home rather than taking care of ill children.

The day will surely come, sooner than most of us ever dreamed, for a large number of infections to be conquered, such as *Escherichia coli* infections or other causes of gastrointestinal tract diseases, because biotechnology is providing new approaches to identify important immunogens and antigens. Those immunogens and antigens can be produced and administered more safely to pregnant women.

New and unique routes of administration can be developed. A whole new field of health protection awaits discovery.

Women's Health: Pregnancy and Childbirth

Progress on Key Issues in Maternal Nutrition

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Synopsis

Great progress on key issues in maternal nutrition has been made in the past few years, mainly because of the legislative requirements of the U.S. Department of Agriculture's Special Supplemental Food Program for Women, Infants, and Children (WIC Program). These advances are most timely because of the general recognition that, in this period of finite resources, we will need to make optimal use of resources such as the food package, nutrition education, and health services that together make up the WIC Program benefits.

Major progress has been made in the following critical areas: (a) agreement on nutritional risk criteria; (b) identification of dietary risk factors; (c) increased availability of a variety of computer-assisted techniques for collecting, managing, and analyzing dietary intakes on large numbers of patients; and (d) recognition of the need for and availability of a variety of alternative dietary standards in the provision of overall services to pregnant women.

Of even greater importance is the recognition that we can no longer treat nutrition as a single variable, independent of the many other forces that together influence the course and outcome of a pregnancy. Rather, we recognize that there is a seamless web of influences, all of which need to be taken into account in attempts to provide for the needs of pregnant women at risk of poor pregnancy outcomes.

The timely application of all of these advances will greatly facilitate a more efficient and effective use of resources such as are provided by the WIC Program. They will also provide both the patients and their health care providers with more realistic expectations of what might be accomplished towards improving the outcomes of pregnancies at nutritional risk.

THE CHALLENGE WE FACE now is the same one we had 25 years ago, that is infant mortality and how to explain the fact that in the United States infant mortality is higher than in France, Japan, and Scandinavia. One of our objectives for the nation is to reduce infant mortality by 1990 to a level that Japan had achieved 10 years ago.

The specific reduction that we hope to achieve is an infant mortality rate of fewer than 9 deaths per 1,000 live births. Two-thirds of the infant deaths come from the 7 percent of low-birth-weight babies. The issue ultimately becomes then, can we improve birth weights?

When this issue was first raised in the 1960s, there were serious questions such as "Does prenatal care matter?" Then within that question were others about "What is prenatal care?" and, more to our point here, "What is the role of nutrition?" What brought all of this into focus was the coming of the WIC Program (Supplemental Food Program for Women, Infants, and Children) in 1972.

The WIC Program for the first time presented a resource that the health provider could use to meet a dietary deficit when one was identified. But two unusual provisions written into the original WIC legislation set the stage for much of the progress that has followed on nutritional services as part of prenatal care.

The first provision called for the Secretary of Agriculture to report to the Congress on the medical benefits of the supplemental food. Until the WIC Program, it was just considered a good idea to feed pregnant women, and it was not necessary to prove that it was beneficial. This was the first time that we in maternity services were required to show that what we did mattered.

The second provision called for the Comptroller General also to report to the Congress. So, here was the remarkable situation of both the Secretary of Agriculture and the Comptroller General reporting to the Congress on benefits of the supplemental foods provided by the U.S. Department of Agriculture's (USDA) WIC program. It has been said that the only occasion for a "benefit analysis" of a program is when a means is needed to end it. Well, that was the beginning of the WIC Program.

The first of the General Accounting Office (GAO) evaluations was completed in 1974. It made a point then that Dr. Sanford Miller of the Food and Drug Administration (FDA) has recently made, which is that nutrition is a subject in transition.

The GAO evaluation pointed out that there were disagreements on standards to be applied, eligibility requirements varied from place to place, our technical indicators for measuring health and nutrition status were too insensitive and nonspecific, and an interpretable evaluation of the WIC Program was not technically feasible *(1)*.

Congress's response was, in essence, very well, we will authorize the continuation of the WIC Program, but the USDA shall tell us how a supplemental food program could be evaluated. As a result, in 1977, the USDA published a report of its Advisory Committee on Nutrition Evaluation *(2)* that addressed in detail the evaluation of the nutrition and health benefits of the WIC Program. That landmark report remains the best of its kind.

So, we have a program. We have a mandate. In the meantime, the WIC Program grew from 200,000 people and a $20 million fund in 1974 to 3 million people and $1.5 billion in 1984. Against that background, the GAO reported to the Congress in 1984 that WIC evaluations have provided some favorable but not conclusive evidence on the effects expected of the program. More to the point of this presentation, it noted that there were few or no data that would allow judgments to be made about the effectiveness of the three benefits of the WIC Program (food supplements, nutrition education, and access to health care) *(3)*. The National WIC Evaluation, in its reports to the USDA, came to roughly the same kinds of conclusions *(4)*.

The most recent GAO report pointed out that we live in an era of tight money and that we must make better use of our resources *(5)*. So, here we are, with a program that has grown enormously in both numbers of participants and in the size of its budget, and the question is: Can we really make better use of the program resources? And the answer is a very strong yes because there has been a great deal of progress in recent years.

First of all, it was not until 1978 that there was a beginning agreement on what the nutritional risk criteria might be in pregnancy. More definitive agreement was reached in 1981 *(6)*. These were rough criteria, but already, within these guidelines, have come some extremely useful refinements *(7)*. For example, with regard to weight gain during pregnancy, in the past the desirable pattern was presented as a single smooth curve; now we realize that a range of weights conforms more to the reality of healthy pregnancies. Further, older criteria defined pregnant women as "underweight" or "overweight." With the availability of standards such as have been presented by Rosso, the question becomes not whether the person is "underweight," but rather "how much" underweight? More refined criteria can also be expected for obesity in pregnancy *(8)*. So, we are making real progress in refining our criteria for defining nutritional risks of pregnant women who participate in the WIC Program, which will lead to more realistic expectations both on the part of the women themselves and the WIC service providers.

Thus, one set of problems has been resolved. But a major problem remains, and that is how to relate dietary intakes to pregnancy outcomes. Data on intermediary metabolism have been plentiful, but it has been impossible to make interpretable measurements of dietary intakes on very large numbers of people, for example, the 1 million pregnant women per year eligible for the WIC Program. This difficulty has been reflected in the makup of the nutritional risk criteria in that there were no risk criteria based directly on food intake.

The problem of dietary risk criteria has been addressed by King *(9)*, who proposed as criteria: *(a)* insufficient food intake, *(b)* poor food selection, and *(c)* poor food distribution. This is only a partial solution, for the problem remains of how to collect the data to make these judgments. The answer surely lies in the vastly increased availability of computer-assisted techniques and the sharp drop in the costs of the equipment. As an example, when we first explored the use of machine-readable dietary intake forms in the mid-1970s, a scanner cost about $1 million. Today, an ordinary supermarket has four or more scanning devices at the check-out counters. We have recently completed a feasibility study in North Carolina on an interactive video device (nicknamed "the smark Kiosk"), prepared by Reflectone Media Systems of Tampa, FL, with most encouraging results *(10)*. The test was conducted in church soup kitchens and public schools, and it was accept-

able in a public health clinic of the kind that serves women in the WIC Program.

This brings us to another concern, that nutrition is a field in transition. Indeed, Wayne Calloway, in his conference presentation, added the term "confusion." This has certainly been the case with differing opinions about what dietary standards would be most appropriate to use in the assessment and management of high-risk pregnant women. For this and other reasons (*11*), there has come the realization that no single dietary standard can meet the needs of all users and, therefore, we need to explore the use and availability of alternative dietary standards. This has been done and we have learned that a number of different dietary standards are already available for such purposes as food procurement, menu planning, nutrition education, survey evaluations, and nutrition counseling *(11)*.

One of the sources of information about diet and health that we have not used enough is the National Health and Nutrition Examination Survey (NHANES). We will see much more information from that source in the future. Further, there is a remarkable study, the "NHANES Epidemiologic Followup Survey", of a very large group of people at two points in time: 1971 and 1980-81. The findings will be presented in the near future. The availability of these kinds of data means that we will have information on food intakes and health outcomes of a defined population followed over time. We will be able to assess issues such as safety of long-term comsumption, and more importantly, we will be able to relate food intake to functional outcomes. The availability of data of this quality will allow us in the nutrition community to join the rest of the scientific community in learning how to handle multivariate data. This type of analysis is already being done in the field of nutrition as exemplified by the work of the Japanese. Prof. Hiroyuki Toyokawa *(12)* of the University of Tokyo, a pioneer in this field, has set out to assess the consequences in economic terms and health outcomes in Japan, of the changing of the Japanese diet to a more Westernized diet. We are seeing, therefore, in nutrition the use of cluster analyses, of pattern analyses, as fresh ways to look at the quality of a diet and not merely at the quantity. What Toyokawa has accomplished with the Japanese data will now soon be possible with the food intake and outcome data available from national surveys such as NHANES, and also, when suitably linked, from the USDA's National Food Consumption Survey.

Earlier, the point was made that we cannot look at health issues in isolation from the rest of life. The same broadened outlook has become evident in nutrition. We can no longer talk about nutrition by itself. Rather, we are obliged to look at nutrition in context. We need to be aware of the available food budget, income, and health services, in terms of quality, availability, accessibility, acceptability, motivation, education, and the family as a whole. The days of more simple-minded, single-variable studies in nutrition are over. And this issue of the inherent complexity contributes to the confusion already commented on, and it feeds the forces of nutrition in transition that Dr. Sanford Miller of the FDA mentioned previously.

Finally, one of the changes that affects this situation is the shifting of the center of gravity towards the States as part of the new federalism. This means that as more and more activities go on at the State levels, we will need new technological and organizational innovations to facilitate the needed activities.

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