ABSTRACT
The objective of this paper is to present an update on plant-based diets. Concerns about the rising cost of health care are being voiced nationwide, even as unhealthy lifestyles are contributing to the spread of obesity, diabetes, and cardiovascular disease. For these reasons, physicians looking for cost-effective interventions to improve health outcomes are becoming more involved in helping their patients adopt healthier lifestyles. Healthy eating may be best achieved with a plant-based diet, which we define as a regimen that encourages whole, plant-based foods and discourages meats, dairy products, and eggs as well as all refined and processed foods. We present a case study as an example of the potential health benefits of such a diet. Research shows that plant-based diets are cost-effective, low-risk interventions that may lower body mass index, blood pressure, HbA1c, and cholesterol levels. They may also reduce the number of medications needed to treat chronic diseases and lower ischemic heart disease mortality rates. Physicians should consider recommending a plant-based diet to all their patients, especially those with high blood pressure, diabetes, cardiovascular disease, or obesity.

INTRODUCTION
The word health means different things to different people, depending on the situation. If somebody says "I was worried about my husband's health when he climbed Mt. Everest", it is clear that the woman is referring to her husband's physical health, possibly his heart, skin (frostbite) and risk of developing hypothermia (when the body's temperature drops too low). On the other hand, if you hear the phrase "With all these deadlines, presentations and working weekends, I wonder what the effect will be on her health," most likely the word "health" refers more to mental health than physical health (although the two are often linked). The English word "health" comes from the Old English word hale, meaning "wholeness, being whole, sound or well,". Hale comes from the Proto-Indo-European root kailo, meaning "whole, uninjured, of good omen". Kailo comes from the Proto-Germanic root khalbas, meaning "something divided". "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". (WHO definition of Health)

Wellness vs. health
The term wellness was first used by a doctor called Halbert L. Dunn, USA, who published a small booklet entitled "High Level Wellness" in 1961. The term is much more widely used in
North American than in the United Kingdom. According to the McKinley Health Center, University of Illinois, wellness "is a state of optimal well-being that is oriented toward maximizing an individual's potential. This is a life-long process of moving towards enhancing your physical, intellectual, emotional, social, spiritual, and environmental well-being."

**Determinants of health**

The health of individual people and their communities are affected by a wide range of contributory factors. People's good or bad health is determined by their environment and situations - what is happening and what has happened to them, says WHO. WHO says that the following factors probably have a bigger impact on our health than access and use of health care services?
- Where we live
- The state of our environment
- Genetics
- Our income
- Our education level
- Our relationship with friends and family.

**WHO says the main determinants to health are:**

- Our economy and society (**"The social and economic environment"**)  
- Where we live, what is physically around us (**"The physical environment"**)  
- What we are and what we do (**"The person's individual characteristics and behaviors"**).

As our good health depends on the context of our lives, praising or criticizing people for their good or bad health is wrong. Most of the factors that contribute towards our good or bad health are out of our control. According to WHO, these factors (determinants), include the following, among others?

**Socio-economic status**

The higher a person's socioeconomic status is, the more likely he/she is to enjoy good health. The link is a clear one. Socioeconomic status affects all members of the family, including newborn babies. Australian researchers found those women of lower socioeconomic status are less likely to breastfeed their newborn babies - a factor which will have an impact on the health of the baby just as he/she enters the world. A South Korean study revealed a clear link between low socioeconomic status and attack and stroke risk.

**Education**

People with lower levels of education generally have a higher risk of experiencing poorer health. Their levels of stress will most likely be higher, compared to people with higher academic qualifications. A person with a high level of education will probably have greater self esteem. A study carried out by researchers at North-western University Feinberg School of Medicine, Chicago; found that elderly people who had a higher level of health literacy were more likely to live longer. Another study from San Francisco VA Medical Center found that literacy at less than a ninth-grade level most doubles the five year risk of mortality among elderly people.

**Physical environment**

If your water is clean and safe, the air you breathe is pure, your workplace is healthy, your house is comfortable and safe, you are more likely to enjoy good health compared to somebody whose water supply is not clean and safe, the air he/she breathes is contaminated, the workplace is unhealthy etc. A study carried out by researchers at Zuyd University, The Netherlands; found that just an hour of sniffing car exhaust fumes induces a stress response in the brain’s activity. Another study carried out at Indiana University-Purdue University found that chronic lead poisoning
caused in part by the ingestion of contaminated dirt, affect hundreds of thousands more children in United States and Asian countries than the acute lead poisoning associated with imported toys or jewellery.

**Job prospects and employment conditions**
If you have a job, statistics show you are more likely to enjoy better health than people who are unemployed. If you have some control over your working conditions your health will benefit too. Researchers at State University of New York at Albany found that workers who lost their job through no fault of their own were twice as likely as continuously employed workers to report over the next 18 months that they developed a new illness, such as high blood pressure, diabetes or heart disease. Support from people around you
If you have family support, as well as support from friends and your community your chances of enjoying good health are far greater than somebody who has none of these things. A team from the University of Washington found that strong family support, not peer support, is protective in reducing future suicidal behavior among young adults when they have experienced depression or have attempted suicide.

**Culture**
The traditions and customs of a society and how a family responds to them play an important role in people's health. The impact could be either good or bad for health. The tradition of genital mutilation of women has an impact on infection rates and the mental health of millions of girls and women in many countries. A study published in the Journal of Epidemiology and Community Health found that when young people dress according to the customs of their own ethnic group, they may be less likely to have mental health problems later in life.

**Genetic inheritance**
People's longevity, general health, and propensity to certain diseases are partly determined by their genetic makeup. Researchers from Vrije Universiteit, Holland, the Medical College of Georgia, USA, and Duke University, USA showed that people's genes play a key role in how they respond both biologically and psychologically to stress in their environment.

**Gender**
Men and women are susceptible to some different diseases, conditions and physical experiences, which play a role in our general health. For example, childbirth, ovarian cancer, and cervical cancer, are experienced only by women, while prostate cancer, testicular cancer are only experienced by men. During wars, more men than women tend to be called up to fight, and subsequently become injured or die. Adult women are more likely to be the physical victims of domestic abuse compared to adult men. In some societies women are not given the same access to education as men - education is a factor that influences health. Many studies have revealed gender disparities in healthcare services, even in developed countries.

**Definitions of Plant-Based Diets**
A plant-based diet emphasizes vegetables, fruits, legumes, and whole grains. These foods are good sources of protein, carbohydrates, fat, vitamins, and minerals. They are also naturally lower in calories than foods made from animals. *(The American Institute for Cancer Research (AICR))*
A plant-based diet is one based on vegetables, whole grains, legumes and fruit, with little or no animal products (including dairy). It may refer to:
- **Vegan diet**: a plant-based diet with no food from animal sources. The term *veganism* refers to the practice of abstaining from the use of animal products for any reason.
- **Fruitarianism**: a form of vegan diet, in which meals consist primarily of fruit.
- **Raw veganism**: a form of vegan diet, in which food is uncooked or only dehydrated.
- **Vegetarianism**: a plant-based diet that may include eggs, milk, and cheese.
- **Semi-vegetarianism**: a plant-based diet with occasional inclusion of meat products.
- **Macrobiotic diet**: a plant-based diet with occasional seafood.
- **Nutritarian**: a person who eats as many micronutrients per calorie as possible, primarily from vegetables and fresh fruits, and avoids processed foods.
- **Starch-based diet**: a plant-based diet deriving most of its calories from starchy vegetables, beans, and grains, and supplemented by other whole fruits and vegetables.
- **SOS-Free**: a diet that is free of sugar, oil and salt, and is an additional characteristic of many that follow a plant-based diet.

**Food Group**

Use the chart on the following pages to help you choose the foods that you will need to thrive on your new eating plan.

**Tips**

- If you want to lose weight, choose a lower number of servings of nuts, seeds, and tofu.
- Choose unprocessed, whole foods instead of processed foods most of the time.
- Choose whole grains (barley, quinoa, or brown rice) more often than processed grains (bread or pasta).
- Avoid processed vegan or vegetarian “meats” and “cheeses.”
- Avoid all kinds of processed oils.
- If you have diabetes or high triglycerides, limit fruit to 2 servings a day.
- Do not focus on portion control. Focus on calorie density instead.

<table>
<thead>
<tr>
<th>FOOD GROUP</th>
<th>EXAMPLES OF FOOD CHOICES</th>
<th>DAILY SERVING SIZE</th>
<th>SERVING SIZE; PROTEIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tubers and starchy vegetables</td>
<td>Potatoes, yams, winter squash, corn, green peas, cassava (yucca) plantains</td>
<td>2–4 servings ½ cup: 2 grams</td>
<td>½ cup: 2 grams</td>
</tr>
<tr>
<td>Whole grains</td>
<td>Whole grains: bulgur, quinoa, oats, brown or wild rice, buckwheat, barley, faro, whole wheat, rye, millet, sorghum. Processed grains: whole-grain bread, whole-grain unsweetened cereal, whole-wheat tortillas, whole-wheat pasta</td>
<td>5–8 servings</td>
<td>Unlimited, but eat at least 6 servings a day. Include at least 1 serving of leafy green vegetables a day. But eat at least 6 servings a day. Include at least 1 serving of leafy green vegetables a day.</td>
</tr>
<tr>
<td>Non-starchy vegetables</td>
<td>Spinach, kale, Swiss chard, mustard greens, collard greens, broccoli, bok choy, carrots, cauliflower, asparagus, green beans, Brussels sprouts, celery, eggplant, mushrooms, onions, garlic, tomatoes, lettuce, sugar snap peas, summer squash, peppers, artichoke hearts, cabbage, cucumbers</td>
<td>Unlimited, but eat at least 6 servings a day. Include at least 1 serving of leafy green vegetables a day.</td>
<td>But eat at least 6 servings a day. Include at least 1 serving of leafy green vegetables a day.</td>
</tr>
<tr>
<td>Fruits</td>
<td>Apples, oranges, bananas, berries, melon,</td>
<td>2–4 servings</td>
<td>1 medium</td>
</tr>
</tbody>
</table>
papaya, grapes, mango, pineapple, kiwi, apricots

Almonds, cashews, sunflower seeds, walnuts, pistachios, flax seeds, chia seeds, nut butter, avocado, tofu

Unsweetened milks, such as soy, almond, rice, and hemp (look for brands fortified with vitamin B12)

Kidney, black, garbanzo, pinto, great northern, and adzuki beans; lentils; edamame (green soybeans); green and black-eyed peas; tofu; tempeh

High fat plant foods
Suggested dairy substitutes
Beans, peas, and lentils

Colorful plant foods are also good sources of phytochemicals. Phytochemicals are naturally present in plant foods, and they can help to protect our body’s cells from damage by cancer-causing agents. They also help support overall health. Eating a plant-based diet does not mean that you have to become a vegetarian; it just means that you should try to select most of your foods from plant sources.

<table>
<thead>
<tr>
<th>COLOR</th>
<th>EXAMPLES OF COLORFUL FOODS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>Phytochemical: lycopene</td>
</tr>
<tr>
<td></td>
<td>Tomatoes, tomato products, pink grapefruit, and watermelon</td>
</tr>
<tr>
<td>Red/Purple</td>
<td>Phytochemical: anthocyanins</td>
</tr>
<tr>
<td></td>
<td>Grapes, grape juice, prunes, cranberries, blackberries,</td>
</tr>
<tr>
<td></td>
<td>strawberries, red apples, and red wine</td>
</tr>
<tr>
<td>Orange</td>
<td>Phytochemical: carotenoids</td>
</tr>
<tr>
<td></td>
<td>Carrots, mangos, apricots, cantaloupe, pumpkin, acorn squash,</td>
</tr>
<tr>
<td></td>
<td>winter squash, and sweet potatoes</td>
</tr>
<tr>
<td>Orange/Yellow</td>
<td>Phytochemical: beta cryptothanxin</td>
</tr>
<tr>
<td></td>
<td>Orange juice, oranges, tangerines, peaches, papaya, and</td>
</tr>
<tr>
<td></td>
<td>nectarines</td>
</tr>
<tr>
<td>Yellow/Green</td>
<td>Phytochemicals: lutein and zeaxanthin</td>
</tr>
<tr>
<td></td>
<td>Spinach; collard, turnip, mustard greens; yellow corn;</td>
</tr>
<tr>
<td></td>
<td>green peas; avocados; and honeydew melon</td>
</tr>
<tr>
<td>Green</td>
<td>Phytochemicals: indoles and sulforaphanes</td>
</tr>
<tr>
<td></td>
<td>Cabbage, broccoli, Brussels sprouts, and kale sprouts, and</td>
</tr>
<tr>
<td></td>
<td>kale</td>
</tr>
<tr>
<td>White/Green</td>
<td>Phytochemicals: allicin, quercetin, flavonoids.</td>
</tr>
<tr>
<td></td>
<td>Leeks, onions, garlic, chives, white grape juice, and white</td>
</tr>
<tr>
<td></td>
<td>wine</td>
</tr>
</tbody>
</table>

Benefits of Plant-Based Diets

Diabetes
The evidence favoring a new approach came first from comparisons of various populations around the world. People whose diets were based mainly on plant-derived foods—that is, rice, noodles, beans, and
vegetables—were less likely to develop diabetes, compared with people whose diets are fattier or centered on meatier dishes. The following plant foods are sometimes used for diabetes treatment particularly for those with type-2 diabetes: Brewer’s yeast, Buck wheat, Broccoli, Cinnamon, Cloves, Coffee, Kara, Peas and Sage.

Heart Disease & High Blood Pressure

A plant-based diet can be good for your heart. If you’re eating mostly or only fruits, vegetables, nuts, beans, whole grains, and meat substitutes like soy, you may cut your odds of getting heart disease, high cholesterol, high blood pressure, and type 2 diabetes, compared to a diet that includes a lot more meat. There are many different types of plant-based diets. The three most common ones are:

Vegan: No animal products such as meat, eggs, or dairy products. Lacto-vegetarian: No meat or eggs, but dairy products are OK. Lacto-ovo-vegetarian: No meat, but dairy products and eggs are OK.

You can eat a plant-based diet without going completely vegetarian. Some people call themselves "flexitarians" or "semi-vegetarians," meaning that they occasionally eat meat, poultry, pork, or fish. You might also hear the term "pescatarian," which means they eat a plant-based diet plus fish.

Mortality

Research has shown that the foods you eat influence your health. Eating certain foods, such as fruits and nuts, has been associated with reduced death rates, while other foods, such as red meat and processed meat, have been linked to increased mortality. Studies comparing overall eating patterns and mortality rates, however, have had mixed results.

A research team led by Drs. Michael Orlich and Gary Fraser at Loma Linda University explored the connections between dietary patterns and death in Seventh-day Adventist men and women. The research was part of an ongoing analysis of people recruited at Seventh-day Adventist churches in the United States and Canada between 2002 and 2007. Adventists tend to have similar lifestyle habits. For instance, they typically don’t smoke or consume alcohol. However, they have a range of dietary patterns, making them an ideal group for teasing out the links between diet and the causes of death and disease.

The researchers studied more than 73,000 people ages 25 and older. The participants were categorized into dietary groups at the time of recruitment based on their reported food intake during the previous year. The study was funded in part by NIH’s National Cancer Institute (NCI), and appeared online on June 3, 2013, in JAMA Internal Medicine.

Nearly half of the participants were non vegetarian, eating red meat, poultry, fish, milk and eggs more than once a week. Of the remaining, 8% were vegan (eating red meat, fish, poultry, dairy or eggs less than once a month); 29% were lacto-ovo vegetarians (eating eggs and/or dairy products, but red meat, fish or poultry less than once per month); 10% were pesco-vegetarians (eating fish, milk and eggs but rarely red meat or poultry); and 5% were semi-vegetarian (eating red meat, poultry and fish less than once per week).

Over about 6 years, there were 2,570 deaths among the participants. The researchers found that vegetarians (those with vegan, and lacto-ovo-, pesco-, and semi-vegetarian diets) were 12% less likely to die from all causes combined compared to non vegetarians. The death rates for subgroups of vegans, lacto-ovo–vegetarians, and pesco-vegetarians were all significantly lower than those of non vegetarians. Those on a vegetarian diet tended to have a lower rate of death due to cardiovascular disease, diabetes, and renal disorders such as kidney failure. No association was detected in this study between diet and
deaths due to cancer. The researchers also found that the beneficial associations between a vegetarian diet and mortality tended to be stronger in men than in women.

The researchers note several limitations to the study. Participants only reported their diet at the beginning of the study, and their eating patterns might have changed over time. In addition, they were only followed for an average of 6 years; it may take longer for dietary patterns to influence mortality.

“This research gives more support to the idea that certain vegetarian dietary patterns may be associated with reduced mortality and increased longevity. This is something that may be taken into account by those making dietary choices and by those offering dietary guidance,”

Protein

Protein is in every cell of the body. It is used to build and repair muscles, bone, skin, and the immune system. We also need it to make hormones and enzymes. Proteins are made up of amino acids. Your body can make some of the amino acids, but not all of them. The ones your body cannot make are called essential amino acids. You can easily meet your protein needs each day from plant foods.

Iron

Iron is a mineral in the blood that carries oxygen. Getting enough iron is important for everyone, especially pregnant women, women of childbearing age, children, and infants. Iron-rich plant foods include whole-grain breads and cereals, dried beans and peas, dark green leafy vegetables, dried fruits, nuts, and seeds. Some foods, such as breakfast cereals, are fortified with iron. The type of iron found in plant foods is not absorbed as easily as the iron in animal products. However, eating iron-rich foods along with vitamin C can help your body better use the iron. Some foods with vitamin C are oranges, mangos, kiwis, strawberries, red peppers, tomatoes, broccoli, and bok choy. Vitamin B12 Your body needs vitamin B12 to make red blood cells and for nerve function. If you don’t get enough B12, you can develop anemia or nerve damage. Vitamin B12 is made by bacteria and is found in higher concentration in animal foods. But B12 requirements can be met in nutritional yeast and some fortified foods such as:

• Cereals. • Rice or hemp milk.

Calcium and Vitamin D

Calcium helps build bones and teeth. It is also important for the function of the heart, muscles, and nerves. Good sources of calcium are Chinese cabbage, bok choy, kale, calcium-set tofu, and broccoli. There are also many calcium-fortified foods, such as soy or almond milk and cereal.

Vitamin D is actually a hormone. It is needed for strong bones. It is also needed for muscles and nerves and for the immune system to work properly. We get most of our vitamin D when our skin is exposed to the sun. Very few foods naturally have vitamin D. Some foods, such as soy or almond milk and cereal, have added vitamin D. It is important to get outside and get a limited amount of unprotected sun exposure. If you are not able to get outside enough, you may need a supplement.

Fatty Acids

Omega-3s are used in the formation of cell walls and assist in improving circulation. Omega-3 fatty acids include alpha-Linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA).

Good sources of plant-based omega-3 fats include flaxseeds, black beans, winter squash, walnuts, and chia seeds. It is important to remember that all plant proteins contain varying amounts of omega-3 in the form of ALA. Your body then converts ALA to EPA and DHA as required.

Zinc

Zinc is important for the immune system, wound healing, and blood sugar control. Good sources are whole grains, sprouted grains, tofu, tempeh, beans, peas, lentils, nuts, seeds, and fortified breakfast cereal.
CONCLUSION
A healthy, plant-based diet requires planning, reading labels, and discipline. The recommendations for patients who want to follow a plant-based diet may include eating a variety of fruits and vegetables that may include beans, legumes, seeds, nuts, and whole grains and avoiding or limiting animal products, added fats, oils, and refined, processed carbohydrates. The major benefits for patients who decide to start a plant-based diet are the possibility of reducing the number of medications they take to treat a variety of chronic conditions, lower body weight, decreased risk of cancer, and a reduction in their risk of death from ischemic heart disease.

A plant-based diet may also help in averting and/or slowing certain cancers (like breast, prostate, cervical, colon as well as BPH, benign prostatic hypertrophy)

This is in part because plant foods contain anti-aging, anti-cancer antioxidants (on average 64 times more than animal) fiber and phytochemicals which in some cases can help repaired DNA damage. Even two weeks on a plant based diet appears to dramatically improve cancer defences. The blood of those on plant-based diets is more effective at killing cancer cells than those who eat a standard diet even if they exercise strenuously. Angiogenesis inhibitors in plant foods may help prevent cancerous tumours from connecting to a blood supply. Methionine restriction, best achieved through a plant-based diet, starves human tumours of the amino acid necessary for their growth—all while potentially extending our life span..

To reduce cancer risk, we can suppress the engine-of-aging enzyme TOR (Target of Rapamycin) by reducing intake of leucine—rich animal products such as dairy products.

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