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### **India: A Holistic Approach for the Rural Population**

Throughout history, India has been a frontier for change. From the Mughal invasions to British imperialism, India has experienced a variety of complexities resulting in a vastly diverse nation. With each state almost having its own official language, communication is often difficult between the lower-classes. In addition to the second largest population in the world, India has the largest Hindu population, but is home for many Muslims, Christians, Sikhs, and more. With poor health campaigns and little physical education, malnutrition runs rampant, wreaking havoc among the people. In fact, India has the second highest malnutrition rate in the world at 47% (Malnutrition Report). Even though India has the largest child development program in the world, the fight against malnutrition has had little progress. Malnutrition results in a decrease in educational achievement, labor productivity, and economic growth. Because micronutrient deficiencies, alone, cost India over \$2.5 billion annually, it is in India's best interest to improve the situation. From the 75% of students undernourished in rural areas to the 15% of students over-nourished in urban areas, malnourishment encompasses the majority India's population (Shukla). About 43.5% of children under 5 are underweight. According to a study conducted by the Indian National Family Health Survey, which encompassed 90,303 women in 26 different states, socio-economic status is positively related to obesity, but is inversely related to being underweight. Because 70% of Indians live in rural settings, the backbone of the economy is the typical farmer. Although the immense diversity and tremendous poverty complicate efforts to revitalize the Indian population, there are a multitude of solutions, ranging from the use of RUTFs to tech-loans, which may assist in easing malnutrition in India.

Farmers in India typically live in patriarchal families (Indian Rural Family). Generally, farmers live in large, joint families, which include three to four generations in the same household. Recently, however, a few have begun to move towards modified-extended families. These nuclear families frequently visit nearby extended members, financially, medically, and emotionally supporting one-another. Rural families are often different in northern and more isolated communities, where polygamy may be practiced. Living in such a large family means that a farmer must grow enough crops, sell enough of those crops, and make enough money to support the entire family. In many cases, farmers are not able to fulfill their duties, resulting in rising suicide rates (Desperate Indian Farmers). Tribal farmers usually cannot afford to support their families, let alone themselves.

India's diverse population has led to complications in the delivery of valuable nutrients to the population. For instance, Muslims cannot eat pork. It is strictly against Hinduism (80.5% of the population) to eat beef. Jains do not eat meat, onions, or garlic, limiting their nutritious options. Throughout India, the seasons and climates differ, resulting in a wide array of foods around the nation. One thing that remains constant is the use of spices and herbs. In northern India, there are extremely hot summers and extremely cold winters. However, people can still find vegetables year-round. Dried fruits and nuts are also common. Southern India is very hot and humid, full of coastal states. Here, fish, fruit, vegetables, and rice are popular. East India, filled with beaches and mountains, has a largely rice-based diet. Pork and fish are often consumed here. West India consists of a hot and dry climate with a few deserts. This results in a smaller variety of vegetables and fruits, leading to pickled vegetables, commonly known as achar. This region is predominantly Hindu and vegetarian, resulting in frequent protein deficiencies. Milk, dairy products, lentils, and dal are the leading sources of protein for the majority of the vegetarian population around India. Rice is predominantly used as the staple food for East and South Indians, while breads like roti and chapatti are most widely consumed in West and North India (Sarkar). Protein deficiency, obesity,

and undernourishment plague the nation due to a lack of education and the ability to afford nutritious foods.

Almost one in three malnourished children in the world live in India (Nutrition). Malnutrition does not only limit development, but also learning capacity. Worst yet, it costs lives: about half of all childhood deaths are due to malnutrition. According to the British charity, Save the Children, about 1.83 million Indian children die every year before turning 5. “Most...deaths occur from treatable diseases like pneumonia, diarrhea, malaria, and complications at birth” (Vyawahare). Madhya Pradesh ranks as the state with the highest malnutrition rate at 55%, while Kerala is among the lowest at a still significant 27%. Malnutrition in children results in long-term consequences, impeding motor, sensory, cognitive, social, and emotional development. Vitamin and mineral deficiencies are the primary culprits for Indians. In fact, anemia affects 74% of children under 3, 90% of adolescent girls, and 50% of women. Iodine deficiency, which results in decreased learning capacity, is widespread due to a lack of knowledge/use of iodized salt. Vitamin A deficiency, which causes blindness and increases the chance of death among preschoolers, is another significant issue.

India’s educational system reaches urban populations, but fails to have a significant standing across rural areas. In India, only about 2/3 of school-going-age children are enrolled; at least half drop out in rural areas. Because of India’s 61% literacy rate, urbanization is hampered, sitting at a mere 2.47%. Many children go on to become poor farmers or servants, resulting in inadequate wages with which they cannot afford nutritional foods. Even though there is a positive correlation between states with nutrition program funding and a decrease in malnutrition, India only spends 3.3% of its GDP on promoting education (CIA World Factbook).

Many Indians dream about serving through Healthcare, but, according to the CIA World Factbook, only 6 physicians exist for every 10,000 people. In fact, only 42% of births in India are attended by skilled staff. This is due to India contributing only 4.1% of its GDP on health expenditures. The low life expectancy of 67.48 years can be attributed to malnutrition along with a poor healthcare system. Malnutrition thrives in these areas, where healthcare facilities are expensive and difficult to find.

Infrastructure in India is insufficient at best. Economist Amartya Sen once said, “Famine is almost always a problem of food distribution and poverty, not global food production.” In fact, the Food & Agriculture Administration estimates 80% of malnourished children live in countries producing food surpluses (Allen). This year, India may lose a \$1.5 billion grain surplus due to deterioration (Blackstone). From poorly tarred roads to incomplete irrigation projects, India is full of “holes”. Because most farmers depend on rain-fed agriculture, there are few adequate canals that direct water throughout the country. Due to ridiculous amounts of corruption, it is difficult for farmers and poverty-stricken civilians to attain and even retain their own land. In addition to stringent land regulations, the rural poor have little access to credit, so they cannot obtain new machinery or better seeds.

To tackle malnutrition in India, there must be a holistic approach. No one solution can solve the predicament at hand. Malnutrition must be tackled through direct approaches, but ultimately solved through indirect and structural improvements in Indian society.

Protein deficiency is commonly found in rural India. Due to significant numbers of village-dwelling vegetarians, there are limited solutions. Steve Collins has worked around the world, establishing large therapeutic feeding centers for severely malnourished patients (Allen). His method works in treating severe acute malnutrition, but fails to regard long term solutions. Even if they are temporarily cured, people are prone to return due to a lack of education. In future centers, during or after recovery, patients could be educated in attaining a complete diet and avoiding malnourishment. Centers would teach everything from the BRAT (Bananas, Rice, Applesauce, Toast) and CRAM (Cereal, Rice, Applesauce,

Milk) diets to the idea behind getting all the macronutrients and micronutrients necessary to be fully capable humans.

Collins has also derived a ready-to-use-therapeutic-food (RUTF) that provides the malnourished with nutrients, energy, and protein (Allen). The fortified-protein-paste-based food would be perfect for India's largely vegetarian population. Collins's nonprofit organization, Valid Nutrition, works to aid malnourished children throughout the world, from Malawi to Ethiopia. With the help of non-governmental organizations (NGOs), such as India's Reliance Foundation, these RUTFs could be sent throughout India to rural therapeutic feeding centers. In 1968, UNICEF established networks of child feeding stations in schools, churches, and town halls, no more than three miles from one-another (UNICEF at 40). Through UNICEF's K-Mix-2, malnutrition was fought off in Nigeria. However, due to India being the seventh largest country in the world, establishing so many therapeutic centers is implausible. Competition may be the solution to this issue. Valid Nutrition, specifically, has plants in its respective countries, allowing for local crop cultivation and product manufacture. Similar projects would ensure that locals are educated in malnutrition and its prevention through hands-on experience. However, Valid Nutrition is not alone in this field. For-profit companies, like Nutriset, are springing up to build RUTFs. If RUTF companies established plants in India, they could contract with farmers and provide them with initial assets. Then they could hire locals to create the products. These companies could work with the Department of Food & Public Distribution, which seeks to allocate food to poverty-stricken areas. The companies could be given tax deductions so as to encourage employment and the fight against malnutrition. Companies like Nutriset would compete against each other in this newly formed field eventually leading to breakthroughs that would benefit the entire world.

Unlike RUTFs, Soylent provides wholesome nutrition from day one. The product contains all the necessary nutrients to sustain one's health. Soylent allows consumers to drink an inexpensive, convenient meal by mixing small packets with water. In malnutrition-prone areas, this would allow people to attain everything they need without having to worry about the diversity of their meals. By adding different flavor packets based on the local diets, Soylent could effectively reach out to the Indian population. This simple and efficient drink could be the fuel for the future, saving lives throughout India (Rhinehart).

In Madhya Pradesh, government-sponsored programs have already reduced anemia by enabling the Sahariya Tribe access to free, fortified wheat flour. This government initiative is one of many possible and practical options for ending malnutrition in India. The best part is that the fortification is added into the everyday staple food of chapatti, while remaining flavorless. Projects like this, perhaps using amaranth as a protein source, could be run throughout the country and empowered by government-run soup kitchens in rural areas (Fortified Wheat).

Scheduled (disadvantaged) Tribes make up 8.6% of India's 1.2 billion population (Ny Times). Among these tribes, water-deficiencies are consistent. For Bandrachiwadi Village families, the nearest water-source, a well, is 3 kilometers away (Vyawahare). To tackle this issue, state governments could initiate well-building and canal-building public works projects. While corruption and unaccountable local governments may hinder progress, the citizens must refrain from the status-quo and demand more of their political leaders.

Rural children must be taught the power of education. Often, many children are withdrawn from school by parents who seek temporary and minimal wages to support their families. One government initiative already in play is providing free cooked, hot food in public schools. These schools are to provide green, leafy vegetables in order to ensure the successful nourishment of the students. In rural schools though, food is often poorly made or spoiled. The Food Safety and Standards Authority of India along with state governments should take care in ensuring quality lunches in all schools so as to increase attendance rates. This would result in increased literacy and more people leaving the cycle of poverty and malnutrition.

Schools should also begin mandated health classes from an early age. These health classes could cover everything from fitness to nutrition. In rural societies, especially, agriculture-based schools should be formed. Even though India already has numerous agricultural colleges and universities, the nation lacks early disposition to agriculture. Early education would ensure locals were educated in their respective occupation from a very young age, allowing them to develop strong, hardy farms throughout their lifetime. Parents would also be inclined to send their children to school, seeing immediate and potential benefits for their children as well as their businesses.

Throughout India, genetically modified (GM) crops provide farmers with benefits, but at significant costs. T. Venkatesh of Andhra Pradesh uses Bt cotton, a genetically modified strain, to prevent bollworm infection. Venkatesh has found that even though the crop grows better, his revenue does not account for the crop's exorbitant costs. In fact, he must purchase new seeds annually. Because GM seeds account for 95% of cotton seeds in the country, Venkatesh is unable to revert to the conventional seed now that the bollworm is gone. Monsanto, the Bt cotton supplier, claims that it must keep costs high due to lengthy government regulation. Regardless, GM companies take advantage of uneducated farmers, charging thousands of rupees above the government-fixed price of ₹750. Because of this, India has created a black market for seeds that also exceed government-fixed prices, but remain lower than those of Monsanto's original product. These high seed costs have left small Indian farmers more vulnerable to harsh monsoons and other climate change-related dangers. In order to combat resistance or re-infestation by new pests, farmers could plant buffer zones, but because of how precious every morsel of land is, it would be "wasteful". In order to prevent large GM corporations from bullying small farmers, the government must pass legislation allowing farmers to reuse GM seeds or buy conventional seeds from GM-seed manufacturers. Because of this bullying, individual-owned small farms may eventually cease to exist, leading to the rise of a monopolized agriculture industry in India. This would cause a downturn in competition, resulting in poor production throughout the nation. In order to make the best of GM crops, the government must ensure the safety of the crop, the farmer, and the consumer. The government could also sponsor gene marker projects, to allow the artificial breeding of insect-resistant or drought-resistant crops, with no "genetic modification". Because rice is a staple crop, the Indian government could look to the Golden Rice Project for a strain rich in Vitamin A, as there is a significant nutrient-deficiency across the nation (Vitamin A). To further the use of Golden Rice and other nutrient-rich crops, farmers and companies growing crops to fight malnutrition could be provided subsidies and tax-breaks. Farmers must be educated in improving the biodiversity of their crops and using low-technology eco-friendly farming methods (Nemana).

While these projects tackle malnourishment through direct approaches, indirect approaches are essential to stabilize the infrastructure and delivery of nutrients to malnourished, rural Indians. These can range anywhere from healthcare augmentation to the improvement of the farm-to-market system.

Many farmers fall into poverty and lead nutrient-deficient lives because they cannot afford crops or goods. NGOs and large networks like the Indian Society of Agribusiness Professionals (ISAP) could fund microloan projects, following a policy of tolerance and understanding. This would allow farmers to buy quality seeds, goods, and/or machinery in order to build up their farms. After growing a surplus of food and selling it off, the farmers would eventually be able to reimburse donors. Farmers would also provide for the malnourished population. These companies could also offer tech loans so as to ensure that farmers do not waste money.

Healthcare facilities are infrequently found in rural settings. Most people here are left in the dust when it comes to being sanitary. The government could encourage healthcare facility and hospital construction in villages so as to provide for the poverty-stricken. In order to ensure that physicians and administrators would work in such settings, the government could provide incentives. If helping people was not enough,

people could be enticed to work in poverty-stricken areas for tax breaks and perks. Perhaps, it could be a mandated “service” as part of residency, modeled after the required military service found in Israel.

In addition, the Indian government could work with the International Atomic Energy Agency (IAEA) and the Food and Agriculture Organization (FAO) to eradicate pests attacking important crops and livestock. In Senegal, an FAO/IAEA project has practically eradicated the tsetse fly, a pest costing Niayes farmers \$1.6 million a year (Senegal). In India, similar joint ventures could be held in order to prevent pests like the Hispa which causes up to 65% of rice crop loss (Singh). Using radiation-induced sterilization techniques, India could rid the nation of dangerous pests, resulting in increased crop yields, empowering farmers who could supply malnutrition-prone regions with nutritious food.

The largest culprit keeping families malnourished is the farm to market system. There are too many middlemen involved in the transportation of goods. These middlemen reap large profits by manipulating farmers. Middlemen must be cut out to ensure the productivity and longevity of a farmer’s business. These farmers could then increase their revenue, and, in turn, provide for themselves and their family. This would allow for their children to attend school and learn proper agricultural techniques.

As Amartya Sen had described, food distribution, not production, is the most impeding problem hampering efforts to end malnutrition. One method of cutting out the middle man would be using a sort of tech loan. This specific technology could use cellphone towers, the internet, and WiFi. It could be designed to look like and work like a tablet/laptop. For more technology-prone areas, it would also serve as a platform accessible through one’s cellphone or computer. This device would connect farmers with each other and the outside world; everyone from local businesses to global businesses. Companies like McDonald’s would display how much of a specific crop they need. If a farmer saw that the spot was taken, they could grow other crops so as to fill the occupancy of another company or local restaurant. Grocery stores could display what they were in need of as well. Farmers markets and farm festivals would be put on a calendar, advertised for free. This would allow farmers to see exactly who they need to sell their products to. If their products are being produced in excess, they can either fill in a different niche or try to connect with global companies in order to export goods. The platform would also display graphs and tables of how certain commodities were looking, showing average pricing throughout the city, state, and nation. The farmer could also contract with the government in order to provide certain foods needed to support the malnourished in India. This would allow for them to help ensure food security throughout the country. The farmers could also communicate through some sort of “news-feed,” which would talk about which crops grew best in which conditions, or what farming methods worked best. With the help of the Ministry of Food Processing Industries, who welcomes new ideas that will support farmers, this technology could become a reality. By cutting out the middleman and connecting with businesses and companies throughout India, farmers would be thoroughly empowered and enabled to pay off their past debts, leading to a life full of happiness and nourishment.

The Indian people are in a dire situation where malnutrition plagues everyone, irrespective of caste. The wealthy are suffering from increasing obesity rates while the poor remain largely undernourished. Everything from iodine deficiency to anemia wrecks the rural people. Because micronutrient deficiencies, alone, cost India over \$2.5 billion annually, the Indian government must show its full-fledged support to its significantly rural population. If India cannot support 70% of its people, the nation is wired for disaster. In order to improve not only the infrastructure but the knowledge necessary to solve malnutrition, India must take a holistic approach. By solidifying its education system, the nation will begin the process to a fruitful future. To ensure attendance and give immediate satisfaction to the parents who would want their children working in the fields, rural schools must focus on agriculture and entrepreneurship. By promoting both ideals, young children will start their journey to a healthy and prosperous life. If malnutrition arises, RUTFs must be made available through widespread, competitive therapeutic centers. The patients must be educated in malnutrition while at the facilities in order to end a

repeating process. In addition, the facilities could teach individuals how to fortify their traditional foods using nutritional supplements or ingredients such as iodized salt. To augment the food distribution system in India, a farm-to-market technology is necessary. By empowering farmers with the knowledge of the environment, they would be able to provide essential crops to the right markets without letting large stores go to waste. By contracting with the government in a program to reach malnutrition-prone areas, these farmers would help save millions of lives. In order to end malnutrition and prevent a future onset, India must develop a holistic program that will empower its rural population. Only through government support and non-governmental initiatives will India finally see a decrease in malnutrition rates.

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