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A Measure of Uncertainty: The Nature of Vulnerability and Its Relationship to Malnutrition

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Terms such as 'vulnerability' and 'insecurity' are used widely in the general nutrition literature as well as in work on humanitarian response. Yet these words are used rather loosely. This paper argues that more clarity in their usage would benefit those seeking a bridge between development and humanitarian problems. Since vulnerability is not fully coincident with malnutrition, poverty or other conventional indices of human deprivation, public action must be based on a better understanding of the nature of crises and human uncertainty beyond physiological and nutritional outcomes. More attention is needed to be paid to the context-specific nature of risks, the capacity of households to manage such risks and the potential for public action to bolster indigenous capacity through targeted development investments, not just relief.

Keywords: vulnerability, risks, malnutrition, needs assessment.

Introduction

John Snow (1855) continues to be lauded for the ground-breaking work on cholera in which he identified water as a medium through which contagious disease can be transmitted. Yet his contribution went further than that. He also drew attention to the synergy between 'predisposing causes' (Susser, 1998: xiii) (the characteristics of person or place that determine the impact of a given hazard), and 'localizing influences' (ibid.) (factors which enable some people or places to cope better than others). In other words, Snow suggested that the vulnerability of individuals or groups is not predetermined — the outcome depends on an interaction among contextual processes that allow some people to mitigate the impact of a hazard better than others.

Today, practitioners of development and humanitarian relief make wide use of such epidemiological insights. Chambers' discussion of vulnerability refers to 'defencelessness, insecurity and exposure to risks, shocks and stress … and difficulty in coping with them' (1989: 1). Other authors have elaborated on this conceptualisation, each stressing that exposure to drought, pests or conflict is *not* the only factor determining crisis outcomes (Downing, 1991; Longhurst, 1994; Blaikie et al., 1994; Riely, 1996). Households cope with hazards in different ways according to their

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Vulnerability can be viewed as:

$$V\ (\text{Vulnerability}) = H\ (\text{Hazard}) - C\ (\text{Coping})$$

Where,
H is a function of:

- Probability (the statistical likelihood of an event or process occurring)
- Primacy (shock value based on time elapsed since previous occurrence)
- Predictability (the degree of warning available)
- Prevalence (the extent and duration of hazard impacts)
- Pressure (intensity of impact)

And C is a function of:

- Perceptions (of risks and potential avenues of action, based on prior experience, information flows and expectations of group behaviour)
- Possibilities (options for action ranging from hazard avoidance and insurance, through income diversification, depletion of savings and divestment of productive assets, to physiological compromise or household dissolution)
- Private Action (the degree to which social capital cements or unravels community bonds in times of stress — the distribution of sharing and caring)
- Public Action (the behaviour of non-local agents of change before, during and after crises in supporting or ignoring local needs)

Figure 1 A conceptual framework for understanding vulnerability

capacity, which is itself determined by prior experience, access to information, subjective perceptions of potential loss or gain, cultural norms, and even rational expectations of public assistance (see Figure 1).

By extension, it is crucial in the design of effective relief, and even development, interventions to look beyond conventional targeting categories of 'at risk' people based principally on physiological or anthropometric parameters. Hazard risks, their impacts and local responses are not predetermined by individual or location — some are more resilient to shocks than others. That is why malnutrition is not always coincident with (or perfectly explained by) familiar measures of poverty, food shortage or human development. Certain synergies among factors play out one way in one place, but differently elsewhere. While assessments of medical or nutritional conditions are important in their own right, they are therefore insufficient on their own to assess vulnerability.

This paper offers an overview of key issues in the analysis of vulnerability with particular attention to relationships among nutritional-status indicators and other measures of human development. It is argued that vulnerability should be seen not only in terms of individual harm but linked to the broader context of crises, including the differentiated nature of responses across households and communities. A better understanding of the uncertainties that underscore human behaviour in risky environments is a first step not only towards crisis prevention but also to making development sustainable.

'Women and children first!'

Uncertainty about the outcome of one's actions is a fundamental aspect of life — the basis of aversion to personal loss, but also the essence of innovation (Bernstein, 1996).

However, we do not all share an equal capacity to manage uncertainty. While much development policy seeks to improve the ability of poor people to deal more effectively with the socioeconomic risks and potential returns that they encounter, humanitarian relief comes into play when local capacity to mitigate risk fails for large numbers of people.

The immediate response to crisis involves trying to match large-scale needs with limited resources. The 'needs' definition is fairly clear where medical trauma is involved. Processes of triage discriminate between patients requiring immediate attention (for whom the chance of survival is reasonable), and those who can wait to be treated. Although the individual is the focus of analysis, certain objective categories (smokers, high body weights, previous history of heart disease) often help classify relative risk to specified medical outcomes (Yohannes and Webb, 1999).

The same is often true with regards to malnutrition. Although operational agencies may use different benchmarks and protocols, it has long been assumed that 'nutritional vulnerability' is inherently highest among certain age/gender categories, such as women and children, in general, and children under five years old and pregnant or lactating mothers, in particular (Levinson, 1991; Engle, 1996). During the 1990s, numerous agencies officially recognised the largely unmet special needs of women and children (Jahan, 1995; World Bank, 1997). For example, the World Food Programme (1997) established a policy of identifying 'women and children whose nutritional vulnerability is directly linked to a lack of sufficient and appropriate food intake' (1997: 2). During crises WFP seeks to channel up to 80 per cent of food assistance into the hands of women. Similarly, UNHCR accorded priority attention in its Rwanda Women's Initiative to 'the most vulnerable: [female] heads of household and widows' (1998: 78).

The tradition of focusing on women and children as priority groups, particularly in emergencies, is desirable. No one suggests that they should have *less* attention than they now receive. Indeed, much remains to be done to make public action more responsive to their needs, and many agencies have only recently formalised policies in that direction. More sensitivity is, however, called for in the analysis of vulnerability beyond the realm of physiology. It is not always appropriate to extend the principles of personal harm to the context of group vulnerability to economic and social losses, even if these also include negative nutritional outcomes.

There is growing evidence that since women and children are not uniform categories, they are not equally or uniformly vulnerable. The implicit coupling of 'women' with poverty, food insecurity or vulnerability has been challenged by researchers who argue that this confuses overlapping, but separate, issues (Jackson, 1996; O'Laughlin, 1998). The tendency to equate generalised poverty with female gender implies that women-targeted anti-poverty programmes will necessarily improve the status of all women versus men, and also that raising women's income will in itself remove generalised poverty. Neither assumption is tenable because of wide divergences not only in the status of women but also in the causes of poverty and in the success or failure of operational responses (Buvinic and Gupta, 1996). Some women are less poor, better nourished and have more coping options than other women, or men. As a result, women are not invariably more vulnerable to morbidity, malnutrition or mortality than men in a development context (Payne and Lipton, 1994; Haddad et al., 1996), or during crises (Rivers, 1988; Seaman, 1993; von Braun et al., 1998).

The same holds for generalisations about children. The range of physical, developmental and cultural risks facing children varies widely by age, sex, household

class or caste, seniority (linked to mother's status) and care patterns (Engle et al., 1996; Svedberg, 1999). Some age cohorts face more nutritional difficulties than others regardless of gender, and some individuals of the same age and gender survive crises better than others thanks to education, social capital and socialisation (Toole, 1996; Sahn and Alderman, 1997). As Rivers points out, 'physiological vulnerability is … modified by social factors which can totally reverse … expected effects. Although children are more physiologically vulnerable, increased death rates among children are not the invariable consequences of famine' (1988: 91).

It is instructive that in 1849 more than 53,000 people died of cholera in England, but mortality was not concentrated among women and children, or even among the poor. Although it was a 'little girl' who contracted the first case of cholera in July of that year, not only did she survive but children under 15 accounted for less than 27 per cent of all fatalities (Snow, 1855). Similarly, more adult men died than women, in a ratio of 100:80. Furthermore, poorest Londoners did not suffer disproportionate mortality since their rate was 'as low as that of the most opulent classes' (Snow, 1855: 135–6). In other words, local socioeconomic context and individual resiliency were both determinants of outcomes.

This point has been taken up by humanitarian practitioners concerned with the over-simplification characterising many crisis planning and response activities. For example, Seaman's review of seven African famines concludes that 'adolescents have sometimes suffered disproportionate mortality' (1993: 28) and that sex-specific differences in mortality 'favours females in some cases, males in others and different risks in different age groups' (1993: 30). Similarly, work in Somalia, Sudan, Rwanda/Zaire, Mexico, Russia and the Middle East has shown that school-age children, adolescents, male adults and the elderly can be highly vulnerable to negative outcomes (Varley, 1996; Davis, 1996; Byrne and Borrel, 1997; Watson, 1997; Salama and Collins, 1999).

What is more, not only is the increase in risk of a negative outcome proportionately greater among such groups than among infants and young children, they are often overlooked by targeted relief interventions (Young and Jaspars, 1995). The relative neglect seems to occur because of standard assumptions about vulnerability during needs assessments, a lack of technical guidelines for measuring and responding to such groups, the public relations focus on women and children and a lack of shared experience (Ferro-Luzzi and James, 1996; Salama and Collins, 1999; Jaspars and Shoham, this volume).

Clearly the characteristics of the individual matter, but these must be understood as only one part of the vulnerability equation. A nutritional problem or life-cycle status represents an input into understanding potential risks and responses, it is not simply a final output of such processes. Thus, assessments of physiological vulnerability to increased morbidity and mortality based on pre-assigned age/gender categories (important in themselves) should be enhanced by analysis of predisposing and mitigating factors for all demographic groups at household, community and regional levels.

A risky predisposition

The assessment of vulnerability beyond physiology is certainly not immune from simplified assumptions and generalisations.[1] For example, the idea that whole

continents and nations can be classified as 'famine prone' has a long and colourful history (Mackinder, 1904; Huntington, 1933), and it occasionally reappears despite clear evidence to the contrary (Cox, 1981; Cuny, 1999). However, institutional attention to the risks facing poor people has become very sophisticated very fast, and typically does a good job at challenging received wisdom and many grosser assumptions (Riely, 1998).

The systematic assessment of risk in developing countries is usually traced to the 19th-century Indian Famine Codes with subsequent 20th-century iterations in the Sudan and former Rhodesia, and post-colonial systems across Africa and Asia specialised in monitoring locusts, bovine diseases or drought (Drèze, 1989; Iliffe, 1990). In the post-colonial era interest in institutionalised early warning grew in the 1970s during years of renewed Indian and African drought coupled with falling food stocks worldwide. That period generated many new national, regional and global systems that had climatic forecasting and agricultural assessments at their core (Buchanan-Smith and Davies, 1995; UNICEF, 1996; von Braun et al., 1998).

Some, but not all, of these systems also held responsibility for responding to food crises. For example, Ethiopia's Relief and Rehabilitation Commission (RRC) developed quite elaborate multi-level 'needs assessments' aimed at determining targeting priorities for food aid at a local level. Since then certain donor (USAID) and non-governmental agencies (Save the Children Fund (UK)) have also developed systems that assist international agencies and national authorities in contingency planning, emergency response formulation, and also in development planning in risky environments (USDA, 1995; Boudreau, 1998; FAO, 1998).

It is the latter type of analysis that seeks to fill gaps in our understanding of relative 'need' in countries where poverty and/or malnutrition are widespread and public capacity to respond is limited. Although closely associated in operational terms with famine early warning and food-aid targeting systems, vulnerability analysis has become an area of professional expertise in its own right during the 1990s. Great strides have been made in generating broad consensus on concepts, complementary approaches and knowledge gaps (Boutrif, 1997; USAID, 1999). However, progress is needed in defining appropriate combinations of indicators and analytical methods, and in the independent validation and *post-hoc* evaluation of methods and outputs (Maxwell, 1996; FAO, 1998; Boudreau, 1998). This is perhaps why UNICEF has called vulnerability assessment an 'art' that is 'still in its infancy' (1996: 7).

Three main difficulties have yet to be overcome:

- multiple scales of analysis leading to aggregation problems;
- the absence of objective benchmarks (against which to compare a 'zero state' of no vulnerability); and
- dynamic systems that involve different combinations of explanatory variables over time and place.

Scale matters

First, many agencies continue to classify entire countries in terms of 'risks' of epidemic disease, food insecurity or malnutrition using national averages, only sometimes complemented by sample survey data for small populations (World Bank, 1997; UNEP/GRID, 1997). At either scale, extrapolation up or down is fraught with

difficulties due to a general lack of information about distributional parameters; that is, the degree to which a given problem is shared among localities and households within a country.

For instance, Brazil, Peru and Ecuador have large discrepancies in standards of living between their higher and lower productivity regions. Brazil's drought-prone north-east, Peru's interior highlands and Ecuador's lowlands each contain above-average concentrations of both poverty and malnutrition (Webb, 1998). Yet, environmentally marginal or fragile regions are not perfectly correlated with measures of deprivation. Some of the worst malnutrition in countries like Kenya, Ethiopia and Zimbabwe is found in regions of high agricultural productivity and relative prosperity (Haaga et al., 1998; Pelletier et al., 1991). And the UNEP/GRID (1997) study of West Africa found no significant difference between child stunting (derived from cluster sampling) among arid, semi-arid or sub-humid agroclimatic zones. In other words, the precise pattern of sub-national conditions is not easy to predict.

For example, Table 1 shows the Human Development Index (HDI) for three of the world's largest countries (in population terms) along with the share of children under five classified as underweight.[2] At first glance the national HDI is strongly associated with the level of child malnutrition — the common assumption drawn is that malnutrition mirrors low HDI. However, analysis of data at province level for the same three countries (a total of 50 administrative units) shows no statistically significant correlation between the two measures.[3] Since the range of causal factors of malnutrition is not uniformly shared among provinces, some places with high malnutrition (such as Guangdong province in China) also have a high HDI, while others have relatively low HDI but also relatively low malnutrition (such as Ningxia). Indeed, although China's national-level HDI in 1993 was calculated at 0.609, thereby placing it in the 'medium human development' category of nations, three provinces had HDIs far exceeding the national average, while another 14 fell far short (UNDP, 1996). As a result, the disparity among China's provinces was equivalent to 16 per cent of the aggregate national HDI indicating a wide range in the state of human development in this one country.

Yet as Akder rightly points out, interpretation of such data 'has to be done with care' (1994: 4). Significant aggregation problems arise due to variance in the size of provinces and in the need to ascribe population-weighed adjustments to the components of any index like the HDI. While selecting a logically consistent set of variables to represent vulnerability is not hard, it is no easy matter to determine which are the more important factors in different contexts (either singly or in combination), or their predictive power (Currey, 1978; Borton and Shoham, 1985; WHO,

Table 1 Comparison of UNDP's Human Development Index (HDI) to data on child malnutrition for selected countries at national level

Country	*HDI (1993)*	*Underweight (1985–1995)*
India	0.436	53%
China	0.609	17%
Brazil	0.796	7%

Source: UNDP (1996)

forthcoming). This raises the second major problem: namely, the lack of an objective benchmark for any scale of analysis.

Setting standards

Assessing vulnerability is like trying to measure something that is not there. It is an *absence* of security, basic needs, social protection, political power and coping options that define the problem, making the search for a visible reference point a difficult task. While drought (absence of rainfall) can be measured as a level below a long-term average, the monitoring of insecurity in developing countries lacks such a long-term database against which to compare trends.[4] Similarly, while anthropometry is an indication of nutritional deficiency, it is based on standards that are derived from comparable populations *not* showing deficiencies.

Such standards have yet to be derived for vulnerability. Practitioners tend to make do instead with 'expert opinion' and/or available proxy variables. The former approach explicitly recognises not only the absence of objective measures but the importance of indigenous perceptions of risk and possible responses (Maxwell, 1996; Jaspars and Shoham, this volume). This approach requires heavy investments in understanding local contexts, contacts and constraints, but it can generate a depth and quality of insight not easily matched by more remote statistical systems (Seaman et al., 1993; Boudreau, 1998). On the other hand, the use of proxy variables in more formal information-gathering procedures allows analysts to examine larger scale processes and outcomes (Riely, 1998; USAID, 1999). The problem with both sources of information is that they tend to be cross-sectional in nature. Even 'expert' opinion tends to be time-bound. Given that vulnerability is essentially a dynamic condition, a monitoring of trends may be more important than determining absolute status at only one point in time.

A further difficulty relating to both approaches is that of defining what one variable or perception 'means' in relation to vulnerability. Even communicating the question to local informants or counterparts is complicated; it typically results in reference to relative states of food deficiency, hunger or poverty — conditions that are in themselves open to multiple interpretations (Maxwell and Frankenberger, 1992; Moser, 1998). This is true of recent attempts to measure hunger and food insecurity in the US through carefully crafted questionnaires rather than direct measurement (Frongillo, 1999). Focusing on household behaviour and experience, the US questionnaires assess food quantity and quality (two parameters with close links to poverty), and food-supply certainty and acceptability (parameters carrying social, cultural and subjective components). This approach has apparently been successful in generating consensus on definitions and methods, but the external validation issue remains open. As Rose points out, 'although we see strong relationships between income and hunger indicators [in the US context], and between poverty and the likelihood of food insufficiency, a one-to-one correspondence between measures of food insecurity and measures of poverty does not exist' (1999: 518).

The same is true for developing countries. Haddad et al. (1997) have shown that the correlation between child undernutrition (low weight-for-age) and aggregate food availability on a per-capita basis is small and insignificant for 37 developing countries (-0.087), while the correlation between national economic growth and child undernutrition is significant, but only weakly so (-0.494). Thus, the associations

among nutrition, poverty and food supply (as well as measures of human development) are neither consistent nor always (Payne and Lipton, 1994). Their reliability for validating standards of vulnerability cannot be assumed.

For example, in 1995 the USAID/FEWS project conducted a *chronic* vulnerability assessment in Kenya with a view to assisting in targeting decisions for food aid allocation (Riely, 1996). The variables used in the analysis at district level were:

- average income from export crop production;
- income from non-agricultural sources;
- per-capita livestock ownership;
- access to high-potential land;
- accessibility to urban markets; and
- drought risk (in terms of variability in vegetative growth over several seasons weighted by share of rainfed crop money in total income).

These variables were converted into comparable units (Z-scores) and totalled to generate a simple ranking of the 42 districts included. This commonly adopted approach has the merits of transparency and feasibility, but problems remain.

On the one hand, the summing approach leads to different results from a more intricate approach in which objective weights are allocated to each variable through principal components analysis. That is, although the overlap between rankings is generally high (a Spearman correlation of 0.85), striking differences appear in the rank positions for some locations (Riely, 1996). The district of Narok, for instance, is ranked first in priority status by the simple index, but only 21st in the weighted analysis. Similarly, Kajiado is ranked 11th by use of the simple index compared to 33rd in the weighted ranking. Such divergence in rankings poses difficulties for the prioritisation of public action.

On the other hand, one has to ask whether the components of the ranking were necessarily the most appropriate variables to use despite their ease of availability. Many indicators commonly used in vulnerability analysis are interchangeable (mutually correlated), while others are less so. But, rigorous analysis of their substitutability and/or exclusivity is generally lacking (Riely, 1996; Frongillo, 1999). One study that has explored such relationships among variables tried to explain variance in government 'population in need' figures for districts across Ethiopia (Webb et al., 1994). It found that while the main explanatory factors were consistent with expectations, the principal surrogates (next-best variables which could be substituted for the first best and still obtain the same results) were often surprising: a surrogate for terms of trade (between sheep and maize prices) was the 'standard deviation from long-term average of satellite-imaged vegetation growth indices for the short rainy season' (Webb et al., 1994: 32); the main surrogate for density of road infrastructure was the percentage of children enrolled in school per district; and the main surrogate for household size was district literacy rate.

It is important to examine such elements of association not only because of the search for appropriate benchmarks, but also because of a need for greater confidence in the results produced by one set of indicators versus another. This is as important to humanitarian action as it is to development work. Take the Kenyan example again which focused not on acute but chronic conditions. There the statistical correlation between rankings of the weighted vulnerability index and alternative measures of district-level population density or distance to Nairobi were strongly significant.[5] This

implies that either of the alternatives could also be considered in future as substitutes for other index components. Similarly, the correlation between share of children underweight (for the same districts and time period) is also highly significant against the weighted vulnerability index (0.503, 2-tailed sig. 0.002). However, the correlation between underweight rankings and the simple vulnerability index is *not* significant (0.316), nor is the correlation between either of the vulnerability indices and child stunting (which is conventionally considered to be the nutritional indicator of chronic problems).[6] In other words, the choice of indicators, as well as the nature of their association, are crucial to determining analytical results. Limited attention has been paid to such associations in emergency settings. This allows the targeting of humanitarian resources to be based on a few standard indicators that have been subject to little analytical scrutiny.

Degrees of uncertainty

The third major difficulty in vulnerability analysis is the dynamic nature of the interaction among variables. Vulnerability is not a steady state but a process to be understood in terms of cumulative conditions. Combinations of causal factors change over time and place, and not every variable is significant for the same geographic location in every year (Webb et al., 1994). Synergies exist not only among health, nutrition and mortality at the individual level, but also among wider factors such as population density, prior level of market activity and degrees of information asymmetry. This means that whatever measures are chosen, their co-dependency and their 'expiry dates' need to be monitored; it cannot be assumed that a household classified as 'vulnerable' or even 'poor' in one season or year necessarily remains so throughout the year or across years.

For example, Krishnan (1997) found that although 33 per cent of 500 households surveyed in Ethiopia classified as 'poor' in 1989 were still poor in 1995, another 30 per cent of the originally poor were now in the 'non-poor' category. By contrast, almost 12 per cent of households had fallen behind to enter the 'poor' category over the same period. While 'the poor' may always be with us they do not represent the same people all the time.

Of course, only part of the dynamic process relates to changing causal factors — the risk dimension. The other aspect relates to coping responses which also vary across time and place. A study by Reardon et al. (1988) of public responses to drought impact in Burkina Faso showed that while donors assumed that households in the semi-arid northern provinces must be worse affected (and so channelled most of the food aid there), they were in fact less vulnerable than households in the central provinces of the country because of stronger experience of coping with droughts, more diversified income sources and greater mobility. In other words, emergency responses based on one indicator of hazard impact alone can be mis-targeted unless they consider both indigenous and public responses.

The literature on indigenous coping has proliferated during the 1990s generating a wealth of indicators and insights (Ellis, forthcoming). But the analysis of institutional coping capacity and action has been neglected. It is often assumed that effective forecasting (of impending hazard) equates with the potential for effective public action. However, forecasting capacity tends to degrade over time as public memory of major disasters dims (USAID, 1997). What is more, good forecasts are not invariably

coincident with good response. As noted by the multi-donor evaluation of preparedness and response to Hurricane Mitch:

> while vulnerability analyses are an integral part of good disaster management, the data are sketchy or non-existent. Techniques for evaluating the effects of interventions are poorly developed and hence, the data available are poor with the result that assistance may be misdirected and inappropriate or detrimental assistance may be repeated (PAHO, 1999: 5).

Response capabilities are not fixed; they rely on solid political, institutional and financial support, each of which represents an important part of the vulnerability equation.

It is for these many reasons that vulnerability tends to be assessed without reference to fixed benchmarks or time-frames. It is all about degrees of change relative to better or worse conditions. The FEWS project refers to moderate, high or extreme vulnerability, for which 'levels' increase or decrease (USAID, 1999). The US activity also classifies households on a scale from 'food insecure with severe hunger' to food insecure with moderate or no hunger (Hamilton et al., 1997).

Thus, measures of vulnerability are akin to the maritime Plimsoll line — marks on the hull of ships that indicate safe loading levels for different sea conditions.[7] Aimed at reducing the risk of sinking, the Plimsoll line acknowledges that a ship floats at different heights depending not only on the weight of its cargo but also on the density of the water in which it is floating. In this context, buoyancy (vulnerability) is determined by the interaction between water conditions (the degree of hazard) and the recommended weight of lading (coping response). Although the Plimsoll line is not fixed to the seabed (it moves up and down with the ship), it offers standardised guidelines for action under a variety of objectively assessed conditions. Current measures of household vulnerability are similarly astute in technical terms, but it remains unclear where 'on the hull' they should draw their own lines relating to levels of risk and appropriate public response.

Conclusions

Vulnerability is all about the context of human responses to potential suffering. It is about a set of conditions that are worse than they should be and possibly continuing to worsen. Analysis of such conditions, and potential responses, is not only relevant to emergencies. Indeed, the urgency of most relief activities makes sound vulnerability analysis very difficult, hence the primacy of assessments of physiological needs. But narrow attention to physiological vulnerability or nutritional status can mislead and misdirect resources. Broader, cross-disciplinary insights are required. Understanding the scale and distribution of malnutrition in a given context is one important task, but understanding its association with broader risks and likely household responses is equally crucial to effective public action.

Thus, understanding vulnerability at household, community and sub-regional levels should be seen as an investment not only in improved relief targeting but in the better use of development resources as well. As Snow put it, 'the measures which are required for the prevention of [a crisis] … are of a very simple kind. They may be divided into those which may be carried out in the presence [of a crisis], and which, as

they require time, should be taken beforehand' (1855: 133). Vulnerability analysis is relevant to both realms: it covers ground common to disasters and development. But to be effective such analysis is not achievable in a short time or at short notice. It should be based on detailed understanding not only of local conditions in difficult environments, but also on monitoring of trends and processes in such environments over different scales and time-frames.

Much remains to be done to push the boundaries of understanding about how complex factors interact at different levels and scales to generate positive or negative synergies. Improved *post-hoc* ground-truthing is needed to assess how well (or poorly) analytical judgements match actual outcomes. There are grounds for demanding greater transparency in methods and greater accountability in how outputs are used. If such goals can be achieved, public institutions will in turn need to be more discriminating and innovative in their responses to human needs in risky environments. The one-size-fits-all feeding programme aimed at 'nutritionally vulnerable groups' may be relevant to certain circumstances, but it has little to do with tackling household and community vulnerability.

Notes

1. Unfortunately assumptions about methods and data are too easily masked by today's impressive analytical and presentational technologies.
2. UNDP's Human Development Index is a composite representing real Gross Domestic Product per capita, life expectancy at birth and several measures of adult literacy and school enrolment.
3. The Spearman rank correlation coefficient between province-specific HDI and province-specific underweight data is −0.143 (2-tailed Sig. of 0.328). For province-level HDIs see Akder (1994). The nutrition data for Brazil and India derive from WHO (1997), those for China from the national nutrition survey of 1992.
4. USAID's FEWS project has built up an impressive database on market prices and satellite imagery of vegetative growth for the countries in which it works, but even this is patchy and extends only a few years.
5. Spearman rank correlation between the weight vulnerability index and population density is −0.767, and for distance to Nairobi is 0.543, both significant at the 1 per cent level.
6. Spearman rank correlation between the weighted vulnerability index and child stunting (height for age −2 Z-scores from WHO, 1997) is −0.189, and −0.239 for the simple vulnerability index (the direction of the signs is puzzling). This analysis was conducted for 37 of the districts.
7. Developed by Samual Plimsoll of Bristol in the 1870s.

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