Use of Rapid Survey Methodology to Determine Immunization Coverage in Rural Burma

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Summary

Immunization coverage on DPT, OPV, and BCG was quickly determined for a population-based sample of 396 children in rural Burma using Rapid Survey Methodology (RSM), a new approach to information gathering using a portable, battery-powered computer and printer, contemporary software, and a recently validated sampling procedure. Five days after the survey team went into the field, the findings were presented in tables and computerized graphs to the local programme manager. Within 10 days of the initial field day, a final 50-page report was issued. Using RSM, health professionals in Burma can now quickly and effectively monitor and evaluate immunization programmes at the community level.

Introduction

Systems for routine reporting of the number and type of immunizations given by health care providers are common throughout the world. Yet in many developing countries the data are of questionable quality, with under- or incomplete reporting being the rule rather than the exception. The Expanded Program on Immunization (EPI) of the World Health Organization (WHO) has promoted surveys as an effective means for both validating information derived from routine reporting systems and for identifying the reasons for inadequate coverage. The sampling method favoured by EPI/WHO is a two-stage cluster sample of 210 children; 30 clusters with 7 children per cluster. Most EPI/WHO surveys estimate immunization coverage, but some assess the occurrence of disease, or the use of health services. While commonly used, this two-stage sampling procedure has only recently been statistically validated.

In a rural region of Burma, we used Rapid Survey Methodology (RSM) to quickly gather immunization-related data for a sample of children from birth to three years of age. RSM uses:

1. the recently validated EPI/WHO sampling methods;
2. powerful, battery-powered computers and printers; and
3. appropriate software to rapidly process, analyse, and report survey findings.

The intention is to quickly provide programme managers with information on health measures at the community level. A complete description of RSM and a report of early dietary practices and weight-for-age have been presented elsewhere. Here, we will describe how the method was used to quickly assess and report immunization coverage in a rural township of Burma.

Materials and Methods

Survey Population

A two-stage cluster sample was conducted from May 4 to 7, 1987 of 417 of nearly 5200 births during the previous 3 years in 79 communities in Hlegu Township, Rangoon Division, Burma. Using a spreadsheet program, 30 clusters were selected with probability proportionate to size (PPS) from the 79 villages in the sample population. In accord with the general EPI/WHO procedure, interviewers randomly selected the first household and then proceeded to the nearest household until 14 children/births were sampled; 25 clusters had 14 births, 3 had 15, 1 had 16 and 1 had 6 (all the children in the community). Participation was 100 per cent.

Computer Hardware and Software

The computer used to assist with the survey was a portable, battery-powered unit weighing 9 pounds with a liquid crystal display (LCD) screen, 512 kilobytes (K) of internal memory, and one 3.5-inch disc...
drive (720 K). Software, or the operating instructions for the computer, was of four types:

1. word-processing;
2. spreadsheet;
3. data entry, editing and analysis; and
4. form development.

The word-processing program was used to prepare the interview form and the final report, while the form development program was used to create the management forms for the study. The uses of the other software are described below. A portable, battery-powered printer weighing less than 4 pounds was used to print all tables and graphs.

Interview/Examination Procedures
All interviews were conducted by teams of two physicians and/or statisticians. Live births in the household during the prior 3 years were identified using the annual Thingyan (or Water) Festival as a reference point. If 'yes' and alive, questions were asked about the first, second, and third doses of diphtheria, pertussis, and tetanus (DPT) vaccine, oral poliomyelitis vaccine (OPV), and the first dose of BCG (bovine tubercle bacillus of Calmette and Guerin). The mode of administration (oral or site-specific injection) was mentioned by the interviewer to help stimulate the memory of the respondent. Finally, each child received a brief examination to look for the characteristic BCG scar on the upper arm.

Data Entry and Analysis
All data were entered at the end of each day into a portable, battery-powered computer using Survey Mate. Parameter estimates and three levels of confidence intervals (90, 95, and 99 per cent, respectively) were calculated using SuperCalc4. Cross-tabulation analyses were done using Survey Mate. Graphs by age group were generated and printed using SuperCalc4.

Completion Time
The field activities took 3.5 days with data entry into the battery-powered computer and editing occurring on a daily basis. By the end of the fourth day, all preliminary analyses were completed and a set of tables and graphs were printed with the study findings. The next morning (i.e. within 5 days of going into the field), the results were presented to the local medical officer and his staff. Within 5 more days, a 50-page final report with an extensive set of tables and graphs was submitted to the Director General of Health and the Director of Public Health in Rangoon.

Results
During the previous 3 years, between May 1984 and May 1987, women living in the sampled households of Hlegu Township gave birth to 417 infants. Of these, 21 were dead and 396 were alive at the time of the interview. Age and sex groups were evenly represented in the sample; 52 per cent were males, and 38, 31 and 31 per cent were less than 1, 1–2, and 2–3 years of age, respectively.

Each child in Hlegu Township was to have received three doses each of DPT and OPV, and one dose of BCG during the first year of life. Both DPT and BCG have been offered to children at the village level for many years. The OPV coverage campaign, however, did not begin in Hlegu Township until October, 1986, some 7 months before the survey. Thus, older children in the survey had been offered DPT and BCG, but not the OPV vaccine. The results for immunizations coverage are presented in two forms.

1. As a single point estimate with varying confidence intervals for all children 1–3 years of age.
2. As the age trend from birth through 35 months.

Point and Interval Estimates
For the first analysis, we assumed that all children should be completely immunized by 1 year of age; thus, the analysis is limited to children aged 12 through 35 months. Since the data are derived from a sample survey, we present the point estimate for the proportion immunized and, more appropriately, confidence intervals bracketing the 'true' proportion immunized in the sampled population. OPV results are not included in this first analysis since coverage estimates among 1–3-year-olds would have spuriously underestimated the recent OPV campaign efforts among younger children.

Point estimates and confidence intervals for the three doses of DPT and single dose of BCG are shown in Table 1. Coverage for DPT declines from 78 per cent for the first dose to 41 per cent for the third dose. BCG immunization coverage was nearly the same as for the first dose of DPT: 78 per cent for the reported immunization and 73 per cent for the presence of the characteristic scar on the upper arm. A set of graphs showing confidence intervals for each of the five variables shown in Table 1 were printed in the field and presented to the local medical officer and his staff. An example of these graphs is shown in Fig. 1 for the third DPT dose. Based on the survey findings, we are 90 per cent confident that the 'true' proportion immunized with the third DPT dose lies between 0.30 and 0.32, 95 per cent confident it lies between 0.28 and 0.54, and 99 per cent confident it is between 0.24 to 0.58.

Age Trend
A computer-generated graph of the relationship between age and DPT immunization is shown in Fig. 2.
Table 1
Proportion reported immunized or with BCG scar among children, aged 12–35 months. Hlegu Township, Burma, May, 1987

<table>
<thead>
<tr>
<th>Immunization attribute</th>
<th>n</th>
<th>P</th>
<th>90% (lower, upper)</th>
<th>95% (lower, upper)</th>
<th>99% (lower, upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interview</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First DPT dose</td>
<td>237</td>
<td>0.781</td>
<td>(0.707, 0.855)</td>
<td>(0.692, 0.869)</td>
<td>(0.664, 0.897)</td>
</tr>
<tr>
<td>Second DPT dose</td>
<td>231</td>
<td>0.576</td>
<td>(0.481, 0.670)</td>
<td>(0.463, 0.689)</td>
<td>(0.427, 0.724)</td>
</tr>
<tr>
<td>Third DPT dose</td>
<td>231</td>
<td>0.411</td>
<td>(0.303, 0.519)</td>
<td>(0.282, 0.540)</td>
<td>(0.241, 0.581)</td>
</tr>
<tr>
<td>Single BCG dose</td>
<td>239</td>
<td>0.782</td>
<td>(0.707, 0.857)</td>
<td>(0.693, 0.872)</td>
<td>(0.664, 0.900)</td>
</tr>
<tr>
<td>Examination</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCG scar</td>
<td>246</td>
<td>0.732</td>
<td>(0.652, 0.811)</td>
<td>(0.637, 0.827)</td>
<td>(0.607, 0.857)</td>
</tr>
</tbody>
</table>

n, The total number of children in the sample survey.
P, Proportion of sampled children who were immunized or had BCG scar.

Fig. 1. Proportion of children, aged 1–3 years who have received the third dose of DPT, survey, Hlegu Township, May 1987.

Besides showing the existing state of immunization, this same graph can provide information for programme managers on the age when children are receiving their vaccinations, assuming that the timing of immunization activities has remained consistent during the past year. In Hlegu Township, only 38 per cent had received their first dose of DPT by 3–5 months of age. By 6–8 months of age, this figure increased to 78 per cent. Thus, we can infer that 40 per cent of the children (or half of those who were going to be immunized) had to wait until they were between 6–8 and 9–11 months of age. For the third dose of DPT, the rise in immunization coverage was much more gradual with almost 20 per cent of the children (or half of those who were going to be vaccinated) not receiving their vaccination until between 6–8 and 9–11 months, and 14 per cent (or about one-third of those who were going to be immunized) having to wait until between 12–14 and 15–17 months of age.

For the three doses of OPV, Fig. 3 shows a different age pattern. The children who were 3 months of age in October, 1986 received their first dose of OPV during October when their local vaccination programme was initiated. These children were 10 months of age in...
May at the time of our survey. Others who followed them, in time, also received the OPV vaccine as they reached 3–8 months of age. Older children may have received the vaccine after the start of the October campaign, but based on Fig. 3, this was less common. Projecting the present trend in OPV coverage into the future, it would appear that in a few years 75–85 per cent of the eligible children will have received the first dose, 55–65 per cent the second dose, and 45–55 per cent the third dose, with the age at the time of immunization being the same as for DPT.

Figure 4 presents immunization coverage by age for both the BCG immunization question and the examination for the characteristic BCG scar. Both indications of BCG coverage are nearly identical and follow closely the pattern of the first DPT dose.

**Discussion**

Findings from sample surveys permit administrators to assess what is occurring at the community level and to use the information for monitoring or evaluation of programme activities. Surveys, however, are of low utility unless the gathered data can soon be converted into useful information. This conversion process means the data are quickly assembled and reported to
the busy administrator in such a way that he or she can rapidly understand the findings. Graphs are an ideal way to quickly convey information. Yet in most developing countries, graphs are rarely used, especially in routine reports. We have shown two types of graphs used as part of RSM. Both permit a quick assessment of study findings. With some additional interpretation, the second type of graph also provides an estimate of the age when vaccines are being administered. The Expanded Program on Immunization of WHO has recommended, in their most recent publication, that both BCG and OPV be given at birth and three doses of DPT and OPV be given at ages 1.5, 2.5, and 3.5 months. Based on our findings in Hlegu Township, it appears that children in this rural region of Burma are not receiving their vaccine until much later in life. It is not our intention to criticize the local health workers since there are many valid reasons that could account for these delays. Rather, the survey findings are meant to provide the local administrator with an independent view of the immunization status of the population and of the percentage of children at risk of acquiring the childhood diseases before they are adequately immunized.

As portable microcomputers become less expensive, they will be much more evident throughout the developing world. We have observed in Burma and elsewhere that health professionals can quickly be taught how to use computers for survey, research, and decision-making purposes. Since immunization programmes are essential for safeguarding the health of children throughout the world, immunization coverage surveys will always be necessary. Using Rapid Survey Methodology, community-based surveys in developing countries can be done more quickly than has heretofore been possible.

References
11. Berge N, Ingle MD, Hamilton M. Microcomputers in