Data Utilization and Analytical Skills among Mid-Level Health Programme Managers in a Developing Country

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Mid-level health managers in a developing country were studied to examine the extent to which they are able to use and analyse data they receive from a new health information system. Among 168 managers filling out a self-administered questionnaire, 52% could compute a simple cost-effectiveness ratio and 27% were able to calculate proportions. Only 43% of the managers were able to construct a cumulative graph similar to the one recommended by WHO. Facility with these tasks was not related to levels of training or age. Twelve out of 25 programme managers interviewed in depth did not know how well their particular programme had performed in the previous year. Similarly, only six of these managers knew their best and poorest performing districts. The results of this study suggest: 1) Training managers in data analysis and use is critical if health information systems are to actually improve health care delivery. 2) Data intended for the use of programme managers need to be presented in simple ways. 3) Further social research is required to understand how managers perceive and use data. 4) Efforts to ensure the use of data should not be seen as something to be 'added on' after information systems are in place.

Since the advent of microcomputers in the early 1980s there has been a large increase in the number of computerized health information systems in developing countries. The speed, accuracy, and low cost of the computers gave a new impetus to the systematic collection and analysis of routine data from peripheral health facilities. The new information systems were seen as ways of providing health programme managers with the data they needed to effectively plan and monitor service delivery.

Research directed towards practical problems in health care delivery is another major source of data for health programme managers. According to recent estimates US$835 million is spent annually on health research performed in developing countries out of which 10-40% is used for research on issues related to public health.1

While advances in information technology have been impressive, some scepticism has been expressed that improvements in the technology itself will improve health care delivery.2,3 In order for health information systems and problem oriented research to make a contribution to improving health services, managers must understand and pay attention to the data they have. The present study was undertaken to examine the extent to which managers understand and are aware of the data to which they have easy access. It also served as a needs assessment in the design of a training course on data analysis and use.

METHODS
This study was carried out in a developing country with a per capita GNP above US$500 and an adult literacy rate above 75%. The study involved Ministry of Health managers working in an area with a population of nearly 6 million people. A survey questionnaire was used to test the managers' knowledge and skills in simple data analysis, while structured interviews were conducted to assess the extent to which managers actually use the data they receive from the health information system.

Survey Questionnaire
Managers were invited to a workshop in their own province to discuss the implementation of a new health in-
DATA ANALYSIS SKILLS AMONG HEALTH PROGRAMME MANAGERS

formation system. The new system was a refinement and consolidation of previously existing data collection systems that had been set up by each public health programme. The new information system was meant to simplify the collection of routine data from all health facilities and used microcomputers to collate results. During the workshop a self-administered questionnaire was filled out anonymously by all the staff that attended. A review of records showed that 92% of the invited managers attended the workshop and completed a questionnaire.

In addition to the 142 provincial staff who filled in the survey questionnaire, 26 municipal health officers (MHO) who attended the provincial meetings also completed a questionnaire. The MHO were selected by the Provincial Health Officer and most worked in health centres near the provincial office. Hence, the sampling procedure used among the MHO must be regarded as one of convenience. The total sample size was 168.

The questionnaire consisted of two parts. The first part dealt with background information on the respondents and their opinions about the new health information system. The second part of the questionnaire (Appendix) consisted of 20 questions which were meant to test the managers' skills in interpreting and manipulating simple data; a few questions were deliberately designed to be difficult. The questionnaire had been pre-tested extensively prior to the study and was printed in the language used in official government communication.

All the respondents had completed university training, 34% were doctors, and 21% had the equivalent of a master's degree in public health (MPH). In all 71% had been working in the Ministry of Health for more than 5 years.

Structured Interviews
The 25 provincial programme managers who took part in the structured interviews were asked which single indicator obtainable from the health information system was most important in monitoring the performance of their programme. The managers were then asked about how well their provinces had performed on the specified indicator during the previous year. Thirteen of the 25 (52%) knew the answer to

Calculated a simple average (question 5) caused the managers few problems but only 11% could compute a weighted average (question 6).

Construction and Interpretation of Graphs
The Expanded Program on Immunization (EPI) has recommended that cumulative graphs of performance should be kept in each health facility and at district, provincial, and national levels. However, among the 10 EPI managers who filled out questionnaires only seven constructed a cumulative graph correctly (question 13) and five gave the right interpretation (question 14). The other managers had an even harder time with cumulative graphs.

Constructing and interpreting bar charts was also not done very well (questions 17, 19, and 20) however a simple pie chart (question 7) was correctly interpreted by 76% of the respondents.

Knowledge of Epidemiology
The results of household surveys were felt to be more accurate than data coming from a routine reporting system by only 55% of those studied. Roughly the same proportion understood the difference between incidence and prevalence. As expected, very few understood the basics of experimental design such as the difference between a cross-sectional survey and a randomized trial (question 11).

Score on Test of Analytical Skills
The average score for all managers surveyed was 8.1 correct answers out of a possible 20 (Figure 1). Respondents with an MPH (or its equivalent) did no better than staff without postgraduate degrees, and nurses did as well as doctors. There was also no significant difference between the staff working at provincial or municipal level. The absence of a difference between these groups was not because some questions were difficult. As the Appendix demonstrates, only five questions were answered correctly by less than 20% of respondents.

Years of service in the government (and hence age) did not affect a manager's score (Figure 2).

Data Utilization
The 25 provincial programme co-ordinators who took part in the structured interviews were asked which single indicator obtainable from the health information system was most important in monitoring the performance of their programme. The managers were then asked about how well their provinces had performed on the specified indicator during the previous year. Thirteen of the 25 (52%) knew the answer to
<table>
<thead>
<tr>
<th>Question (see Appendix)</th>
<th>All respondents No. = 168</th>
<th>Medical doctor No. = 57</th>
<th>Registered nurse No. = 50</th>
<th>MPH (MD &amp; RN) No. = 35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculate a simple ratio from a table (Q 1)</td>
<td>52</td>
<td>47</td>
<td>52</td>
<td>57</td>
</tr>
<tr>
<td>Average of four numbers (Q 5)</td>
<td>74</td>
<td>67</td>
<td>88</td>
<td>77</td>
</tr>
<tr>
<td>Two questions on percentage change (Q 4, 15) per cent getting both right</td>
<td>20</td>
<td>16</td>
<td>18</td>
<td>26</td>
</tr>
<tr>
<td>Three questions on proportions (Q 3, 9, 18), per cent getting two right</td>
<td>27</td>
<td>32</td>
<td>32</td>
<td>23</td>
</tr>
<tr>
<td>Able to construct cumulative graph (Q 13)</td>
<td>43</td>
<td>53</td>
<td>42</td>
<td>29</td>
</tr>
<tr>
<td>Able to interpret cumulative graph (Q 14)</td>
<td>54</td>
<td>60</td>
<td>64</td>
<td>46</td>
</tr>
<tr>
<td>Multiple choice question on prevalence (Q 10)</td>
<td>49</td>
<td>46</td>
<td>56</td>
<td>60</td>
</tr>
<tr>
<td>Multiple choice question on incidence (Q 16)</td>
<td>57</td>
<td>56</td>
<td>60</td>
<td>74</td>
</tr>
<tr>
<td>Believed survey better than routine report (Q 12)</td>
<td>55</td>
<td>46</td>
<td>72</td>
<td>66</td>
</tr>
</tbody>
</table>

**Figure 1** Average score on test of analytical and mathematical skills

**Figure 2** Average score by years of service in the Ministry of Health
within ± 5%. For the specified indicator, 36% of the managers knew their poorest performing district (or province) and only 24% knew both their best and worst performing districts.

Few of the managers interviewed (3, 12%) had graphs that related to the current or previous year’s accomplishments. However, 40% had at one time drawn graphs related to their performance. Cumulative performance graphs, such as the monitoring charts recommended by the EPI, were not in use at all, even by the nine EPI staff questioned.

It may be that managers are hesitant to use data from the health information system because they are sceptical about its accuracy. However, 57% of all the managers, including 84% of those who participated in the structured interviews, responded to a closed question that the data they received from the health information system was ‘acceptably accurate’.

DISCUSSION
The managers that were interviewed appeared not to use, and displayed little familiarity with, the data that they received from the health information system. Many of the managers surveyed had such a hard time interpreting and analysing data that it could seriously impair their ability to use quantitative information in making decisions.

There are a number of possible explanations why, despite being well educated and experienced, the managers demonstrated little inclination to use the data they had available. Firstly, because they lacked some of the mathematical and statistical skills needed to analyse data, managers may have felt uncomfortable with any but the most cursory analyses. Secondly, at the time the study was carried out there was little institutional pressure on managers to seriously examine their data. This situation has changed recently with the introduction of an area-based planning approach which forces managers to examine the performance of specific programmes and in particular geographical areas. Thirdly, managers would, naturally, be reluctant to use the data coming from a health information system if they felt it to be inaccurate or misleading. However, this is unlikely to be an important factor since most of the managers surveyed perceived the data as being acceptably accurate.

Whatever the cause, the fact that managers do not understand or much rely on quantitative information significantly reduces the effectiveness of health information systems and problem-oriented research in improving the delivery of health services.

The results of this study lead to a few conclusions:

1) There is a need for the effective training of managers in appropriate data analysis skills. The lack of such skills could seriously impair managers’ ability to use data to improve service delivery.

2) Data intended for the use of programme managers need to be presented in a simple way. Pie charts appear to be very useful while complex tables and complicated graphs do not appear to be well understood.

3) Health managers need to feel some ‘institutional pressure’ to use the data they routinely receive. For example, where budget allocations are linked to planning exercises that require the analysis of routine data, it is likely that managers will pay more attention to the information they have.

4) Further social research is required to understand how managers perceive and use data. Efforts at promoting primary health care interventions have made extensive use of focus groups, in-depth interviews etc. to understand mothers’ perceptions. Similar research approaches should be used with programme managers and their use of data.

5) Strategies to ensure that reliable data is actually used should be elucidated before the information system is in place or the research is completed. This means that budgets need to contain line items for such efforts and people need to be identified who are specifically responsible for ensuring that data is applied in making decisions.

REFERENCES

(Received June 1993)

APPENDIX
Test of Managers’ Data Analytical Skills
(Number in brackets indicate the percentage getting the correct answer to that question.)

Part B: Please fill in this part of the questionnaire to the best of your ability. Some of the questions are difficult but please don’t worry. You are not expected to know the answers to all the questions.
Questions 1 and 2 refer to the following data:

| TABLE 1 Comparison of costs and accomplishments before and during a TB case-finding operation |
|--------|--------|
|         | Month before case finding | Month during case finding |
| Number of symptomatics found | 80 | 200 |
| Number of sputum positive cases found | 20 | 40 |
| Total costs of TB case-finding for the month | US$1100 | US$3400 |

1. From Table 1. In the month before the sweep what was the cost of case-finding, per sputum positive case that was found? (52%)

2. From Table 1. What was the difference in cost of finding a sputum positive case during the sweeping operation compared to before the sweep? (43.5%)

3. The infant mortality calculated from reported deaths (on ‘notification of death’ forms) in Province A was 38 per 1000 livebirths. However, a survey in the same province indicated that only 50% of all infant deaths are reported, whereas all births are reported. What is the true infant mortality rate likely to be? (48%)

4. In March 2369 cases of measles were reported while in April only 1646 cases were reported. What was the percentage change in reported measles cases from March to April? (36%)

5. A provincial EPI co-ordinator has received reports from only four out of eight districts but would like to present her results at a regional meeting. From the data below, what is the average coverage in the four districts?

<table>
<thead>
<tr>
<th>District</th>
<th>Measles coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>65%</td>
</tr>
<tr>
<td>B</td>
<td>50%</td>
</tr>
<tr>
<td>C</td>
<td>80%</td>
</tr>
<tr>
<td>D</td>
<td>85%</td>
</tr>
</tbody>
</table>

(74%)

6. On her way to the meeting the EPI co-ordinator in question 5 realizes that she also has the target populations for each district. These are: 4000, 3000, 7000, and 10 000 respectively. Now what should she report as the average coverage in the four districts? (11%)

The next two questions refer to Graph 1:

7. In 1988 what percentage of the provincial health budget was spent on drugs? (76%)

8. In 1989 there was a 22% increase in the total budget. The proportion spent on salaries increased to 55% of the budget. Disregarding the effect of inflation, in which year was the most money spent on drugs?

1. 1988
2. 1989
3. same amount for both years
4. cannot tell from information given (14%)
9. A malaria programme co-ordinator calculates that he has achieved 35% of his annual target of houses sprayed by the end of May. Assuming that performance continues at the same rate what percentage of his annual target will he have accomplished by the end of the year?

(52%)

10. A survey is carried out in Province B in which randomly selected individuals are asked whether they have diabetes. Out of 1000 individuals interviewed, 50 said they have diabetes. The number 50/1000 is referred to as the:
1. incidence
2. prevalence
3. case-fatality rate
4. attack rate

(49%)

11. The kind of study referred to in question 10 is an example of a:
1. case-control study
2. longitudinal or cohort study
3. a cross-sectional study
4. a randomized trial

(9%)

12. In Province C the routine information system reports that the DPT3 coverage for 1988 was 78%. A standard cluster survey conducted in September 1989 indicated that DPT 3 coverage was 61%. Which result do you think most accurately reflects the true coverage in the province?
1. routine information system results
2. cluster survey
3. neither
4. both are equally accurate

(55%)

13. In Municipality A the 1990 target population for children who should be weighed is 600. Below is a table of the number of children weighed each month from January to May. Use Graph 2 and construct a CUMULATIVE performance chart (i.e. a cumulative graph of the number of children weighed) for Municipality A.

<table>
<thead>
<tr>
<th>Month</th>
<th>Number of children weighed</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>80</td>
</tr>
<tr>
<td>February</td>
<td>10</td>
</tr>
<tr>
<td>March</td>
<td>20</td>
</tr>
<tr>
<td>April</td>
<td>40</td>
</tr>
<tr>
<td>May</td>
<td>40</td>
</tr>
</tbody>
</table>

(43.5%)

14. Also on Graph 2 is a line showing performance in 1989. What proportion of the target population was weighed during the whole of 1989?

(54%)

15. In 1988 one health centre gave out 288 cycles of birth control pills. The following year the health centre gave out 349. What is the percentage change in the number of cycles (of pills) distributed?

(26%)

16. Using data from the notifiable disease forms a Provincial Health Officer calculates that there have been 4500 new cases of measles in the last year among a population of 1300000. The number 4500/1300000 is referred to as the:
1. incidence
2. prevalence
3. case-fatality rate
4. vaccine efficacy

(57%)

The next question refers to Graph 3

17. The Provincial Health Officer would like a graph showing the performance of different districts in terms of getting new acceptors of family planning.
Below is the data for five districts of the yearly target for pill acceptors and the actual accomplishments. Use Graph 3 to show how well each district is doing.

<table>
<thead>
<tr>
<th>District</th>
<th>Yearly target</th>
<th>Acceptors (Accomplishment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>300</td>
<td>180</td>
</tr>
<tr>
<td>B</td>
<td>450</td>
<td>315</td>
</tr>
<tr>
<td>C</td>
<td>700</td>
<td>455</td>
</tr>
<tr>
<td>D</td>
<td>400</td>
<td>320</td>
</tr>
<tr>
<td>E</td>
<td>650</td>
<td>325</td>
</tr>
</tbody>
</table>

(26%)

18. An EPI co-ordinator notices that one district has reported 118% DPT1 coverage and 82% measles coverage. He knows that 118% coverage is impossible and suspects that there's a problem with the denominator (i.e. target population). He thinks the true DPT1 coverage is about 95%. If this is the case what would be the true measles coverage?

(15.5%)

19. Referring to Graph 4; How many sputum positive cases were found before the TB sweeping operation?

20. Also referring to Graph 4: Compared to the month before did the TB sweeping operation find proportionately more symptomatic cases or sputum positive cases?

(15.5%)