

# Food insecurity: How to orchestrate a global health crisis

John Quinn<sup>1</sup>, Vladimir Bencko<sup>2</sup>

<sup>1</sup>Prague Center for Global Health, Charles University in Prague, First Faculty of Medicine, Institute of Hygiene and Epidemiology, Praha, Czech Republic; [john.quinn@lf1.cuni.cz](mailto:john.quinn@lf1.cuni.cz)

<sup>2</sup>Charles University in Prague, First Faculty of Medicine, Institute of Hygiene and Epidemiology, Praha, Czech Republic; [vladimir.bencko@lf1.cuni.cz](mailto:vladimir.bencko@lf1.cuni.cz)

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## ABSTRACT

**In 2007-2008, the world experienced over 1 billion people going hungry. This complex food security and public health crisis have many levels, actors and stakeholders. There lacks equity in access food markets, unbalanced consumption of nutrients and poor state institutions that, all negatively impact food security. Global financial products and regimes can greatly influence food prices, and if not properly regulated, this can lead to whole market manipulation and starvation. This paper discusses the basics of food security in a public health framework and describes the legal and financial mechanisms that lead to food insecurity.**

**Keywords:** Food Security; Nutrition; Famine

## 1. INTRODUCTION

Humankind has rarely been able to achieve balance between adequate food production, food allocation, food distribution, safe financial mechanisms and market access and equity in agricultural access or economies of scale that provide satisfactory nutrition. Pestilence and drought may be caused by natural influences, but people and extractive institutions cause famine and starvation. Food security is the availability and equitable adequate access to nutritious food. An adequate food supply is foundational to human security and development. Food and health security in fragile and failed nation states is of growing importance in an interconnected global sphere. At present, there is a growing private sector seeking influence on the public realm and health security may suffer as a result. Owing to the complex interplay of economic issues, global change, population development

and consequent increased demands, altered social expectations, resource depletion, and geopolitical instability, global food security is now a regional public health crisis.

## 2. PUBLIC HEALTH AND FOOD SECURITY

Access to adequate food and water are fundamental to population health. Access to consistent clean water helps decrease the incidence of infectious diseases and water-borne illnesses and can promote sustainable hygiene; the prevention of disease, which is safer, cheaper and easier than its treatment. Access to a nutritious and consistent food supply aids healthy child growth and development and helps individuals to thrive and provide for others in family, community and economic mobility and diversity. Excess or shortage of food can lead to either over- or under-nutrition, both of which have significant and possibly permanent negative health outcomes and mortality. Over-consumption in both the developed and developing worlds is a leading factor accounting for the world's growing pandemics of obesity, diabetes and cardiovascular disease—the ever growing in global incidence non-communicable diseases (NCDs); which are no longer only the focus of health programming in the developed world and have started to greatly impact health security in the developing world as well. The reality of under-nutrition in any form is increasingly obvious. This arises not only through food access issues, but the soil and environment must be capable of producing foods that are healthy and do so on a sustainable trajectory to include water. Through over-farming, the depletion of elements essential to nutritious food is becoming evident globally. Soils, water supply and inclement weather are only some of nature's services that are under extreme stress and in some states have already failed.

For the poorest billion people on Earth, poverty is inversely proportional to food security; and in fragile and failing nation-states, institutions extract wealth and health instead of ensure it. With the inability of a region or population to grow or purchase its food, food security becomes increasingly tenuous and the risk of food shortages and political instability rises. Said simply, as food security decreases, state stability disappears. Despite the fact that more of the developed world has health issues associated with over-consumption of food, the developing world is quickly catching-up with these entirely preventable NCDs and is no longer only plagued by infectious and communicable disease. With this, some areas of the developing world experience over-nutrition and obesity and micronutrient deficiencies, completely preventable health problems.

Some highlighted micronutrient deficiencies in the developing world include the following **Table 1** [1].

All of these are preventable nutrient deficiencies affecting countries with inadequate food security and unbalanced food consumption. Equitable access to food and stable food markets can greatly improve these micronutrient deficiencies and diseases facing the developing world today. State stability with inclusive institutions that provide an environment for equitable access to food and food markets can improve food and health security.

However, simply sending money or food stuffs to the worlds hungry in an acute crisis is not an entirely possible, credible or evidenced-based policy solution [2-4]; behavioral economics, and incentives and sustainability must be accounted for. Using double-blind field research, it has been demonstrated that poverty leads to a world where those without enough to eat may save up to buy a TV instead of adequate food for their family, where more money

does not translate into more food, and where making rice cheaper can even lead people to buy less rice [5-7]. Indeed, when many communities have gained more access to wealth and can afford adequate and balanced food supplies, many opt for the better tasting and less nutritious option purely as a right of becoming “civilized”. This economic conundrum is ever more relevant in fragile nations as financial crisis, lacking institutional capacity, affect citizens equitable access to global food markets and subsequent health security.

As communities and societies gain more access to wealth, the greatly needed outcome of more balanced consumption is not guaranteed and is sometimes even hindered as more market forces encourage the purchase of luxuries instead of adequate and balanced nutrition. Education for these at-risk communities is needed in the form of primary prevention to prevent misguided family and household expenditures on poorly nutritious food and other superfluous financial expenditures that are not directly linked to their own food or health security. The need to build household, community and state resilience to food price shocks is required.

The public health issues of unbalanced nutrition, inadequate access to food, and misappropriation of resources—at the governmental and household levels—are present globally and affect billions. They are compounded by inadequate access to nutritious food, scarcities building up in the world of global agricultural land and lack of state institutions to be resilient to price shocks and potential market disruption. Among some scarcities are: arable land, fresh water, fossil fuels for energy and for fertilizer production, appropriate farm technology and access to this technology and dwindling fish supplies. Global markets and the commoditization of basic elements that support life are impacting global health.

In addition, the excessive use of fertilizers, and inappropriate and aggressive farming techniques has led to macro- and micro-nutrient depletion in soils. Other factors include diminishing access to appropriate financial support and an increasingly unstable climate. A final and increasingly important factor is the use of food crops for biofuel production and energy, as opposed for consumption [8,9]. All of these factors make increasing global food output extremely difficult [10,11]. The public health situation in relation to agriculture and food security is worsening. We will see that the cornerstone to public health action and improvement in the present food security crisis can be found in climate change reduction and state institutional capacity building.

### 3. ECONOMICS OF FOOD SECURITY

Supply and demand are the driving forces in the pricing of commodities. Items that are scarce fetch a higher

**Table 1.** Micronutrient deficiencies in the developing world.

Deficiency	Disease
Vitamin A (retinol)	vision and eye disorders
Thiamine	Beri-Beri, muscle weakness and wasting
Niacin	pellagra, memory loss and disorientation
Folate and Vitamin B12	megaloblastic anemia
Vitamin D	rickets and osteomalacia
Vitamin C	scurvy and poor wound healing
Copper	anemia and mental retardation
Fluoride	dental carries
Iodine	thyroid enlargement (goiter) and cretinism
Zinc	developmental retardation and congenital malformations
Iron	muscle weakness and abnormalities, anemia and mental development disorders

price, while items in abundance tend to be cheaper. Global economic markets and economies of scale are directly linked to food security. When harvest yields on crops change, even by very small amounts, the effects are long lasting, and greater than one might anticipate. When crop yields dwindle locally and globally, food insecurity ensues and health security drops.

Due to unknown future crop yields in many types of agriculture, financial instruments have been developed for investors to wager on the future price of agricultural commodities; this helps offset the economic effects of potential crop losses and poorly yielding harvests. If crop yields for a commodity (e.g. wheat, grain, corn etc.) are greater than expected in a certain market, the market price may drop precipitously as product would flood the market. Conversely, if there is a poor harvest and less grain reaped, the market price would rise as scarcity fetches the higher price in economic models.

In 1991, in order to limit risk and maximize the potential profit from uncertain commodity prices, the firm of Goldman Sachs developed the Goldman Sachs Commodity Index (GSCI) [12]. In 1999, the Commodity Futures Modernization Act of 2000 was promulgated. This act deregulated over-the-counter financial products or derivatives. This included the commodity market and it let investors engage in commodity trading without limit. An unintended consequence was the development of a prolonged food crisis that would leave over one billion people food insecure. How this arose is described below.

Before the GSCI was constructed, the Commodity Research Bureau (CRB) index functioned to help measure the overall direction of commodity sectors. Investors to help assess the risks associated with long and short-term investments also used the CRB index. However, this index was less sophisticated than the GSCI, which let investors focus their investments more tightly, and eventually dictate market price changes that resulted in considerable food market disruption and ultimately public health catastrophes in several countries that were unable to weather price variation and market shocks.

For example, the price of grain was traded between buyers and sellers at its future price—before the bushel had been grown, harvested or valued by that market. This may sound like a questionable gamble with large stakes, but this practice helped stabilize the price of grain over time and eventually decrease it. It also allowed farmers to hedge investment for times of poor crop yield years and to invest within their own farms and business with tangible goods and assets that help raise their overall yield. This greatly affected public policy and humanitarian aid and promoted food security for many countries and markets; these are defining features of a very connected global grain and food market.

However, many countries still attempt to impose sub-

sidy interventions, including grabs of arable land in poor nations by wealthier nations in order to farm a variety of crops that enhance the investor country's food security. This has been seen with recent land scarce country's movement in sub-Saharan Africa, South America and other areas of cheap arable land where food can be grown and whisked away for production and consumption elsewhere. These crops, now grown in a poorer nation by multinational agricultural firms mainly based in wealthier nations enter markets in wealthier nations. This reduces equity, reduces food security and can lead to public health food crisis.

The link between the price variability of grain on local and international markets is complex. However, when grain is traded on one of the three major American primary grain exchanges in Chicago, Kansas City or Minneapolis, the price affects global food pricing. Some factors influencing price are weather and geopolitical conflict, but market influences, like speculation, also affect price. These factors may be present in one region but can affect global and local markets with shocks and price variation, and ultimately, the price of bread in distant countries can spiral out of control. In fragile nations, food can be linked to socio-political change and upheaval. Land rights and equity in access to land can lead to food security and insecurity across communities and populations. There are many aspects that must be in play to enable food security for any individual, family, community, region or country. Yet, the need for equity in access to the many elements that influence food security is lacking the world over [13].

With this as context, the advent of the GSCI slowly set the stage for great disruption and shocks to the global market through long-term investment in grain but with no commitment to food production. The ability to buy and sell grain commodities, as well as to provide liquidity in the market with actual grain storage and food production, became disconnected. The market could treat grain and other food related commodity futures on the GSCI just like a stock or other financial product; it did not have to produce, store or actually sell any grain at all. This was a departure from what grain really is, namely a palpable, agricultural product of nature and made into food that is essential for life, and it was quickly transformed into an investment product with limitless paper value [14]. But what happens to the grain market when investors wish to take their money out of the investment, placing orders to sell in large volumes? Did the commodity index, through such a simple process of speculative selling (or buying), enable skyrocketing grain prices and eventual starvation?

This new investment tool attracted many investors to consider their investment in grain futures as safe; after all, everyone must eat. Although this investment strategy led

to significant investments in grain futures, it also led to extreme market speculation and subsequent wide fluctuations in price [15]. The GSCI enabled futures to be traded as stocks, with prices linked more to investor interest and greed than to the true value of the commodity. While perhaps “rational” investor behavior, these actions are not rational from the perspective of maintaining natural ecosystems, ensuring equitable and adequate food supply or even human life. Investor sentiment of profiting from essential commodities is not sustainable and there are inherent biophysical limits to global ecosystems [16]. The GSCI thus precipitated a global crisis of food security experienced by about one billion and decreased environmental sustainability.

As these commodity-based financial products became increasingly profitable, more and more investment occurred. This led to gross food price inflation, excessive price variability, and consequential food insecurity, famine, and ultimately, social, political and economic disruption. These disruptions started to push fragile states into potential failure. The problem was particularly apparent during the financial crises of 2007-2008 when investors sold their stocks and invested in gold and grain, thus driving commodity prices to new heights. Grain and many other commodities, were seen as safer investments to park capital than other risky products such as mortgage backed securities and others. In market terms, the competition to maximize crop yields, especially in wheat and grain, and to enable basic food security to support public health, faced the unscrupulous investment banker who artificially increased the price of food based commodities to maximize financial yield and, in doing so, orchestrated a manmade food security crisis [17,18]. With food security decreasing and state fragility and failure increasing, a public health suffered. Put simply, if the price of grain was rising considerably, the food commodity product grown in a poor country will enter markets in wealthier nations, not local markets with lower commodity prices and definitely not for local consumption.

Market manipulation and investment corruption occurs the world over. However, manipulators can be identified and held accountable for actions that lead to clinical starvation and an increased mortality en masse as a result. Presently, we are at a stage in human economic development where the actions of a very few on one side of the globe can impact and negatively influence food and health security of millions globally, whether such actions are intentional or not. In reality, the ones that should be held responsible are often anonymous and it is impossible to hold their actions accountable for the health outcomes that result. Today’s economic structure and practices, such as speculation buying and computer assisted trading, makes the risks of manipulation even greater.

The consequences of these actions can be disastrous and irreparable on a global health, social, economic and environmental scale. Investors and speculators must be regulated especially where the right to food is concerned. Non-compliance in a regulated environment would require that culprits be held accountable for their actions on the global market. Corporations are considered people under the law and can be held accountable as such [19].

#### 4. FOOD PRICING AND FOOD SECURITY

The basic economic principles of supply and demand hold true with agricultural products and in food markets; scarcity of product raises price and limits access. Recent price fluctuations in the global food market have been influenced by factors such as grain-fed beef cattle for human consumption and grain crops grown for biofuels instead of for food [20]. These are examples of “food affluence”; where the price of food is not a key deciding determinant to purchase the food. Most humans do not enjoy this luxury. The consequences and negative impacts of major shock such as a rise in the price of food are not felt equally across markets [21]. Nation-states that collectively spend a large proportion of their income on food, such as in Egypt, Jordan, or Ukraine, feel the effects of a relatively small rise in the futures price of food far more than those living where food-costs are relatively low, such as in Europe or North America. Resilience to price shocks is a key indicator of food security and is directly proportional to state stability.

To gauge food price variability across the globe, the Food and Agriculture Organization (FAO) of the United Nations monitors the monthly change in international prices of a basket of food commodities [22]. It is called the “FAO Food Price Index” (FFPI) and is a weighted average of the commodity group price indices of meat, dairy, cereals, oils and fats, and sugar. The FFPI helps gauge food security based on market price; it results in numerical “points” based on pricing in each commodity field. In 2000, the FFPI was 90; in 2007 it was 159, and it peaked in 2008 at 200 points when the most recent food crisis hit. In June 2011, it hit 234 [22], and with this, food price become top economic news. Before investment products like the GSCI were created, such commentaries were not investor sentiment indicators throughout the market. However, at 234, many speculators and investors became more interested in using food commoditization as an investment product despite potential drastic consequences to global food security [23].

While the FAO collects and analyses global agricultural data and provides technical assistance, there is no organized effort to ensure the adequacy of world food supplies or food security [21]. Indeed, within the last decade, major investment bank interest rates have risen

sharply with that of food prices and commodity indices as market volatility, geopolitical and other socio-economic factors make food a speculative, but now a relatively safe investment. However, this “investment product” became much more and its price variation and extractive economic product reduces food security and can lead to public health crisis.

A reduction in crop yields, environmental and political instability, conflict, violence and war can lead to food insecurity. After World War II, in order to mitigate the problem of food insecurity, the US Department of Agriculture instituted a program where the US government would purchase surplus wheat and grain from US farmers so as to stabilize US market prices. In so doing, it found itself in control of a sizable quantity of US grain that was not available on the open market—a surplus that did not negatively impact market price. In fact, the surplus became so huge that the US government at times paid farmers to not grow wheat at all, because the potential future price might have been adversely affected and further manipulated. This practice of government wheat subsidies is still carried out today, but to a much smaller extent than it was in the 1950s and 1960s. Nevertheless, it was a major influence on the global wheat market.

The wheat surplus enabled many governmental and humanitarian programs to shift off-market wheat held by the US government to global areas with greatest need. These programs employed US farmers and helped to maintain a stable wheat price via government subsidization. For example, under the Carter Administration, part of this grain surplus enabled the US to send humanitarian grain to the Soviet Union in hopes of improving relations, along with many other Cold War adversaries and allies. Recently, US government food surpluses have evaporated because of record high prices and farmers are selling their crops on the open market [24]. In light of recent environmental and economic instability, the US wheat surplus has been eliminated, along with governmental or humanitarian programs. Food has become too costly to be used for the common good.

## 5. BIOFUELS AND FOOD SECURITY

Biofuels are fuels derived from organic matter, namely raising crops, and converting or adding them to burnable material to be used in combustible engines. Biofuels have also contributed to an unprecedented rise in the food market. Precious arable land once used for edible wheat and grain has been supplanted by a more profitable commodity such as rapeseed that is turned into oil and used in the production of biofuels. The rate at which the US is converting grain into ethanol has grown significantly. For example, in the US in the year 2000, 16 million tons of grain was used to make ethanol, whereas 126 million tons were used in 2010. As a consequence,

the price of grain is now tied to the price of oil [21]; this is good for investors, but disastrous for those who need grain for food.

Brazil, which obtains ethanol from sugar cane, is second in production of biofuels after the US. The European Union aims to obtain 10 percent of its transport fuel from biofuels by 2020. All these efforts serve to divert land from growing food to “growing energy” and they may be leading to food scarcity and food insecurity [25]. Indeed, the economics of food and food price play a much larger role than simply to feed the hungry or than the need of food as a human right.

## 6. CONFLICT, WAR, DISASTER AND FOOD SECURITY

Food is as critical to national security as are resources like oil, steel, rubber, water and raw materials, or maintaining state borders flows which often preempt food security in a country [26]. Access to a consistent food supply provides a minimum level of health and basic state security. Indeed, food is security and the ability of a state to provide basic infrastructure and free market access for its citizens to purchase affordable and sustainable food is a key state role; extractive institutions and the inability to provide a duty of care at any level of health security is a mark of a failed state. Failed states do not guarantee human or food security and increase human suffering through inadequate public health and hygiene. Fragile and failed states provide little or no health, food or economic security. Thus, ensuring access to reliable and sufficient food during a crisis must be a public policy priority. The short term solution only can start with a sustainable land, food and market plan. Failure to do so often leads to political instability and endangered public health. A growing population and the consequences of climate change and environmental degradation will only compound these problems.

Access to arable land, rule of law and ownership of the rights to land and agriculture and safe and secure access to food and equitable access to food markets do not exist in many countries; even in times of peace, with an increase in states during times of crisis and conflict [27]. Conflict and food security are multifaceted and inextricably connected. Those countries and communities that experience active conflict are at an increased risk of food insecurity [28]. The many determining factors of human conflict that affect food security are: **Table 2**.

## 7. ECOLOGICAL INTEGRITY, THE ENVIRONMENT AND FOOD SECURITY

From a natural and environmental perspective, access to arable land, seed, sustainable water supplies and envi-

**Table 2.** Determining factors of human conflict that affect food security.

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Access to food at the market: price variability and supply
Rural and agricultural infrastructure destroyed
Loss of livestock and access to arable land
Deforestation, desertification and rising water levels
No access to water for irrigation; water infrastructure destroyed
No consistent access to seed, farm technology or human capital
Migration flow: large influx of people into one region, with insufficient in another
The use of landmines and other explosive devices throughout arable land
The use of food access as a weapon

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ronmental sustainability are the bulwark of sustainable food access and food security and sustainability. Geopolitical instability, human conflict, economic and market manipulation and volatile market fluctuations can lead to significant barriers to food security. However, without environmental sustainability, arable land, access to seed and water, communities cannot grow food. With an imbalance in any of the above-listed factors, a food crisis can easily ensue despite best efforts made by aid agencies and governments and citizens. The prevailing paradigm in food markets and food security holds that the health of the environment drives agriculture, agriculture drives commodity markets and pricing, price and food demand drives food production, which in turn drives local and international economies of scale—distortion at any level can lead to disaster.

Ecological integrity reflects the resilience of the relevant environment to respond to natural and man-made, market and environmental shock. Public health and food security for the global population are directly linked to the environmental health and integrity of the planet. Only a healthy and sustainable approach to Earth's ecological integrity will prove successful in providing food for healthy populations and stable nation-states. Decades of global policies for the pursuit of growth at all costs through energy and ecological exploitation, has resulted in declines in ecological integrity and state stability [29]. An exploding global population and inextricably linked global markets compound the already tenuous challenge of ensuring food security while simultaneously maintaining global ecological integrity and sustainable state stability.

Climate change is linked to health and food security. Adverse effects of climate change will aggravate existing threats to international peace, security and new state stability threats due to the loss of territory in some regions due to sea-level rise, desertification and low-lying island

states, presents significant regional health, food and international security implications [17]. Environmental degradation leading to the loss of topsoil, depleted and polluted water supplies, the use of genetically modified or immunologically tainted seed, and drought brought on by a warmer climate all lead to food insecurity. Preventable desertification, poorly planned crop rotation and land abuse, an over-dependence on specific crops and climate change indicate that the seams on any remaining global ecological integrity have been blown open. These factors led to a global food crisis, public health disaster and regional state stability instability.

## 8. CONCLUSIONS

Most of the famine, starvation, and food insecurity experienced by people around the world are of human origin. Natural events such as drought and flood often exacerbate food insecurity, but underlying man-made problems and events bring it to the fore. Fragile and failed states, investment speculators and climate change lead to food insecurity. Policy and human action can mitigate these problems by states providing inclusive and accountable state institutions. Adequate food production, balanced consumption and economies of scale that provide satisfactory nutrition for all, define the needed pillars of a global health framework in order to sustain life by ensuring food security. Food security is defined as a person's availability and access to food. With continued market manipulation, conflict, a deteriorating environmental situation with climate change, exponential population growth, food security is not guaranteed for all. Adequate food supply is the foundation of human security and development, and this must be pursued under a global policy framework from both practical and theoretical vantage points in order to bring one billion hungry people into the fold of a fed and civilized world and to bolster food security.

With the complex interchange of economic markets, market manipulation and economic arbitration, climate change, the lack of adequate access to clean water, widespread geopolitical and state instability, growing food demand and supply issues, food security has been proven to be a global public health crisis. Market misadventure has led to the current food crisis plus significant food insecurity for nearly one billion people or more. Eliminating unacceptable speculation on future's markets is not the only policy option, nor would it stop climate change, unbalanced food consumption, water scarcity or population growth. True policy options must include not only market reform, but also by encouraging sustainable agriculture for emerging markets and developing nations. This provision must guarantee equal and fair access of small farmers and agricultural workers to their own local and wider global food markets in the form of free, fair

and equitable trade.

This global policy shift to sustainability at a small and organic-based level can engender an environment for the increased global food security and subsequent global health. Presently however, worldwide food security is deteriorating and a global public health crisis is unfolding and will be chronic without a change of policy course towards sustainability and overall resilience is inclusive government institutions. The underlying causes are not only financial speculation and greedy global markets, but also diminishing crop yields, abuse and depletion of precious water supplies, the destruction and desertification of topsoil, climate change, chronic conflict and a booming population in a world of increasing health and economic inequality. A stable climate means stability in food price and food security and possibly fewer fragile and failed states. By tackling market reform, climate change and ecological degradation, food and health security can follow.

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