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To: Frances Davidson, AID/S&T/N

From: Paul R. Crowley, USDA/OICD

Subject: Vitamin A Intervention Cost-Effective Analysis

The final report from the University of Michigan covering its work to develop vitamin A cost-effectiveness models was received several weeks ago by USDA and has been circulated for review. I have now received comments from a number of the reviewers and can provide AID with summary comments about the report together with my suggestions for follow-up.

Summary

Third world countries which have major health problems arising from vitamin A deficiency have three types of interventions from which to choose to cope with those problems. One option is to distribute periodic large doses of vitamin A in the form of capsules; the second is to fortify processed foods with vitamin A; and the third is to increase consumption of vitamin A rich foods through diet modification. These three interventions can be implemented singly or in combination.

When faced with selecting a particular intervention or combination of interventions to use in a given situation, third world planners find that the interventions have a number of inherent differences in terms of the population groups reached, types of inputs required, coverage, etc. Nonetheless, in the context of health/nutrition planning, all three types of interventions can be considered as practical and timely solutions to the problem of vitamin A deficiency. Therefore planners need a rational basis for selecting among the alternatives.

The University of Michigan project was supported by USDA and AID to explore the use of cost-effectiveness analysis as a basis for selecting among the three interventions. The Michigan scope-of-work called for it to develop models with which to predict the costs and health effects of the major vitamin A interventions and to provide suggestions about how to utilize the models to help select among alternative vitamin A interventions.

Michigan complied with the scope-of-work by providing a report which describes models with which to predict the costs and health effects of each of the three interventions. It also provided a computer program and PC software with which to facilitate use of the model. The Michigan program permits users to

estimate the total costs and the expected health effects for particular interventions based on known or assumed conditions in particular countries. In addition it facilitates the estimation of changes in health effects when program inputs are increased or decreased. Thus the model permits comparison of alternative vitamin A interventions and the selection of the least costly intervention to achieve a specific effect or, alternatively, the most effective intervention at a given cost.

Michigan tested its generalized models using data and assumptions from Indonesia and concluded that the model appeared to make reasonable predictions of performance. However the models were not thoroughly tested and Michigan recommended that they should be applied and evaluated by working directly with policy makers and workers in particular countries. Indonesia, Bangladesh, and Nepal were suggested as sites for this activity.

The Cost-Effectiveness Models

The Michigan models were designed to predict improvements in the health status of population groups arising from implementation of each of the three major vitamin A interventions. Improvements in health were treated specifically in terms of blindnesses prevented and deaths averted and also in terms of reduction in the more traditional indicators of vitamin A deficiency such as Bitot spots, night blindness, etc.

In order to use the Michigan models, it is necessary to have all of the following information:

1. Unit costs for the various inputs needed to implement each of the vitamin A interventions.

2. A disease profile for the population covered by the intervention, i.e. the numbers of persons in the population who exhibit the adverse effects of vitamin A deficiency (become blind, die, or, as indicators of health status, have Bitot spots, low serum levels of vitamin A, etc.)

3. The changes in the disease profile which will result from the intervention (the reduction in blindnesses, deaths, etc.) with each change expressed as the health outcome resulting from specific program input.

It should be noted that item (1), unit costs, and item (2), the disease profile, are for the most part numerical estimates which can be collected by financial analysts and epidemiologists, and therefore are accessible, at a price, for essentially any site. Item (3), on the other hand, is a set of predictive relationships which requires knowledge of expected changes in health status resulting from specific programmatic activities.

The Michigan cost-effectiveness models were first developed in a generalized form (see pp.44-53) and then specific models were constructed using data and assumptions derived from West Java in Indonesia (see Tables A-5 through A-10). Finally cost-effectiveness comparisons of the three interventions were made using the West Java models.

The Michigan report suggests that in West Java, diet modification is the most cost-effective intervention at low expenditure levels (less than $0.24 per person per 20 years), capsule distribution is the preferred intervention at intermediate expenditure levels ($0.24-1.25), and fortification is the best at high expenditure levels (greater than $1.25).

Michigan concluded that the models, in their present form, can help policy makers determine the costs of alternative programs and can guide them in allocating resources for a particular type of intervention. However the report notes that a major uncertainty of the model is "in the marginal contribution of budgetary line items to the performance of a program", i.e. the ability of the models to predict effectiveness. It suggests that follow-up work should be carried out to improve the models based on more information on the relationship between program costs and health effects. It also suggests the present models might be applied in countries like Indonesia, Bangladesh, and Nepal as a means of assessing their utility and as aids to policy makers. As further follow-up, the Michigan report suggests additional models should be developed to treat cost-effectiveness of competing health interventions, such as diarrhea control, so that decision makers can compare vitamin A interventions with other programs in the health field.

Comments

The reviewers were generally complementary about Michigan's efforts to develop cost-effectiveness models for alternative vitamin A interventions. However they have noted a number of concerns which are summarized below:

1. Epidemiological data and, to some extent, cost data on which to base models for use in specific locations are very limited and therefore an inordinate amount of effort might be required to obtain the data needed to construct the models. The reviewers noted that the information from Indonesia used by Michigan to construct its specific models is probably the most complete information available in the world at this time and yet even this information might not be adequate to draw accurate, meaningful conclusions. Furthermore, it was noted that the information from Indonesia required many years and a large expenditure to obtain and therefore would not be expected to be available or easily obtainable in other countries in which interventions are under consideration.

2. The present state-of-the-art regarding vitamin A interventions may not be sufficiently well developed to be able to attribute specific health effects to specific programmatic inputs. The Michigan report does not provide evidence that valid quantitative predictive relationships are available or can be developed at this time, and in fact notes that the capability of the models to predict program performance is the major uncertainty.

3. Use of the models could lead to seriously misleading conclusions due to potential errors in the analysis arising from uncertainties in the cost factors, disease profiles, and predictive relationships. One reviewer noted that cost-effectiveness considerations have rarely determined program choices by local governments. This points to the need to provide government officials with decision-making tools, in this case cost-effectiveness models, which they can use with confidence in exercising their responsibilities to use public resources more effectively.

4. The Michigan models are not designed to deal with combinations of interventions and therefore they exclude the consideration of the likely possibility of using two or more interventions concurrently.

Suggestions for Follow-up

Use of the Models to Select Among Alternative Interventions

It is reasonably clear that the Michigan cost-effectiveness models in their present form are not suitable for use in selecting among alternative vitamin A interventions. The Michigan models, as presented, permit users to calculate cost-effectiveness indicators for West Java but the results have not been tested and may or may not be valid. Models for other areas are not presented and no methodology is given for developing specific models for other areas. Therefore the model can't be meaningfully applied in West Java because of uncertainty concerning the accuracy of the estimates, and can't be applied elsewhere because of lack of specific models.

Because the models do not permit meaningful comparisons to be made between alternative vitamin A intervention programs, I recommend that the models not be used for that purpose. Meaningless or misleading use of the models could not only be damaging to the user but in the long run could create lack of confidence in the field of cost-effectiveness analysis and even in vitamin A interventions in general.

Additional Informational Needs

While the Michigan models require information of several types (see above), the information needed to predict the change in health status caused by the various programs seems to be the most uncertain.

Information on the costs required to implement a program in a particular area can probably be estimated with reasonable certainty by competent financial analysts. Likewise, information concerning the vitamin A status of the target population (the disease profile), can be obtained by epidemiologists although the costs and time for doing so might be considered prohibitive if a high degree of certainty is required. (It should be noted however that any country that gives consideration to implementing a vitamin A intervention program should have an assessment of the problem and therefore have some data concerning the disease profile.) However we have little information about how to predict the health outcome of vitamin A programs since only a few programs have been evaluated to measure the outcome and little effort has been made to analyze the information

as to cause and effect. Therefore predictive relationships between costs of program inputs and the expected health outputs are lacking. This bridge between cause and effect (inputs and expected outputs) is vital to the Michigan cost-effectiveness models. And aside from the judgmental relationships developed by Michigan for West Java (Tables A-7 through A-10), it is missing.

I suggest as follow-up that an effort be made to develop relationships with which to predict the health effects of alternative vitamin A interventions based on intervention inputs. Relationships of this type clearly have utility beyond cost-effectiveness analysis. Since any expenditure for a vitamin A field program should be made with the expectation of reducing the adverse health effects of vitamin A deficiency, donors and recipients alike should have this information whether they are carrying out a cost-effectiveness analysis or not.

While a number of different approaches might be used to obtain predictive information, it might be appropriate to carry out the work in stages, starting first with the intervention that is known best, capsule distribution. If the effort to develop effectiveness predictors for capsules is unproductive, then work on fortification or diet modification is probably unwarrented. However, if the effort on capsule effectiveness is successful, then the effort can be extended to the other two interventions. If these efforts are successful, then the effectiveness predictor models can be integrated into cost-effectiveness models.

Additional Use for the Michigan Models

Although the Michigan models do not appear to have immediate applicability for selecting programs based on cost-effectiveness analyses, they represent a useful format in which program costs and effectiveness indicators might be cast. If all workers in the field of vitamin A interventions used the same format for reporting costs and measuring effectiveness, it would make communications easier, program evaluations more meaningful, and serve as a guide for the design and implementation of new programs.

I suggest that the Michigan models and PC program be reviewed and modified as appropriate, possibly as an IVACG activity, as the basis for collecting and disseminating information on costs and effectiveness of vitamin A intervention programs.

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