Alternative Approaches to Locating the Food and Nutrition Insecure

Work in Progress in South India

Lawrence Haddad
Kimberly Chung
P Yasoda Devi

This paper reports on the design of a multidisciplinary, collaborative project intended to make food and nutrition security systems more viable. The objective of the project is to identify 'alternative' indicators that can be used in food and nutrition monitoring and evaluation systems.

ALTHOUGH India contains at least 215 million hungry people [Gopalan 1992], Indian famines are a 'nightmare of the past'.[1] Famine mitigation has been due to the combination of a number of factors: food production which has kept up with population increases, government buffer stocks of grain which have stabilised foodgrain prices, democracy and a free press to give the rural poor a voice, the existence of relatively efficient inter-regional grain markets, the availability of informal consumption credit, and a set of explicit famine-relief policies such as rural public works programmes [Dreze 1989; Bidinger et al 1990]. While this array of food policy instruments has proved effective in helping to averting acute undernutrition, many economists - inside and outside the government of India - feel that the current level of food security could be achieved with less strain on public expenditure if policies were more targeted to the undernourished [Government of India 1990; Ravallion and Subbarao 1992; Jha 1992; Dev, Suryanarayana and Parikh 1992; Bapna 1991; Harriss 19911.

The economic policy reforms currently underway in India are likely to provide the government with greater incentives to raise the cost-effectiveness of social sector spending. Public sector expenditure on poorly targeted programmes will become less easy to justify on economic grounds in the face of fiscal austerity measures that typically accompany economic reform packages [Parikh 1992].

One means of potentially raising the cost effectiveness of food security programmes is to target programme resources to households and villages according to the policy objective being pursued. For example, a familiar strategy is to minimise the severity or depth of undernutrition by targeting the most severely undernourished. If the objective is to minimise the incidence of undernutrition, then the optimal strategy is to target all individuals just below the food poverty line [Ravallion 1990], Another way of improving cost-effectiveness is to monitor food security during the course of programme operations. This enables programme design to be more responsive to the changing causes and patterns of undernutrition.

These calls for more targeted and flexible approaches to the promotion of food security are not easily addressed. There are several reasons for this. First, targeting is politically controversial. Fligibility criteria can create incentives among those who administer programmes to 'rent-seek' by taking advantage of unenforceable criteria. Eligibility criteria can also provide incentives for households to misrepresent their circumstances, such as reporting female-headship when this is not the case [Jain 1992]. The unpopularity of those who write eligibility criteria into law and are charged with administering them can have political consequences, particularly since the non-eligible are likely to be the more politically powerful. Finally, the very term 'targeting' has become politically charged, in large part due to the family planning drives of the 1970s in which targeting was interpreted in terms of the number of individuals touched by a programme rather than whether or not those individuals would have benefited most from the programme [Gupta et al 1992].

Second, even if an accurate and inexpensive indicator of undernutrition were found, targeting and monitoring can still be costly. Specifically, both require the regular collection of accurate and timely data on household food security, an activity that may cost more than the savings promised by targeting. Moreover, for an indicator to be integral to undernutrition reduction schemes, the information generated must be acted upon. If the associated interventions prove to be expensive to execute, then the tradeoff between the costs of indicator collection and the benefits of the indicator collection are even more uncertain [Haddad, Kennedy and Sullivan 1991],

Therefore, given political will, the cornerstone of a viable monitoring system is the identification and use of indicators that are valid and reliable and yet straightforward and inexpensive to collect and analyse. This is one of the lessons derived from the last 10 years of experience with food and nutrition monitoring and surveillance systems world-wide [Tucker et al 1989]. However, a recent global inventory of food security and nutrition monitoring systems indicates that policy-makers and implementors in developing countries have found many of the recommended 'traditional' indicators difficult to incorporate into ongoing information systems [Kennedy and Payongayong 1991]. Too often indicators are laborious and expensive to collect, difficult to analyse and interpret, and of limited use in early warning or targeting related policies.

I
Project Objectives and Overview

For this work we define food security as a state in which there is an availability of sufficient food at all times for all people to ensure an active and healthy life. Sufficient food refers to both the quantity and quality required for good health. The term 'food security' has been used at the national, regional, community, household, and individual levels [Maxwell 1990). The research reported here will aim to develop food security indicators at the household, individual, and village levels.

Nutrition security is defined as the appropriate quantity and combination of inputs such as food, nutrition, and .health services, and caretaker's time, to ensure an active and healthy life at all times for all people. Food security, therefore, is a necessary, but not sufficient, condition for nutrition security. Nutrition security indicators will be developed at the individual level.

Given these,definitions, the overall objective of this study is to field test and document the validity and reliability of alternative indicators of food and nutrition

FIGURE 1: OVERVIEW OF ALTERNATIVE INDICATORS PROJECT

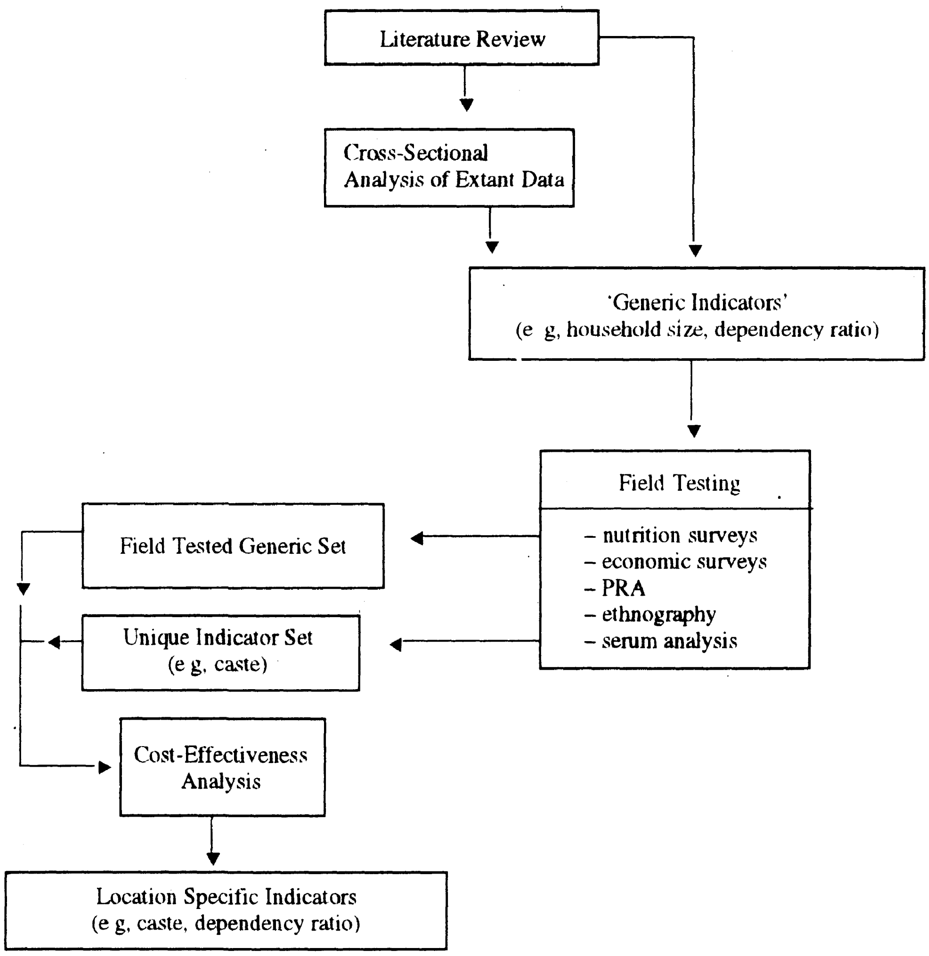
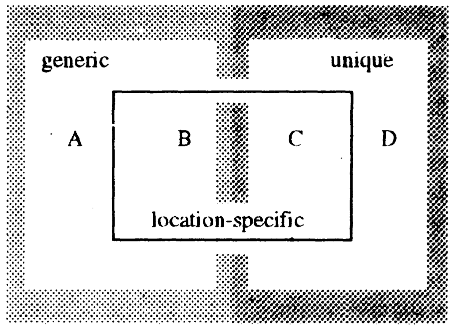


FIGURE 2: CONCEPTUAL DIAGRAM SHOWING THE RELATIONSHIP BETWEEN GENERIC, UNIQUE, AND LOCATION SPECIFIC INDICATORS OF FOOD AND NUTRITION SECURITY



Indicator set A: Generic indicators that do *not* work well in terms of ability to locate the food insecure at low cost in the four villages.
Indicator set B: Generic indicators that work well in terms of ability to locate the food insecure at low cost in the four villages.
Indicator set C: Indicators unique to the four villages which work well in terms of ability to locate the food insecure at low cost.
Indicator set D: Indicators unique to the four villages work well in terms of ability to locate the food insecure but NOT at low cost.

security in the Indian semi-arid tropics (IS AT). The proposed set of indicators will include biological and socio-economic variables that are typically collected by international or national research stations, as well as some easily collected alternative indicators.

Supporting objectives include

(1) To assess the ability of a set of 'generic' indicators (indicators which are not unique to a particular setting) to locate food and nutrition insecure households, women, and pre-schoolers in the ISAT.
(2) To develop a set of generalisable guidelines for identifying indicators which are 'unique' in locating food and nutrition insecure groups in the ISAT, and to identify that 'unique' set.
(3) To assess the ability of the 'unique' indicators to locate the food and nutrition insecure, particularly in relation to the 'generic' set.
(4) To assess the costs of collecting the 'generic' and 'unique' indicators and to determine a set of 'location specific' indicators which are both accurate and cost-efficient in locating the food and nutrition insecure in the ISAT.

The Alternative Indicators Project was initiated through an extensive literature survey on indicators of food security. In turn this review informed an empirical analysis of extant data from seven different settings from four countries (Brazil, Ghana, Mexico, and the Philippines).

The literature review and the empirical analysis generated a set of alternative indicators that were successful in locating the food insecure in a number of different settings. Because of their generalisability, this group of indicators is called the 'generic' set. Although many of these indicators may be able to locate the food and nutrition insecure in the ISAT, the usefulness of each generic indicator for this area may only be determined through field testing. Field testing may alsor,eveal a set of indicators which are 'unique' to the study area. Such indicators may perform well in certain regions, but have little meaning elsewhere. In India a possible example of a unique indicator might be 'caste' or 'number of male children'. Finally, the most appropriate set of indicators is determined by the cost .effectiveness of putting the indicator into use. Since cost of indicator collection will vary by location, the set of cost-effective indicators are called the 'location-specific' indicators. This set may contain indicators

TABLE 1: TIMING OF SURVEY ROUNDS IN STUDY VILLAGES

Village	1992					1993						
	A	S	O	N	D	J	F	M	A	M	J	J
Aurepalle												
Round			'Peak'					'Lean'			'Hi Mor'	
Harvest			surplus					low			low	
Labour demand			medium					low			high	
Dokur												
Round	'Lean'					'Peak'					'Hi Mor'	
Harvest	low					surplus					low	
Labour demand	low					high					high	
Shirapur												
Round		'Lean'					'Peak'				'Hi Mor'	
Harvest		low					surplus				medium	
Labour demand		low					high				med-low	
Kanzara												
Round		'Lean'				'Peak'					'Hi Mor'	
Harvest		low				peak					medium	
Labour demand		low				surplus					medium	

which are either generic or unique. Above all, however, these indicators are both accurate and cost efficient.

Figure 2 shows a conceptual representation of the three sets of indicators. The generic and unique sets are shown to be mutually exclusive but variables from either set may be cost-efficient. This set of accurate and cost-efficient indictors forms the 'location-specific set'. It is this set that forms the basis for cost-efficient targeting and monitoring.

In terms *of* generic indicators, the literature review suggested a number of relatively simple indicators which have proved effective in locating and tracking the food insecure. The central message of the empirical analysis reinforced this conclusion. Compared to more complex indicators, such as household income level, indicators such as number of unique foods consumed, region, dependency ratio, household size, rooms per capita, incidence of illness, vaccination status, age at weaning, drinking water and sanitation facilities - all coded with only two or three different values - were able, either singly or in combination, to identify households and pre-schoolers at risk. The indicators that located food insecure households in several data sets from developing countries

- Household size
- Dependency ratio
- High percentage of pre-schoolers
- Region
- Rooms per capita in home
- Quality of drinking water and sanitation facilities
- Land area cultivated and owned (in rural areas)
- Occupation/tenancy status
- Number of unique foods consumed or available
- Subjective perceptions of participant as to quality of diet
- Number of missed meals.

Indicators that located nutrition insecure households in several data sets from developing countries include:

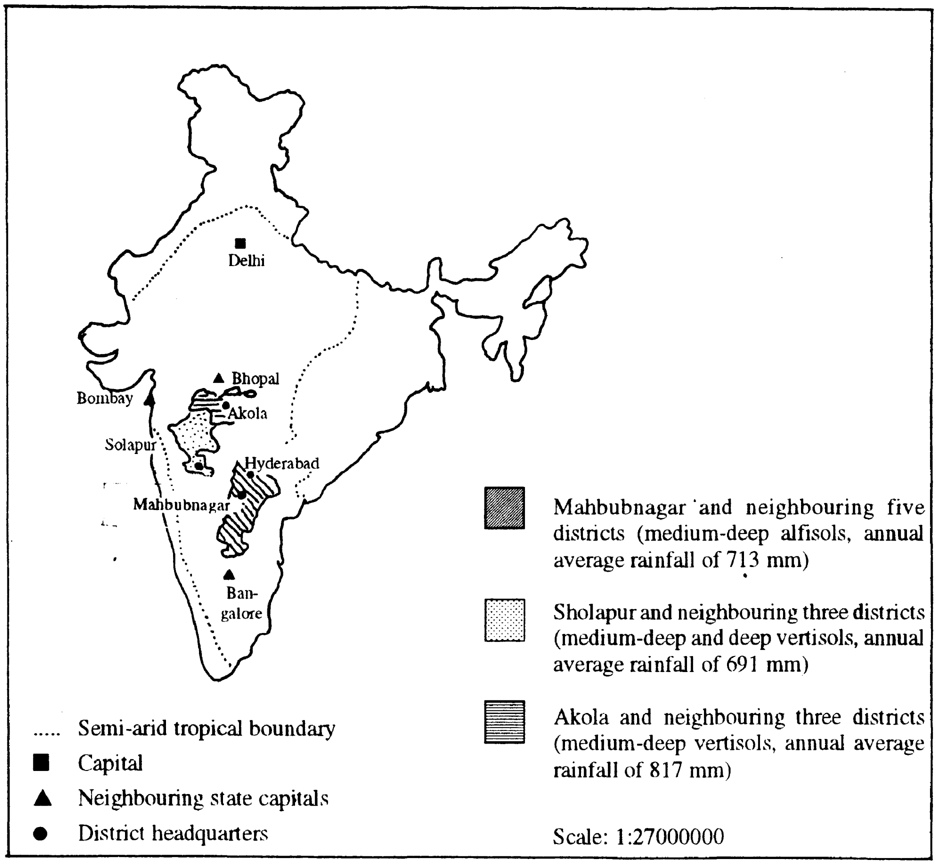
- Age of pre-schooler (low for low wt/ht z-score, high for low ht/age z-score)
- Incidence/duration of illness (self-reported)
- Vaccination records
- Improved water and sanitation facilities
- Use of improved fuel for cooking
- Characteristics demanded in food
- Households' opinion about quality of diet
- Number and type of unqiuefoods consumed
- Region
- High age of weaning
- Income from remittances
- Dependency ratio
- Crop-tenancy status of household
- Number of income sources.

TABLE 2: SUMMARY STATISTICS FOR STUDY VILLAGES

Characteristic	Aurepalle	Dokur	Shirapur	Kanzara
Location	Mahabubnagar, Andhra Pradesh	Mahabubnagar, Andhra Pradesh	Sholapur, Maharashtra	Akola, Maharashtra
Distance from Hyderabad	70 kms south	125 kms south	365 kms west	528 kms north-west
Rainfall (general)[a]	Unassured; 630 mm	Unassured; 630 mm	Unassured; 630 mm	Assured; 890 mm
Total rainfall in 1992 (monthly standard deviation)*	428 mm (38.72)	578 mm (57.11)	319.4 mm (36.17)	450.6 mm (94.78)
Soils[a]	Red Soil; Low water retention	Red Soil; Low water retention	Deep black clay soil; High water retention	Medium deep black clay soil; Medium water retention
Major crops[a]	Kharif sorghum, pearl millet, castor, paddy, pigeon pea, groundnut	Kharif sorghum, pearl millet, castor, paddy, pigeon pea, groundnut	Rabi sorghum, pigeon pea and minor pulses	Cotton, sorghum, mung bean, pigeon pea and wheat
Number of households in 1975[a]	476	313	297	169
Number of households in 1989-90*	664	464	451	292
Per cent labourers[a]	31	24	33	32
Dominant caste groups[a]	Reddis	Reddis	Marathas Dhangars	Mali Marathas
Per cent literate[b]	15	16	17	34
Average landholdings (ha)[b]	3.53	2.62	6.53	6.1
Per cent of male adults in landless/small farm households consuming < 50 per cent RDA for calories (lean season)[c]	7.3	0	1.4*	1.8*
Per cent of female adults in landless/small farm households consuming < 50 per cent RDA for calories (lean season)[c]	23.9	2.9	7.1*	2.0*
Per cent of children age 1-3 in landless/small farm households consuming <50 per cent RDA for calories (lean season)[c]	46.2	42.9	35.3	27.3
Median per capita net income (Rs) 75-78[d,e,f]	238	389	365	518
Sorghum price 1992 (Rs/kg) (monthly standard deviation)*	3.76 (0.35)	n/a	6.13 (0.53)	n/a
Pigeonpea price 1992 (Rs/kg) (monthly standard deviation)*	8.06 (1.47)	n/a	10.02 (1.01)	10.92 (0.49)
Daily wages* (men) agricultural labour force (Rs/7 hr), 1992	21.8	n/a	23.3	17.6
Daily wages* (women) agricultural labour force (Rs/7 hr), 1992	12.0	n/a	12.1	8.5

Notes: * Unpublished ICRISAT data.
a Walker and Ryan (1990: 4).
b Information for Aurepalle and Dokur from 1971, Kanzara and Shirapur from 1961. [Ryan et al 1984: 67].
c Information for 1977-78. [Ryan et al, 1984: 95].
d Data are averages from 1975-78. [Asokan, Bhasker Rao, and Mohan Rao 1991: 30].
e Data are averages from 1975-78. [Kshirsagar 1983: 35].
f Data are averages from 1975-78. [Bhende 1983: 33].

FIGURE 3: MAP OF THE STUDY SITE



Source: Walker and Ryan (1990).

II
Project Site

The ICRISAT villages are not located in the most undernourished states in India. However, the villages provide a unique opportunity for the study of rural food security. The Alternative Indicators Study is able to take advantage of (i) the high level of trust between the villagers and ICRISAT enumeration team; (ii) the accumulated human capital of the ICRISAT enumeration team; and (iii) the longitudinal series of data on consumption and income which constitute the Village Level Studies (VLS) data [Walker and Ryan 1990].

The longitudinal dimension is important for the indicators analysis because food and nutrition monitoring systems have two important functions:
(1) Identification of the food and nutrition insecure;
(2) Identification of those households or individuals that move in and out of this classification over time.

The two functions are, of course, interrelated, to the point that the definitions of food and nutrition security become contentious. For example, consider two households: Household 1 falls below the undernutrition line one-out-of-four times over a two-year period; and Household 2, which does not fall below the line, but has a lower average calorie adequacy than Household 1. Which household should be considered the more food insecure? If time-series information is available, the answer to this question depends on the definition of food security adopted. There are under three alternative definitions of food security: (1) the ability of a household to stay above a nutrition threshold; (2) the potential of a household to fall below that threshold; and (3) the ability of a household to recover from falling below that threshold. Under the first definition, Household 1 is classified as more food insecure, but under the second and third definitions, it is ambiguous which household is more food insecure. If only cross-section information is available, only the first definition of food security can be utilised. Moreover, the classification of Household 1 as food secure or insecure will depend on its calorie adequacy at the time of the cross-section. These definitional considerations are extremely important in regions that experience severe seasonality.

PAST DATA COLLECTION EFFORTS

The six VLS villages have been the subject of study for almost 20 years at ICRISAT. Past studies can be grouped into three categories: (1) the 'Old VLS' studies; (2) the 'New VLS' study; and (3)the 'Six Village Nutrition Study'. The Old VLS data constitute an economic time-series collected from three villages over a 10-year period, 1975-85 (Aurepalle, Shirapur and Kanzara) and three villages over aperiod of two years (Dokur, Kalman and Kinkheda). The Six Village Nutrition Study consists of four enumerations of nutrition information during 1977-78 on the Old VLS sample. The New VLS data consist of three enumerations of economics data on an overlapping sample of the households in the six Old VLS villages (12 Old VLS households plus 36 new households per village), collected during 1989-90.

CHOICE OF STUDY SAMPLE

The size and composition of the sample was selected to (1) maximise the use of the Old VLS time series for an analysis of structural factors affecting current food and

TABLE 3: INDIVIDUALS COVERED BY SURVEY MODULES

	Dokur and Kanzara	Aurepalle and Shirapur
Module 1: Household roster		
Module 2: Education		
Module 3: Migration		
Module 4: Occupation		
Module 5: Housing	all households in the sample	
Module 6: Land		
Module 7: Income generating assets		
Module 8: Durables		
Module 9: Credit		
Module 10: Expenditures		
Module 11: Dietary recalls	all individuals	all individuals
Module 12: Food frequency	all women kids < 6 years	all women kids < 6 years
Module 13: Anthropometry	all women kids < 6 years	all individuals
Module 14: Morbidity	all females > 10 years all children < 6 years	
Module 15: Breast feeding	all mothers of partially or completely breastfed children	
Module 16: Reproductive history	all females married or engaged	
Module 17: Vitamin A food frequency	all children < 6 years mother of the child	

Figure 4: The Need for an Accurate Benchmark for Indicator Comparison

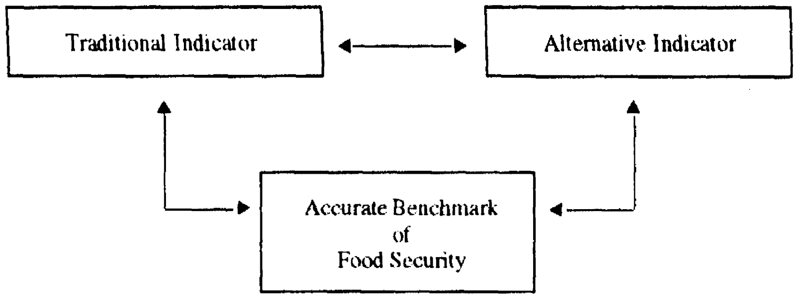
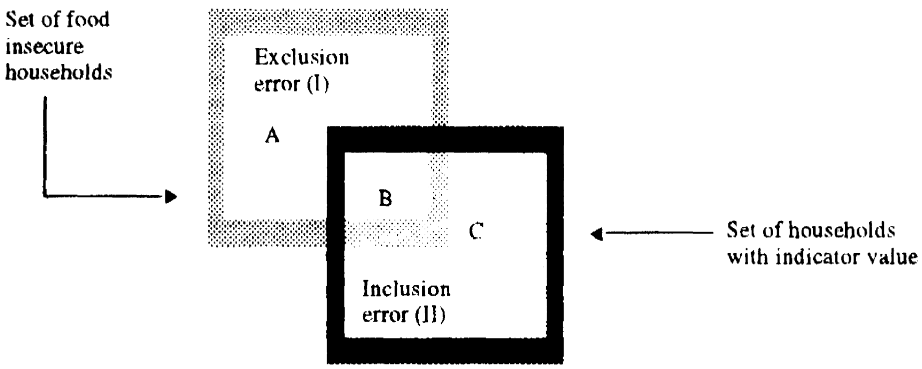


Figure 5: Overlap of Households with a Certain Indicator Characteristics and Households That Are Food Insecure



nutrition security; and (2) maximise intra-village variability. With regard to the first objective, the three-village Old VLS time series contains a household-level time path of the economic status of 120 households over 10-years. In addition to the Old VLS time series, the Six Village Nutrition Study provides a 15-year-old nutrition baseline for individuals in the 240 Old VLS households. The children in this data set are now adolescents and adults and may have separated into families of their own. Combined with a present-day follow-up of the same households, these data allow us to compare nutritional status and economic well-being during childhood and adulthood.

To maximise the number of cases on which longitudinal contrasts may be performed, it was necessary to (1) re-survey as many of the Old VLS families as possible; and (2) survey the households of individuals who have separated from the original Old VLS household ('spin-off families'). An investigation of the spin-off families required an increased survey burden in each of the Old VLS villages so the number of villages investigated needed to be reduced. Visits to the six villages in March 1992 indicated that a four village study of Kanzara, Shirapur, Aurepalle and Dokur would be both feasible and desirable. Kalman and Kinkheda villages were dropped from the sample since agricultural conditions in Maharashtra were found to be more variable between districts rather than within districts. Specifically, rainfall patterns (and hence crop performance) were quite similar in Kanzara and Kinkheda; yet they varied considerably from those found in the dry Sholapur district where Kalman and Shirapur were located, in the Mahabubnagar villages, the significant variability in cropping patterns and irrigation practices prompted us to retain both villages (Aurepalle and Dokur) in the sample.

To maximise intra-village variation, the sample was expanded beyond the Old VLS sample and their spinoffs. Specifically, the New VLS households were included and a few 'Non-VLS' families were added to bring the sample up to 80 households in each village. In total, 320 households were surveyed from the four villages,

The criteria for the selection of the sample are as follows. Within each village all Old VLS families with children less than 18 years of age were included in the sample. These households were selected since the children of these families were pre-schoolers at the time of the original nutrition study. In addition, spin-off families (those that separated from the Old VLS households since 1984) were included to enhance the sample size for inter-generational analyses. The new VLS households were included, regardless of family composition, in order to take ad vantage of the 1989-90 economics survey of these households. Finally, 'Non-VLS' households (less than 11) were randomly chosen from a list of landless and small farming families which had more than two pre-school children. These families were given priority to ensure that we had a sufficient sample of pre-schoolers.

TIMING OF SURVEY ROUNDS

The semi-arid climate of the VLS villages results in seasonal variations in food production, labour demand, and purchasing power |Behrman 1987). In the four study villages, the timing of cropping cycles and labour demand differs significantly. We therefore chose to survey during rounds which represent periods *of* (1) high food production and high labour demand ('peak'); and (2) low food production and low demand ('lean'). In addition, due to the interaction between morbidity and nutritional status, a 'medium production-high morbidity' round was included.

Food security at the village level is expected to be low following harvest periods. During these times, staple crops are abundant and prices are relatively low. During the period preceding the harvest, however, food stocks are low and the price of staple crops rises. For large farmers who have ample stocks, food availability is not a problem at this time. But for small and medium farming households food security can be problematic since food stocks have usually been exhausted. Landless households are expected to be particularly vulnerable since they must purchase grain at market prices if they are not paid in kind. The form of payment is usually dictated by employers and is dependent on the market worth of the crop. If, for example, prices are high, employers tend to pay in cash; if prices are low they tend to pay in kind.

Tabel 4: Frequency Distribution of Serum Vitamin A and Hemoglobin Levels for Pre-Schoolers in Aurepalle and Shirapur, Round 1, 1992

Biochemical Indicator (pre-schoolers)		Aurepalle	Shirapur
Serum	< 20 ug/dl	8 (16)	16 (49)
Vitamin A	> 20 ug/dl	41 (84)	17 (51)
Hemoglobin	< 10 g/dl	21 (41)	13 (39)
	> 10 g/dl	30 (59)	20 (61)

Note: Figures in parenthesis are percentages.

Tabel 5: Frequency Distribution of Serum Vitamin A and Hemoglobin Levels for Mohers in Aurepalle and Shirapur, Round 1, 1992

Biochemical Indicator (mothers)		Aurepalle	Shirapur
Serum	< 20 ug/dl	2 (3)	6 (11)
Vitamin A	> 20 ug/dl	60 (97)	49 (89)
Hemoglobin	< 10g/dl	7 (11)	11 (20)
	> 10 g/dl	56 (89)	44 (80)

Note: Figures in parenthesis are percentages.

Table 1 shows the timing of each round in the four villages as well as the timings of harvests and labour demand. The survey rounds are not necessarily concurrent across villages because peak and lean seasons are not identical in all villages.

BACKGROUND INFORMATION ON STUDY VILLAIN

The study villages are located in three districts in two states. Dokur and Aurepalle are located in Mahabubnagar district in Andhra Pradesh, Shirapur is in Sholapur district, Maharashtra, and Kanzara is in Akola district, Maharashtra (Figure3). The village economies are based on rain-fed agriculture, but rainfall is low and is particularly erratic in Mahabubnagar and Sholapur districts (Table 2). Indeed, as Walker and Ryan (1990:221) state:

> What distinguishes the SAT from more humid environments is the high incidence of rainfall-related production risk. If insurance markets were complete, capital markets allowed households to save and borrow to smooth income variability, and future markets gave information on prices, risk would not be a source of concern in a country as large as India.

In terms of overall welfare, Aurepalle is the worst-off village. In Aurepalle, percapita income is lowest and the percentage of landless individuals who are not meeting 50 per cent of their energy requirements is highest. Aurepalle is characterised in Walker and Ryan as "poorly developed and subsistence-oriented, with a high degree of seasonality and substantial relative and absolute poverty" [Walker and Ryan 1990:297]. However, according to the 1977-78 nutrition study, mean calorie adequacy is under 100 per cent for most of the year in all villages except Kanzara. In the hot dry season in Aurepalle, mean calorie adequacy is a mere 70 per cent [Walker and Ryan 1990:275]. Micro-nutrient adequacy is even less satisfactory. All four villages have mean nutrient adequacy well below 100 per cent for beta-carotene and ascorbic acid. In addition, Aurepalle has low intake levels for thiamine, iron, and niacin while Dokur has low consumption of calcium, thiamine, niacin, iron, and riboflavin.

In Aurepalle, Shirapur and Kanzara, the nutrition data have not been updated since 1978. In Dokur, nutrition data from 1985/86/87 show sustained improvements in energy and nutrient intake, but they are not accompanied by concomitant increases in weight-for-age and weight-for-height. This most likely reflects a lack of improvement in non-food health input levels such as morbidity and time intensity of activities.

Walker and Ryan (1990) state that most *of* the explained variation in dietary intake and anthrompometry in 1977-78 was due to inter-regional and inter-village differences. They, therefore, maintain that nutrition interventions should be undertaken at the village or regional level. In terms of indicators, the obvious implication is that the collection of poverty and food and nutrition indicators is most efficiently conducted at the village or even regional level, but not at the level *of* the household or individual. For example, they state that:

> The results in this chapter show how hard it is to establish centralised guidelines for targeting beneficiaries for subsidised poverty alleviation programmes, such as the Integrated Rural Development Programme (IRDP), in poor dryland farming communities. In Aurepalle, membership in the harijan community would be an effective marker of low economic status; in Kanzara, landlessness would likely be as good as any other criterion to identify endemic poverty in the village; and lastly, in Shirapur, one would be hard pressed to suggest an indicator that effectively sheds light on the shades of poverty in the village.

Walker and Ryan further suggest that the case for nutrition targeting *of* young children is strong, but not for adults. Again. the majority of the variation in adult nutrition status and *food* intake is due to inter-village, as opposed to intra-village, variations. Instead, Walker and Ryan are much more enthusiastic about 'self-targeting' public works interventions such as the Maharashtra Kmploymenl Guarantee Scheme (MEGS).

There are, however, a number of compelling reasons to continue the search for appropriate household-level indicators in the SAT. First, the VLS nutrition surveys did not specifically measure the nutritional status of pregnant and Iactating women, nor those individuals over 60 (due to small sample sizes in the latter case). It is likely, therefore, that heterogeneity in food security within and among households is under-estimated by the 1977-78 data.

Second, nutrient intake varies considerably by per capita expenditure level, further emphasising the heterogeneity in nutrient consumption within villages. This is clearly demonstrated by the response of the micro-nutrient intake of children under the age of 12 to increases in household per capita expenditure. For example, nutrient-per capitaelasticities forcalcium, beta-carotene and ascorbic acid are 0.56, 0.51 and 0.44 respectively. This result is reinforced by the significant (although quite small in magnitude) positive link between land-holdings and household energy and nutrient consumption.

TABLE 6: EXAMPLES OF FLOW AND STRUCTURAL INDICATORS TO BE TESTED BY TYPE OF DATA COLLECTION METHODOLOGY

Alternative Indicators	Structural or Flow Indicator	Source of Indicator: Survey	PRA	Ethnography
Dependency ratio	Structural	XXX		
Number of meals consumed/day	Flow	XXX		
Household identified on village map as 'at risk'	Flow		XXX	
Number of different foods listed on food chart	Flow		XXX	
Disabled person living in house	Structural		XXX	XXX
Purchased new clothes for Diwali	Flow			XXX

TABLE 7: CONSEQUENCES OF INDICATOR ADOPTION UNDER SITUATIONS OF HIGH AND LOW ASSOCIATION BETWEEN THE ALTERNATIVE AND TRADITIONAL INDICATORS

		Unobserved Association between Traditional Indicator and Benchmark: High	Low
Observed association between traditional indicator and lower-cost alternative indicator	High	Scenario 1 Adoption of alternative indicator; lower cost, equally accurate	Scenario 3 Adoption of alternative indicator; lower cost, but equally inaccurate
	Low	Scenario 2 Non-adoption of alternative indicator; lower cost, but inaccurate	Scenario 4 Non-adoption of alternative indicator; lower cost, but not enough information to determine whether an improvement over traditional indicator

Third, household-level indicators from the basis of village-level indicators. Fourth, the eligibility of self-targeting programmes such as the MEGS may have to be restricted (perhaps based on a food security indicator) in the face of downwardly flexible nominal wages in the villages [Walker and Ryan 1990:148]. For instance, if there is political pressure to offer a MEGS wage at a level just below the labour market wage, universal eligibility may be financially infeasible [Reddy 1993].

Finally, conditions in the villages and the regions have changed in the 15 years since the last nutrition study. Do the mechanisms which reduced the variability in nutritional status among households still exist?[2] This question is all the more relevant as these mechanisms - public and private - will probably experience increased stress as India's economic adjustment package is implemented.'

III
Field Testing

SURVEY

Both economic and nutrition records are being collected in all villages. Table 3 shows the various modules collected in each village. Since the overall objective of the study is to identify the most simple indicators, it will be noted that several modules offer overlapping information. Dietary adequacy, forexample, is assessed by several different methods; 24-hour dielrecall, food frequency and food expenditures.[4] Each of these methods requires different enumerator skills as well as different respondent skills. Each method will also require different amounts *of* time for collection and analysis. Accordingly, the costs of indicator collection and analysis will vary.

Aside from testing the efficiency of different data collection methods, the survey modules also try to keep the form of the alternative indicators as simple as possible. For example, income level will not be calculated for each household. Rather, the number of income sources and interruptions in household income flows (for instance due to unemployment) will be recorded for each household.

Table 3 also shows the coverage of each module in each village. Individual-level data collection is more detailed in Aurepalle and Shirapur. While we would have preferred to collect detailed data on all persons it the sample, financial constraints precluded such a comprehensive survey. We have, therefore, focused our nutrition and health questions on females and children. The focus on children is not new, but the focus on women who are not mothers is. This focus reflects a growing recognition that women contribute significantly to household food production, and in many cases are the sole providers of food. In such cases it becomes important to understand that women's health status plays an important economic role within the household and may therefore have an impact on food and nutrition security beyond that associated with reproduction. To avoid making a priori assumptions that men and boys are not included in the vulnerable groups we will also perform gender-related contrasts for all age groups in Shirapur and Aurepalle.

QUALITATIVE DATA

In addition to the survey data, the project team also collected qualitative data in two villages, Shirapur and Aurepalle.[5] The qualitative data are collected with participatory rural appraisal (PRA) modules, season-specific village-level ethnographic reports, and six case studies of selected families in Aurepalle and Shirapur. This information will (1) provide qualitative support for the information produced by the survey, (2) help develop unique emic indicators of food and nutrition security, and (3) help develop a procedure for determining emic indicators from quali tative information.

Large surveys are often justly criticised for being inappropriately designed and disrespectful of local knowledge. One way of countering this criticism is to improve the design of surveys and treat respondents with the respect they deserve. Another way *of* countering this criticism is to employ data collection methods that encourage researchers to listen to, and learn from, the respondents [Chambers 1991].Specifically, PRA data collection embodies the principles of 'optimal ignorance' (not trying to find out more than is needed) and 'appropriate imprecision' (not measuring more accurately than is necessary for practical purposes).

The use of PRA techniques offers the possibility of obtaining a holistic picture of household/family/community food security interactions while reducing the costs of data collection. The application of the approach to nutrition and health is relatively recent [Bentley 1988] and has been mostly limited to project development and evaluation. Recent research experience focusing on the complementary nature of qualitative and quantitative methods for evaluating health and nutrition status has, however, proved to be quite successful [Paolisso and Regmi 1992].

To explore the use of PRA as a research tool for generating indicators, four different PRA exercises are being conducted concurrently with the survey work. To prepare for this venture, a joint team from two Bangalore-based NGOs, MYRADA and Outreach, conducted a week-long training workshop to teach the investigators various PRA methods. The four exercises chosen for the study are village mapping, food charts, women's activity charts, and seasonality charts. Two investigators on the Aurepalle and Shirapur research teams have special responsibility for conducting exercises. Village mapping is used to identify households that are at 'very high risk' and 'no risk' of food and nutrition insecurity as defined by the villagers. Essentially, the method involves asking a group of villagers to draw a map of their village. Typically, the map is drawn on the ground using

TABLE 10: MISCLASSIFICATION OF THE FOOD INSECURE WITH THE ALTERNATIVE INDICATOR

	Food Insecure as Defined by Traditional Indicator	
Food insecure as defined by alternative indicator	Yes	No
Yes	a	b
No	c	d

Note: a = Number of households or pre-schoolers classified as food insecure by both the traditional and alternative indicators.

TABLE 8: ALTERNATIVE INDICATOR SHOWING PERFECT ASSOCIATION WITH TRADITIONAL INDICATOR OF FOOD SECURITY

Alternative Indicator of Food Security Tercile	Traditional Indicator of Food Security Tercile: Low Food Security	Medium Food Security	High Food Security
Low food security	100	0	0
Medium food security	0	100	0
High food security	0	0	100

TABLE 9: ALTERNATIVE INDICATOR THAT SHOWS NO ASSOCIATION WITH TRADITIONAL INDICATOR OF FOOD SECURITY

Alternative Indicator of Food Security Tercile	Traditional Indicator of Food Security Tercile: Low Food Security	Medium Food Security	High Food Security
Low food security	33.3	33.3	33.4
Medium food security	33.3	33.3	33.4
High food security	33.3	33.3	33.4

'rangoli' (coloured powder) provided by the investigators, a larger group of villagers is then consulted in order to identify households which are 'very high risk'. This identification exercise is conducted separately for men and women in order to measure gender-differentiated perceptions of risk.

The construction of food charts is done at the household level. The key informant is each household should be the person in charge of or 'controlling' the food supply. The informant is asked to picture the foods currently consumed by the household. No attempt is made to standardise the number of foods reported by the informant; the fact that an informant wishes to list three types of sorghum as opposed to one may be a valuable indication of diet diversity. The informant is then asked to place ten beans in a column above the food item most consumed, and one bean on top of the food item least consumed. Consumption of other foods is ranked in relation to the number of beans in these two columns. Women's activity charts are structured in an identical fashion, but the respondent is asked to list activities undertaken instead of foods consumed.

The fourth FRA method used is the seasonality chart. This method is conducted with small groups (differentiated by gender and caste) to understand the yearly changes in rainfall, harvests *of* two main staples, food consumption, male and female labour demand, childhood illness, and women's illness. In a scheduled caste area, separate groups of men and women are asked to 'make a picture' of how the above aspects of village life have varied throughout the past 12 months. The group is asked to place 10 beans of one colour in a column above the month in which a particular characteristic (e g, rainfall) is most extreme. The group is then asked to place one bean on top of the month in which the characteristic is least evident. This exercise is then repeated with a group of higher caste villagers to capture intra-village heterogeneity in perceptions.

Once completed, indicators from each *of* the exercises may be constructed. For example, the number of items listed by the food preparer on the food chart can be constructed and compared with the survey variables. From the village map, we can construct an emic indicator of whether or not a household is identified as at risk' by the villagers. These indicators may be compared with the traditional, etic indicators derived from the survey.

ETHNOGRAPHY

In a further attempt to learn how villagers interpret the terms 'hunger' and 'food insecurity', an ethnographer has been placed in Shirapur and Aurepalle for the duration of each survey round. The ethnographer uses in-depth interviews, key informant interviews, focus groups, and participant observation to conduct six household case-studies as well as village-level profiles each round. The case study work will be used to develop unique, emic indicators of food and nutrition security. These indicators will be compared with the etic indicators produced by the survey.

Although the case study method is meant to be fluid and unstructured, general guidelines for the ethnographers have been developed. The guidelines include the following topics:

(1) What are local perceptions of 'health' and 'food security'? What community, household, and individual resources are required to obtain health and food security? Does this vary by sex and age?

(2) Within this community, what are traditional early signs of 'food insecurity'? How are 'high risk' households or individuals identified by local people?

(3) What is a 'good quality' diet? In times of plenty or scarcity, how does this diet change and what are the consequences of change?

(4) What has been the experience of local people regarding fluctuations in food or nutrition insecurity? What factors are perceived to be responsible for these fluctuations? How do rural households cope with threats to food or nutrition security? what do people do to protect food/nutrition security?

(5) What is the decision-making process within the household with regard to achieving food/nutrition security or respondig to problems in its attainment? Who makes specific decisions, how are resources allocated/reallocated? What is the bargaining power of different family members?

Once collected, the qualitative data will be entered into word processor files and analysed using a software text retrieval programme, Zy-lndex. Data entry and analysis will proceed concurrently with data collection, to allow for the identification of promising unique indicators that can be further investigated. In addition, indicators that are identified in the first and second rounds as potentially useful can be incorporated into the survey in round 3.

SERUM ANALYSES

In order to provide objective benchmarks of micro-nutrient adequacy, serum measurements of vitamin A and iron status are being collected for pre-schoolers and their mothers. The collection and analysis of these biochemical indicators is made possible through collaboration with the National Institute *of* Nutrition (NIN) in Hyderabad. Thus far, the data collection has been quite successful given the usual difficulties of gaining compliance in blood studies. In Shirapur, 82 per cent *of* the possible sample (n = 109) were covered, and in Aurepalle approximately K5 per cent *of* the possible sample (n = 132) were covered. This high level of coverage was achieved for a number of reasons: (i) ICRISATs excellent rapport with the villagers; (ii) the presence of a physician

TABLE 11: DEFINITIONS OF MISCLASSIFICATION INDICES AS APPLIED TO IDENTIFICATION OF ALTERNATIVE INDICATORS

Misclassification Index	Formula	Comments
Sensitivity	a/ (a+c)	Proportion of food insecure (traditional indicator) identified as food insecure by alternative indicator.
Error of exclusion	c/ (a+c)	Proportion of food insecure (traditional indicator) not identified as food insecure by alternative indicator.
Specificity	d/ (b+d)	Proportion of food secure (traditional indicator) identified as food secure by alternative indicator.
Error of inclusion	b/(b+d)	Proportion of food secure (traditional indicator) not identified as food secure by alternative indicator.
Positive predictive value	a/ (a+b)	Proportion of food secure by alternative indicator who are food secure (traditional indicator).
Negative predictive value	d/ (c+d)	Proportion of food insecure by alternative indicator who are food insecure (traditional indicator)

Source: Tucker etal (1989).

TABLE 12: USE OF SELECTED HOUSEHOLD SIZE CUTOFFS TO IDENTIFY HOUSEHOLDS WHICH HAVE CALORIE ADEQUACY VALUES LESS THAN 80 PER CENT (LUZON, THE PHILIPPINES)

Household size cut off	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
	Percentage			
¾ 4	14.8	66.3	49.6	25.7
¾ 5	28.4	43.4	53.0	21.2
¾ 6	44.0	29.5	58.4	19.0
¾ 8	69.9	19.6	63.5	12.5
¾ 9	80.2	5.4	65.6	10.8

for free consultations with respondents; and (iii) the professional conduct of the NIN personnel.

Hemoglobin samples were analysed using the filter paper technique developed by NIN [NIN Annual Report 1986]. Vitamin A samples were analysed using a variation on the micro-fluorometric technique reported in Siva Kumar (1977). Reliminary results from the first round indicate that 49 per cent of the pre-schoolers sampled in Shirapur have margina/Iy low levels of serum vitamin A (< 20 g/dl), and 39 per cent have deficient levels of iron (< 10 g/dl Hb) (Table 4).[6] In Aurepalle. iron statu; is poor among 41 per cent of the sampled pre-schoolers, although vitamin A deficiencies arc not alarmingly high (16 per cent). Among the mothers sampled, serum hemoglobin levels are low in Shirapur, but rot overwhelmingly so in Aurepalle (Table5).

IV
Analysis Plan

A useful indicator can locate the food insecure while being reasonably inexpensive to collect. Pastefbrts to evaluate indicators have tended to focus on locating the food insecure rather than estimating their associated costs Glewwe and van der Gaag 1990; Glewwe and Kanaan 1990: Haddad and Kanbur 1991. The Alternative Indicators Project is making a serious attempt to look at both sides of tie coin: the ability to locate the food insecure, and the relative costs of collection.

ABILITY TO LOCATE THE FOOD INSECURE.

Flow and Strurtural Indicators

The indicators that are generated from the household survey, the PRA exercise, and the ethno/raphic case studies can be classified into wo broad categories: indicators that change values frequently (such as the number ofunique foods consumed) and those that *do* not (such as landholdings or quality of duelling). The former class of indicators, tie 'flow indicators', may be useful measures of short-term fluctuations in food security. If. for example, a flow indicator moves downwards and settles at a lower bound, it may serve to herald changes in the latter category of 'stock' or 'structural' indicators. Negative changes in the structural indicators are likely to indicate risk of acute undernutrition.

The flow and stock indicators can be picked up by all three data collection methodologies (Table 6). From the survey, one cross-section allows us to examine differences across households in terms of flow and stock variables and make inferences about single households over time. With three cross-sections over a 9-month period we can examine changes in flow indicators and possibly some changes in structural indicators for households overtime. Using the VLS time series we can compare current food security with fluctuations in structural variables over the past 15 years. We can also compare the infant-to-adolescent changes in food security of individuals with fluctuations in structural variables over the past 15 years.

Traditional Indicators

A significant limitation of any study that seeks to identify and evaluate alternative indicators of food security is that the analysis relies upon comparisons of the alternative indicator with the traditional indicator. A close association between the traditional indicator and the alternative is therefore useful only when the traditional indicator is accurate at measuring food security. Ideally we should compare the alternative indicator with a 'true' measure of food insecurity, but there is no single, accurate benchmark for this. Figure 4 illustrates the problem.

The implications of this problem for indicator adoption are shown in Table 7. Under scenarios 1 and 2 the traditional indicators accurately reflects the benchmark, and it is useful to compare the alternative to the traditional indicator. Under scenarios 3 and 4. the usefulness of the identification exercise is diminished since the traditional indicator does not reflect the 'true' food security situation.

The traditional indicator of food energy deficit is calorie intake divided by calorie requirement. In order to increase the correlation between this indicator and the true but unobserved food security situation, we (i) undertake two repeated 24-hour recall surveys *within each round:* (ii) collect three rounds of 24-hour recall data; (iii) construct calorie requirements based on age, weight, sex, physiological status, and a three-scale classification or activity patterns; and (iv) construct a variable which broadens the concept of food security beyond that of calorieadequacies. Specifically, we will construct a variable which incorporates the concept of dietary quality using our measure of micro-nutrient adequacy. For example, we propose a benchmark for household food security in which households that meet 80 per cent of the calorie RDA in addition to 80 per cent of vitamin A and iron are classified as food insecure.

Traditional indicators of vitamin A and iron security also tend to be based on dietary intake. However, unlike energy measures of food insecurity, blood serum analyses of vitamin A and hemoglobin serve as benchmarks against which we can validate the traditional indicator.

Measures of Association

There are a number of methods to evaluate the association between traditional and alternative indicators: two-way tables (what are the main characteristics of food insecure verses food secure households?), correlation coefficients (both continuous and rank), factor analysis, cluster analysis and regression analysis. However, all of these methods have limitations for our purposes. Our preferred techniques are overlap analyses (what per cent *of* households or

TABLE 13: SHEET FOR RECORDING ITEMS RELEVANT TO THE ESTIMATION OF COSTS OF VARIOUS DATA COLLECTION METHODOLOGIES

Labour Costs Associated with Data Collection	Survey Module			PRA Module			Ethnography		
	Time	Time Unit	Unit Cost	Time	Time Unit	Unit Cost	Time	Time Unit	Unit Cost
Development of instruments									
Training									
Collection of data									
Monitoring data collection									
Supervising office work									
Editing data									
Creating data entry shells									
Data entry									
Data cleaning									
Costs of Supplies for Data Collection, Data Analysis	Quant	Unit	Unit Cost	Quant	Unit	Unit Cost	Quant	Unit	Unit Cost
Data analysis									
Hardware purchases									
Stationery									
Survey supplies									
Fuel									
Per diems									
Reproductive/communication									

pre-schoolers in an indicator group are food or nutrition insecure?) and the closely related classification analyses.

The flaws in the discarded techniques are not always obvious. For example, in the case of two-way tables, the investigation of the characteristics of households classified as food insecure is suggestive, but it begins with the premise that these households have been located. For instance, the knowledge that 40 per cent, 30 per cent and 20 percent of households in the lower, middle and upper calorie adequacy terciles, respectively, have unimproved drinking water suggests that this is a useful indicator, but we have to make the further calculation that 44.4 per cent of households with unimproved drinking water are in the bottom tercile of calorie adequacy. In other words, it is difficult to rank indicators from these tables.

Correlation coefficients between continuous indicators are subject to extreme values. This can be corrected to some extent by looking at correlation of ranks. Nevertheless, high correlation coefficients could arise due to close association between indicators at the upper end of the calorie adequacy distribution, and we are more interested in the lower end of the distribution.

Factor and cluster analysis techniques do not work well with categorical values, or continuous variables that are not normally distributed. For variables such as household size, income, food expenditure, and calorie adequacy, factor and cluster analyses are useful identifying patterns among indicators. Factor analysis is concerned with identifying indicators with common variances. In this way we could search for variables which load heavily onto the same factor as the traditional indicators. Cluster analysis is concerned with grouping households on the basis of similarities across a set of measured variables. In this way we could select the most food insecure cluster and examine its profile in terms of the alternative indicators.

Overlap analysis is used by Glewwe and van der Gaag (1990) to measure the association among various poverty measures. Essentially, the technique asks, what per cent of households or individuals possessing a certain indicator characteristic are also food insecure households or individuals? In Figure 5 this percentage is represented by areaB over area B+C. Area A represents the magnitude of exclusion error, or the food insecure set that is not identified as such by the indicator. Area C represents the magnitude of inclusion error, or the food secure set that is incorrectly identified by the indicator. Area B represents the correctly identified food insecure set.

In this study we can identify areas A,Band C. Indicators can be ranked on the basis of B/(A+B) or B/(B+C). The chosen method of .ranking will ultimately depend on whether the policy-maker is more intent on minimising errors of exclusion or errors of inclusion. Initially, we choose to rank indicators on the basis of the ratio B/(B+C), because in a true monitoring situation we lack information on the size of (A+B). That is, in a true monitoring system one can observe the set of households with a certain indicator value, but one cannot observe the set of truly food insecure households. For example, we are more interested in the percentage of households with no access to land that are food insecure (B/(B+C)) than the percentage of the food insecure that have no access to land (B/(A+B)).

As an example of overlap analysis, consider a continuous alternative indicator (per capita land ownership) that splits households into three groups of equal size. The traditional indicator, household calorie adequacy, also splits households into three groups of equal size with the households in the lowest calorie adequacy tercile being defined as food insecure. Table 8 presents an alternative indicator that is a perfect predictor of the traditional indicator. In this case 100 per cent of all households that are classified as food insecure according to the alternative indicator (lowest tercile) are also classified as food insecure with the traditional indicator (lowest tercile). By contrast, Table 9 presents an alternative indicator that shows no association with the traditional indicator. With this indicator, only 33 per cent of the individuals classified as food insecure using the alternative indicator are also insecure using the traditional indicator (see top left hand cell). The magnitude of this 'lower tail' overlap indicates the indicator's ability to locate households at either end of the food security scale. For example, if 60 per cent of all households in the bottom tercile of per capita land ownership are also in the bottom calorie adequacy tercile, then this is a good indicator of food insecurity. If only 10 per cent of all households in the bottom tercile of household size are in the bottom calorie adequacy tercile then household size is a good indicator of food security.

An example of the misclassification method is shown in Table 10 and defined by Tucker et al (1989) in Table 11. These measures are useful when dealing with two by two matrices such as in Table 10, but lose some interpretation when there are more than two alternative and traditional indicator values. An example of the use of classification indices is given in Table 12. Household size is used as the alternative indicator of food security and household calorie adequacy is used as the traditional indicator. Table 12 shows what happens when a programme uses household size as an indicator to determine eligibility. In the example. eligibility is initially based on small household size. When the eligibility cutoff is raised, more and more households are correctly classified as undernourished according to the traditional indicator, household calorie adequacy (illustrating high sensitivity), but fewer and fewer households are correctly classified as not undernourished (indicating low specificity).

The overlap analysis is not without problems either. For instance, an indicator group can have a high percentage of the total households which are food insecure yet cover only a small percentage of at risk households. Similarly, some indicators will be so general that they will contain all the food insecure households, but the food insecure households will only represent a small percentage of the households with that indicator value.

Ultimately, the only way to rank indicators is to specify what they will be used for. For example, if the policy objective is to minimise undernutrition with a fixed transfer of money or food, indicators can be used to target that transfer. I fan indicator-targeted transfer reduces undernutrition by more than an untargeted transfer, the value of that indicator is the amount of food or money an untargeted transfer would have to deliver in order to achieve the same reduction in undernutrition.

COSTS OF LOCATING FOOD AND NUTRITION INSECURE

The cost of collecting and analysing different indicators involves collecting detailed information on time spent in each activity, as well as the cost of supplies required for each method of data col lection and data analysis. Table 13 shows the types of information that must be collected for each survey module, each PR A exercise and the ethnography case studies. To compile this information, survey forms included an area to record the time started and ended on each module. For the ethnography investigators were trained to record how much time was spent conducting interviews and writing up interviews. Similarly, for the PRA exercises, investigators recorded the time needed to complete each exercise. Finally, records of all purchases were kept in spreadsheet files.

V
Summary

This paper reports on the design of a multi-disciplinary, collaborative project intended to make food and nutrition security systems more viable. The objective of the project is to identify 'alternative' indicators that can be used in food and nutrition monitoring and evaluation systems.

The project is situated in four villages formerly studied by ICRISAT in Maharashtra and Andhra Pradesh, For this study, alternative indicators of household, individual, and village food security are collected using survey, ethnographic and participatory methods three times over a period of a year. These alternative indicators will be compared to traditional indicators, such as individual and household calorie adequacy, that are assumed to represent the true food security situation.

The performance of the alternative indicators will be judged by their ability to track movements in the traditional indicators. Two types of analysis will be used - overlap analysis and classification analyses. Overlap analysis is used to measure the association between various poverty issues by illustrating what percentage of households or individuals possessing a certain indicator characteristic are also food insecure.

The performance of the alternative indicators will also be judged by their cost effectiveness. Specifically, the cost of collecting and analysing different indicators will be calculated by collecting detailed information on time spent in each activity, as well as the cost of supplies required for each method of data collection and data analysis.

Notes

1 *Down to Earth,* January 1993, p 15.

2 Risk-management and income-smoothing mechanisms described by Walker and Ryan (1990) include: informal credit markets, participation in a tightening agricultural labour market, government land redistributing programmes, and public works programmes.

3 In fact, visits to Sholapur district in March 1992 suggest that the MEGS is no longer a significant source of steady income.

4 Examples of recent comparative work in this area from India includes Thimmayamma (1987) and Thimmayamma et al (1988).

5 Only two villages were selected for additional data collection since project resources were limited.

6 We have considered 'marginally low' serum vitamin A values to be < 20 ug/dl. To assess iron deficiency, we have used a hemoglobin cutoff of 10 g/dl. For a full discussion on the appropriate cutoff levels for both indicators, see Gibson (1990).

References

Asokan, M V Bhasker Rao and Y Mohan Rati (1991): 'Agroeconomic Profile of Selected Villages in Mahbubnagar Region of Andhra Pradesh', *ICRISAT,* Economics Group, Resource Management Programme, VLS Series, Patancheru, India.

Bapna, S (1991): 'Reaching the Rural Poor: India's Experience with the Public Distribution of Food Grains', *Food and Nutrition Bulletin,* Vol 13, No 3, pp 230-40.

Behrman, J (1987); Nutrition, Birth Order, and Seasonality; Intrahousehold Allocation in Rural India', *Journal of Development Economics,* Vol 28(1), pp 43-62.

Bentley, M (1988): 'The Household Management of Childhood Diarrhea in Rural North India', *Social Science and Medicine,* Vol 27(1), pp 75-85.

Bhende, M J (1983); 'Agro economic Profile of Selected Villages in Sholapur Region of Maharashtra State', *ICRISAT,* Economics Programme, VLS Series; Patancheru, India.

Bidinger,PD, T S Walker, B Sarkar, A Ram Murthy and P Babu (1990): 'Economic, Health, and Nutritional Consequences of the Mid-1980s Drought on a Tank-Irrigated, Deccan Village in South India', International Crops Research Institute for the Semi-Arid Tropics, Resource Management Programme, Economics Group, Progress Report 98.

Chambers, R (1991): 'Rapid and Participatory Appraisal for Health and Nutrition', *Proceedings of the Nutrition Society of India,* Vol 37, pp 339-56.

Dev, S M, M H Suryanarayana and K S Parikh (1992): "Rural Poverty in India: Incidence, Issues and Policies *Asian Development Review,* Vol 10, No 1, pp 35-66.

Dreze, J (1988): 'Famine in India', Suntory Toyota International Development Centre Discussion Paper, London School of Economics.

Gibson. R S (1990): *Principles of Nutritional Assessment,* Oxford University Press.

Glewwe, P and O Kanaan (1989): 'Targeting Assistance to the Poor: A Multivariate Approach Using Household Survey Data', Development Economics Research Centre Discussion Paper No 94, Department of Economics, University of Warwick, Coventry,

Glewwe, P and J van der Gaag (1990): 'Locating the Poor: A Comparison of Indicators', *World Development.*

Government of India (1990): *Approach to the Eighth Five - Year Plan: 1900-1995.* Planning Commission, Centre for Monitoring Indian Economy, Bombay.

Gupta, N, P Pal, M Bhargava and M Daga (1992): 'Health of Women and Children in Rajasthan', *Economic and Political Weekly,* October 17, pp 2323-30.

Haddad, L and R Kanbur (1991): 'The Value of Intrahousehold Data for Age-Based Targeting', World Bank Working Paper, PRE Series, *Washington,* DC.

Haddad, L, J Sullivan and E Kennedy (1991): *Identification and Evaluation of Alternative Indicators of Food and Nutrition Security: Some Conceptual Issues and an Analysis of Extant Data.*

Harriss, B (1991): *Child Nutrition and Poverty in South India: Noon Meals in Tamil Nadu,* Concept Publishing Company, New Delhi,

Jain, D (1992): 'Can Poor Women Be Targeted?', Population Council, New York, (mimeo).

Jha, S (1992): 'Consumer Subsidies in India: Is Targeting Effective?' *Development and Change,* Vol 23, No 4, pp 101-28.

Kennedy, E and E Payongayong (1991): *'Patterns of Macro-and Micro-Nutrient Consumption and Implications for Monitoring and Evaluation',* International Food Policy Research Instate, Washington.

Kshirsagar, KG(1983): 'Agro economic Profile of Selected Villages in Akola Region of Maharashtra State', *ICRISAT,* Economics Programme, VLS Series; Patancheru, India.

Maxwell, S (1990): 'Food Security in Developing Countries: Issues and Options for the 1990s', *IDS Bulletin,* 21 (3), pp 2-13.

National Nutrition Monitoring Bureau (1987): *Achievements and Constraints (by* Prahlad Rao, Gowrinath Sasty, Narasinga Rao), National Institute of Nutrition, Indian Council of Medical Research, Hyderabad.

National Institute of Nutrition (1986): 'Development of a Field Method for Haemoglobin', *Annual Report 1985-86,* p 60.

Paolisso, M and S C Regmi (1992): *Gender and the Commercialisation of Subsistence Agriculture in Nepal,* International Centre for Research on Women, Washington, DC.

Parikh,K S (1992): 'Importance of Food and Agriculture Policies in the Success of Structural Reforms in India', Invited Paper for the 29th European Association of Agricultural Economists' Seminar, Honheim, Germany.

Ravallion, M (1990): 'Reaching the Poor Through Rural Public Employment: A Summary of Theory and Evidence', *World Bank Discussion Paper,* World Bank, Washington, DC.

Ravallion, M and K Subbarao (1992): 'Adjustment and Human Development in India', World Bank, Population and Human Resources Division, Washington. DC.

Reddy, S Sudhakar (1993): 'Towards Employment Guarantee Programme in Andhra Pradesh', *Centre for Economic and Social Science Research Studies,* Vol 9, pp 5-6.

Ryan, J G. P Bidinger, N Prahlad Rao and P Pushpamma (1984): The Determinants of Individual Diets and Nutrition Status in Six Villages of Southern India', *ICRISAT Research Bulletin,* No 7, Andhra Pradesh, India.

Sivakumar, B (1977): Evaluation of Micro Spectro fluorimetric Method for Serum Vitamin A', *Clinica Chimica Acta,* Vol79, pp 189-95.

Thimmayamma, B V S (1987): 'Food Consumption Pattern of Rural Families by Weighment and Expenditure Pattern Methods of Diet Survey', *Indian Journal of Nutrition and Dietetics,* Vol 24. pp 34-39,

Thimmayamma,B V S, Parvathi Rau and T Prasanna Krishna (1988): Meal Pattern and Energy-Protein Adequacy of Pre-school Children by Different Socio-Economic Groups', *Thelndian Journal of Nutrition and Dietetics,* Vol 25, pp 212 28.

Tucker, KDPelletier. K Rasmussen, J P Habicht, P Pinstrup-Andersen, and F Roche (1989): *Advances in Nutritional Surveillance: The Cornell Nutritional Surveillance Programme 1981-1987,* Cornell Food and Nutrition Policy Programme Monograph 89-2, Cornell University, Ithaca.

Walker, T S and J G Ryan (1990): *Village and Household Economies in India's Semi-A rid Tropics,* Johns Hopkins University Press, Baltimore.