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New Conceptual Thinking about Surveillance: Using Micronutrient Status to Assess the Impact of Economic Crisis on Health and Nutrition

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INTRODUCTION

Over the past three decades Indonesia had achieved a considerable standard of living – GNP had increased from US$70 in 1965 to US$1000 in 1996 and the prevalence of poverty had declined from 40% in 1976 to 11.3% in 1996 (World Bank/SMERU, 2000). As a result of this period of growth, the diets of Indonesians had improved, the rates of malnutrition in 1996 were low compared to other countries in SE Asia, and vitamin A deficiency was no longer considered a problem of public health significance (Sommer & West, 1996; UNICEF, 1998).

When the Asian economic crisis hit in mid-1997, Indonesia's progress in both social and economic development was threatened. The crisis led to a rapid devaluation of the local currency, an increase in food and other commodity prices and a reduction in employment. At a similar time, Indonesia was affected by El Niño, which destabilized agricultural production in parts of the country and by political instability. Combined, these events resulted in lowering real income and household purchasing power, particularly among the poor and households in poor urban areas (Bloem & Darnton-Hill, 2000).

In response to the threat of the crisis eroding past progress and the risk of slowing future social and economic development, the Nutrition and Health Surveillance System (NSS), originally established in 1995 in Central Java to monitor a social marketing program to promote the consumption of vitamin A-rich foods, was re-activated and expanded in 1998 to collect comprehensive information to assess the impact of the economic crisis on the nutrition and health status of Indonesians (Helen Keller International, 2000; De Pee *et al*., 1998).

Two conceptual models were developed for the NSS that predicted how the economic crisis would impact on health and nutrition. The first model (Figure 1) hypothesized that the events of the crisis (decreased household purchasing power and increased grain price) would have a larger impact on access to more expensive food items (e.g., animal foods), thus reducing micronutrient intake, which would lead to micronutrient deficiencies and ultimately to a 'lost generation' and to increased mortality. The term 'lost generation' reflects the recent evidence that micronutrient deficiencies during childhood, particularly iron deficiency, can have long-lasting and irreversible consequences on child cognitive development and physical growth. In turn, when these

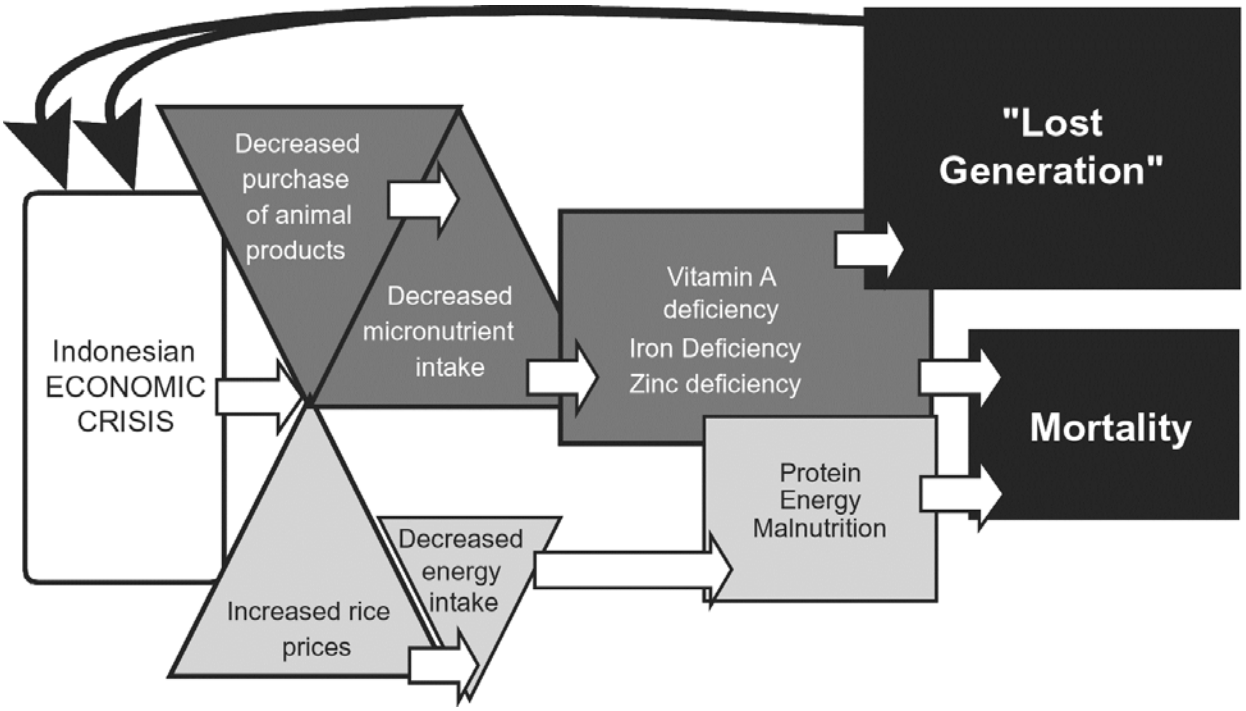

Figure 1. Conceptual model of the impact of the economic crisis in Indonesia.

consequences occur within a large percentage of the population, a country's economic and social development can be negatively affected. The model also predicts that the crisis might decrease energy intake, mostly likely due to lower intake of caloric dense foods such as oil, leading to energy malnutrition and increased mortality, but to a lesser extent than the impact on micronutrient intake. The nutrition and health situation in Indonesia prior to the crisis, the nature and events of the economic crisis, and the coping strategies of households were considered along with technical knowledge to create this model. The second model (Figure 2) shows how the indicators were identified to monitor the two pathways described above. Decreases in micronutrient intake are referred to as 'dietary quality' whereas decreases in energy intake are referred to as 'dietary quantity'. The best indicators were believed to be those that reflected food accessibility. This model is described in more detail in the results/discussion section of this paper.

Applying these models, indicators of micronutrient status, particularly maternal and child anemia and vitamin A deficiency disorders (VADD), were included in the NSS from the onset, along with measurements of food consumption, household expenditure and illness. To our knowledge, it is the first time that indicators of micronutrient status have been used to assess the impact of a crisis or disaster at the population level in developing countries. Furthermore, it is, again to our knowledge, the first time that indicators of micronutrient status, other than clinical signs and symptoms, have been incorporated into routine nutrition, food or health surveillance systems in developing countries.

This paper describes how conceptual thinking was applied to the particular environment in Indonesia to select the best indicators to monitor the impact of the economic crisis on health and

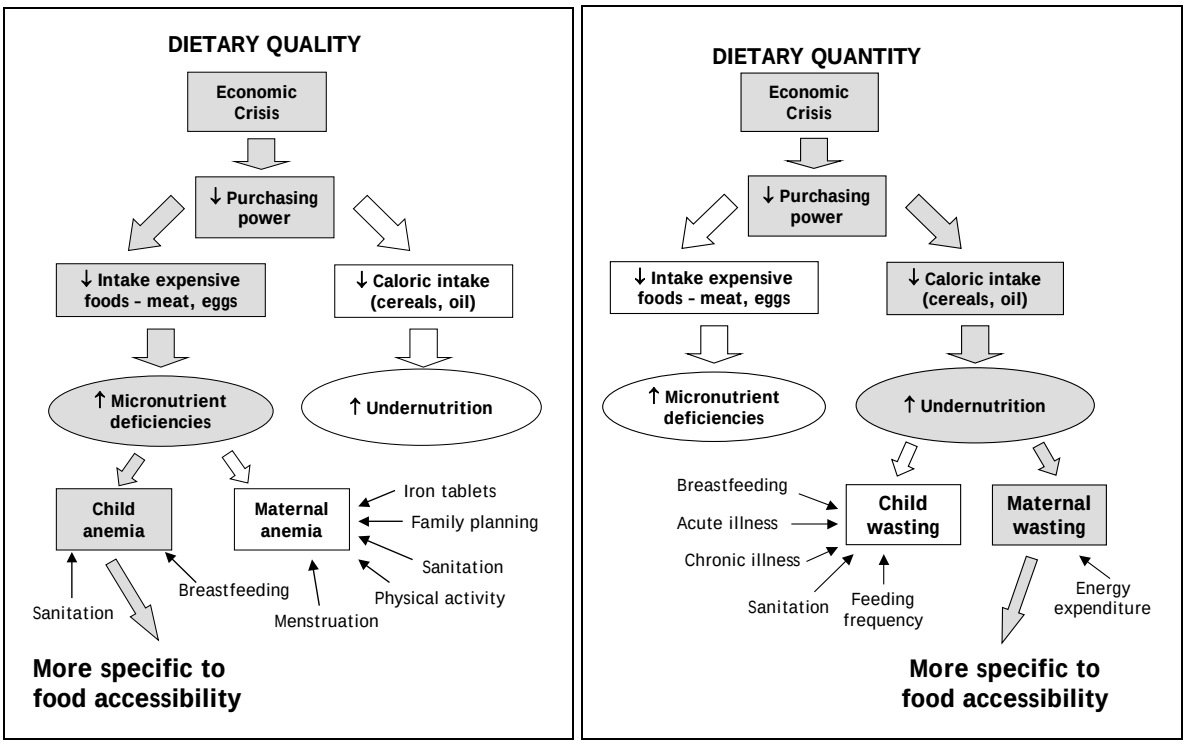

Figure 2 (a,b). Conceptual model of indicators of food access and dietary quality and quantity.

nutrition. Data from the NSS provide evidence that the conceptual models described above and the use of indicators of micronutrient status were the best way to measure impact and monitor changes overtime. The model is tested using information on the crisis impact as well as the recovery period when prices and employment began to stabilize. This experience provides insight into monitoring trends of micronutrient status and is a good example of how ongoing surveillance systems can be used to assess and monitor particular crises or events, but also broader objectives and longer-term efforts to reduce poverty.

SUBJECTS AND METHODS

The methods employed in the NSS are presented elsewhere (Helen Keller International, 2000; De Pee *et al*., 2001). In summary, data from two different surveillance sites and three different time periods are used for the analysis presented in this paper. To show the impact of the crisis on maternal and child anemia and vitamin A deficiency, data is presented from the rural Central Java site of the NSS prior to and immediately after the crisis. Data was only available prior to the crisis in this province in Indonesia. The recovery or transition period, January 1999 through December 2000, is presented using data from the sample of the NSS from urban poor Jakarta, where the consequences of the economic crisis were more severe. Questionnaire content, data collection and management methods and statistical analyses are similar in these two surveillance sites.

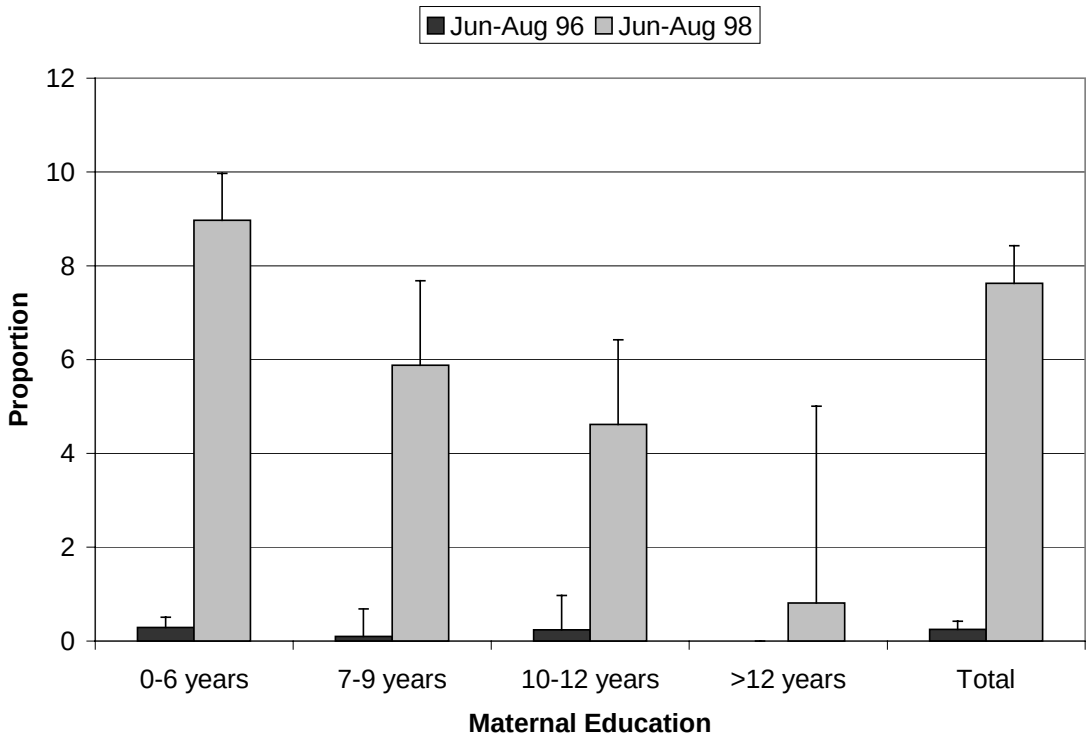

Figure 3. Proportion of mothers who did not consume eggs in the past week in June1996 and June 1998 by mother's educational level.

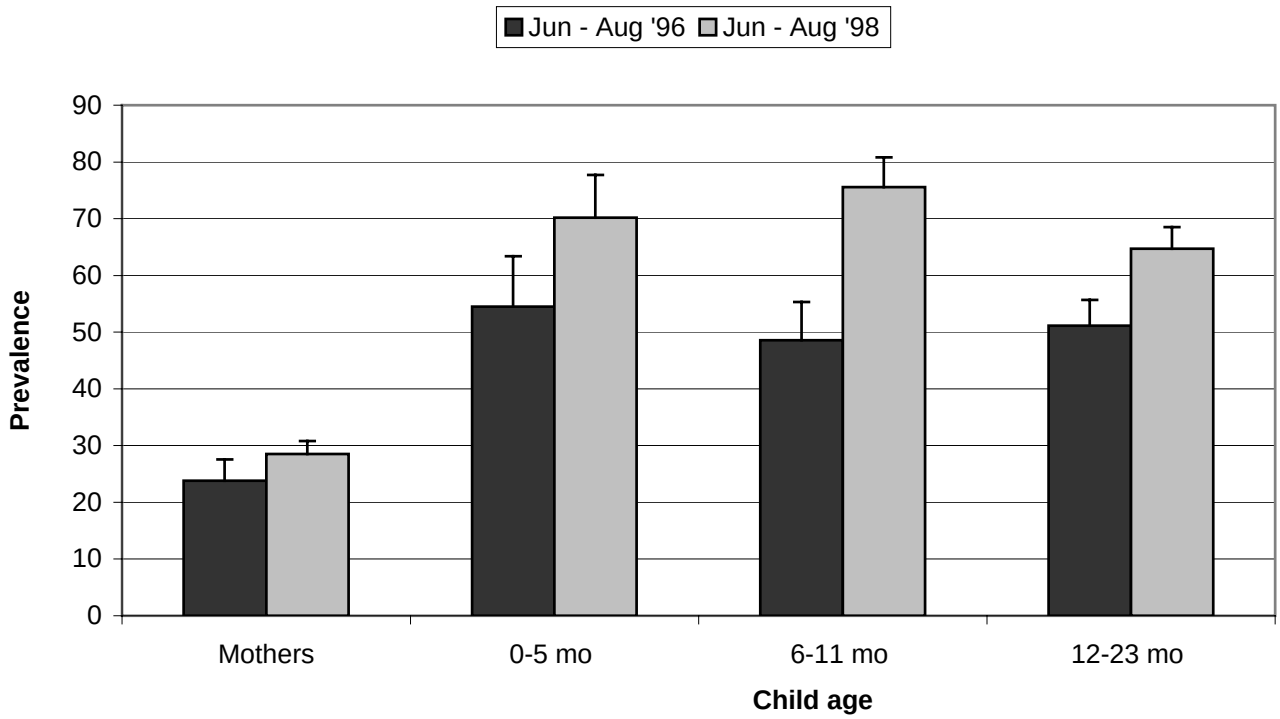

Figure 4. Prevalence of anemia among non-pregnant mothers (hemoglobin <120 g/L), infants and children (hemoglobin < 110 g/L) in 1996 and 1998. Error bars indicate 95% CI.

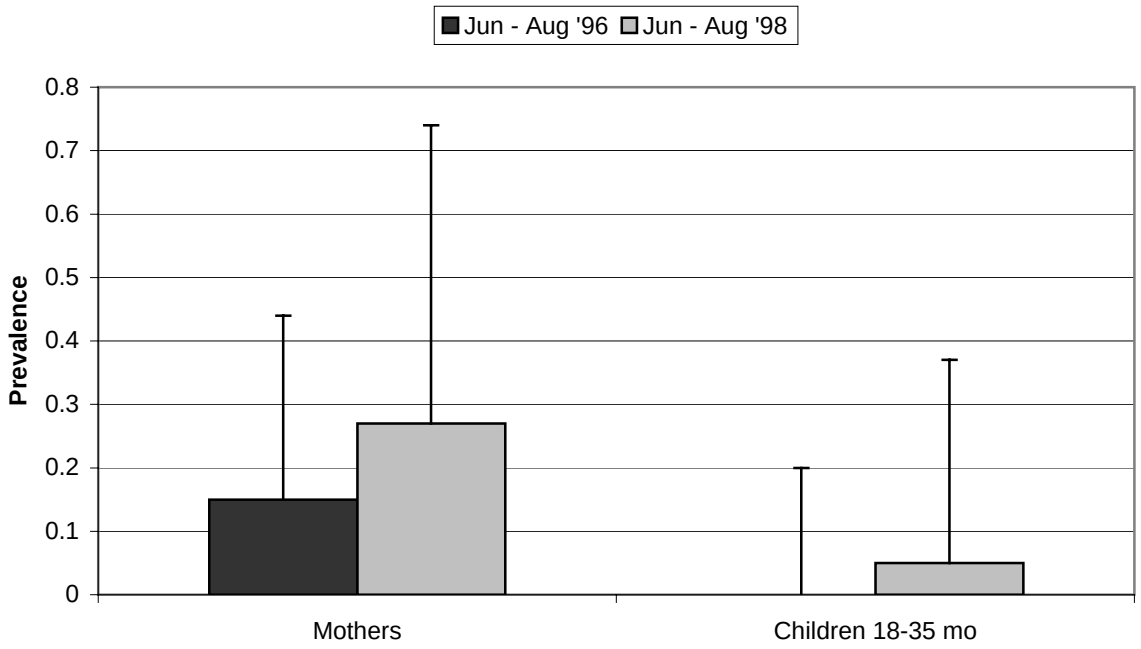

Figure 5. Prevalence of nightblindness among mothers and children in June 1996 and June 1998. Error bars indicate 95% CI.

Statistics

All analyses were conducted using SPSS for Windows version 7.5 (SPSS Inc, Chicago, Illinois).

RESULTS AND DISCUSSION

Impact of crisis and initial recovery period on micronutrient status of women and children

The economic crisis in Indonesia reduced the real income and purchasing power of households. The predicted model, that these events would affect food access, particularly access to expensive animal foods, is confirmed by findings from the NSS which showed a decrease in expenditure on and consumption of animal foods across all socioeconomic strata. Egg consumption was particularly responsive to the onset of the economic crisis as NSS data showed that the percentage of mothers who did not consume eggs at least once in the past week increased from less than 1% in June 1996 to 7.6% in June 1998 (Figure 3). The proportion of mothers and children that had not consumed any vitamin A from retinol sources in the past 24 hours had increased between ‘96 and ’98, from 34% to 52% among mothers and from 36% to 47% among children.

Following the conceptual model for malnutrition, this reduced intake of micronutrient-rich foods is likely to result in the worsening of micronutrient status. Again, the data from the NSS show that the prevalence of anemia increased, particularly among children (Fig 4). Night blindness, the first clinical sign of vitamin A deficiency, increased among women, the target group that is not covered by a vitamin A capsule supplementation program (Fig 5). (The current levels of night

blindness, which only reflects the tip of the iceberg in terms of vitamin A deficiency, are quite low in Indonesia making it difficult to detect changes in prevalence without a large sample size.)

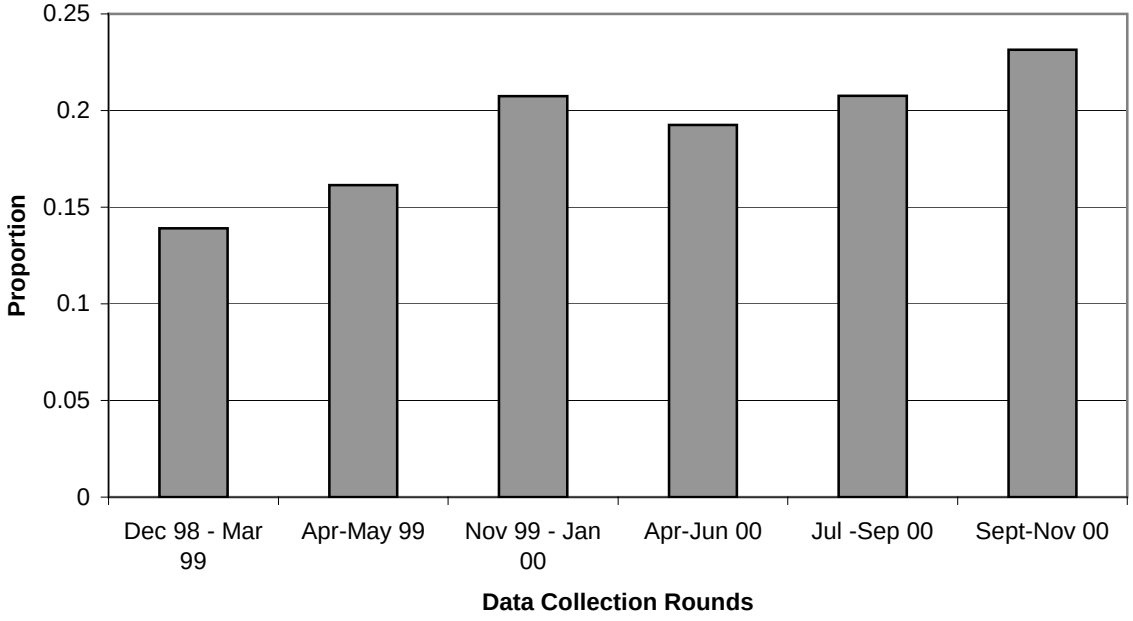

Figure 6. Trends in proportion of household food expenditure on animal foods in Jakarta, Oct 1998-Nov 2000.

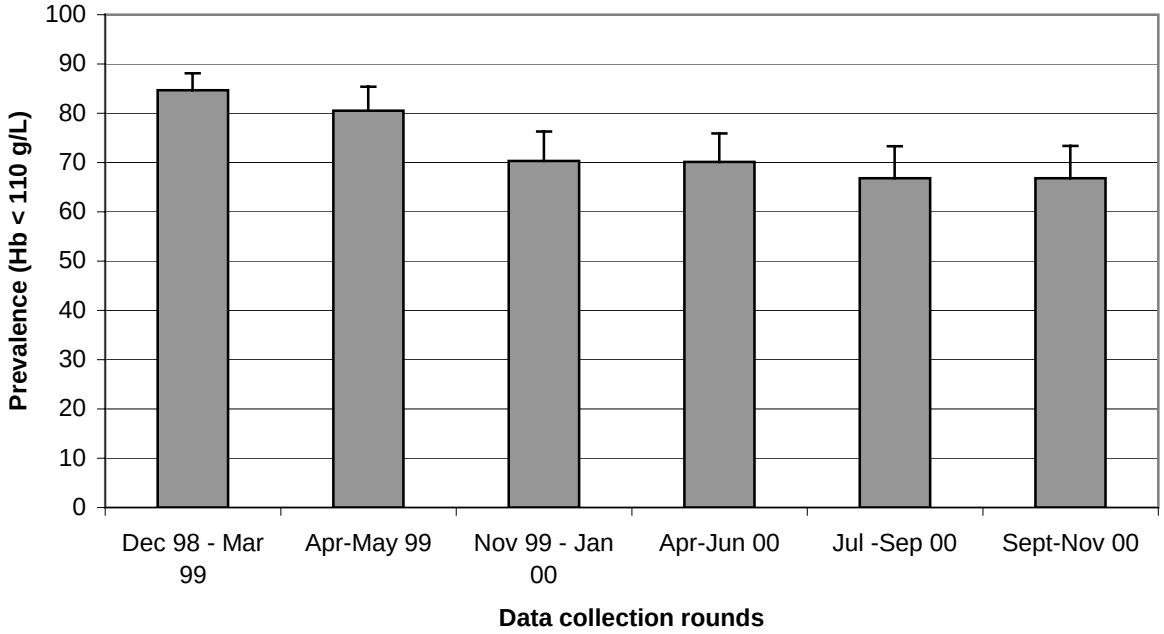

Figure 7. Prevalence of anemia (hemoglobin < 110 g/L) among children 12-23 months of age in urban poor Jakarta, Oct 1998-Nov 2000. Error bars indicate 95% CI.

Since 1999, the economic situation in Indonesia has improved slightly. Again the NSS shows an increase in the share of household food expenditure on animal foods from 14% in October 1998 to 23% in November 2000 and anemia among children 12-23 months of age in urban poor areas in Jakarta declined during this same 'transition period' from 84.5% in October 1998 to 67.4% in late 2000 (Figure 6-7) (χ^2 test for trend; $p<0.001$). Again, household egg consumption appeared to be particularly sensitive to these changes. We conclude that the economic crisis in Indonesia followed the predicted model - affecting first the consumption of high-quality foods rich in micronutrients, then affecting micronutrient status. The high rates of anemia and vitamin A deficiency that resulted from the economic crisis have consequences such as reduced resistance to infection, slower physical growth, reduced cognitive development and lower work productivity. Thus, not only did the economic crisis erode some of the significant progress in the social and economic development achieved over the past 30 years, but without adequate response, the high levels of anemia and vitamin A deficiency that have resulted could slow future economic and social development in Indonesia.

Indicators of the impact of the economic crisis on nutrition

Traditionally, surveillance systems have relied on anthropometric indices of children to monitor health and nutrition. The use and interpretation of these indices and indicators have been reviewed extensively by the scientific community (WHO, 1995). Yet, although there has been considerable research on the operational aspects of nutrition indicators in emergency situations (Moench, 1989; Young & Jasper, 1995), on the epidemiological characteristics of nutrition indicators in surveillance (Habicht & Pelletier, 1990; Brownie *et al*., 1986; Habicht, 1980), and on 'alternative, indicators' for famine early warning and food insecurity, (Maxwell, 1999; Haddad & Kennedy, 1994) there is little experience in incorporating indicators of micronutrient status, such as ,anemia and vitamin A deficiency, into surveillance systems and interpreting the trends and patterns of such indicators.

The overall goal of surveillance is to find the problem if it exists, monitor changes, and communicate these findings effectively to diverse audiences, including policy makers, donors, program managers, and communities. As such, an understanding of the technical aspects of indicators as well as an understanding of the situation being monitored is essential in selecting the appropriate indictors. This reference to 'the situation' is multi-dimensional. It includes understanding the nature of the crisis and how it might have an impact on food access – decreasing or increasing access. In the context of Indonesia, the most important immediate cause of anemia is inadequate intake of iron. Disease is much less important because the two diseases associated with anemia, malaria and hookworm, have low prevalence in Indonesia and their onset would not be linked to a crisis of this nature. Assessment of 'the situation' also includes a careful examination of other factors that influence the interpretation of the indicator. For instance, for children the main source of iron is the diet (no supplementation or fortification programs were ongoing at the time of the crisis), and the best sources of iron in the diet are animal foods and fortified foods, because of the high content of iron and the bioavailability of the iron.[16] The economic crisis impacted on real income and purchasing power, therefore reducing access to these important sources of iron. Thus one of the first nutritional consequences of the crisis would be an increase in the prevalence of anemia. Maternal anemia is influenced by many factors other than food access, including ongoing iron supplementation programs, thus

maternal iron status might not be as strongly or quickly affected by a change in diet quality. In addition, maternal anemia is affected by a number of other factors, including family planning use, menstruation and energy expenditure. Because child anemia is more exclusively dependent on and reflective of diet quality and intake of iron from food sources, it is a better indicator to monitor the impact of the crisis (Figure 2a).

We combined the recent evidence on the importance of micronutrient malnutrition in economic and social development and the conceptual thinking described above to incorporate indicators of micronutrient status into the NSS to monitor the economic crisis in Indonesia. Anemia and vitamin A deficiency disorders appear to be more sensitive to rapid changes in dietary quality than child anthropometric indicators. Other findings from the NSS show that maternal wasting was also sensitive to the crisis and the recovery period (de Pee *et al*., 2001). Again, we believe that maternal wasting is a better indicator of food access than child wasting because the most important immediate cause of loss of body weight in women is reduced food intake. Disease is a less important immediate cause of weight loss in adults because of the low prevalence and because it does not cause a substantial loss of weight. In addition, in a crisis situation, there is some evidence that a mother is more likely to reduce her food intake first, protecting the quantity and quality of food intake of her children and husband.

This experience with monitoring the affect of the Asian economic crisis in Indonesia also shows the important linkages between food policy and nutrition. Monitoring commodity prices, household expenditure, consumption of grain and animal foods, and multiple indicators of nutritional status simultaneously provides a comprehensive picture of household circumstances and behavior. Food policy responses to these types of crises can influence access to micronutrient-rich foods and therefore can positively or negatively affect nutritional status. Recent analysis from the Nutrition Surveillance Project in Bangladesh showed similar results. Analysis of approximately 10 years of data showed that the decline in rice price was associated with an increase in household expenditure on non grain foods and also strongly correlated with the decline in child malnutrition (Torlesse *et al*., in press).

Advances in technology have made the collection and assessment of nutritional status more available and affordable. In addition, advances in nutrition knowledge mean that we have a greater understanding of how to use indicators for different situations. This experience in monitoring the economic crisis in Indonesia can and should be incorporated into surveillance and assessments in other situations (Figure 2b).

Finally, describing and applying conceptual thinking alone is inadequate since the fundamental goal of surveillance is to stimulate action to improve a situation. The findings presented here show that the prevalence of micronutrient deficiencies is high among poor households in Indonesia following the Asian economic crisis. Programs that lead to improvements in micronutrient status are needed, such as social safety net programs, food policy, health and education. These efforts will also help countries reach the International Development Goals to reduce maternal and child mortality and alleviate poverty (Bloem *et al*., 2001). As these programs become effective, flexible surveillance systems will be needed and new conceptual thinking may be required to monitor the new environment.

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