria for selection of a health facility, our findings highlight that quality of the prescriber received precedence in this decision-making process. Trust and confidence with the system and assured service delivery were factors that brought people to health facilities.

The health service utilization rate in our study was lower than that reported by DLHS-3 for a majority of the study districts. These rates were in the range of up to 40% lower than DLHS-3 in a few districts of Rajasthan and Orissa. Though, these rates were lower, the trends in these health-seeking practices were similar for various types of illnesses. The probable explanation for this may be seasonal variation and the changing pattern of health service utilization. However, we suggest that this is an area for possible future research in India, i.e. to explore and understand seasonal variations in child morbidity in India.

The wide inter- and intrastate variations in the status of health facilities (Table III) are as much a cause of concern as is the variation in mortality and morbidity rates. Such differences in primary care services may also be an underlying factor behind the variation seen in care-seeking. Low to medium utilization of health services (Table II) reflects the poor demand for these services, and health facilities not matching IPHS raise questions.
### Table I. Interdistrict variations in child mortality and morbidity in eight states of India

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Haryana</th>
<th>Karnataka</th>
<th>Maharashtra</th>
<th>Meghalaya</th>
<th>Madhya Pradesh</th>
<th>Orissa</th>
<th>Rajasthan</th>
<th>Uttar Pradesh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neontal (per 1000 live-births)</td>
<td>47.3</td>
<td>23.0</td>
<td>42.2†</td>
<td>37.7‡</td>
<td>34.8</td>
<td>61.2</td>
<td>39.6†</td>
<td>36.5§</td>
</tr>
<tr>
<td>Infant (per 1000 live-births)</td>
<td>91.5</td>
<td>81.2</td>
<td>75.1</td>
<td>68.9</td>
<td>57.8</td>
<td>75.4</td>
<td>65.4</td>
<td>59.0</td>
</tr>
<tr>
<td>Under-5 (per 1000 live-births)</td>
<td>105.2</td>
<td>94.3</td>
<td>92.8</td>
<td>107.4</td>
<td>68.2</td>
<td>91.7</td>
<td>101.2</td>
<td>94.8</td>
</tr>
</tbody>
</table>

Values in parentheses are 95% CI

#### Mortality rate

* Difference of >5 points OR >0.5% among districts of the state except in two states

** Difference of >5% among districts of the state

#### Morbidity among under-5 children (in past 2 weeks; %)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Haryana</th>
<th>Karnataka</th>
<th>Maharashtra</th>
<th>Meghalaya</th>
<th>Madhya Pradesh</th>
<th>Orissa</th>
<th>Rajasthan</th>
<th>Uttar Pradesh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall period prevalence</td>
<td>16.0</td>
<td>14.4</td>
<td>16.5</td>
<td>16.5</td>
<td>15.6</td>
<td>8.7</td>
<td>13.0</td>
<td>12.1</td>
</tr>
<tr>
<td>Neonatal (per 1000 live-births)</td>
<td>6.1</td>
<td>15.1</td>
<td>25.8</td>
<td>26.1</td>
<td>25.4</td>
<td>28.3</td>
<td>25.1</td>
<td>28.3</td>
</tr>
<tr>
<td>Infant (per 1000 live-births)</td>
<td>5.6</td>
<td>6.2</td>
<td>12.3</td>
<td>6.2</td>
<td>22.5</td>
<td>25.4</td>
<td>15.2</td>
<td>25.4</td>
</tr>
</tbody>
</table>

Values in parentheses are 95% CI

* Difference of >5 points OR >0.5% among districts of the state

### Table II. Interdistrict variations in proportion of sick under-5 children taken outside home for treatment

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Haryana</th>
<th>Karnataka</th>
<th>Maharashtra</th>
<th>Meghalaya</th>
<th>Madhya Pradesh</th>
<th>Orissa</th>
<th>Rajasthan</th>
<th>Uttar Pradesh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Care-seeking for any indicator illness (i.e. fever, cough or diarrhoea)</td>
<td>68.2*</td>
<td>58.3*</td>
<td>50.0*</td>
<td>41.5*</td>
<td>36.0†</td>
<td>48.1†</td>
<td>61.1</td>
<td>56.5</td>
</tr>
<tr>
<td>Proportion seeking government health facilities</td>
<td>43.8</td>
<td>38.9</td>
<td>48.9</td>
<td>53.4</td>
<td>57.8</td>
<td>57.0</td>
<td>46.6</td>
<td>62.2</td>
</tr>
<tr>
<td>Equipment for newborn/child care</td>
<td>4.0</td>
<td>0.0</td>
<td>4.2</td>
<td>5.9</td>
<td>8.7</td>
<td>12.5</td>
<td>0.0</td>
<td>4.8</td>
</tr>
<tr>
<td>Emergency services</td>
<td>36.4†</td>
<td>45.8§</td>
<td>65.5*</td>
<td>70.1†</td>
<td>84.0</td>
<td>88.5</td>
<td>72.2†</td>
<td>91.3†</td>
</tr>
<tr>
<td>Referral facility</td>
<td>40.0†</td>
<td>61.9†</td>
<td>69.0</td>
<td>85.2‡</td>
<td>66.7</td>
<td>87.0</td>
<td>76.2</td>
<td>83.3‡</td>
</tr>
</tbody>
</table>

Values in parentheses are 95% CI

* Difference of >5 points OR >0.5% among districts of the state

### Table III. Interdistrict variations in proportion of government/public health facilities conforming to Indian public health standards (IPHS)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Haryana</th>
<th>Karnataka</th>
<th>Maharashtra</th>
<th>Meghalaya</th>
<th>Madhya Pradesh</th>
<th>Orissa</th>
<th>Rajasthan</th>
<th>Uttar Pradesh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manpower</td>
<td>68.2*</td>
<td>58.3*</td>
<td>50.0*</td>
<td>41.5*</td>
<td>36.0†</td>
<td>48.1†</td>
<td>61.1</td>
<td>56.5</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>43.8</td>
<td>38.9</td>
<td>48.9</td>
<td>53.4</td>
<td>57.8</td>
<td>57.0</td>
<td>46.6</td>
<td>62.2</td>
</tr>
<tr>
<td>Equipment for newborn/child care</td>
<td>4.0</td>
<td>0.0</td>
<td>4.2</td>
<td>5.9</td>
<td>8.7</td>
<td>12.5</td>
<td>0.0</td>
<td>4.8</td>
</tr>
<tr>
<td>Emergency services</td>
<td>36.4†</td>
<td>45.8§</td>
<td>65.5*</td>
<td>70.1†</td>
<td>84.0</td>
<td>88.5</td>
<td>72.2†</td>
<td>91.3†</td>
</tr>
<tr>
<td>Referral facility</td>
<td>40.0†</td>
<td>61.9†</td>
<td>69.0</td>
<td>85.2‡</td>
<td>66.7</td>
<td>87.0</td>
<td>76.2</td>
<td>83.3‡</td>
</tr>
</tbody>
</table>

Values in parentheses are 95% CI

* Difference of >5 points OR >0.5% among districts of the state

### Table IV. Interdistrict variations in indicators of healthcare infrastructure

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Haryana</th>
<th>Karnataka</th>
<th>Maharashtra</th>
<th>Meghalaya</th>
<th>Madhya Pradesh</th>
<th>Orissa</th>
<th>Rajasthan</th>
<th>Uttar Pradesh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of medicines</td>
<td>61.2</td>
<td>60.4</td>
<td>73.8*</td>
<td>65.0*</td>
<td>70.4</td>
<td>68.2</td>
<td>61.7*</td>
<td>56.1*</td>
</tr>
<tr>
<td>Availability of vaccines</td>
<td>81.7†</td>
<td>67.7†</td>
<td>79.9</td>
<td>80.5</td>
<td>82.7</td>
<td>66.4</td>
<td>74.1</td>
<td>93.0</td>
</tr>
<tr>
<td>Other supplies/ logistics</td>
<td>73.5*</td>
<td>63.9*</td>
<td>84.2</td>
<td>85.3</td>
<td>88.4*</td>
<td>82.8*</td>
<td>55.6</td>
<td>69.2</td>
</tr>
</tbody>
</table>

Values in parentheses are 95% CI

* Difference of >5 points OR >0.5% among districts of the state

** Difference of >10% among districts of the state
on the quality from the supply side (Table III). It was noticed that health facilities are better when factors such as availability of vaccines, logistics and infrastructure, and supply of medicines is taken into consideration. A reason for this finding could be that these parameters are usually more strictly monitored, and have therefore improved over time. However, there has been limited focus upon the quality of services till recently and a majority of the health facilities have an average performance on the quality of health service delivery. The improvement in health services requires that interventions are focused upon both demand and supply in healthcare delivery for children in India. It has been reported that both are complementary and efforts to strengthen only one aspect may not pay dividends.11 The NRHM is expected to improve the supply side by improving infrastructure, ensuring availability of human resources and supply of medicines by innovative funding.12 The evidence on the role of improving the demand side in improving child survival has only recently emerged.13 There is a need for implementing programmatic strategies to improve care-seeking and increase the demand for child health services in India. Improved quality will bring trust and confidence of the general public in government health services and will generate demand and improve utilization of these services; which will indirectly improve child survival in the country.

We suggest that the above interdistrict variations can be best addressed by local data generation and decentralized district-level planning. Though, under NRHM, as also by the 73rd and 74th amendment to the Constitution of India,14 Panchayati Raj institutions (PRIs) at the village, block and district level are to be empowered to take a leadership role in planning and management of health programmes,15 these policy intentions need to be implemented. In developing countries such as India, where the demand for various health services competes with limited resources, improved healthcare may not be a priority unless the capacity of decentralized priority setting institutions (such as PRIs) is improved and they are equipped with accurate micro-level information.16

Our study underscores a need for strengthening and providing technical assistance for decentralized district-level public health planning and management. It also underlines the need to build a comprehensive district-level public health database to suitably inform often advocated decentralized programme planning and priority setting. The IPHS should be used for health facility assessment, frequent planning and to assess supply side interventions.

Conclusion

Our study documents substantial interdistrict differences within states, with respect to various domains of child health, even under the ambit of common governance and underscores an important information gap in the country. Presently, health planning relies heavily on a few selected national-level databases, and may not be adequate at the micro level. We conclude that the current process of sporadic health surveys is inappropriate and inadequate. The difference in the findings of our study and DLHS (with the advantage of a larger sample size in our study) suggests the need to generate regular, good quality, valid and reliable data at the district level for health planners and programme managers. Our study identifies supply and demand side challenges, and recommends strengthened local level (or decentralized) planning, improving quality in service delivery and demand generation. The need for district-specific data for planning, improving quality of service and generating demand for health service utilization is the felt need for improving child survival in India.

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Role of funding agencies

The sponsors/funding agencies of the study had no role in the study design, data collection, data analysis, data interpretation or writing of the manuscript. The corresponding author had full access to all the data in the study, and had final responsibility for the decision to submit for publication.

Conflict of interest. None declared

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