

## Review

# Securing health through food systems: an initiative of the nutrition consortium of the National Health Research Institutes in Taiwan and Asia Pacific regional partners as a network

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There are growing concerns about the health impacts of climate change with ecosystem degradation and global warming, finite reserves of non-renewable energy, water shortages in food-producing regions, limits to contemporary agriculture with its dependence on exhaustible petrochemical nitrogen and rock phosphate fertilizers, and failure of the global financial system. To date, health security has meant attention to safe environments especially water, sanitation and waste disposal; and access to health care and its affordability. Its dependency on food security (safety, sufficiency, sustainability, and satisfactoriness which requires diversity and quality) has been under-estimated because the current and imminent risks have increased and extended to more populations, because these may be less tractable and because the nature, extent and dynamics of nutritionally-related health are better appreciated. As a step towards more collaborative food and health systems, the National Health Research Institutes in Taiwan has created an interdisciplinary Nutrition Consortium (NC) with research and policy agendas. The NC held a food in Health Security (FIHS) in the Asia Pacific region roundtable in conjunction with the World Vegetable Center based in Tainan, supported by the National Science Council and Academia Sinica in Taiwan and the Australian Academies of Science and of Science Technology and Engineering, August 2-5<sup>th</sup> 2009 in Taiwan. A FIHS Network is being established to further the initiative. It should form part of the broader Human Security agenda.

**Key Words:** food crisis, NRD (Nutritionally-Related Disorder and Disease), energy, water, fertiliser, natural and anthropogenic disaster

## **A ROUNDTABLE TO ADDRESS THE PROBLEM OF FOOD IN HEALTH SECURITY IN THE ASIA PACIFIC REGION ON THE EVE OF A NATURAL DISASTER IN TAIWAN, AUGUST 2009**

The mind and policy are most commonly focussed by natural and anthropogenic disasters, their proximate causes, immediate management and short-term effects. Taiwan experiences typhoons and earthquakes as a matter of course. They bring with them resource-intensive preparations and safeguards in so far as is possible; human misery, injury and disease, loss of food stocks, safe water and cooking facilities, along with other infrastructural loss, social and environmental costs, decreased food production and availability with their advent; the demoralisation of recurrent loss, rising food prices which compromise those on marginal incomes, difficulties with housing and limited schooling and health care access for the short, medium and long-term.

The typhoon of August 2009, named Morakot, broke a serious drought where major Taiwanese reservoirs were parched with cracked basins and nearly empty – these were the scenes appearing in the daily press at the end of July as proposed water restrictions were being introduced. These scenes framed the opening of the Food in Health Security (FIHS) roundtable, August 2-5<sup>th</sup> 2009 in Taiwan.

Reports from the US National Climatic Data Center in July 2009<sup>1</sup> indicated that the world's oceans were warmer than ever recorded with 2-6 °C above average in the Pacific Ocean and 10 °C in the Arctic. Such oceanic warming increases the risk of typhoons, hurricanes and cyclones and may lead to their greater severity. A study by Academia Sinica in 2009 indicated that changes in atmospheric pressure caused by typhoons are predictive of tectonic plate movement and of slow earthquakes in Taiwan; thus there is an heretofore unrecognised link between global warming and earthquake patterns.<sup>2</sup> Whilst typhoons may, therefore, reduce the likelihood of a major earthquake, the conjunction of earthquakes and typhoons increases the risk of the typhoon itself. Within days of the opening the Roundtable, Morakot had transformed the Taiwanese landscape into one of floods and devastation.

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Revision accepted 28 August 2009.

It came on the back of unusually numerous earthquakes in the three preceding weeks and with unprecedented heavy rains of over three metres in three days in southern and mountainous tropical Taiwan. Unstable lake formations, post-earth-quake and after flooding with debris blockages, and water-logged softened earth, ruptured and released torrential currents and mud flows, cutting away swathes of riverside housing, whilst engulfing and burying villages and their residents alive, where there was no prior experience of such extremes. Survivors remained isolated or displaced for days and many family and community support networks were lost, with orphaned children and widowed spouses. Hunger amongst the isolated was less where 'wild mountain foods' were known and accessed, especially for those indigenous communities who have retained the relevant knowledge and skills. At the same time, remote mountain communities have less good conventional food chains and access to health care, putting them at greater risk, not only by where they live, but on account of their lack of connectedness to services and amongst themselves, except for mobile-satellite linked communication technologies which had resisted the devastation. This constituted a complex crisis, including one of food and health

About 20 percent of Taiwan's animal production, agricultural, horticultural and aquacultural production is considered to have been wiped out at a time of growing world food shortage and inequitable food chains.<sup>3,4</sup> The situation has presented difficult ethical and political dilemmas in regard to vulnerable groups and how their immediate, medium and long-term food and health security needs should be met.<sup>5</sup>

The local and international readiness for this kind of disaster is still demonstrably inadequate whether in governance, logistics or materials, in the future revisions of what constitutes unacceptable risk and in the planning for future risk where climatic conditions are changing.

The Morakot experience, which affected the Philippines and mainland east China as well, has considerable relevance for present and future food and health security in various locations. The Asia Pacific region has a number of ecologically vulnerable settings where disaster relief may be required at short notice, and then in the longer-term for reconstruction or migration to safer places, because of weather patterns, ocean-warming, sea-level rises, over-fishing, bush-fire proneness, soil degradation, deforestation, drought, over-use of ground-water,<sup>6</sup> poor agricultural practice with crop and farm animal management (like excessive herbicide, pesticide and antibiotic usage)<sup>7</sup> and more.<sup>8-11</sup>

Early warning systems and improved, more appropriate infrastructure including civil engineering, telecommunications, and food and health systems, amongst other considerations, may alleviate catastrophe of the Morakot kind. Indeed, we know, in the Bay of Bengal, that, even with similar frequency of storms, better information about weather for fishing communities has progressively reduced death rates over the last 100 years or so;<sup>12</sup> the same systems have added to the livelihoods of people on the east coast of India and reduced sea harvest wastage. Even natural disaster can be mitigated by intelligent and informed human anticipation and intervention. The ecological fragility and resilience of the Asia Pacific Region, as

with other regions, needs better definition, monitoring and analysis of future scenarios. In the case of Morakot, there has been "a large amount of driftwood seen in flood devastated areas [as] evidence of the abusive development of mountainous areas." The connection between forest management and loss of livelihood, health outcomes and loss of life is not readily made in the minds of those responsible. If it had been made, the present response to move indigenous people out of their precarious territory in mountainous Taiwan might not have been as necessary. To alter the course on which vulnerable localities are now set will require a high degree of interdisciplinary collaboration and regional co-operation with adherence to the principles of good governance.<sup>13</sup>

The conjunction of the Morakot typhoon disaster with the Food in Health Security (FIHS) roundtable August 2-5<sup>th</sup> 2009 in Taiwan has provided a timely post-meeting example of how the food and health sectors need to come together to reduce the burden of nutritionally-related disorder and diseases (NRD).<sup>14</sup>

#### **WHY HEALTH SYSTEMS NEED DEPENDABLE FOOD SYSTEMS FOR THEIR SECURITY**

It is generally under-appreciated the extent to which food systems contribute to public health, let alone clinical diagnosis and management<sup>14</sup> and how much this contribution is changing.<sup>15</sup> Literally, every body system and function is, in some way, dependent on the way and what we eat. Ultimately, although we are a resilient species, with the capacity to live in a wide range of eco-systems, our food supply (including risk of food-borne illness), habits and intake account for a major proportion of our well-being, freedom from disorder and disease, and life expectancy.<sup>16,17</sup>

However, this is almost certainly an underestimate of the contribution of the food chain to health because it usually looks at only the end of this chain, the particular foods, nutrients (and not all food components) and their contaminants (but not all contaminants). For example, in turn, food patterns are often more predictive of health outcomes than individual foods or nutrients;<sup>18</sup> there are many food components, other than the so-called essential nutrients, which contribute to optimal health, many of them plant-derived and referred to as phytonutrients; and the conventional food survey methods for contaminants have neglected, or been unable to detect in the past, chemicals which are toxic in unsuspected ways. A most notable example is that of endocrine disruptors from insecticides like the now banned DDT, plastics like bisphenol A and phthalates, flame retardants like polybrominated diphenyl ethers (PBDE), coolants or lubricants like polychlorinated biphenyls (PCBs) and weedicides or herbicides in the dioxin class of compounds. They characterise manufacturing and industrialised societies and often persist in food systems long after the phase of intensive manufacture has moved elsewhere (as in Taiwan). The virtual absence of urban planning where industry (even hi-tech with its arsenic and other toxic materials) and agriculture are mixed is an added and often enduring problem evident throughout landscapes like those in semi-rural Taiwan. The endocrine disruptors have behavioural

effects, may increase the risk of certain cancers, and increase the risk of obesity and of type 2 diabetes.<sup>19</sup>

Situations like these arise when there is inadequate interaction between the food-producing and health sectors at the policy, regulatory and enforcement levels.

Food technology offers much potential for increased, efficient and cost-effective ways to produce food stuffs. However, novel methods require full safety evaluation.<sup>20</sup> A current example of risk management of new and promising food technology is the development of nano-ingredients, nano-food property options which may be programmable and intelligent nano-packaging which might be less demanding on plastic and petrochemicals. There are now some 500 or so nanofoods in the market place and nano-ingredients (like vitamin and elemental micro-nutrients-eg beta-carotene and iron). These are promoted as 'natural' options but their physiology and toxicology is virtually unknown and food regulatory authorities are only slowly acknowledging the urgent need for an approval process. There is a very likely risk of serious side effects given what we know about their kinetics in mammalian systems which tend to be persistent and concentrated in certain tissues increasing the potential for organ damage.<sup>21</sup>

At every point in the food chain energy, water and usually fertilizers are required<sup>22</sup> – the origins of these inputs, the way they are used, the extent to which they increase the risk of food contamination and the environmental impact of the demand on them may alter the health risk profile of food systems.<sup>23-25</sup>

It may be possible to reduce the overall energy costs of food production if energy is a by-product of 'waste' and becomes a 'biofuel'.<sup>26</sup> However, there are concerns if arable land is re-allocated for energy production in its own right. One of the limits to food production is arable land. The problem of access to arable land is presently being exacerbated, especially in poor countries, but even in major food producing countries by the purchase of such lands by countries where the food supply is increasingly inadequate or projected to be so, as in the Middle East or China.<sup>29</sup> The general trend world-wide has been to convert arable land to urban developments, industrial usage or to mining (increasingly for energy resources).

Food security has four dimensions – safety, sufficiency, sustainability and satisfactoriness (diversity and quality).<sup>28,29</sup> Most attention by policy-makers, regulatory authorities and consumers has been given to safety and sufficiency with some directed to how edible and attractive food is. Much more attention is now required to the sustainability of food systems, especially in regard to biodiversity to underpin food variety as an essential measure for an omnivorous human species to achieve optimal health,<sup>30</sup> but with an emphasis on plant-derived foods.<sup>31</sup> Food system sustainability also depends on the extent to which our food choices contribute to global warming with preference for plant-based diets,<sup>5,32,33</sup> minimise use of fossil or precarious tree timber fuels,<sup>34</sup> and achieve conservation of limited water supplies for agriculture, horticulture and aquaculture.<sup>9,10,24</sup> Food security is also an important basis not only for health security, but also for human security in general.<sup>27,29,35-37</sup>

## CRITICAL ISSUES AND CRITICAL POINTS

With problems of the magnitude of food insecurity and health insecurity, their multiple causes and consequences, it is helpful to have an operational model, with purposes and deliverables, which can be challenged and revised as situations change and new information and insights emerge (Figures 1 and 2). In Taiwan, a Nutrition Consortium (NC) has been established with the mission to "To document, coordinate and synthesis as far as practical, the national research effort and to enable it to inform National Health Policy; this will entail inter-sectoral as well as intra-sectoral efforts." It has a remit which would allow it, as a national food and nutrition reference group, to address the place of food systems in health security. A cautionary tale may be told about similar efforts at an earlier point in food, nutrition and health history (beginning in the 1990s) in Australia. At a point of keen interest in how collaboration might progress this food-health agenda, FANO,<sup>38</sup> a federation of science-based food and nutrition organisations was formed to increase intersect oral dialogue and problem-solving. It had funding from the Australian and New Zealand Food Authority and the Australian Nutrition Trust (a philanthropic trust for the support of nutrition science). Its membership came from the chairs or presidents of the Australian Academy of Science national nutrition committee, the Australian Nutrition Foundation (Nutrition Australia), the Nutrition Society of Australia, the Dietitians Association, the Public Health Association nutrition committee, Australian Parenteral and Enteral Nutrition Society, and the Australian Institute of Food Science Technology. It had a website and played a science-based advocacy role for food and nutrition research, education and policy.<sup>39</sup> Only recently it was dissolved, just as the present global food security crisis emerged. How is this possible when it seems the irrational thing to do and very difficult to recreate? The answer is surely more complex than we understand, but probably has more to do with individual and collective human behaviour and leadership than we recognise. So for the FIHS which we seek, these behaviours, along with the conduct and governance of organisations or purposeful arrangements, however formal or informal, require diligent attention and creative, inspired, diplomatic and effective leadership.

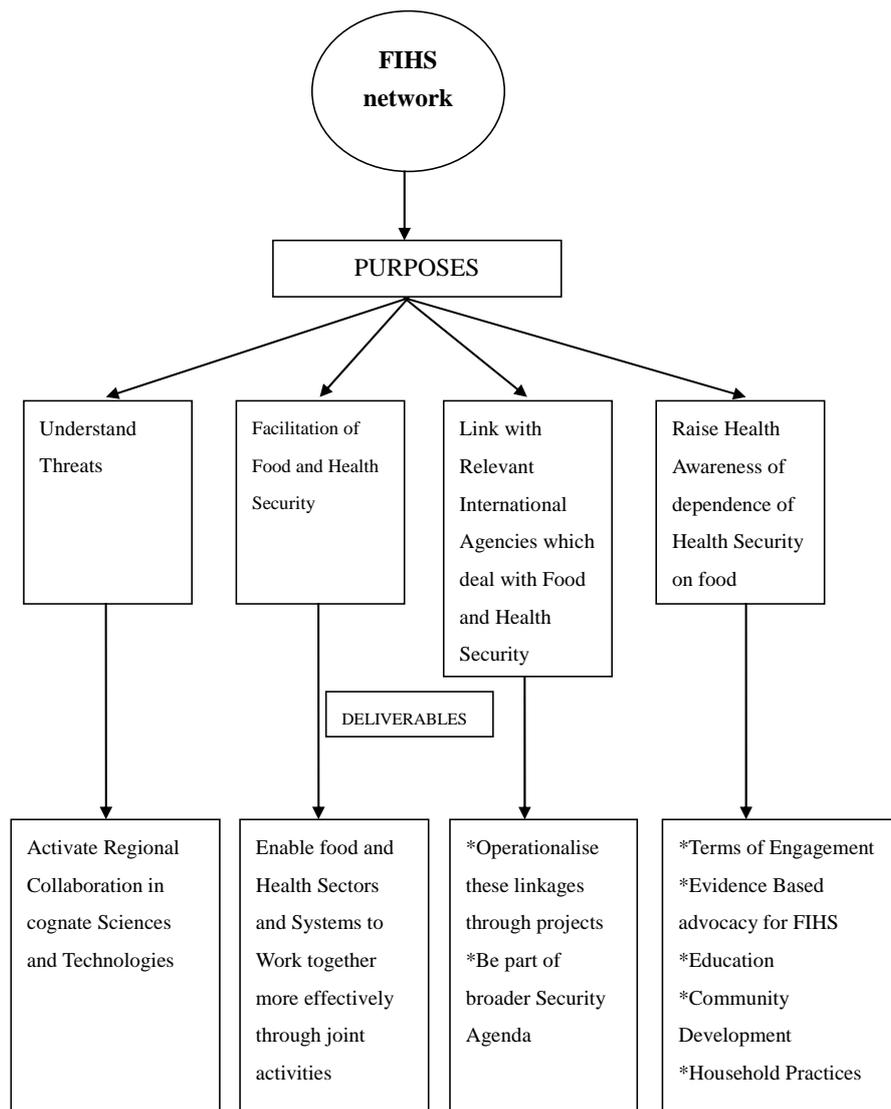
No one answer is likely. The acknowledgment of food systems and health systems and their interaction pre-sages this conclusion. But problem-solving inertia may arise simply because the problems are not identified. As in clinical work, 'No diagnosis, no problem, and no management'. Moreover, there may be a critical point for intervention, even though it is not part of causality or even pathogenesis. In public health this is appreciated too; its foundations were laid by Florence Nightingale who argued for hygiene to decrease mortality from battle wounds and John Snow who 'turned off the pump' to control cholera outbreaks in London. Can we do the same for Food in Health Security? Even though poverty, ignorance and inequity may be root causes of NRDs, if there were the four elements of food security (safety, sufficiency, sustainability and satisfactoriness-diversity and quality) a large fraction of the GBD would fall away.

It could be argued that interventions a step or two away from food may provide answers. When asked at the FIHS roundtable what the most important might be, one of us answered (1) maternal literacy;<sup>40</sup> (2) inexpensive, renewable, environmentally-friendly energy with which to grow, harvest transport, store and cook food and; (3) abundant safe water. Other priorities considered more proximal to the food system itself were plant-based diets with an emphasis on vegetables, sustainable aquaculture or genetically modified single cell production of nutrients and designer fuels. At the same time, soil scientists reminded the participants that limiting factors for future food production would not only be water and nitrogen, but phosphorus, essential to life, since the global reserves were near exhaustion<sup>41</sup> and vigorous means will be necessary to recover urinary phosphorus to be re-cycled.<sup>42,43</sup> It is encouraging to think that science and technology may enable us to achieve these critical outcomes, or others which might be prioritised before chaos reigns.

#### APPROACHES TO PROGRESSIVE IMPROVEMENTS IN THE SECURITY OF FOOD AND HEALTH SYSTEMS

Critical point interventions for FIHS may or may not be as successful as we would like and may have unintended consequences.<sup>44</sup> Systematic gathering and evaluation of evidence must remain pivotal to FIHS wherever possible.<sup>45</sup> But given the rate of food environmental and health pattern change, and the magnitude and complexity of the dilemmas, best judgements will need to be made on less than ideal evidence. They will also need to take into account evidence to do with areas unfamiliar to health and biomedical scientists, namely sustainability and affordability, which will mean co-operation with environmental scientist and health and agro-economists, as foreshadowed by the IUNS (International Union of Nutritional Sciences) New Nutrition Science initiative.<sup>46,47</sup> Our actions will often need evaluative procedures during their execution and provide for project reformulation as we proceed.<sup>48,49</sup>

To win the survival day, there will need to be much innovation. It is never clear how we can increase the likelihood of creative moments which may favourably alter the course of human and planetary history. But milieus supportive of difference, where ideas flow, dreaming is possible and responses are non-judgemental may be con-



**Figure 1.** The purposes and deliverables of a Food in Health Security Network

ductive.

In the food and health sciences, we must first respect and support each other. It is clear that agricultural science and careers have been undervalued and under-funded in recent times when rural communities and farming are even more important. We will increasingly need to work together as advocates for joint agricultural and health policy.

**PLANNING FOR FIHS AND ITS FUTURE NETWORK**

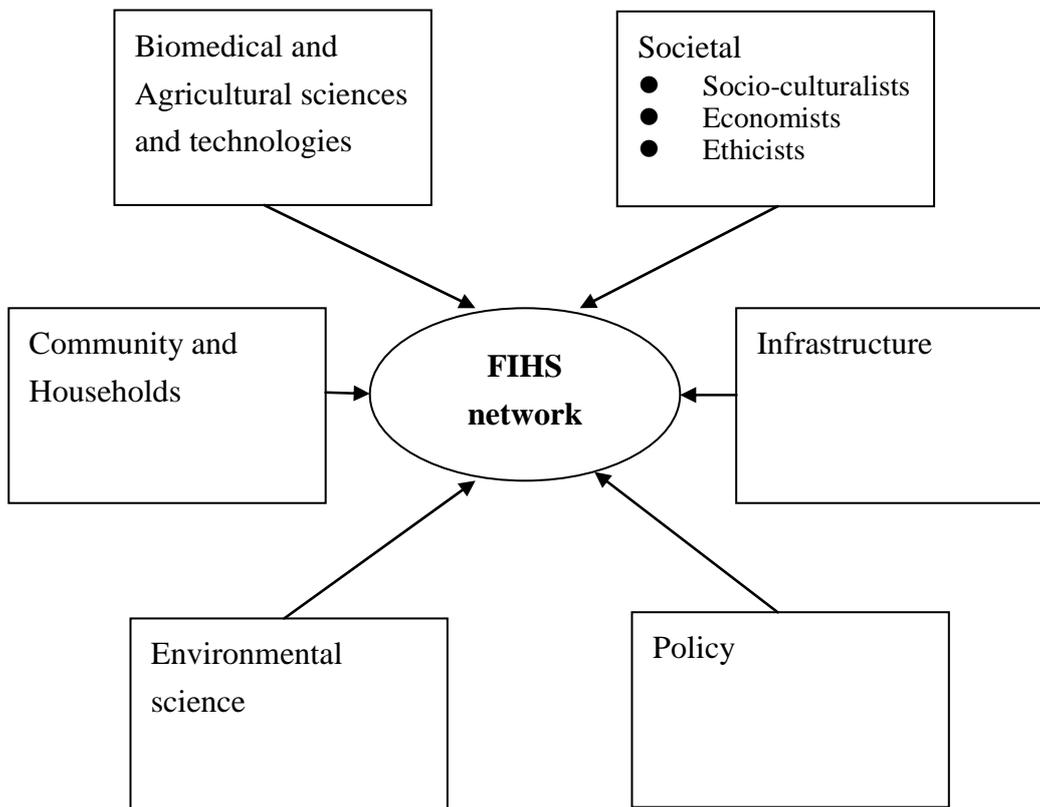
In the case of the FIHS roundtable, the NC instigated by the National Health Research Institutes in Taiwan and including Academia Sinica, the World Vegetable Center based in Tainan, the National Taiwan University and the National Defense Medical Center, was the planning group. The National Science Council in Taiwan and the Academies of Science (AAS) and Science, Technology and Engineering in (ATSE) in Australia actively supported the initiative. It engaged a much wider reach into the food and health sectors in Taiwan and the Asia Pacific region to achieve its several purposes<sup>29</sup> (Figure 1):

- To understand the current and future threats to food and health security in the Asia Pacific Region and to plan to alleviate these through regional collaboration between the relevant cognate sciences and technologies.
- To develop an integrated food and health systems network to enhance food and health security in the region.
- To link with relevant international agencies expert in food and health security.

- To raise global awareness of broad ranging issues relating to food security.

It is envisaged that risk reduction and advances in food system performance will operate favourably on health systems and security as well as planetary health and that the process can become a more substantial part of the human security effort. These aspirations will be best served if they are not only ‘top down’, but also ‘middle out’, given the importance of the middle ground of interested, informed, concerned and active people in many societies, and ‘bottom-up’, an approach espoused by the environmental health scientist and practitioner, Colin Butler.<sup>42,43</sup>

To arrive at a contextual, humanistic and planet-sensitive approach to health security through food (FIHS), we invited scholars, practitioners and stakeholders to extend their usual horizons and contribute to 4 themes: health systems, food systems, ethics and equity and security. We began with an overview of these themes and an up-date on the food regulation by Prof Jaw-Jou Kang, a toxicologist and chair of the preparatory committee for the Taiwan Food and Drug Administration, for stakeholders.<sup>27,31,42,43,49</sup> We continued with status reports from the Asia Pacific (NE Asia, SE Asia, China): reviewed the food and health connections with water energy and fertilizers (with the help of a critical review of Paul Roberts book, The End of Food, by Dr Lu-Hung Chen, Institute in Hsinchu; looked at particular food commodities (fish, livestock, crops); and examined food-health mapping for security. With prepared background papers, we systematically looked at each of the themes in some detail, but with all participants irrespective of expertise so that we



**Figure 2.** The knowledge and skill sets, informants and infrastructural expertise requirements for a Food in Health Security Network

could have a shared exposure to the ideas and information. On subsequent days, material was reviewed by an expanded NHRI group and then theme integration and 'rotational' sessions with facilitators, where participants reflected both within and outside their primary theme area, took place. A combined session drafted an on-screen digital report of FIHS which is published.<sup>50</sup>

The original intention of the NC planning group was to have an operational FIHS Network, spring-boarded from the FIHS Roundtable, its background papers and its spectrum of expertise and interests (Figure 2). This was supported and there has been much active in-group iteration beyond the roundtable. This should develop into a widening group with motivation and evolving expertise to grapple with food-related health security issues. Not only should FIHS be seen as a growing security concern, but begin to replace a less tractable elite security agenda with one of community concern and commitment.

There are existing networks which provide an invaluable resource and linkage for the FIHS Network, principally emanating from the UN System. FAO has the Asia-Pacific Network for Food and Nutrition (ANFN).<sup>51</sup> FAO (Rome) also manages the FSN (Food Security Network) Forum discussions. This valuable web-based forum is at <http://km.fao.org/fsn/><sup>52</sup> and WHO has made resolutions to support food security initiatives, largely from a food safety perspective.<sup>53</sup>

Needless to say partnerships which are interdisciplinary and can accommodate cultural and development diversity will be the most sought. The Asia Pacific region includes a wide range of vulnerable settings, at risk from climate, fuel, water, food, educational, infrastructural, and economic susceptibilities, from small island states and river deltas at sea level, to large coastal populations and increasingly arid regions which have been major food producers, but are now in decline insofar as these roles and livelihoods are concerned. However, solutions to at least some of these disparate food security situations are possible.<sup>54</sup> The region has many health security needs which are shared but not necessarily acknowledged.<sup>55</sup> We can expect increasing pressure for migration from less to more secure locations in the near future. And the Asia Pacific region cannot escape its relevance and responsibilities to the world at large, with Africa in greatest need, but with enormous potential Collaboration between Asia and Africa through shared know-how, technology, investment, trade, and consumer protection should be possible.<sup>55</sup> However, the risks of Asian exploitation of Africa, especially for its rich resources and for arable land is to be avoided; to minimize this it has been recommended that there be agreed "Terms of Engagement" which could benchmark this phase of international development.<sup>21</sup>

#### AUTHOR DISCLOSURES

No conflicts of interest.

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Review

## **Securing health through food systems: an initiative of the nutrition consortium of the National Health Research Institutes in Taiwan and Asia Pacific regional partners as a network**

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### **由糧食體系確保健康：倡議臺灣國衛院的營養聯盟小組與亞太地區伙伴建構互助網絡**

隨著氣候變遷導致生態系統崩解以及溫室效應、非再生能源的受限、糧食生產地帶水資源的短缺、現代農業依賴有限可耗盡的石化氮和磷礦肥，以及全球金融體制的潰敗，這些對人類健康上的衝擊，已被投注越來越多的關注。今日所謂「衛生安全」意指對環境安全的注意，特別是水、環境衛生、下水道及廢棄物的處置，也包括醫療照護的可近性及負擔力。因為目前和近期風險的增加，以及此風險將延伸影響更多的族群，加上這些風險的不易處理及健康上營養相關的性質、廣度和變動開始被重視，顯示一直以來低估了衛生安全對糧食安全的依賴(在安全性、足量性、永續性以及需求多樣化和高品質的滿意度上)。國家衛生研究院因此成立由學界組成的營養聯盟小組，發展針對這些議題深入研究及衛生政策建言的議程，並於 2009 年 8 月 2 日至 5 日與世界蔬菜中心共同舉辦「亞太地區糧食、食品與健康安全國際研討會暨專家會議 (FIHS)」，由國家科學委員會、中央研究院、以及澳洲 Australian Academy of Technological, Sciences & Engineering (ATSE) 協同贊助。會中倡議建置的 FIHS 網絡，將對更廣泛的人類安全議題有所貢獻。

**關鍵字：**糧食危機、營養相關的失調和疾病、能源、水、肥料、自然及人為的災變