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Experiential household food insecurity in an urban underserved slum of North India

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Abstract One-third of India's urban population resides in extreme poverty, in slums and squatters. Food insecurity remains a visible reality among this segment. Yet, it is scarcely documented. This paper describes levels and determinants of experiential household food insecurity (HFI) in an underserved urban slum of Delhi (India) and reports the internal validity and reliability of the measure used to assess experiential HFI. A four-item scale was adapted from the U.S. six-item short-form food security scale and was administered in Hindi through household interviews with 410 female adults. Association of HFI with household economic and socio-demographic characteristics were examined using multiple logistic regression. Cronbach's alpha and Rasch-model-based item fit statistics were used to assess reliability and internal validity. Fifty-one percent of households were food insecure. Significant HFI predictors were unemployed to employed family members' ratio of >3:1 (Odds Ratio 2.1, Confidence Interval 1.2 – 3.4) and low household standard of living (OR 4.9, C.I. 2.7 – 8.9). Cronbach's alpha was 0.8. Item severities as estimated under Rasch model assumptions spanned 9.7 logits. Item infit statistics (0.77 – 1.07) indicated that the Rasch model fit the data well. Item outfit statistics suggested that one item was inconsistently understood by a small proportion of respondents. For improving HFI among the urban poor, in addition to improving behaviors/entitlement access, programs should consider linkage of urban poor to existing employment schemes, upgrading of their skills and linkage to potential employers. The adapted scale was reliable and easy to administer. However, being a subjective assessment, its sensitivity to social expectation and its association with nutrition security require examination.

Keywords Urban poor · Household food insecurity · Slums

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Introduction

India is home to 1.1 billion people. Out of these, an estimated 340 million people reside in urban areas (Office of Registrar General and Census Commissioner of India 2006). While urban areas are recognized as centers for economic development, opulence co-exists with deprivation. Nearly one-third of India's urban population i.e., 100 million out of 340 million, live in extreme poverty (Ministry of Health and Family Welfare 2000), in slums and squatters. One in every two (54.2%) poor urban children under 5 years of age are stunted, an indicator of chronic undernutrition and 38.5% of poor

urban women of reproductive age suffer from acute undernutrition, i.e., body mass index less than 18.5 kg/m^2 (Urban Health Resource Center 2008). Apart from poverty which hinders the urban poor's capacity to fulfill basic survival needs, they live in congested conditions which promote the spread of infectious disease with poor sanitation and drinking water facilities. Moreover, they are frequently excluded from basic government nutrition and health services as they often live in unauthorized settlements (Agarwal and Taneja 2005). For example, less than one-third (29%) of India's urban poor have below poverty line cards, an essential prerequisite for subsidized access to food and other commodities of India's food assistance program called the Targeted Public Distribution System (PDS) (Press Information Bureau, Government of India 2007). Furthermore, only 53.3% of urban poor children under the age of six live in areas covered by an *Anganwadi* (a courtyard), which delivers, at grass-roots level, the services of the largest nutrition program of India — the Integrated Child Development Services (ICDS) (Urban Health Resource Center 2008).

Undernutrition is caused by an array of interrelated factors including household food insecurity, poor household care of women and children and poor access to health and sanitation services (Black et al. 2008). A household is considered food insecure when, due to lack of money, it faces problems such as limited or uncertain availability of nutritionally adequate and safe foods, or limited or uncertain ability to acquire acceptable foods in socially acceptable ways. Thus, the concept of household food insecurity includes not only undernutrition and hunger but also householders' perceptions of problems with the quantity and quality of food available, uncertainty of food supply and experiences of going hungry (Carlson et al. 1999). Nevertheless, when food insecurity is severe or prolonged, hunger is likely to be present (Coates et al. 2006).

Food security has multiple aspects: availability, food safety, economic access and social acceptability (Hamilton et al. 1997). No single measure can capture these multiple dimensions. Four approaches have commonly been used to assess household food insecurity in epidemiological studies — measures of dietary energy supply, measures of individual food intake, anthropometric measures and experiential measures of inadequate food access or availability. Experiential measures are based on the idea that the experience of food insecurity causes predictable reactions and responses that can be reported in a survey and quantified and summarized in a scale to provide an indicator of the degree of a household's food insecurity. Compared with the first three approaches, experiential measures are simpler and less expensive and they have been found to be valid for application to diverse populations (Coates et al. 2003; Frongillo and Nanama 2003; Hamilton et al. 1997).

Two validated questionnaire measures developed in the U.S. are widely used to assess experiential food insecurity caused by poverty. The first is an 18-item Household Food Security Scale (Hamilton et al. 1997). This scale includes items about food conditions among children, if any are present in the household, as well as adults. The 18-item scale supports differentiation of four categories of food security: food secure, food insecure without hunger, food insecure with moderate hunger and food insecure with severe hunger[1]. The second measure is a 6-item scale comprising a subset of the above-mentioned 18 items, which was developed by researchers at the National Center for Health Statistics (Blumberg et al. 1999). It differentiates three categories of food security: food secure, food insecure without hunger, and food insecure with hunger, but cannot differentiate moderate from severe hunger. Despite its brevity, this measure is considered valid for classifying household food insecurity in a general population (Blumberg et al. 1999; Dastgiri et al. 2007). It is the measure of choice in surveys with constraints related to cost, time and respondent burden.

India committed to halving hunger by 2015 at the 1996 World Food Summit in Rome, Italy (United Nation's Food and Agriculture Organization 1996). Hence, understanding and addressing household food insecurity issues related to the urban poor, which comprise about one-tenth of India's 1.1 billion population, is pertinent. At present, such an understanding is limited, there being only one Indian study of experiential household food insecurity, but this was of the rural poor in Orrisa (Nord et al. 2002), not of the urban poor.

The work described in this paper explored levels and determinants of economic access to adequate food among slum residents of a city in North India. An experiential measure of household food security was developed to measure economic access to adequate food. The findings suggest programmatically feasible options to address the issue of food insecurity at the slum level.

[1] The U.S. Department of Agriculture used these food security category labels in its early food security research (Hamilton et al. 1997). Subsequently, the categories "food insecure with moderate hunger" and "food insecure with severe hunger" were collapsed into a single category "food insecure with hunger." Beginning in 2006, new category labels were introduced: "low food security" replaced "food insecure without hunger" and "very low food security" replaced "food insecure with hunger".

Methods

Study setting

The present study was household-based and cross-sectional. It was conducted in *Janta Mazdoor* colony, one of the 36 slum clusters in Shahdra North, the North-East district of Delhi. The population of the 36 slum clusters was 236,000 (Agarwal et al. 2007). *Janta Mazdoor* colony is a densely populated with approximately 70,000 persons and was selected because of the feasibility of data collection. This was owing to an urban health program of a non-government organization (NGO), which was operational in the slum for a 1 year period prior to the initiation of our study. The NGO consented to participation in our work and this aided entry into the slum by the data collection team. Selecting *Janta Mazdoor* was also apt as it had not been exposed to any household food and nutrition security interventions by the NGO except for promoting access to national food assistance programs by facilitating the availability of below poverty line cards to residents.

Data collection

A team of two trained nutrition postgraduates, who were not involved in the program activities of the NGO, collected the data between June 1 and July 15, 2008.

The respondents were adult females of the household who were≥18 years of age (unmarried or married without children or married with children or divorced or widowed) and who were involved in cooking and purchasing food and were thus aware of household food insecurity conditions. It has been repeatedly suggested that household food insecurity is best documented in adult women as young children are generally protected from the consequences of household food insecurity until this is severe (Olson 1999; Townsend et al. 2001; Nord and Bickel 2002; Adams et al. 2003). Hence, selecting adult females as respondents seemed apt.

A household was defined as people who 'normally lived together' (slept under the same roof) and shared food from a common kitchen. 'Normally' implied that temporary visitors were excluded but temporary stay-aways were included.

A sample size of 385 was calculated to estimate a hypothesized prevalence of 50% with a margin of error of 5 percentage points and 95% confidence, assuming a design effect of one. We hypothesized 50% prevalence for household food insecurity as no prior estimates were available in the study population and 50% required the largest sample size. The calculated sample size of 385 was inflated to 410 assuming a non-response rate of approximately 5%.

Respondents were identified with the assistance of field workers of the NGO. *Janta Mazdoor* colony was divided into 10 catchments and all 10 catchments were covered. Within each catchment, at least 40 respondents, who were identified using a systematic random sampling procedure and conformed with the sample eligibility criteria were selected.

A total of 456 eligible respondents were visited in their homes. Of these, 410 consented to participate in the study and were included as the final study sample. Data were collected through household-based face-to-face interviews using a pre-tested interview schedule. Prior to data collection, the respondents were informed that their responses were important only to the researchers' understanding of food insecurity among slum dwelling urban poor caused by poverty and would not entitle them to any financial assistance. Providing this information was important as the responses were subjective and could be skewed if there were expectations that they would affect financial assistance.

The following data were requested from respondents (information was cross-checked through observation, when possible):

i) Household characteristics — religion, family size, respondent's literacy level, literacy level of head of household and number of currently employed family members. Family size was defined as total number of persons in the household.

ii) Employment and income: Family members who were carrying out paid work and were employed in this work in the 30 days preceding the enquiry were considered as currently employed. Total numbers of currently unemployed family members was divided by total number of currently employed family members to arrive at a currently unemployed: employed ratio. The monthly income for each currently employed family member was calculated and summed and the average monthly income of the household calculated.

iii) The socio-economic status of households was assessed using District Level Household Survey Standard of Living Index (SLI) (International Institute for Population Sciences and ORC Macro 2006). The index is calculated by summing the scores, which are based upon the relative significance of ownership of the specific household assets — drinking water, types of house, source of lighting, fuel for cooking, toilet facilities and ownership of items: fan, radio/transistor, sewing machine, television, bicycle, motor cycle, car, tractor. In the present study sample, the SLI scores varied between 5 and 21. Study samples were placed in three SLI classes: Low SLI (Score <33rd percen-

tile); Medium SLI (greater than 33rd but less than 67th percentile) and high SLI (greater than 67th percentile).

iv) Household Monthly Per Capita Expenditure (MPCE): To assess the MPCE of the household, the household consumer expenditure schedule used by National Sample Survey (2005–06) (National Sample Survey Organization 2008) was simplified and adapted to an urban context. Groups of expenditure items included — food, fuel, conveyance, medicinal, water, electricity, rent and non-food daily items. The reference period of recall was generally the last 30 days but for some less frequent purchases such as clothing, footwear, education, medical care (institutional) and expenses on ceremonies/religious festivals/out station visits, it was the last 365 days. The total expenditure incurred by households on domestic consumption during the reference period was divided by the family size to arrive at MPCE.

v) Household Food Insecurity: In the present study a 4-item version of the short-form six-item HFSS developed by Blumberg et al. (1999) was used after pretesting and adaptation to context to ensure that it was well understood. The questions were asked in Hindi and respondents were asked to refer to the experience of adults in the household only. The sequence of questions that was revised by the U.S. Department of Agriculture (2008), was used in the present study. The four items in the present study included:

(1) "The food that [I/We] bought just didn't last, and [I/We] didn't have money to get more". Was that often, sometimes, or never true for you in the last 12 months?

(2) "[I/We] couldn't afford to eat balanced meals". Was that often, sometimes, or never true for you in the last 12 months? Balanced meals may contain starchy food such as rice, potato, bread and wheat; and a protein-rich food such as meat/fish/milk/curd, pulses and fruits and vegetables.

(3) In the last 12 months, since (date 12 months ago), did you (or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food? Was that almost every month, some months but not every month, in only 1 or 2 months, never?

(4) In the last 12 months, since (date 12 months ago), were you ever hungry but didn't eat because you couldn't afford enough food? (Yes, No)

Thus, compared with the original HFSS six-item scale, it can be noted that the cut/skip item and its 'How Often' follow-up were merged to simplify non-computerized administration. The 'eat less' item was omitted because preliminary qualitative assessments suggested that it could not be discriminated satisfactorily from question 3 in the context in which the scale was administered.

Questions 1 and 2 were coded as affirmative for the responses "often" or "sometimes," question 3 as affirmative for responses "almost every month" or "some months but not every month," and question 4 as affirmative for the response of "yes."

As the terms "often," "sometimes," "almost every month," and "some months but not every month" could be interpreted differently by different respondents, a follow-on question was added if these responses were given to Questions 1, 2 and 3. The follow-on question was, "How many months did that occur in the last year?" Based on the responses, the researcher categorized 10–12 months as "often" or "almost every month" and 3–9 months as "sometimes" or "some months".

"Balanced meal" represented a measure of dietary quality as perceived by the respondent. The added explanation to clarify the meaning of "balanced meal" has been used in previous food security surveys (Gulliford et al. 2003; Gulliford et al. 2006).

In the present study, households with zero or 1 affirmative response were classified as food secure, those with 2 or more affirmative responses were classified as food insecure and those with 3 or more affirmative responses were classified as food insecure with hunger. Considering the coding of responses, the food insecure classification represents a somewhat more persistent condition than the corresponding category used in the United States, while the food insecure with hunger classification is roughly equivalent to the category "very low food security" (previously called "food insecurity with hunger") in the United States.

For further use of this or a similar measure in India, especially in any official capacity, a panel of experts should be convened to select cutoffs and language to describe the ranges of severity that are appropriate in the linguistic and policy context of India. While the "food insecure with hunger" range is roughly equivalent to that used in the United States, it results in a substantially larger percentage of households classified as "food insecure with hunger" than the percentage that directly reported having been hungry but not eating because of limited resources. The cutoff used here results in a percentage of households classified as food insecure with hunger that is about the same as the percentage reporting that they repeatedly cut the size of meals or skipped meals. Research on the physiology of hunger, summarized in Hamilton et al. (1997, Appendix A), links the physiological experience of hunger to behaviors such as these, so there is theoretical justification for this threshold. Nevertheless, an expert consultation on the issue would be appropriate prior to any official or high-visibility use of the measure.

Statistical analysis

First, standard univariate descriptive statistics were calculated. Then, bivariate associations of food insecurity (combining with and without hunger) with household socio-demographic characteristics, employment, household MPCE on food, and household SLI were examined by cross-tabulation. The statistical significance of the bivariate associations was assessed using Chi-square tests for homogeneity. Finally, the net associations of food insecurity with literacy of household head, family size, employment, and SLI were examined in a multivariate logistic regression analysis. As MPCE on food is an outcome or another manifestation along with food insecurity, while it was included in bivariate analysis as an external validation measure, it was not included in the adjusted multivariate analysis. All analyses were conducted with STATA 9.1 (STATA Corporation, college station, TX, USA). P values <0.05 were considered statistically significant.

The internal consistency and reliability of the four-item scale were examined using item point bi-serial correlations and Cronbach's alpha. Cronbach's alpha is reported because it is a familiar statistic, even though it can be distorted in scales such as these, comprising dichotomous items that differ greatly in severity. Streiner and Norman (1989) suggest that values for alpha should exceed 0.7, while values in excess of 0.90 might be suggestive that some items are redundant.

Rasch-model-based item severity parameters and fit statistics were estimated using conditional maximum likelihood methods described by Fischer and Molenaar (1995) and implemented in SAS data steps. Conditional maximum likelihood methods are preferred for small item sets. The Rasch-model assumes that all items discriminate equally. Rasch-model-based item's infit statistic essentially measures the extent to which the item discriminates more or less sharply than the average item in the scale. Infits less than 1 indicate that item discriminates more sharply than the average. Infit values too far above or below 1 raise questions as to the suitability of the item for inclusion in the scale. In general, infits between 0.8 and 1.2 are considered quite good, and infits between 0.7 to 1.3 may be acceptable. Item outfit statistics were also examined. This statistic measures the extent of highly improbable responses. Outfit values substantially above 1 indicate a greater than expected frequency of erratic or highly unusual responses. This may indicate that the item is misunderstood by some subset of the population, or that it is a behavior with a somewhat erratic relationship to the underlying construct of food security. The outfit statistic is, however, very sensitive and can be inflated by only one or two highly unexpected responses in a sample of several hundred. Thus, as long as the infit for the item is reasonable, high outfit is not usually grounds to drop the item. It may suggest the need for cognitive or other qualitative research, however, to improve the item (Nord et al. 2002).

Results

Sample characteristics

Out of 410 respondents, 86.1% were Muslims and 13.9% were Hindus (Table 1). The respondents were aged between 18 and 50 years. Illiteracy rates were high amongst the respondents (64.9%). The head of the household was a male in all households. In 44.6% households the head of households was illiterate. Few (15%) of respondents were living in rented homes while the remaining 85% lived in their own homes. Average family size was six. In most (58.8%) households there was only one currently employed family member (Mean, SD: 1.6, 0.9). Occupation of the employed members included rickshaw pulling, daily labour, domestic servant, carpentry, mechanic/electrician and vendor. Currently unemployed: employed ratio in the families was >3: 1 in 46.6% families. About one-third (29.8%) families had a low SLI (Table 1).

The average MPCE was Rs. 1,102/-. Half (50.2%) of households had MPCE above Rs. 890/-, 26.3% households had MPCE between Rs. 580–890/- and 23.4% households had MPCE less than Rs. 580/-. Average MPCE on food was Rs. 530/- (Mean, SD: 530, 255). Average MPCE on non-food items was Rs. 619/- (Mean, SD: 620, 557).

Internal consistency of the household food security scale

Item severity parameters ranged from -4.75 (SE 0.464) for the balanced meal item to 4.98 (SE 0.724) for the hungry item (Table 2). The range of nearly 10 logistic units implies that responses were consistently ordered across respondents and that the scale comprising the items can differentiate severity of food insecurity across a rather wide range.

Cronbach's alpha (0.80) and point biserial correlations in the range of .55 to .58 suggest that the items are all related to the same underlying trait.

Infit statistics for the four items ranged from 0.77 to 1.07—well within a range (0.7–1.3) considered to meet the Rasch-model assumption of equal item discrimination. The outfit statistic was somewhat elevated for cut meal size or skipped meal item (4.63), suggesting that at least a few respondents gave highly improbable responses to it, considering their responses to other items (Table 2).

Table 1 Selected characteristics of the study sample, N=410

Characteristics	No.	%
Religion		
Hindu	57	13.9
Muslim	353	86.1
Literacy level of respondent		
Literate	144	35.1
Illiterate	266	64.9
Literacy level of head of household		
Literate	277	55.4
Illiterate	183	44.6
Family size (Mean, SD: 6, 3 Min: 1, Max:19)		
<=4	92	22.4
5–6	134	32.7
7–8	106	25.9
9 or more	78	19.0
Currently employed members in family (Min, Max: 1, 6: Mean, SD: 1.6, 0.9)		
>2	58	14.1
2	111	27.1
1	241	58.8
Currently unemployed members/ employed members ratio		
2:1 or less	131	32.1
3:1	87	21.3
4:1	68	16.7
5:1 or more	122	29.9
Standard of Living		
High	108	26.3
Moderate	180	43.9
Low	122	29.8
Total monthly per capita expenditure (MPCE)		
>890	206	50.2
580–890	108	26.3
<580	96	23.4
MPCE on food (Rupees)		
>890	30	7.3
580–890	104	25.4
<580	276	67.3
MPCE on non-food (Rupees)		
>890	66	16.1
580–890	91	22.2
<580	253	61.7

Extent of household food insecurity

Two-thirds (65.8%) of households reported that they sometimes or often could not afford to eat balanced meals in the 12 months preceding the survey (Table 3). Similarly, 51.7% households sometimes or often faced the problem of 'food not lasting for the purchased period and having no money at hand to buy more food'. 'Cutting size of meals or skipping meals' was sometimes or often faced by 23.9% households. Few (14.7%) households ever faced a condition wherein 'one or more family members were hungry but family could not afford to buy food'. A total of 135 households (32.9%) never faced any of the above 4 conditions. Overall, 51% households were 'food-insecure' (27.1% food-insecure without hunger and

Table 2 Internal reliability, item severity and internal validity of the 4-item scale

Item (prefaced with 'in last 12months')	Item point biserial correlation	Item Severity (SE)[a]	Infit Statistics	Outfit Statistics
Balanced meal	0.58	-4.75 (0.46)	1.00	0.31
Food did not last	0.69	-2.2 (0.4)	0.77	0.55
Cut meal size or skipped meal	0.64	1.97 (0.52)	1.07	4.63
Hungry all day/night	0.55	4.98 (0.72)	1.00	0.19
Cronbach's Alpha for 4-item scale (scale reliability co-efficient)	0.80			

[a] under Rasch model convention thresholds are scaled so arithmetic mean is zero

23.9% food-insecure with hunger). The remaining (49%) households were 'food-secure'.

Correlates of household food insecurity

In bivariate analysis (Table 4), significant differences ($p < 0.05$) between food insecure vs. food secure households were observed by illiteracy level of head of household (50.7% vs. 38.2%), family size of 7 or more (52.6% vs. 36.8%), unemployed: employed family member ratio>3: 1 (53.4% vs.39.5%) and moderate/low standard of living (84.7% vs. 72.2%). Low food spending is a symptom (almost an aspect) of food insecurity. In the present study, families whose MPCE on food was reportedly less than Rs. 580 were more likely to be food insecure (78% vs. 56.2%), thus externally validating the food security measure used.

In the adjusted multivariate model, illiteracy level of head of household and family size did not emerge as significant predictors of household food insecurity as revealed through their Odds Ratio (OR) and Confidence Interval (C.I.). Households where unemployed: employed family member ratio was>3: 1 were twice as likely to be food insecure (OR 2.1 C.I. 1.2–3.4) as households where this ratio was 2:1 or less. Compared to high SLI households, those households with moderate SLI were nearly three times more likely (OR 2.7 C.I. 1.6–4.7) and low SLI were nearly five times more likely (OR 4.9 C.I. 2.7–8.9) to be food insecure (Table 4).

Discussion

Several important findings emerged from this study. First, a large proportion (51%) of urban slum dwellers were food-insecure. Second, predictors of experienced household food insecurity are directly or indirectly related to low income (currently unemployed: employed family member ratio>3: 1 and moderate to low SLI). Lastly, the adapted scale was simple and easy to administer in household settings, and the

Table 3 Responses to individual items on the household food security scale, N=410

	No.	%
a) Affirmative responses to individual items:		
1. 'Couldn't afford to eat balanced meals' (often/sometimes)	270	65.8
2. 'Food did not last and no money for more' (often/sometimes)	212	51.7
3. 'Cut size of meals or skipped meals' (almost every month/some months)	98	23.9
4. 'Hungry but couldn't afford food'	60	14.7
b) Summed affirmative responses (Raw Score)		
0	135	32.9
1	66	16.1
2	111	27.1
3	40	9.8
4	58	14.1
Food secure households[a]	201	49.0
Food insecure– without hunger[b]	111	27.1
Food insecure– with hunger[c]	98	23.9

[a] None or one affirmative response

[b] Two affirmative responses

[c] Three or four affirmative responses

Table 4 Selected characteristics of food insecure households vs. food secure households

Independent variables	Column %		Unadj. OR (C.I.)	Adj. OR (C.I.)[a]
	Food secure Households (*N*=201)	Food insecure Households (*N*=209)		
Literacy level of head of household				
Literate	61.7	49.3	1.6 (1.1–2.4)	1.4 (0.9–2.2)
Illiterate	38.3	50.7		
Family size				
<=4	26.9	18.2	1.2 (0.9–2.0)	0.6 (0.5–1.8)
5–6	36.3	29.2	2.1 (1.3–3.5)	1.6 (0.9–3.1)
7 or more	36.8	52.6		
Currently unemployed/employed member ratio				
2:1 or less	39.5	25.0		
3:1	21.0	21.6	1.6 (0.9–2.8)	1.1 (0.6–2.2)
>3: 1	39.5	53.4	2.1 (1.3–3.5)	2.1 (1.2–3.4)
Socio-economic status				
High	37.8	15.3		
Moderate	41.8	45.9	2.7 (1.6–4.5)	2.7 (1.6–4.7)
Low	20.4	38.8	4.7 (2.6–8.2)	4.9 (2.7–8.9)
MPCE on food (Rupees)				
>890	11.4	3.3		
580–890	32.3	18.7	2.2 (0.9–5.1)	
<580	56.2	78.0	4.0 (1.8–8.7)	

[a] Adjusted for: literacy level of head of household, family size, currently unemployed/employed family member ratio, standard of living

OR (C.I.) = Odds Ratio (Confidence Interval)

scale demonstrated good internal reliability and reasonable internal validity.

The finding that 51% households were food-insecure highlights an urgent need for re-positioning and added focus on nutrition and food security programs for the urban-poor. Even if 51% is taken as an overestimate in view of it being a self-reported response, 51% food insecurity in urban slum dwellers of Delhi correlates well with disaggregated data from the Third National Family Health Survey (Urban Health Resource Centre, unpublished data). These data showed that, in Delhi, 57.7% of urban poor children under five are stunted and 14.8% of women suffered from acute undernutrition, figures which can be considered as nutritional outcomes of food insecurity. However, all food-insecure households may not necessarily be nutritionally insecure. Further studies in the Indian context of the assessment of food and nutrition security using such a rapid HFSS coupled with anthropometric assessments of women and /or children could be carried out. Such studies might bring out the association of food and nutrition security and at the same time test the sensitivity and specificity of the rapid HFSS.

Studies in other countries have found food insecurity to be strongly associated with low income (Tingay et al. 2003), unemployment of father, overcrowding (Gulliford et al. 2005) and household capacity to save money (Nolan et al. 2006). The present study showed a significant association between high unemployment to employment ratio and household food insecurity. Employment related food insecurity in the urban poor set-up has much to do with the pattern of employment amongst urban poor slum dwellers and, in the present study area, casualisation and erratic patterns of employment among households were reported (Agarwal et al. 2007). Among the urban poor, relative prices of commodities retailed are higher, levels of daily wage are lower and there are simultaneous pressing expenses such as paying rent, education and entertainment. This decreases the proportion of their income spent on food (M.S. Swaminathan Foundation 2002; Agarwal et al. 2007). Furthermore, in the present study, average family size was six and currently unemployed: employed ratio was greater than 3: 1 in as many as 47% families. Apart from all these issues, this segment of the population spent a large proportion of their money on ceremonies/festivals, repayment of loans borrowed at high interest and on alcohol (Agarwal et al. 2007). In the present study, only 20% respondents had a bank account. All these factors could possibly have increased the chance of food insecurity with hunger prone conditions (which was seen in 23.9% households). Food access is dependent on access to livelihoods

which in turn is dependent on having a job. There is a need to promote community awareness of the government's existing livelihood generation programs and to link the urban poor community with the government departments implementing these schemes. Efforts which promote opportunities for entrepreneurship can be experimented with e.g., urban poultry farming or other untapped existing urban/peri-urban agricultural opportunities where reasonable land is available. Skill upgrading, training, community linkages with potential private employers/industrial units can improve employability and opportunities to obtain gainful livelihoods.

In the present study as many as 20% low SLI urban poor families were food-secure (Table 4). This finding provides evidence that despite poverty a substantial proportion of families can achieve successful outcomes (with respect to food security in this instance). Families who experience successful outcomes despite income constraints are called positive deviants (PDs) (Wishik and Van der Vynkt 1976). It would be worth learning the coping mechanisms adopted by PDs during food insecurity months and analyzing factors leading to their efficacy in achieving food security. Such findings will give leads to — i) culturally acceptable behaviors/coping approaches adopted by PDs to achieve food security despite income constraints, which can be promoted; ii) understanding the logic of PD households behind practicing positive behaviors and identifying effective motivations for promoting positive behaviors and iii) key influencers of positive behaviors within PD families, who can be then motivated to promote recommended behaviors in their neighbourhood. In the urban context, where the social support system is weak, motivating and training community members to form groups who could contact and advise peers from the same community would help families make effective nutritional choices and improve their access to information, linkages to food-security and nutrition services and provide a support system to rely on (Agarwal et al. 2008). Such initiatives have the potential of motivating other neighborhoods and their lessons can be adopted in other cities. Promoting community contributions for development of a community grain bank for coping with periods of food scarcity has been successfully implemented in rural areas (Biswa 2008 online access) and could be tried in urban slums.

Regarding the consistency of the scale, responses to the items in the 4-item HFSS were found to be reliably associated with the trait of food insecurity based on the point biserial (item-score) correlationsand the acceptable value of Cronbach's alpha, which was close to the 0.86 reported in US data (Hamilton et al. 1997). Since alpha is associated with the number of items in a scale, a somewhat lower value might have been expected for a scale with only four items, and with the percentage of affirmatives ranged from 14.7% to 65.8%. Thus, the observed value of 0.80 may be considered even stronger evidence of the internal validity of the measure. The validity of the measure was also supported by the generally satisfactory fit with the Rasch model. Yet, the high outfit statistic of the 'cut meal or skip meal' item indicates that it was inconsistently understood or responded to by a small number of respondents. Further qualitative assessment may be in order to improve the item. However, outfit statistics can reflect unusual responses of a very small number of respondents, and the small number of items in the scale may also have contributed to the high outfit of this item, so it is not certain that the item is problematic.

Furthermore, while in the present study the item 'cut meal size or skip meal' and its 'how often' follow-up were combined into a single item, it is worthwhile maintaining the follow-up structure. This allows coding of the item for recurring cutting/skipping, which is more consistent with the labeling of the category as food insecure with hunger. The utility of asking separate questions about cutting the size of meals and skipping meals should also be explored. These denote distinct behaviors which indicate distinct levels of severity. The added item would be likely to increase the scale's precision and reliability as well. More research is also required to gauge the appropriateness of dropping the 'eat less' item for applications in poor communities in low-income countries. In higher-income contexts, this item differs from the 'cut meal size or skip meal' in that the reference standard for 'eat less' is the amount the respondent thinks they should eat, whereas the implied reference standard for 'cut meal size' is the amount normally eaten (which could be in excess of need). However, in chronically low-income households, that distinction would generally be narrow as they are already consuming marginally sufficient or insufficient numbers of calories. Possibly, it would be worth preceding such interviews on food security with focus group discussions to gauge how low income people perceive their food security situations, coping strategies they use in such situations and what their interpretations of each item are. This process would enhance the appropriateness of the items to the context in which they are applied.

Strengths and limitations of the study

The present study was one of the first slum-based studies on experiential household food insecurity in India. Data were collected through face-to-face interviews and there were no missing values amongst the sample. Sample size was adequate for the purpose and the scale assessment statistics indicated good reliability implying that the questions were well framed and that respondents gave attention to the questions, understood them, and gave thoughtful responses.

However, the study had some limitations that suggest its findings should be interpreted cautiously. First, the study was conducted in a single slum and may not be representative of conditions in all slums in North-east Delhi or in other parts of the country. Second, since findings are based on self-reported measures, they may include a subjective component related to social expectations, and comparisons across different populations may not be valid. Lastly, there is evidence that HFSS can be used for surveillance of food insecurity and low energy intakes accurately but that it is not accurate for nutrient intake (Dastgiri et al. 2007). However, in the present study as the nutritional status of women and children was not assessed, nor was a diet survey carried out, an association between perceived food insecurity assessed through HFSS and nutrition insecurity assessed through a diet survey and anthropometric assessment could not be made.

To conclude, significant association of unemployment with food insecurity highlights the need to link urban poor with employment generation avenues, schemes, skill upgrading, training and linkages with potential employers. Awareness of low cost nutritious food items and appropriate cooking methods can be generated and coping strategies adopted by PDs during food insecure periods can be promoted. Non-government organizations, *Anganwadi* workers and community welfare societies can play pertinent roles in the above-mentioned processes. Finally, although the 4-item HFSS performed adequately, further development is recommended to improve it and to ascertain its sensitivity for identifying nutrition as well as food insecure populations. Such populations could then be compared with those identified through dietary and anthropometric methods.

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Authorship Statement SA conceptualized and designed the study and participated in conceptualization of the paper. VS conceptualized the paper and analysis plan, conducted the descriptive data analysis and drafted the manuscript. AA designed the study tools and supervised data collection and data entry. AA also participated in conceptualization of the paper. PG and MJ collected the data, carried out the data entry and participated in data interpretation. MD conducted the Rasch model analysis and wrote related sections of the manuscript. All authors provided inputs in reviewing and editing the manuscript.

Conflict of Interest None.

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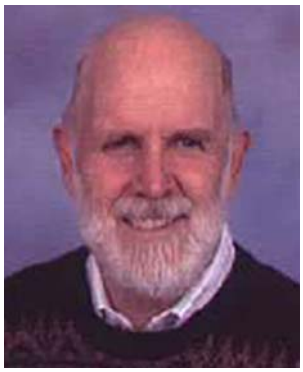

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