



The New Bioethics

A Multidisciplinary Journal of Biotechnology and the Body

ISSN: (Print) (Online) Journal homepage: <https://www.tandfonline.com/loi/ynbi20>

Will the plant-based movement redefine physicians' understanding of chronic disease?

Maximilian Andreas Storz

To cite this article: Maximilian Andreas Storz (2020) Will the plant-based movement redefine physicians' understanding of chronic disease?, The New Bioethics, 26:2, 141-157, DOI: [10.1080/20502877.2020.1767921](https://doi.org/10.1080/20502877.2020.1767921)

To link to this article: <https://doi.org/10.1080/20502877.2020.1767921>



Published online: 27 Jun 2020.



Submit your article to this journal [↗](#)



Article views: 375



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 1 View citing articles [↗](#)

Will the plant-based movement redefine physicians' understanding of chronic disease?

MAXIMILIAN ANDREAS STORZ 

Medical doctor at Peter-Goessler-Strasse 14, 72076 Tübingen, Baden-Württemberg, Germany

The world is experiencing a cataclysmically increasing burden from chronic illnesses. Chronic diseases are on the advance worldwide and treatment strategies to counter this development are dominated by symptom control and polypharmacy. Thus, chronic conditions are often considered irreversible, implying a slow progression of disease that can only be hampered but not stopped. The current plant-based movement is attempting to alter this way of thinking. Applying a nutrition-first approach, the ultimate goal is either disease remission or reversal. Hereby, ethical questions arise as to whether physicians' current understanding of chronic illness is outdated and morally reprehensible. In this case, physicians may need to recommend plant-based diets to every patient suffering from chronic conditions, while determining what other socio-ecological factors and environmental aspects play a role in the chronic disease process. This article provides insights to aspects of diet and chronic illness and discusses how the plant-based movement could redefine current understanding of chronic disease. The ethical justifications for recommending of a plant-based diet are analyzed. The article concludes that not advocating for plant-based nutrition is unethical and harms the planet and patients alike.

KEYWORDS Vegan, plant-based diet, chronic illness, chronic disease, remission, reversal

Introduction

The world is experiencing a cataclysmically increasing burden from chronic illness (Hajat and Stein 2018). Cardiovascular disease, obesity, diabetes and other chronic conditions spread around the globe like an unstoppable virus. The number of patients suffering from multiple concomitant lifestyle-related conditions is skyrocketing – without any prospect of sustained improvement. According to Hajat and Stein (2018), current data suggest that up to 57% of adults in developed countries suffer

from more than one chronic condition. In 2020, 157 million Americans are expected to live with at least one chronic condition and the future health care work-force is not projected to include an appropriate mix of personnel capable to deal with this trend in a multidisciplinary manner (Bodenheimer *et al.* 2009).

From an economical perspective, this alarming development imposes a growing burden on insurers, government health programmes, and businesses (Barnard 2013). At present, more than 85% of health care costs are attributable to chronic health conditions in the United States (Beckman 2019). The rising epidemic of diabetes and obesity is now outstripping most preventive efforts, adding further to the cost of healthcare and costing lives (Williams 2017).

From an ecological point of view, current trends are appalling and lead into a virtual *cul-de-sac*. The healthcare sector, and hospitals in particular, is a major contributor to worldwide carbon emissions (McGain and Naylor 2014, Tomson 2015, Pichler *et al.* 2019). Increasing patient numbers suffering from chronic lifestyle-related disease will inevitably result in additional medical interventions and procedures which, in turn, will further contribute to a steadily rising hazardous waste production, energy expenditure and, finally, depletion of natural resources.

Treatment approaches for chronic conditions, such as cardiovascular disease, rheumatoid arthritis and diabetes, are often dominated by symptom control and risk factor management. This is, *inter alia*, the result of our current understanding of the terms ‘chronic disease’ and ‘chronic condition’. Although definitions appear inhomogeneous and vary tremendously in the academic literature (Bernell and Howard 2016), most include some common features.

Chronic illnesses are usually prolonged, difficult to treat (Bell *et al.* 2016) and do not resolve spontaneously. They are rarely completely cured, require ongoing medical attention and ‘limit activities of daily living’ (Warshaw 2006). Moreover, chronic conditions are associated with impairment or disability (Bell *et al.* 2016) and have a detrimental influence on a patient’s quality of life (Whittemore and Dixon 2008, Somrongthong *et al.* 2016). In short, many definitions imply the basic idea of a generally slow progression of disease that can only be hampered, but not stopped.

The current plant-based movement is attempting to fundamentally alter this way of thinking. By practicing a nutrition-first approach (Ha 2019), participating health-care professionals aim for a different path. While classical polypharmacy-dominated treatments often target temporary relief of symptoms, the nutrition-first approach is based on a diametrically opposed understanding of chronic conditions. Instead of a mere management of symptoms and slowing down disease progression, the ultimate goal is disease reversal, which means remission of clinical symptoms and normalization of relevant laboratory values. To understand this concept, a closer look at the plant-based movement and vegan eating patterns is required.

Plant-based nutrition and vegan diets

The proportion of individuals deciding to follow a vegan diet has significantly increased within recent years (Radnitz *et al.* 2015). Within the plant-based

movement, unhealthy nutrition is considered the key factor for the development of several chronic conditions such as obesity, diabetes and cardiovascular disorders. According to Kahleova *et al.* (2017), almost one half of cardio-metabolic deaths in the United States could be prevented through proper nutrition.

The consumption of a Western diet, including large amounts of red meat, poultry, fish, dairy products and eggs is seen as the common denominator promoting inflammatory reactions (Zinöcker and Lindseth 2018), diminished endothelial function (Esselstyn 2017), insulin resistance (McMacken and Shah 2017) and immunogenic compounds such as N-Glycolylneuraminic acid (Neu5Gc) in the human body (Tangvoranuntakul *et al.* 2003). It has been often suggested that a Western diet rich in animal foods leads to increased inflammation, reduced control of infection, increased risk for allergic and auto-inflammatory disease and even increased rates of cancer (Myles 2014).

Plant-based diets avoid or heavily restrict the frequency of animal food consumption (Satiya and Hu 2018). According to Ostfeld, a plant-based diet excludes all animal products, including red meat, fish, poultry, eggs, and also dairy (2017). Instead of animal products, a whole-food, plant-based diet emphasizes vegetables, legumes, fruits, whole grains, nuts, herbs and seeds. Due to the frequent intake of fruits, vegetables, whole grains, and legumes, a plant-based diet is high in fibre and rich in vitamins and minerals (Physicians Committee for Responsible Medicine 2019). Since animal products are usually excluded, it is also free of cholesterol, and low in calories and saturated fat (Coulston 1999).

It should be taken into account that the term *plant-based* is sometimes used interchangeably with *vegan* or *vegetarian* (Tuso *et al.* 2013). Technically, however, this is not correct since a vegan (or total vegetarian) diet on the one hand stringently excludes all animal products (meat, seafood, poultry, eggs, and dairy products), while it does not require consumption of whole foods or restriction of fat and refined sugar on the other. Vegetarian diets exclude meat and fish consumption but may include dairy products (lacto-vegetarian) or eggs (ovo-vegetarian) (Timko *et al.* 2012, Patelakis *et al.* 2019).

Unhealthful vegan diets including large amounts of less-healthy and processed plant foods (sweetened beverages, refined grains, fries and sweets) were associated with an increased risk for coronary heart disease (Satiya *et al.* 2017). Therefore, caloric intake still requires attention and patients need to be taught that foods that are labelled vegan are not necessarily healthful because they are often dense in calories and high in sodium (Radnitz *et al.* 2015). Vegan diets adopted for religious or ethical reasons may or may not be healthy, heavily depending on what kind of foods they include and not only on what they exclude (Tuso *et al.* 2013). Therefore, it seems prudent to emphasize eating healthy, and whole, plant-based foods while avoiding or heavily restricting the frequency of animal food consumption.

Patients are subsequently encouraged to refrain from refined and (ultra) processed foods (Tuso *et al.* 2013), including savoury snacks, reconstituted meat products and substitutes, pre-prepared frozen dishes, and soft drinks (Lawrence and Baker 2019). While usually free from animal-suffering, popular meat substitutes for example are often rich in sodium, emulsifiers, monosodium glutamate, flavours, colours and

other cosmetic additives. A higher consumption of such ultra-processed foods (>4 servings daily) was independently associated with a 62% relatively increased hazard for all-cause mortality (Rico-Campà *et al.* 2019). Of note, benefits from consuming a plant-based diet will be relative to the level of frequency, as well as the amount, of animal products consumed (Tuso *et al.* 2013). As a corollary, emphasizing a healthy diet requires physicians not only to encourage patients to refrain from animal product consumption, but also to stress the importance of whole, plant-based foods.

It is of paramount importance that more and more societies and academies recommend the use of vegetarian and vegan diets. In a 2016 position paper, the Academy of Nutrition and Dietetics recognized vegan diets appropriate for all stages of the life cycle, including childhood, adolescence, pregnancy, lactation, infancy, older adulthood and also for athletes (Melina *et al.* 2016). Another renowned organization, the British Dietetic Association, recently affirmed that a well-planned vegan diet can support healthy living in people of all ages (British Dietetic Association 2020).

The use of a plant-based diet as a means of prevention and treatment has frequently been shown in both clinical and epidemiological studies. These findings could slowly but steadily lead to a new understanding of chronic conditions.

Disease reversal

A whole-food plant-based diet is the key to understand disease reversal (Klaper 2019). A diet that strictly excludes animal products may not only stop the progression of many chronic conditions, but has the potential to reverse them. The most prominent example of this is cardiovascular disease.

Cardiovascular disease

Heart disease remains the single largest cause of death in countries of all income groups (Nowbar *et al.* 2019). Despite more than 40 years of aggressive drug and surgical interventions (Esselstyn *et al.* 2014), cardiovascular disease is also the leading cause of loss of disability-adjusted life years globally (Stewart *et al.* 2017). Millions of patients around the globe suffer from angina – an impairing condition that is often just temporarily relieved by pharmacological treatment.

Dean Ornish and colleagues demonstrated that a plant-based diet – combined with a lifestyle programme including moderate aerobic exercise – may substantially help affected patients (1998). According to the results of their randomized trial, patients that received the described lifestyle intervention for one year reported a remarkable 91% reduction in angina attacks. The control group in this study included patients that were asked to listen to the advice of their physicians. Astonishingly, these patients had a 186% increase in reported attack frequency. The long-term effects in regard to chest pain frequency and severity were comparable to that of coronary artery bypass surgery or angioplasty (Greger 2015). Lifestyle interventions are cheaper and do not bear the side effects of surgical procedures or pharmacological treatments.

Of note, other subsequent studies that focused primarily on adoption of a plant-based diet without additional exercise revealed comparable results. A landmark study by Esselstyn and colleagues included 198 patients with significant coronary artery disease (Esselstyn *et al.* 2014). The subjects in this study suffered from multiple comorbidities such as hyperlipidaemia ($n = 161$), hypertension ($n = 60$), and diabetes ($n = 23$).

The patients were prescribed a whole-food plant-based diet, including whole grains, legumes, lentils, other vegetables, and fruits. Added oils and processed foods that contain fish, meat, fowl and dairy products were not allowed. During the following four years of follow-up, angina improved significantly in approximately 93% of patients. Moreover, 99.4% of the participants who followed the plant-based diet avoided any major cardiac event – including myocardial infarction – stroke and death. Unfortunately, 21 participants did not adhere to the prescribed diet and more than 60% (13/21 participants) of them consecutively experienced an adverse event.

In a more recent editorial, Esselstyn (2017) compared the findings from his trial to other well-known studies including the COURAGE trial (Boden *et al.* 2007) and the Lyon Diet Heart Study (de Lorgeril *et al.* 1999), which both consisted of conventionally treated participants. The author concluded that there is more than a 30-fold positive difference in major cardiovascular events when individuals eat a whole food plant-based diet (Esselstyn 2017). Findings from Esselstyn *et al.* (2014) strongly suggest that dietary change is the most active ingredient (Greger 2015) in reducing cardiovascular events. Plant-based diets are not only capable of slowing progression of coronary artery disease, but can reverse it. In many cases, this is possible without medication and additional procedures (Massera *et al.* 2015, Mejia *et al.* 2016).

It is now widely accepted that diets higher in plant foods and lower in animal foods are associated with a lower risk of cardiovascular mortality and morbidity (Kim *et al.* 2019). The fact that plant-based nutrition has beneficial effects on several established cardiovascular risk factors, such as hypertension (Alexander *et al.* 2017), adds to the overwhelming body of evidence. A meta-analysis by Yokoyama *et al.* (2014a) revealed that consumption of vegetarian diet was associated with lower mean systolic blood pressure (-6.9 mmHg; 95% CI, -9.1 to -4.7 ; $p < .001$) and diastolic blood pressure (-4.7 mmHg; 95% CI, -6.3 to -3.1 ; $P < .001$) in comparison with the consumption of a conventional diet.

Disease reversal by adopting a plant-based diet has been observed in various other chronic conditions affecting millions of people worldwide. Another example frequently cited in the literature is type 2 diabetes.

Type 2 diabetes

Type 2 Diabetes has been referred to as the ‘Black Death’ of the twenty-first century in terms of its detrimental economic impact and devastating health burden (Matthews and Matthews 2011). Since the 1980s, the global prevalence of diabetes has nearly quadrupled (NCD Risk Factor Collaboration 2016) and the costs of the disease and its consequences will substantially increase by 2030 (Bommer *et al.* 2018). This development is most alarming, considering the fact that the disease is caused mainly by poor diet and lifestyle habits (Barnard 2013).

Findings from large epidemiological cohort studies several years ago revealed that a low fat, plant-based diet is associated with a substantial and independent reduction in diabetes incidence (Tonstad *et al.* 2013, Satija *et al.* 2016). In a series of clinical trials, the American physician Neal Barnard and his team of researchers and physicians consistently demonstrated the effectiveness of a vegan diet in individuals suffering from type 2 diabetes.

In 2003, Barnard and colleagues performed one of the first major randomized clinical trials in the field. Subjects with type 2 diabetes were told to consume a purely plant-based (vegan) diet. The latter was compared to a conventional diet based on the 2003 American Diabetes Association (ADA) guidelines. After only 22 weeks, haemoglobin A1c fell 1.23 points in the vegan group, compared to 0.38 points in the control group ($p = 0.01$). Furthermore, a substantial decrease in body weight was observed (−6.5 kg in the vegan group and 3.1 kg in the ADA group ($P < 0.001$)). The same cohort was followed for a total of 74 weeks, showing a significant absolute reduction in haemoglobin A1c of −0.40 points in the vegan group versus +0.01 in the ADA group. Dr. Barnard repeatedly presents such cases during conference lectures and in his books (2007).

The effectiveness of a plant-based, vegan, diet in patients suffering from type 2 diabetes has also been shown by a meta-analysis by Yokoyama and colleagues (2014b). A plant-based diet is a powerful tool – not only for preventing and managing type 2 diabetes – but also for reversal of clinical symptoms (Davis *et al.* 2019, McGoe-Smith *et al.* 2019). It is crucial to note that a disease that was once associated with steadily progression can take a completely different course. Adoption of a plant-based diet may lead to remission of clinical diabetes symptoms and normalization of relevant laboratory values, such as glycated haemoglobin (HbA1c). The latter is an important and commonly used indicator of long-term glycaemic control, reflecting the cumulative glycaemic history of the preceding three months in patients suffering from type 2 diabetes (Sherwani *et al.* 2016, Pan *et al.* 2019).

Diabetic neuropathy

One of the most prevalent complications of diabetes is diabetic neuropathy (Feldman *et al.* 2019). The disease, which has a lifetime prevalence of approximately 50% (Juster-Switlyk and Smith 2016), is often resistant to conventional treatment. According to Greger (2015), the disease is one of the most frustrating clinical conditions to treat. Patients often respond insufficiently to pharmacological treatment and suffer from both marked impairment in daily activities and a significantly reduced quality of life.

Considering these findings, it is even more remarkable that a simple lifestyle intervention, including a vegan, plant-based diet, can actually lead to complete remission of clinical symptoms (Greger 2015). The rapid regression of neuropathic pain after initiation of lifestyle changes was reported more than two decades ago (Crane and Sample 1994). Patients suffering from diabetes and concomitant moderate or worse systemic distal polyneuropathy were enrolled in this trial. Subjects were prescribed a low fat vegan diet, which was high in fibre and unrefined foods. In addition to that, the 25-day in-residence life-style programme included daily conditioning exercise.

Complete relief of the neuropathic pain occurred in 17 of the 21 patients within just 4–16 days. Of note, the 17 responders were followed for another period of 1–4 years. In all but 1 of the 17 patients, the relief from the systemic distal polyneuropathy had continued, or there was further improvement.

A newer study by Bunner *et al.* (2015) revealed comparable results. A 20-week intervention including a low-fat, vegan diet, vitamin B12 supplementation, and weekly support classes for following the prescribed diet lead to significant improvements in individuals with type 2 diabetes and painful diabetic neuropathy. Amongst others, significant improvements in pain were observed in the respective cohort, as measured by the Quality of Life questionnaire and Short Form McGill Pain Questionnaire (Melzack 1975).

Plant-based diets have been shown to exert beneficial health effects with regard to many other chronic conditions including rheumatoid arthritis (Alwarith *et al.* 2019), heart failure (Kerley 2018, Allen *et al.* 2019), bronchial asthma (Lindahl *et al.* 1985, Iikura 2017), diseases of the skin such as psoriasis (Maldonado-Puebla *et al.* 2019), chronic inflammatory bowel disease (Chiba *et al.* 2019) such as Crohn's disease (Stewart and Amanda 2018, Sandefur *et al.* 2019) and retinopathy (Kempner *et al.* 1958, McGoey-Smith *et al.* 2019).

The number of studies on vegan and vegetarian diets is continuously rising (Medawar *et al.* 2019). Their favourable health effects are emphasized in more and more clinical trials and case reports. Ultimately, this development may translate into a new perception of chronic conditions. Chronic diseases, which were once thought to be irreversible and progressive, can actually be stopped and reversed with proper diet. This fundamental shift from managing towards healing has nutrition as the key driver.

Ethical aspects

Such a redefined perception of chronic conditions will inevitably raise a wide range of ethical concerns. Perhaps our current understanding of chronic illness is outdated and morally reprehensible. Physicians may be obligated to recommend a plant-based diet to every single patient suffering from chronic conditions. Finally, other socioecological and economic factors play a role in the process of chronic disease that needs to be evaluated. Considering the current evidence for the effectiveness of plant-based diets, definitions of chronic illness appear to be inadequate and outdated. Remission of clinical symptoms and disease reversal after adopting a plant-based diet have been frequently described.

As a corollary, physicians must consider redefining their understanding of chronic disease. If a cure exists for many pathologies, there are few reasons to still treat just the symptoms. Heart disease is maybe the most impressive example. Instead of prescribing analgesics and nitro-glycerine spray, doctors ought to tackle the root cause of angina. Physicians should dare to routinely prescribe plant-based diets in the same way we prescribe anti-platelet agents or nitrates. The latter is of paramount importance considering the concept of beneficence. This principle requires physicians to prevent and remove harmful conditions from patients (Munyaradzi 2012) and

describes the moral obligation to act for the benefit of others (Jahn 2011). Hereby, plant-based nutrition could be a powerful tool and help physicians to prevent harm from occurring to others, e.g. by exposing them to an unhealthy, atherosclerosis-inducing diet.

Medicine does not stand still – it evolves continuously (Snyder 2012). The same should apply to physicians. The ethical principle of utility implies that physician's actions should yield good results, achieving maximum benefits for patients while not wasting precious resources (Nandi 2000). Hence, it is their responsibility and obligation towards their patients to offer evidence-based treatment options. The utilitarian approach asks for medical decisions that allow for the greatest amount of benefits obtained for the largest number of individuals (Mandal *et al.* 2016). For that reason, physicians are obliged to speak out the inconvenient truth. Physicians may no longer ignore the interconnection between nutrition and health. It is time to prescribe healthy diets because medications are by no means a substitute for a dietary intervention (Barnard 2013).

Reducing medication also plays an important role when it comes to the law of therapeutic parsimony (Kalra *et al.* 2016). In place of multiple therapeutic interventions, minimal ones should be used, as long as this can achieve equivalent therapeutic outcomes. If this can be done with a plant-based diet, exposing patients to polypharmacy and its side effects is not only unnecessary, but also potentially harmful. Revisiting the concept of parsimony is also crucial when it comes to a discussion about the economic impact of chronic diseases such as diabetes (Kalra and Saboo 2018). Finally, the major goal must be to get data out to the public where it can actually fundamentally change lives – creating not only longer but also healthier ones (Williams 2017).

Informed consent

The most immediate consequence of this data is that physicians should recommend a plant-based diet to every patient, especially to those who suffer from a chronic condition such as coronary artery disease. It is a valid and evidence-based tool that can reverse conditions that would otherwise slowly progress. Even if a physician is not following a plant-based diet on her own, she should recommend it. The reasons behind this are simple: it is the only diet that has been shown to reverse coronary artery disease (Greger 2015) and because patients should not be denied such knowledge.

Patients have the right to information, which implies that all available treatment options are set forth and clarified. This includes a realistic description of a plant-based diet, including all its benefits and possible challenges, which a patient may experience when changing his nutritional habits. This is an important prerequisite when it comes to the ethical principle of respect for autonomy. The latter refers to the right of self-determination, or that patients have the right to choose what is best for them (French 2006). To allow for autonomy, it is essential to have the necessary information and understanding on which to base a decision. Telling patients the truth by presenting all available treatment options, including fundamental lifestyle changes, is a moral obligation that is derived from the application of respect for autonomy (Jahn 2011).

Of note, autonomy could be diminished by a physician's failure to provide adequate information on which to base a decision. Unfortunately, many physicians lack respect for nutrition as a science and consider fundamental dietary changes unrealistic.

In this context, physicians often stress that a plant-based diet is not for everyone. Some go even further and argue that a plant-based diet is only suitable for a small minority of patients blessed with an iron will and considerable perseverance. The latter, however, is generally questionable. While it is true that not every individual is a candidate to make fundamental changes, one may not predict which patients may adopt a plant-based diet and which patients will not (Klaper 2019). This area warrants further investigation and reliable predictors have not been identified yet. Therefore, it must be tried in clinical practice.

Too often, however, physicians maintain that they have been insufficiently trained in the field of nutrition and lack the time to offer nutrition counselling (Ha 2019). In fact, many physicians do indeed possess insufficient knowledge about nutrition and seem to have an unsatisfactory background to counsel patients on lifestyle (Kris-Etherton *et al.* 2015, Storz 2019). Studies revealed a significant deficiency of nutrition education and practice among internal medicine residents (Vetter *et al.* 2008) and even cardiovascular specialists (Devries *et al.* 2017).

In medicine, however, similar to law, ignorance is no defence. It does not protect against punishment. The World Medical Association's International Code of Medical Ethics leaves no room for interpretation here (World Medical Association 2019), stating, 'Whenever an examination or treatment is beyond the physician's capacity, he/she should consult with or refer to another physician who has the necessary ability.' Therefore, a physician that recognizes the interconnection between health and nutrition can simply refer a patient to a specialist colleague or dietician firm in plant-based nutrition. The latter may not be interpreted as a sign of weakness, but rather as an important effort to provide holistic care.

Physicians should take every available opportunity to incorporate a discussion about nutrition in their daily work. Despite an unfavourable framework including omnipresent time pressure and missing economic incentives to support motivated physicians in plant-based diet counselling (Storz 2019), physicians should keep the bigger picture in mind. Hereby, several landmark papers offer significant practical support and assistance for physicians interested in implementing nutritional advice in daily clinical care (Trapp *et al.* 2010, Hever 2016, Hever and Cronise 2017).

Patients have the right to be told the truth and a plant-based diet should be part of every patient-doctor dialogue. Not mentioning this powerful tool is an act of withholding crucial information.

Socio-ethical implementations

Another important aspect of recommending plant-based diets is the physician's role in society and her responsibility to meet society's health care needs (Brett 2012). According to Lockwood (2004), physicians must serve the community – an important premise that can be traced to the Hippocratic Oath, in which physicians pledge

to ‘keep [patients] from harm and injustice.’ This exhortation to protect society is of uttermost importance, since unhealthy eating habits affect not only a single patient but usually the entire family (Barnard 2013). When parents eat poorly they serve as a negative role model for their own children. Thus, prevalent chronic conditions such as cardiovascular disorders and obesity, spread around a family, like a ‘foodborne illness’ (Barnard 2013). Maintaining a high level of suspicion of meat-based diets and embarking on constructive discussions about nutrition is therefore a form of fulfilling one’s responsibilities and societal obligations. The latter is also in accordance with the World Medical Association’s International Code of Medical Ethics, which requires physicians to ‘recognize his/her important role in educating the public’.

Offering plant-based options on a regular basis and incorporating them in routine patient care may also be of great interest for hospitals and other healthcare facilities that aim to engage in corporate social responsibility (CSR). The latter has long been a focus of attention (Liu *et al.* 2016) and refers to business operations that involve initiatives benefiting society (Lee *et al.* 2019). While a business’ CSR activities can encompass a variety of strategies, implementing greener business operations and environmental efforts is nowadays a common concept (Lee *et al.* 2019). As a corollary, including greener plant-based options in a company’s CSR strategy is a powerful tool, since hardly any other CSR measure has a more positive impact than expanding the range of vegan products offered (Albert Schweitzer Foundation 2019). Such an approach might benefit both environmental and human health and could help hospitals to meet their obligation and social responsibilities, e.g. by reducing environmental damage and by protecting animal interests (Brandã *et al.* 2013). Ultimately, CSR activities grow in significance and according to Dropert and Bennett (2015), the global health community would be well-advised to devote itself more to engage in this important practice.

Economic aspects

Currently more than 85 % of health care costs are attributable to chronic health conditions in the United States (Beckman 2019, Chapel *et al.* 2017). Drug costs and hospitalizations (Raghupathi and Raghupathi 2018), which are often the consequence of undesired medication side effects, strongly contribute to this number. The price of many medications, such as insulin, continues to rise (Cefalu *et al.* 2018). Out-of-pocket expenses for patients are growing, as well (Patel *et al.* 2018). Consequently, there is a financial incentive to reduce medications. Medicine should be affordable and physicians shall ‘strive to use health care resources in the best way to benefit patients and their community’ (World Medical Association 2019). Plant-based diets may help to tackle this issue since they have been frequently associated with reduced medication needs (Tuso *et al.* 2013, Hever 2016, Viguiouk *et al.* 2019) and may therefore help to curb the financial burden from chronic conditions. Beyond this, minimizing medications is good clinical practice and plant-based nutrition may therefore move this concept forward.

According to calculations by Schepers and Annemanns (2018), a wider implementation of plant-based eating would lead to large net economic gains for society. If approximately 10 % of the total population in the United Kingdom commit to a

high adherence of the Mediterranean diet, societal savings over 20 years are estimated at £7.53 billion. These savings could not only lead to increased financial stability, but also allow for a reallocation of resources given the fact that diets low in meat are associated with better health outcomes. Hereby, it must also be taken into account that a Mediterranean diet usually includes high amounts of olive oil and a moderate intake of fish and poultry (Estruch *et al.* 2018). While according to Ornish (2013) a Mediterranean diet is better than what most people are consuming, a low-fat plant-based diet is even more beneficial. Therefore, even higher benefits and savings are to be expected.

Ultimately, a new data set from the Tzu Chi Vegetarian Study revealed that following a vegetarian diet drastically reduces health care expenses when compared to consuming a diet containing meat (Lin *et al.* 2019). In this study cohort, vegetarians had a 15 percent lower total medical expenditure than persons that consumed meat, fish, and seafood more than once per month.

Ecological aspects

Finally, there are environmental aspects that warrant detailed consideration. The authors of a recently published editorial pointed out that in 2018, the scientific proof for human-induced climate change ‘exceeded the gold standard’ – the so called ‘5 Sigma’ threshold (Murray *et al.* 2019). This measure is equivalent to a randomized control trial with a p -value of .0000003. Climate change is happening now and the current food system, including its immense dairy and meat production, is a key contributor (Springmann *et al.* 2018). A diet that focuses on animal product consumption, with the accompanying deforestation required to produce grains fed to cattle, is most unsustainable (Plant-Based Nutrition Movement 2019). Therefore, a radical change towards more plant-based diets is critical for avoiding catastrophic environmental damage (Cleveland and Gee 2017). Tackling animal product consumption is crucial in terms of planetary health (Fresán and Sabaté 2019) and animal welfare. Large-scale livestock farming is one of the most significant contributors to environmental problems (Ilea 2009) and raises many ethical concerns.

It is now widely accepted that preventive care has a significantly lower carbon emission than surgical interventions and procedures. The operating theatre is most likely the most resource-intensive part of an hospital (Thiel *et al.* 2015). The production of disposable materials and single-use surgical devices as well as the energy used for air conditioning, heating and ventilation could be drastically reduced by primary prevention. A care strategy primarily focusing on prevention and building on a nutrition-first approach (Ha 2019) is not only better for patients but also for the planet. Such a concept would also achieve the so-called triple bottom line (Slapper and Hall 2011), including sustainability, good health and ultimately financial savings by reducing per capita cost (Wolf 2013).

Conclusion

Plant-based diets have an enormous potential to improve healthcare and to allow for more sustainable medicine. In a recently published review, Fresán and Sabaté

emphasized the alignment of health and environmental outcomes for vegetarian diets (2019). Tackling animal product consumption and the intake of saturated fat is consequently not only beneficial with regard to many chronic conditions, but also in terms of planetary health. Protection of the environment is a fundamental responsibility of physicians because they are in a unique position knowing about the interconnection between planetary and human health. Plant-based diets are a powerful tool – not using and advocating for them is not only unethical, but harms patients and the planet alike.

Once plant-based diets receive increased attention and enjoy higher acceptance in the medical community, they will find their way into mainstream medicine. Hereby, both economic and environmental aspects will be the key drivers, along with the numerous health benefits associated with a plant-based diet. This promising scenario and the continuously increasing body of evidence emphasizing the merits of plant-based nutrition will also affect our perception of chronic disease and chronic conditions.

The reservation must be made, however, that the road ahead is long and stony. Plant-based nutrition has not yet been adopted in standard treatment practices by mainstream medicine (Sterling and Bowen 2019) and physicians that follow the ‘nutrition-first’ approach often encounter considerable resistance (Ha 2019). Despite the meticulous work of renowned experts in the field and the continuously growing body of evidence, the latest findings in this area have not found their way into US national dietetic guidelines (Storz 2019).

Despite these limitations, the plant-based movement could sooner or later redefine our current understanding and perception of chronic conditions. Although a tectonic shift from managing towards curing may raise a number of ethical questions, it will, above all, give new hope and confidence to affected patients, their families and loved ones, while also satisfying numerous ethical demands of informed consent, social and economic wellbeing, and planetary sustainability.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Maximilian Andreas Storz  <http://orcid.org/0000-0003-3277-0301>

References

- Albert Schweitzer Foundation, 2019. Vegan and meat reduction projects with companies. Available from: <https://albertschweitzerfoundation.org/campaigns/vegan-projects-companies>. [Accessed 12 March 2020].
- Alexander, S., *et al.*, 2017. A plant-based diet and hypertension. *Journal of geriatric cardiology: JGC*, 14 (5), 327–330.
- Allen, K.E., Gumber, D. and Ostfeld, R.J., 2019. Heart failure and a plant-based diet. A case-report and literature review. *Frontiers in nutrition*, 6, 82.

- Alwarith, J., *et al.*, 2019. Nutrition interventions in rheumatoid arthritis: The potential use of plant-based diets. A review. *Frontiers in nutrition*, 6, 141.
- Barnard, N.D., 2007. *Dr. Neal Barnard's program for reversing diabetes*. New York: Rodale.
- , 2013. The physician's role in nutrition-related disorders: from Bystander to Leader. *AMA journal of ethics*, 15 (4), 367–372.
- Beckman, K., 2019. A new approach for lifestyle medicine payment. *American journal of lifestyle medicine*, 13 (1), 36–39.
- Bell, M.F., *et al.*, 2016. Chronic illness and developmental vulnerability at school entry. *Pediatrics*, 137 (5), doi:10.1542/peds.2015-2475.
- Bernell, S. and Howard, S.W., 2016. Use your words carefully: what is a chronic disease? *Frontiers in public health*, 4. doi:10.3389/fpubh.2016.00159.
- Boden, W.E., *et al.*, 2007. Optimal medical therapy with or without PCI for stable coronary disease. *The New England journal of medicine*, 356 (15), 1503–1516.
- Bodenheimer, T., Chen, E., and Bennett, H.D., 2009. Confronting the growing burden of chronic disease: can the U.S. health care Workforce do the job? *Health affairs*, 28 (1), 64–74.
- Bommer, C., *et al.*, 2018. Global economic burden of diabetes in adults: projections from 2015 to 2030. *Diabetes care*, 41 (5), 963–970.
- Brandão, C., *et al.*, 2013. Social responsibility: a new paradigm of hospital governance? *Health care analysis*, 21 (4), 390–402.
- Brett, A.S., 2012. Physicians have a responsibility to meet the health care needs of society. *The journal of law, medicine & ethics: a journal of the American society of law, medicine & ethics*, 40 (3), 526–531.
- British Dietetic Association, 2020. Food Fact Sheet: Plant-based diet. Available from: <https://www.bda.uk.com/resource/plant-based-diet.html> [Accessed 12 March 2020].
- Bunner, A.E., *et al.*, 2015. A dietary intervention for chronic diabetic neuropathy pain: a randomized controlled pilot study. *Nutrition & diabetes*, 5 (5), e158.
- Cefalu, W.T., *et al.*, 2018. Insulin access and affordability working group: conclusions and recommendations. *Diabetes care*, 41 (6), 1299–1311.
- Chapel, J.M., *et al.*, 2017. Prevalence and medical costs of chronic diseases among adult medicaid beneficiaries. *American journal of preventive medicine*, 53 (6 Suppl 2), S143–S154.
- Chiba, M., Ishii, H. and Komatsu, M., 2019. Recommendation of plant-based diets for inflammatory bowel disease. *Translational pediatrics*, 8 (1), 23–27.
- Cleveland, D.A. and Gee, Q., 2017. Chapter 9 – plant-based diets for mitigating climate change. In: F. Mariotti, ed. *Vegetarian and plant-based diets in health and disease prevention*. Academic Press, 135–156.
- Coulston, A.M., 1999. The role of dietary fats in plant-based diets. *The American journal of clinical nutrition*, 70 (3), 512S–515S.
- Crane, M.G. and Sample, C., 1994. Regression of diabetic neuropathy with total vegetarian (vegan) diet. *Journal of nutritional medicine*, 4 (4), 431–439.
- Davis, B.C., *et al.*, 2019. An intensive lifestyle intervention to treat type 2 diabetes in the Republic of the Marshall Islands: protocol for a randomized controlled trial. *Frontiers in nutrition*, 6, doi:10.3389/fnut.2019.00079.
- de Lorgeril, M., *et al.*, 1999. Mediterranean diet, traditional risk factors, and the rate of cardiovascular complications after myocardial infarction: final report of the Lyon diet heart study. *Circulation*, 99 (6), 779–785.
- Devries, S., *et al.*, 2017. A deficiency of nutrition education and practice in cardiology. *The American journal of medicine*, 130 (11), 1298–1305.
- Droppert, H. and Bennett, S., 2015. Corporate social responsibility in global health: an exploratory study of multinational pharmaceutical firms. *Globalization and health*, 11 (1), 15. doi:10.1186/s12992-015-0100-5.
- Esselstyn, C.B., *et al.*, 2014. A way to reverse CAD? *The journal of family practice*, 63 (7), 356–364b.
- Esselstyn, C.B., 2017. A plant-based diet and coronary artery disease: a mandate for effective therapy. *Journal of geriatric cardiology: JGC*, 14 (5), 317–320.
- Estruch, R., *et al.*, 2018. Primary prevention of cardiovascular disease with a mediterranean diet supplemented with extra-virgin olive oil or nuts. *New England journal of medicine*, 378 (25), e34.
- Feldman, E.L., *et al.*, 2019. Diabetic neuropathy. *Nature reviews disease primers*, 5 (1), 1–18.

- French, J., 2006. Introduction to the principles of bioethics. *Canadian journal of medical radiation technology*, 37 (1), 31–36.
- Fresán, U. and Sabaté, J., 2019. Vegetarian diets: planetary health and its alignment with human health. *Advances in nutrition*, 10 (Supplement_4), S380–S388.
- Greger, M., 2015. Plant-based diets for the prevention and treatment of disabling diseases. *American Journal of lifestyle medicine*, 9 (5), 336–342.
- Ha, B., 2019. The power of plants: is a whole-foods, plant-based diet the answer to health, health care, and physician wellness? *The permanente journal*, 23, 3.
- Hajat, C. and Stein, E., 2018. The global burden of multiple chronic conditions: a narrative review. *Preventive medicine reports*, 12, 284–293.
- Hever, J., 2016. Plant-based diets: a physician's guide. *The permanente journal*, 20 (3), 15–082.
- Hever, J. and Cronise, R.J., 2017. Plant-based nutrition for healthcare professionals: implementing diet as a primary modality in the prevention and treatment of chronic disease. *Journal of geriatric cardiology: JGC*, 14 (5), 355–368.
- Iikura, M., 2017. 27 – plant-based diets and asthma. In: F. Mariotti, ed. *Vegetarian and plant-based diets in health and disease prevention*. Academic Press, 483–491.
- Ilea, R.C., 2009. Intensive livestock farming: global trends, increased environmental concerns, and ethical solutions. *Journal of agricultural and environmental ethics*, 22 (2), 153–167.
- Jahn, W.T., 2011. The 4 basic ethical principles that apply to forensic activities are respect for autonomy, beneficence, nonmaleficence, and justice. *Journal of chiropractic medicine*, 10 (3), 225–226.
- Juster-Swityk, K. and Smith, A.G., 2016. Updates in diabetic peripheral neuropathy. *F1000Research*, 5.
- Kahleova, H., Levin, S., and Barnard, N., 2017. Cardio-metabolic benefits of plant-based diets. *Nutrients*, 9 (8), 848. doi:10.3390/nu9080848.
- Kalra, S., Gupta, Y., and Sahay, R., 2016. The law of therapeutic parsimony. *Indian journal of endocrinology and metabolism*, 20 (3), 283–284.
- Kalra, S. and Saboo, B., 2018. The law of investigative parsimony. *JPMA. The journal of the pakistan medical association*, 68 (5), 817–818.
- Kempner, W., Peschel, R.L., and Schlager, C., 1958. Effect of rice diet on diabetes mellitus associated with vascular disease. *Postgraduate medicine*, 24, 359–371.
- Kerley, C.P., 2018. A review of plant-based diets to prevent and treat heart failure. *Cardiac failure review*, 4 (1), 54–61.
- Kim, H., et al., 2019. Plant-based diets are associated with a lower risk of incident cardiovascular disease, cardiovascular disease mortality, and all-cause mortality in a general population of middle-aged adults. *Journal of the American heart association*, 8 (16), e012865.
- Klaper, M., 2019. What every doctor needs to know about nutrition. conference lecture at VegMed 2019: Europe's biggest scientific conference on plant-based nutrition. 12–13 October, King's College, London, United Kingdom.
- Kris-Etherton, P.M., et al., 2015. Nutrition competencies in health professionals' education and training: A new paradigm. *Advances in nutrition*, 6 (1), 83–87.
- Lawrence, M.A. and Baker, P.I., 2019. Ultra-processed food and adverse health outcomes. *BMJ*, 365, doi:10.1136/bmj.l2289.
- Lee, H., et al., 2019. Public preferences for corporate social responsibility activities in the pharmaceutical industry: Empirical evidence from Korea. *Plos one*, 14 (8), e0221321.
- Lin, C.-L., et al., 2019. Vegetarian diets and medical expenditure in Taiwan—a matched cohort study. *Nutrients*, 11 (11), 2688.
- Lindahl, O., et al., 1985. Vegan regimen with reduced medication in the treatment of bronchial asthma. *The journal of asthma: official journal of the association for the care of asthma*, 22 (1), 45–55.
- Liu, W., et al., 2016. How patients think about social responsibility of public hospitals in China? *BMC health services research*, 16 (1), 371.
- Lockwood, A.H., 2004. The physician's role in society: enhancing the health of individuals and the public. *AMA journal of ethics*, 6 (4), 189–190.

- Maldonado-Puebla, M., *et al.*, 2019. Efficacy of a plant-based anti-inflammatory diet as monotherapy in psoriasis. *International journal of disease reversal and prevention*, 1 (1), 68–74. <https://ijdrp.org/index.php/ijdrp/article/view/15>.
- Mandal, J., Ponnambath, D.K., and Parija, S.C., 2016. Utilitarian and deontological ethics in medicine. *Tropical parasitology*, 6 (1), 5–7.
- Massera, D., *et al.*, 2015. A whole-food plant-based diet reversed angina without medications or procedures. *Case reports in cardiology*, 2015, 978906.
- Matthews, D.R. and Matthews, P.C., 2011. Banting memorial lecture 2010[^]. type 2 diabetes as an ‘infectious’ disease: is this the Black death of the 21st century? *Diabetic medicine: A journal of the British diabetic association*, 28 (1), 2–9.
- McGain, F. and Naylor, C., 2014. Environmental sustainability in hospitals – a systematic review and research agenda. *Journal of health services research & policy*, 19 (4), 245–252.
- McGoey-Smith, K., Esselstyn, C. and McGoey-Smith, A., 2019. Reversal of pulmonary hypertension, diabetes, and retinopathy after adoption of a whole food plant-based diet. *International journal of disease reversal and prevention*, 1 (2), 35–44. <https://ijdrp.org/index.php/ijdrp/article/view/41>.
- McMacken, M. and Shah, S., 2017. A plant-based diet for the prevention and treatment of type 2 diabetes. *Journal of geriatric cardiology: JGC*, 14 (5), 342–354.
- Medawar, E., *et al.*, 2019. The effects of plant-based diets on the body and the brain: a systematic review. *Translational psychiatry*, 9 (1), 1–17.
- Mejia, M.A., *et al.*, 2016. A vegan diet rich in fats of plant origin may reverse coronary artery disease. *The FASEB journal*, 30 (1 supplement), 904.11–904.11.
- Melina, V., Craig, W., and Levin, S., 2016. Position of the academy of nutrition and dietetics: vegetarian diets. *Journal of the academy of nutrition and dietetics*, 116 (12), 1970–1980.
- Melzack, R., 1975. The McGill pain questionnaire: major properties and scoring methods. *Pain*, 1 (3), 277–299.
- Munyaradzi, M., 2012. Critical reflections on the principle of beneficence in biomedicine. *The Pan African medical journal*, 11, 29.
- Murray, N., Mack, H.G., and Al-Qureshi, S., 2019. The case for adopting sustainability goals in ophthalmology. *Clinical & experimental ophthalmology*, 47 (7), 837–839.
- Myles, I.A., 2014. Fast food fever: reviewing the impacts of the Western diet on immunity. *Nutrition journal*, 13 (1), 61.
- Nandí, P.L., 2000. Ethical aspects of clinical practice. *Archives of surgery*, 135 (1), 22–25.
- NCD Risk Factor Collaboration, 2016. Worldwide trends in diabetes since 1980: a pooled analysis of 751 population-based studies with 4.4 million participants. *The lancet*, 387 (10027), 1513–1530.
- Nowbar Alexandra, N., *et al.*, 2019. Mortality from Ischemic heart disease. *Circulation: cardiovascular quality and outcomes*, 12 (6), e005375.
- Ornish, D., *et al.*, 1998. Intensive lifestyle changes for reversal of coronary heart disease. *JAMA*, 280 (23), 2001–2007.
- Ornish, D., 2013. Mediterranean diet for primary prevention of cardiovascular disease. *New England journal of medicine*, 369 (7), 675–676. doi:10.1056/NEJMc1306659.
- Ostfeld, R.J., 2017. Definition of a plant-based diet and overview of this special issue. *Journal of geriatric cardiology: JGC*, 14 (5), 315.
- Pan, W., *et al.*, 2019. Prognostic value of HbA1c for in-hospital and short-term mortality in patients with acute coronary syndrome: a systematic review and meta-analysis. *Cardiovascular diabetology*, 18 (1), 169.
- Patel, M.R., *et al.*, 2018. Improving the affordability of prescription medications for people with chronic Respiratory disease. An official American Thoracic Society Policy Statement. *American journal of respiratory and critical care medicine*, 198 (11), 1367–1374.
- Patelakis, E., *et al.*, 2019. Prevalence of vegetarian diet among children and adolescents in Germany. results from EsKiMo II. *Ernahrungs umschau*, 66 (5), 85–91. doi:10.4455/eu.2019.018.
- Physicians Committee for Responsible Medicine, 2019. Plant-Based Diets [online]. Available from: <https://www.pcrm.org/good-nutrition/plant-based-diets> [Accessed 8 Dec 2019].
- Pichler, P.P., *et al.*, 2019. International comparison of health care carbon footprints. *Environmental research letters*, 14 (6), 064004.

- Plant-Based Nutrition Movement, 2019. UN climate change report calls for change to human diet ... to eat less meat [online]. Available from: <https://pbnm.org/> [Accessed 8 December 2019].
- Radnitz, C., Beezhold, B., and DiMatteo, J., 2015. Investigation of lifestyle choices of individuals following a vegan diet for health and ethical reasons. *Appetite*, 90, 31–36.
- Raghupathi, W. and Raghupathi, V., 2018. An empirical study of chronic diseases in the United States: a visual analytics approach to public health. *International journal of environmental research and public health*, 15, 431.
- Rico-Campà, A., et al., 2019. Association between consumption of ultra-processed foods and all cause mortality: SUN prospective cohort study. *BMJ (clinical research ed.)*, 365, 11949.
- Sandefur, K., et al., 2019. Crohn's disease remission with a plant-based diet: a case Report. *Nutrients*, 11, 1385.
- Satija, A., et al., 2016. Plant-based dietary patterns and incidence of type 2 diabetes in US men and women: results from three prospective cohort studies. *PLoS medicine*, 13 (6), e1002039.
- , 2017. Healthful and unhealthful plant-based diets and the risk of coronary heart disease in U.S. adults. *Journal of the American college of cardiology*, 70 (4), 411–422.
- Satija, A. and Hu, F.B., 2018. Plant-based diets and cardiovascular health. *Trends in cardiovascular medicine*, 28 (7), 437–441.
- Schepers, J. and Annemans, L., 2018. The potential health and economic effects of plant-based food patterns in Belgium and the United Kingdom. *Nutrition*, 48, 24–32.
- Sherwani, S.I., et al., 2016. Significance of HbA1c test in diagnosis and prognosis of diabetic patients. *Biomarker insights*, 11, 95–104.
- Slapper, T.F. and Hall, T.J., 2011. The triple bottom line: what is it and how does it work? *Indiana business review*, 86 (1), 4–8.
- Snyder, L., 2012. American college of physicians ethics manual: sixth edition. *Annals of internal medicine*, 156 (1_Part_2), 73.
- Somrongsong, R., et al., 2016. The influence of chronic illness and lifestyle behaviors on quality of life among older Thais. *Biomed research international*, 2016, 2525941.
- Springmann, M., et al., 2018. Options for keeping the food system within environmental limits. *Nature*, 562 (7728), 519–525.
- Sterling, S.R. and Bowen, S.-A., 2019. The potential for plant-based diets to promote health among blacks living in the United States. *Nutrients*, 11 (12), 2915.
- Stewart, D.R. and Amanda, J.S., 2018. Crohn's disease prevention and treatment with a plant-based diet. *Advances gastroenterology hepatol*, 9 (1), 555753. doi:10.19080/ARGH.2018.09.555753.
- Stewart, J., Manmathan, G., and Wilkinson, P., 2017. Primary prevention of cardiovascular disease: A review of contemporary guidance and literature. *JRSM cardiovascular disease*, 6, 2048004016687211.
- Storz, M.A., 2019. Is there a lack of support for whole-food, plant-based diets in the medical community? *The permanente journal*, 23, 18–068.
- Tangvoranuntakul, P., et al., 2003. Human uptake and incorporation of an immunogenic nonhuman dietary sialic acid. *Proceedings of the national academy of sciences of the United States of America*, 100 (21), 12045–12050.
- Thiel, C.L., et al., 2015. Environmental impacts of surgical procedures: life cycle assessment of hysterectomy in the United States. *Environmental science & technology*, 49 (3), 1779–1786.
- Timko, C.A., Hormes, J.M., and Chubski, J., 2012. Will the real vegetarian please stand up? An investigation of dietary restraint and eating disorder symptoms in vegetarians versus non-vegetarians. *Appetite*, 58 (3), 982–990.
- Tomson, C., 2015. Reducing the carbon footprint of hospital-based care. *Future hospital journal*, 2 (1), 57–62.
- Tonstad, S., et al., 2013. Vegetarian diets and incidence of diabetes in the Adventist health study-2. *Nutrition, metabolism and cardiovascular diseases*, 23 (4), 292–299.
- Trapp, C., Barnard, N., and Katcher, H., 2010. A plant-based diet for type 2 diabetes: The Diabetes Educator.
- Tuso, P.J., et al., 2013. Nutritional update for physicians: plant-based diets. *The permanente journal*, 17 (2), 61–66.
- Vetter, M.L., et al., 2008. What do resident physicians know about nutrition? An evaluation of attitudes, self-perceived proficiency and knowledge. *Journal of the American college of nutrition*, 27 (2), 287–298.

- Vigiliouk, E., *et al.*, 2019. Effect of vegetarian dietary patterns on cardiometabolic risk factors in diabetes: A systematic review and meta-analysis of randomized controlled trials. *Clinical nutrition*, 38 (3), 1133–1145.
- Warshaw, G., 2006. Introduction: advances and challenges in care of older people with chronic illness. *Generations*, 30 (3), 5–10.
- Whittemore, R. and Dixon, J., 2008. Chronic illness: the process of integration. *Journal of clinical nursing*, 17 (0), 177–187.
- Williams, K.A., 2017. Introduction to the ‘A plant-based diet and cardiovascular disease’ special issue. *Journal of geriatric cardiology: JGC*, 14 (5), 316.
- Wolf, J., 2013. The triple aim and the triple Bottom Line. Available from: <http://healthierhospitals.org/media-center/spark-blog/triple-aim-and-triple-bottom-line> [Accessed 13 Mar 2020].
- World Medical Association, 2019. International Code of Medical Ethics [online]. Available from: <https://www.wma.net/policies-post/wma-international-code-of-medical-ethics/>.
- Yokoyama, Y., *et al.*, 2014. Vegetarian diets and blood pressure: a meta-analysis. *JAMA internal medicine*, 174 (4), 577–587.
- , 2014. Vegetarian diets and glycemic control in diabetes: a systematic review and meta-analysis. *Cardiovascular diagnosis and therapy*, 4 (5), 373–382.
- Zinöcker, M.K. and Lindseth, I.A., 2018. The western diet-microbiome-host Interaction and Its role in metabolic disease. *Nutrients*, 10 (3), 365.

Notes on contributor

Maximilian Andreas Storz is a medical doctor from Germany. His main interests include plant-based whole-food diets and lifestyle medicine. He is also interested in climate change, animal welfare and environmental sustainability.