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International Interdepartmental Master of Science Programme in

**LIFESTYLE MEDICINE**

[ESTABLISHING A NON-PROFIT COMMUNITY-BASED RESEARCH DRIVEN LIFESTYLE  
MEDICINE ORGANIZATION]

by

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## **Author's Contribution Statement**

I certify that I am the author of this thesis and that any assistance I have had in its preparation is fully acknowledged and referenced in the following text. I have also cited any sources from which I have used data, ideas or words, whether they are quoted exactly or paraphrased. I also certify that this thesis was prepared by me personally specifically for the requirements of obtaining a Master's degree in Lifestyle Medicine by the University of Thessaly. I declare that I will respect co-authorship rights in any linked scientific publication and/or presentation stemming from this thesis, in accordance to my signed affirmation, and in respect of the principles of ethics in research. Likewise, I declare I will recognize any funding sources and will acknowledge my affiliation to the University of Thessaly during the preparation of this work in any future presentation.

Maira du Plessis

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## **Purpose statement (Abstract)**

The Grenada Lifestyle Medicine Corporation is a non-profit organization aimed at improving health in the Grenada community through intervention research and education. Following the principles of evidence-based medicine and the pillars of Lifestyle Medicine, interventions will be developed based on community needs and be implemented in a culturally sensitive and appropriate way. The motivation behind the establishment and organizational design is a high prevalence of uncontrolled hypertension and diabetes-type 2 in a setting with a high poverty index. Conventional therapy has proven to be largely unsuccessful as many individuals suffer severe complications despite receiving treatment and medical care. It is believed that cultural barriers and behaviors as well as lack of education are the main driving forces behind the prevalence and severity of these conditions. Lifestyle interventions have proven effective in other countries however the research is not directly transferable to Grenada due to its unique population dynamics. By utilizing interventional research to collect data on effective strategies which directly benefit the participants a greater impact can be made. Through education of the public as well as health care providers and providing access to care for individuals who would not normally be able to afford it a reduction in prevalence of disease as well as severity of adverse effects should be achieved. As part of the growth of the organization a Lifestyle Medicine center is planned. Which would be a physical location offering affordable support for wellness built on healthy lifestyle with easy access to facilities and long-term support for behavioral changes. The ultimate goal is to improve the health and wellness of all Grenadians through sustained healthy behaviors.

## **Doelverklaring (opsomming)**

Die Grenada Lifestyle Medicine Corporation is 'n nie-winsgewende organisasie wat daarop gemik is om gesondheid in die Grenada gemeenskap te verbeter deur intervensie navorsing en opvoeding. Na aanleiding van die beginsels van bewys gebaseerde mediese wetenskap en die pilare van Leefstyl geneeskunde, sal intervensies ontwikkel word op grond van gemeenskap behoeftes en op 'n kulturele sensitiewe en toepaslike manier geïmplementeer word. Die motivering agter die vestiging en organisatoriese ontwerp is 'n hoë voorkoms van onbeheerde hipertensie en diabetes-tipe 2 in 'n omgewing met 'n hoë armoede-indeks. Konvensionele terapie is grootliks onsuksesvol, aangesien baie individue ernstige komplikasies ondervind ten spyte van behandeling en mediese sorg. Daar word geglo dat kulturele hindernisse en gedrag sowel as 'n gebrek aan onderwys, die belangrikste dryfkragte agter die voorkoms en erns van hierdie toestande is. Lewenstyl intervensies het effektief in ander lande bewys, maar die navorsing is nie direk na Grenada oordraagbaar nie weens sy unieke bevolkingsdinamika. Deur intervensionele navorsing te gebruik om data in te samel oor effektiewe strategieë wat die deelnemers direk bevoordeel, kan 'n groter impak gemaak word. Deur opvoeding van die publiek sowel as gesondheidsorgverskaffers en die verskaffing van toegang tot sorg vir individue wat dit normaalweg nie sou kon bekostig nie, behoort 'n vermindering in die voorkoms van siektes sowel as die erns van nadelige gevolge bereik word. As deel van die groei van die organisasie word 'n leefstyl geneeskunde sentrum beplan. Dit sal 'n fisiese ligging he wat bekostigbare ondersteuning bied vir welstand, gebou op 'n gesonde leefstyl met maklike toegang tot fasiliteite en langtermyn ondersteuning vir gedrag veranderinge. Die uiteindelijke doel is om die gesondheid en welstand van alle Grenadane te verbeter deur volgehoue gesonde gedrag.

## Δήλωση σκοπού (Περίληψη)

Η Grenada Lifestyle Medicine Corporation είναι ένας μη κερδοσκοπικός οργανισμός που στοχεύει στη βελτίωση της υγείας στην κοινότητα της Γρενάδας μέσω παρεμβατικής έρευνας και εκπαίδευσης. Ακολουθώντας τις αρχές της τεκμηριωμένης ιατρικής και τους πυλώνες της Lifestyle Medicine, οι παρεμβάσεις θα αναπτυχθούν με βάση τις ανάγκες της κοινότητας και θα εφαρμοστούν με πολιτισμικά ευαίσθητο και κατάλληλο τρόπο. Το κίνητρο πίσω από την ίδρυση και τον οργανωτικό σχεδιασμό είναι ο υψηλός επιπολασμός της ανεξέλεγκτης υπέρτασης και του διαβήτη τύπου 2 σε ένα περιβάλλον με υψηλό δείκτη φτώχειας. Η συμβατική θεραπεία έχει αποδειχθεί σε μεγάλο βαθμό ανεπιτυχής, καθώς πολλά άτομα υποφέρουν από σοβαρές επιπλοκές παρά τη λήψη θεραπείας και ιατρικής περίθαλψης. Πιστεύεται ότι τα πολιτιστικά εμπόδια και συμπεριφορές, καθώς και η έλλειψη εκπαίδευσης είναι οι κύριες κινητήριες δυνάμεις πίσω από την επικράτηση και τη σοβαρότητα αυτών των συνθηκών. Οι παρεμβάσεις στον τρόπο ζωής έχουν αποδειχθεί αποτελεσματικές σε άλλες χώρες, ωστόσο η έρευνα δεν μπορεί να μεταφερθεί άμεσα στη Γρενάδα λόγω της μοναδικής δυναμικής του πληθυσμού της. Με τη χρήση παρεμβατικής έρευνας για τη συλλογή δεδομένων σχετικά με αποτελεσματικές στρατηγικές που ωφελούν άμεσα τους συμμετέχοντες, μπορεί να υπάρξει μεγαλύτερος αντίκτυπος. Μέσω της εκπαίδευσης του κοινού καθώς και των παρόχων υγειονομικής περίθαλψης και της παροχής πρόσβασης στην περίθαλψη σε άτομα που κανονικά δεν θα ήταν σε θέση να αντέξουν οικονομικά τη μείωση του επιπολασμού της νόσου καθώς και της σοβαρότητας των δυσμενών επιπτώσεων. Στο πλαίσιο της ανάπτυξης του οργανισμού σχεδιάζεται ένα κέντρο Lifestyle Medicine. Ποια θα ήταν μια φυσική τοποθεσία που θα προσφέρει προσιτή υποστήριξη για ευεξία βασισμένη σε υγιεινό τρόπο ζωής με εύκολη πρόσβαση σε εγκαταστάσεις και μακροπρόθεσμη υποστήριξη για αλλαγές συμπεριφοράς. Ο απώτερος στόχος είναι να βελτιωθεί η υγεία και η ευεξία όλων των Γρεναδιανών μέσω σταθερών υγιεινών συμπεριφορών.

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## **List of abbreviations**

2-AG: 2-arachidonoylglycerol

ACLM: American College of Lifestyle medicine

AEA: anandamide

BDNF: Brain derived neurotrophic factor

CVD: Cardiovascular disease

DALY: disability adjusted life years

DNA: Deoxyribonucleic acid

DRI: dietary reference intakes

DSM-5: Diagnostic and Statistical Manual of Mental Disorders five

ED: erectile dysfunction

ELMO: European Lifestyle Medicine Organization

FITT: frequency, intensity, timing and type

GLMC: Grenada lifestyle medicine corporation

HBA1c: Hemoglobin A1c

HDI: human development index

IPED image and performance enhancing drug

IR: insulin resistance

LDL: Low density lipoprotein

LM: Lifestyle Medicine

LMA: lifestyle medicine health and fitness adviser

LMGA: Lifestyle Medicine Global Alliance

MET: Metabolic Equivalent of Task

NCD: noncommunicable diseases

QALY: Quality adjusted life years

RDA: recommended daily allowance

REM: rapid eye movement

RMR: resting metabolic rate

SGU: St George's University, Grenada

STEPS: Stepwise approach to surveillance

SUD: Substance use disorders

TV: television

UNDP: United Nations development programme

USA: United States of America

WHO: world health organization

## 1. Introduction

Research studies done over the past 2 decades and more have shown an overwhelming unanimous agreement that individuals who adhere to specific low-risk behaviors have reduced risk of most of the noncommunicable diseases (NCD). In 2016 Mechanick and Kushner, summarized these studies in their textbook dedicated to lifestyle medicine identifying several consistent factors. The most consistent in NCD prevention were; being physically active, eating healthy, not smoking, consuming moderate amounts of alcohol and having a healthy waist circumference (Mechanick & Kushner, 2016). Despite this knowledge being shared and readily available the rate of NCD occurrence worldwide has steadily increased. Based on this two-decade research it's no surprise that the pillars of lifestyle medicine and therefore healthy living are based on these factors. While all agree on the basic principles of lifestyle medicine different regions recognize and apply the pillars somewhat differently. The American College of Lifestyle medicine quotes 6 pillars; Physical activity, nutrition, health sleep habits, healthy social connections, stress reduction and avoidance of risky substances (Lippman et al., 2024). The European Lifestyle Medicine Organization recognizes all of these but add sexual health and environmental health as additional pillars (Natin et al., 2025).

Before discussing details of the pillars of lifestyle medicine and their impact on healthy living one must first define what is meant by healthy living. Health is defined by the world health organization (WHO) as “a state of complete physical, mental and social well-being” others add independence to the definition (Ruxton et al., 2016). Recent advances in psychology have resulted in the term Flourishing for those who experience not only optimal physical wellness but also optimal psychological wellness (Burke & Dunne, 2022). What is abundantly clear regardless of the source of definition or guidelines is that it is not just the absence of disease but they go deeper in a more holistic way (Ruxton et al., 2016). There are two interrelated metrics that are often used to describe and quantify healthy living. One is the Quality adjusted life years (QALY); a measure of the quality and quantity of years added or removed by a medical intervention (Mechanick & Kushner, 2016). The other measure is that of disability adjusted life years (DALY) which considers the number of years lost due to disease, disability or early death (Mechanick & Kushner, 2016). Years of research have indicated that there are 5 determinants of health consisting of internal and external factors. The internal factors include genes, behavior and physical influences while the external factors are environment, medical care and social factors (Burke & Dunne, 2022; Lippman et

al., 2024). We discuss here the history of lifestyle medicine, the pillars and their impact on healthy living, and argue for the inclusion of two additional factors not previously recognized by lifestyle medicine organizations.

## **2. Literature Review**

### **2.1. Overview and history of lifestyle medicine**

The broad definition as posed by Mechanick and Kushner (2016), in their book “Lifestyle Medicine” is that it is ‘the non-pharmacological and non-surgical management of chronic disease’ (Mechanick & Kushner, 2016). There are many specific definitions of lifestyle medicine, however all are based on the application of lifestyle changes according to the pillars of lifestyle medicine to treat, reverse and prevent chronic diseases (Egger, 2019; Lippman et al., 2024; Yeh & Kong, 2013). There is an emphasis on evidence based medicine as the foundation and that treatment of a person as a whole is a core aspect of the discipline (Lippman et al., 2024). Some, though not all, definitions include aspects of self-care and self-management (Egger, 2019; Yeh & Kong, 2013). It differs from conventional medicine by taking into consideration the patient’s environment and behavior, in attempt to expose and eliminate the root cause, rather than simply focusing on diagnosing the condition and managing the symptoms (Egger, 2019; Lippman et al., 2024).

Despite the relatively new formal introduction of lifestyle medicine as a discipline, its principles can be seen dating back to the time of Hippocrates. The “father of medicine” cautioned that eating too much and moving too little, having poor sleeping patterns and the consumption of certain types of wine (and their quantities) plays a role in disease formation and progression (Lippman et al., 2024; Mechanick & Kushner, 2016; Yeh & Kong, 2013). In the east, Confucius, a well-known Chinese philosopher, simultaneously emphasized the same, and added that persistent mindfulness practices and meditation had a positive effect on quality of life (Lippman et al., 2024; Yeh & Kong, 2013). It is unfortunate that during their time and that following, the words of these wise practitioners were not heeded, and more “bad habits” were introduced as the incline of lifestyle related diseases continued over the subsequent centuries (Lippman et al., 2024; Yeh & Kong, 2013).

The estimated global average life expectancy in 1800 was 29 years, in 1900 the world average had increased to 32 years with some countries expecting as many as 47 years total lifespan (Dattani et al., 2023). The industrial revolution brought with it advancement in technologies, better sanitation and more sophisticated medical care (Crane-Kramer & Buckberry, 2023). The revolution also brought with it denser populations, unhealthy environments and the rise of agriculture which contributed to the advancements and indirectly the increase in life expectancy (Crane-Kramer & Buckberry, 2023). Add another 50 years and the world average increases further to 46 and countries such as Northern

America, much of Europe and Oceania increased to nearly 70 years (average 67) (Roser, 2018). With continuing improvement in medical care and scientific advancement the global average lifespan continued to increase steadily to a current 72-80 years depending on the country (Dattani et al., 2023; Roser, 2018). However the contrary has been observed with some countries experiencing a recent decline in life expectancy due to chronic diseases (Lippman et al., 2024). It is important to acknowledge that while over the past 150 years there was an emphasis (and still is) on increasing the length of life, not as much attention has been given to what quality that life is (Noto, 2023). Individuals over the age of 65 are commonly subject to a set of conditions known as “Geriatric syndromes” which increase the susceptibility to falling ill and can have significant effects on quality of life (Noto, 2023). When considering all the possible afflictions that an aged individual (over the age of 65) can experience the vast majority of them are linked to lifestyle (Lippman et al., 2024; Noto, 2023). In a way the decline seen today may also be linked in part to the consequences brought about by the industrial revolution. For all the advancements made the planetary health was not considered, and little attention was paid to the toxins released by factories and the deforestation that occurred as a result of population expansion (Crane-Kramer & Buckberry, 2023). Egger, 2019 suggests that the epidemiology of chronic diseases can be traced back to the presence of low grade chronic systemic inflammation. They highlight the use of the term anthropogens to describe the man-made aspects that affect health and include the environment as well as the behavioral changes that accompany the environmental changes that may be harmful to health. It is also highlighted that the potency of these anthropogens depend greatly on the individuals genetics as well as the environmental factors and exposure (Egger, 2019).

The first mention of the term “Lifestyle medicine” in publication was in 1990 following a symposium the previous year by the same name (Yeh & Kong, 2013). It appears that the increase in attention to lifestyle medicine was brought about in 1993 (Lippman et al., 2024). A study by McGinnis and Foege, investigated the root causes of the top 10 mortality rates in the USA rather than just looking at the diseases themselves. They estimated that nearly 50% of deaths that occurred in 1990 were due to modifiable lifestyle related risk factors (Lippman et al., 2024; McGinnis & Foege, 1993). Despite this knowledge the number of deaths due to these factors increased in some categories 10 years later (Mokdad et al., 2004). With diet and physical inactivity increasing by a third from the 1990 report and tobacco use remaining the top associated factor (McGinnis & Foege, 1993; Mokdad et al., 2004). As part of the drive to awareness and implementation of appropriate strategies to counter these effects, the

American College of Lifestyle medicine (ACLM) was founded in 2004 (Lippman et al., 2024). This was closely followed by the introduction of the American Journal of Lifestyle Medicine in 2007. In response to the rising global interest in lifestyle medicine the Lifestyle Medicine Global Alliance (LMGA) was established in 2015 to better support the need for interventions in lower and middle income countries (Egger, 2019; Lippman et al., 2024). In 2017 the American Board of lifestyle medicine was implemented and the certification of physicians and Allied health professionals began (Lippman et al., 2024). Between 2019 and 2025 the number of countries with lifestyle medicine organizations affiliated with LMGA have grown from 18 to 32 (Egger, 2019; “Sister Organizations,” 2016).

Egger, 2019 eloquently describes the structure of the field under the headings of “the art”, “the materials”, “the procedures” and “the science” (Egger, 2019). In lifestyle medicine the physician (or lifestyle medicine practitioner) no longer relies on only their own skills and knowledge but includes all other health care providers including those in allied health disciplines. Treatment plans require major changes for the patient and are long term commitments with continual progress reassessments (Egger, 2019). The success of implementation is now more reliant on the patient being a partner and driving force for their own health than knowledge and plans made by any physician (Yeh & Kong, 2013). Despite being a discipline in its own right it actually borrows from other health disciplines and takes a combinatorial approach to the treatment of a patient as a whole being (Lippman et al., 2024). Lifestyle medicine even differs from conventional medicine when it comes to research, while conventional medicine typically research patients with diseases to find common trends, much of the research in lifestyle medicine is focused on what identifies healthy populations and distilling the information from those into actionable interventions (Lippman et al., 2024). Logan et al., (2019) emphasizes that when considering Lifestyle Medicine recommendations all pillars of health should be considered. This includes thinking about the environment on a global scale as environment plays a role on human health and human habits influence the health of the planet (Logan et al., 2019). It goes beyond the consumption of food and extends to habits such as screen time, socioeconomic disparities, psychological stress and environmental degradation to name a few (Logan et al., 2019). In summary research has shown that healthy lifestyle choices not only lengthens life but also improves the quality of that life, making the end swift and graceful (Mechanick & Kushner, 2016). Discussed below are the pillars of lifestyle medicine and their implications when well applied on longevity and lifelong quality of life. These pillars are a combination of those

proposed by the various organizations as well as additional aspects encountered in the literature to ensure a complete picture.

## **2.2. The pillars of lifestyle Medicine**

### **2.2.1. Nutrition**

Nutrition is a key factor of life and adequate balanced nutrient intake is essential for healthy living (Santos, 2022). The Third Expert report of the World Cancer Research Fund and American Institute for Cancer Research; Diet, Nutrition, Physical activity and Cancer: a Global Perspective, describes nutrition eloquently. It states that nutrition consists of integrated processes by which the organism acquires the energy and nutrients needed to function normally. These processes occur at all levels; cellular, tissues and organs and is the process that allows an organism to function, grow and develop (Summary-of-Third-Expert-Report-2018.Pdf, n.d.). However people consume a diet, based on their culture and environment or even their circumstances they don't consume nutrients (Santos, 2022). Diet consists of energy producing elements as well as elements which may not contribute to the energy production but influence the absorption and metabolism of nutrients consumed (Santos, 2022; Summary-of-Third-Expert-Report-2018.Pdf, n.d.). The history of nutrition research dates back to times when early scientists asked simple questions such as "how can large bovines thrive on diets consisting of mainly grass?" (Mechanick & Kushner, 2016).

Investigations into the answer to this question initially revealed the existence of macronutrients; in particular proteins, and their subunits. Further research revealed the presence of micronutrients in the form of vitamins and minerals and finally the presence of phytochemicals were identified (Mechanick & Kushner, 2016). It was the understanding, through experimentation, that certain conditions can be treated by adding more of certain types of nutrients and the disease states present in deficiencies that lead to the discovery that health status can be manipulated through diet (Mechanick & Kushner, 2016). While studies have shown that supplements can reduce the symptoms of deficiency the consumption of nutrients through a balanced diet is far more effective (Merlo & Vela, 2021).

In the 50's and 60's the rates of hunger and malnutrition drove the initiative to develop the guidelines of how much food and nutrients should be consumed. It gave rise to two different measures; recommended daily allowance (RDA) and its counterpart the dietary reference intakes (DRI). The rationale behind each value is different, the RDA attempts to prevent disease due to deficiency and the DRI attempts to ensure intake remains within

nontoxic levels (Mechanick & Kushner, 2016). Today in the United States of America (USA) the dietary recommendations have taken an interesting turn, from being prescriptive about the exact quantities to be consumed to behavioral modifications based on reduction of unhealthy and replacement with healthier foods (Mechanick & Kushner, 2016; Santos, 2022). Most current dietary recommendations are centered around reduction or prevention of obesity as a means of prevention of disease related risk factors which, while helpful can vary depending on the disease considered and the age of the individual (Santos, 2022).

Diets rich in whole-food plant based components have consistently shown a positive effect on health such as decreasing inflammation, lowering oxidative stress, better lipid profiles and improved insulin sensitivity (Agnoli et al., 2023; Santos, 2022). Plant based diets are naturally lower in saturated fats which aids in reducing the calory intake (Agnoli et al., 2023). When combined with whole grains it is also rich in fiber and other phytochemicals which aid in microbiome health and regulates fatty acid absorption and metabolism (Agnoli et al., 2023; Kumar et al., 2023; Santos, 2022). Consumption of whole grains have been linked as a determinant factor for reducing disability-adjusted-life-years (DALY) more than any other dietary factor (Santos, 2022).

Studies on specific dietary patterns show that the Mediterranean diet has positive results on health and is attributed to high levels of antioxidants and various other phytochemicals (Mechanick & Kushner, 2016; Santos, 2022). While not identical a common factor among all Mediterranean dietary patterns is the consistent use of Extra virgin Olive oil and limited use of meats and sweets (Arnett et al., 2019; Mechanick & Kushner, 2016; Santos, 2022; Summary-of-Third-Expert-Report-2018.Pdf, n.d.). It also includes the consumption of a variety of different fruits and vegetables as well as whole grains which has been shown to improve health (Santos, 2022; Wallace et al., 2020).

All research points to the consumption of a well-balanced diet rich in fruit, vegetables and whole grains with lower levels of animal projects and the avoidance of saturated fats and refined sugars. A food category that should be avoided because it has been associated with an increased risk of all noncommunicable diseases is processed foods (Mechanick & Kushner, 2016; Santos, 2022). One of the most common reasons stated for this is the addition of large amounts of salt, sugar or fat to improve the taste. However, one should also consider that during the processing the food loses it's natural ratio of phytonutrients and are often stripped of one or more essential components. This leads to imbalance in digestion and absorption on consumption (Mechanick & Kushner, 2016; Santos, 2022). To benefit adequately from food, it should be consumed in its entirety unless what is removed is toxic.

Additional considerations are factors of food preparation methods and timing of meals both of which can also change the bioavailability of certain nutrients and the body's response to the nutrients (Neufingerl & Eilander, 2021). High temperature cooking of meat has been shown to form heterocyclic amines and polycyclic aromatic hydrocarbons. Both have mutagenic potential damaging Deoxyribonucleic acid (DNA). Research showed that there are peak times for insulin production which when timed with carbohydrate rich meals may lead to better health outcomes (Poggiogalle et al., 2018). It has also been shown that daily calorie distribution affects the metabolism and overall metabolic health of individuals. Timing the biggest meal of the day at breakfast has shown advantages in glucose and insulin levels. It also appears that care should be taken when changing eating habits. This is especially true if meals are delayed and may be linked to the same factors that improve health when majority of calories are consumed earlier rather than later in the day (Poggiogalle et al., 2018).

### **2.2.2. Physical activity**

Physical activity is all forms of movement an individual performs, exercise is a structured, planned and timed activity for the purpose of improving health and wellness (Blumenthal & Rozanski, 2023). Although the terms are often used interchangeably this is an important distinction to make. Observational studies have shown strong evidence that consistent regular physical activity reduces the risk of cardiovascular disease, metabolic syndrome, diabetes and certain cancers such as breast and colon (Mechanick & Kushner, 2016). There is also moderate evidence for improvement in bone density, lowered risk of hip fractures and improved sleep quality (Mechanick & Kushner, 2016; Posadzki et al., 2020). The benefits of exercise are multifold and can be examined on a cellular level. Exercise increases the muscle cell mitochondrial action and thereby increases oxidation of both glucose and fats (Peña Carrillo et al., 2024). This benefit is short-lived after the exercise and explains partly why regular exercise as opposed to periodic acute bouts of exercise is more beneficial for health (Peña Carrillo et al., 2024).

The association between physical inactivity and increased chance of early death regardless of the cause is now indisputable (Mechanick & Kushner, 2016). This association has been known since 1953 when the Lancet published a paper on health effects of prolonged sitting in London bus drivers (Ekelund et al., 2016). The term used to describe this type of living is Sedentarism, and describes an individual who spends the majority of the day during both work and leisure time sitting therefore expending very little energy (Ekelund et al.,

2016; Mechanick & Kushner, 2016; Posadzki et al., 2020). The measure used to describe this energy expenditure associated with physical activity intensity is MET – Metabolic Equivalent of Task. MET is associated with the oxygen consumption during activity and is linked to the resting metabolic rate (RMR) of an individual, 1 MET = 3.5 ml/min/kg for most adults (Fridolfsson et al., 2023). Activities that count as sedentary behavior have <1.5 MET such as sitting, standing and lying down and have been associated with increased risk of various chronic disease conditions (Ekelund et al., 2016; Fridolfsson et al., 2023; Posadzki et al., 2020). Intensity of the physical activity is as important as duration and frequency, different exercise intensities have different physiological effects on muscle tissue and metabolism and therefore have different health benefits (Fridolfsson et al., 2023; Peña Carrillo et al., 2024). While METs are intended to be an absolute measure of exertion it is relative to the fitness level of the individual. Individuals who are very fit will experience 3 MET as low intensity while those at lower fitness level will perceive it as high intensity despite it being equivalent to moderate intensity exertion based on oxygen consumption (Fridolfsson et al., 2023).

In a systematic review Ekelund et al. investigated the extent of physical activity required to counteract total sitting time and thereby eliminate the detrimental effects of sedentarism. They found that for individuals who spend more than 5 hours per day sitting, a high level of physical activity (60-75 minutes of moderate intensity) daily is required to reduce the mortality risk. Studies have also indicated that time spent watching television (TV) has a greater effect on mortality and morbidity than sitting time while at work, even at less time. The proposed reason for this is that individuals watching TV tend to get up less and are also more likely to snack, adding an additional parameter (Ekelund et al., 2016). Another interesting finding was that individuals with less sitting time (>4 hours) and less time spent doing physical activity (5 min per day) had significantly higher risk of mortality than those with higher sitting times and higher physical activity overall (Ekelund et al., 2016). Current WHO recommendations for minimum levels of physical activity for adults over 19 years of age, are 30min of moderate intensity aerobic exercise per day or an average of 150 minutes per week. It may be substituted by vigorous activity for 75 minutes per week and must include at least 2 days of strength and muscle building exercise. For an aerobic session to be effective research has shown a continuous exertion of at least 10 minutes is required (Mechanick & Kushner, 2016; Posadzki et al., 2020). Recommendations, based on epidemiological studies, for younger individuals aged 6 to 19 is double that of adults and should include muscle building exercises more frequently (Ekelund et al., 2016; Fridolfsson

et al., 2023; Mechanick & Kushner, 2016). In the systematic review by Ekelund et al., this recommendation appears to be the absolute minimum to reduce mortality associated with a sedentary lifestyle (Ekelund et al., 2016). There is strong evidence that regular physical activity and its associated cardiorespiratory fitness, at the levels prescribed reduces the risk of premature death more than any other factor. Physical activity at levels double the recommendation is even more effective in reducing mortality (Ekelund et al., 2016; Mechanick & Kushner, 2016; Posadzki et al., 2020). Additionally, as individuals gain fitness as measured by cardiorespiratory health and oxygen consumption during exertion the intensity should be increased to continue the health benefit (Fridolfsson et al., 2023).

Boyer et al. (2023) showed that all types of resistance training in individuals who are overweight or obese reduces insulin resistance (IR) regardless of the measure used for assessment. The effect was greater in male individuals over the age of 40 than in any other group. It appears that the mechanism behind this improved insulin sensitivity is linked to more than just increase in muscle size. There is improved fatty acid metabolism and increased usage of energy by the muscles which in turn increases the efficiency of glucose usage by the muscle cells. In addition there seems to be improvement in clearance of insulin which further reduces the insulin resistance (Boyer et al., 2023). Based on their analyses Boyer and colleagues argue that the current recommendation for strength building exercise is too low (Boyer et al., 2023). In addition to the type of exercise that is beneficial to health there are suggestions that timing is also important (Peña Carrillo et al., 2024). Studies have shown that most athletes perform better in the late afternoon and early evening than in the morning (Peña Carrillo et al., 2024). It has been linked to the hormonal rhythm and much research has been done on optimal timing and how it relates to glucose metabolism. There is however little data on healthy individuals with regard to time of day exercise with some suggestions that chronotype plays a role in the effects (Peña Carrillo et al., 2024).

Physical activity have been linked to improved cognitive function in children and older adults and those with neurodegenerative diseases (Blumenthal & Rozanski, 2023; Posadzki et al., 2020; Xue et al., 2023). It is believed that this is achieved due to the release of brain derived neurotrophic factor (BDNF) which is known to increase neuronal growth and synaptic formation. In a recent meta-analysis Xue et al. (2023) showed that multimodal exercise combined with cognitive interventions had the best results on improving global cognition. Important to note however that nearly all the included studies (26/31) had a high risk of bias and an additional 3 had an undetermined risk of bias (Xue et al., 2023). Many studies have investigated the possibility of physical activity as a prescription for Mild

Depressive Disorder and results show comparative outcomes to medication treatment. Physical activity showed an equal reduction in depressive symptoms to the standard pharmaceutical care indicating that it is as effective in reducing symptoms. One study showed that the long term benefits of taking part in an exercise intervention exceeded that of medication use however there may be confounding effects as exercise was performed in a group setting (Blumenthal & Rozanski, 2023). The effectiveness of exercise on reduction of depression seems to be dependent on the comorbidities of the participants which has also been seen in other disease conditions (Posadzki et al., 2020). Individuals undergoing cardiac rehabilitation and exercise as part of treatment for coronary heart disease seem to have a greater reduction in depressive symptoms than individuals with other comorbidities (Blumenthal & Rozanski, 2023). Further studies have shown that individuals engaging in the minimum recommended levels of physical activity per week in the form of aerobic exercise had a 25% reduced chance of displaying depressive symptoms (Blumenthal & Rozanski, 2023).

Exercise has a positive effect on sleep and has been shown to improve sleep when applied appropriately (Peña Carrillo et al., 2024). Chronotype (preference for time of day) plays a significant role in exercise tolerance at certain times of the day (Peña Carrillo et al., 2024). This needs to be taken into consideration when making recommendations for individual health benefits (Peña Carrillo et al., 2024). The list of benefits of physical activity is long and it can safely be said that all bodily functions are dependent on adequate levels of physical activity. How beneficial physical activity is seems to be dependent not only on the frequency, intensity, timing and type (FITT) of exercise but also on the individuals overall health and demographics (Posadzki et al., 2020). Interesting and important to note is that the majority of physical activity and health data is related to one particular demographic and may not necessarily be translatable to other populations (Mechanick & Kushner, 2016). This emphasizes the importance of research conducted on understudied populations as genetic factors may play a significant role in the health effects of lifestyle medicine interventions.

### **2.2.3. Sleep**

The normal regulation and functioning of many physiological processes in the body relies on adequate amount and good quality of sleep (Li et al., 2021; Merlo & Vela, 2021). Some have argued that sleep should be the first lifestyle habit (pattern) to correct in any individual as it underlies the healthy function of all the other aspects of wellness (Kreouzi et al., 2022; Merlo & Vela, 2021). Due to this importance, guidelines on habits that promote sleep quality

and quantity have been established (Mechanick & Kushner, 2016). Research done in the blue zones have also highlighted that adequate sleep is a key factor not only for longevity but also for improved quality of life in elderly individuals (Kreouzi et al., 2022). Healthy sleep patterns consist of a single rapid eye movement (REM) sleep stage preceded by three non-REM stages, which changes in the fraction they contribute to sleep time over the individual's lifetime. Slow wave sleep or N3 sleep is important for cellular restoration and memory consolidation and is the phase that declines as an individual ages (Mechanick & Kushner, 2016). Sleep is reliant on two carefully balanced cycles, the "S" cycle is the drive to sleep which results from buildup of chemical byproducts in the brain while awake. The other is the circadian rhythm, an internal biological mechanism that is associated with alertness signals and determines metabolism of nutrients, energy production and tissue repair (Mechanick & Kushner, 2016; Poggiogalle et al., 2018). The normal functioning of the brain and other vital organs depend on the circadian rhythm. Adequate sleep is related to the release of necessary neurotransmitters that regulate mood and executive functioning, and hormones that regulate hunger and satiety (Peña Carrillo et al., 2024; Poggiogalle et al., 2018; Sampasa-Kanyinga et al., 2020). Research have shown that the proper functioning of all systems relies on these two cycles be not only synced with each other but also with environmental cues. They both depend on and regulate; when an individual eats, how their body responds to the food they eat, which time of the day they eat the majority of their calories and when and how well they sleep (Peña Carrillo et al., 2024; Poggiogalle et al., 2018). Many studies on shift work have shown the relationship between timing of sleep and, glucose and fat metabolism. This is linked to the internal circadian rhythm which becomes mismatched with the external cues when sleep occurs during the day typically increasing appetite (Poggiogalle et al., 2018). The good news is that the effect is temporary and metabolism returns to normal after a few days of returning to normal sleep patterns (Poggiogalle et al., 2018). Reducing sedentary time, in particular outside of work, including Television watching and computer use, may have a positive effect on sleep duration and quality in young adults (Kakinami et al., 2017). This relationship is clear however the exact mechanism of why this occurs is still not fully understood (Kakinami et al., 2017). It is well known that sleep quality may be affected by external factors such as digital devices and artificial light and that it causes emotional, physiological and psychological problems for individuals (Moore, 2023). When the human body is subjected to too much physiological stress it can impact our sleep quality and quantity (Moore, 2023). Adequate sleep has been shown to reduce reflexive stress reactivity leading to better emotional balance and overall

better health (Sampasa-Kanyinga et al., 2020). The right amount of sleep, not too little (>6 hours) but also not too much (>9 hours), clearly has many health benefits and is protective against; Cardiovascular disease (CVD), Diabetes type 2, neurodegenerative diseases and other chronic health conditions (Kreouzi et al., 2022; Mechanick & Kushner, 2016).

#### **2.2.4. Sexual health**

Sexual health is not considered part of lifestyle medicine by all lifestyle medicine organizations and research on it is scarce. Research has been done to investigate the effects of lifestyle and the different factors associated with erectile dysfunction (ED) in men. Very little research has been conducted on women and the majority is linked to metabolic syndrome and its consequences (Towe et al., 2020). Similar to the definition of general health, sexual health is defined in terms of physical, psychological and behavioral aspects that surpasses the simplistic “absence of disease” (Hancu et al., 2021). In accordance with this definition Hanes recommend 4 aspects of sexual wellness to consider. Sexual satisfaction, pleasure, self-esteem and self-efficacy are all considered important aspects of sexual wellness. It is noted too that these may be different and likely tie into the role that sexual behavior plays in an individual’s life for each person. The importance and purpose placed on sexual behavior is highly personal and differs based on many factors such as age and culture (Hancu et al., 2021). Sexual wellbeing is influenced by an individual’s psychological and physical wellbeing. In turn healthy sexual behaviors or more frequently the absence thereof influence the psychological wellbeing of the individual and is particularly noteworthy in women (Hancu et al., 2021; Towe et al., 2020). Different ages have different sexual needs and desires, and it is important to consider sexual wellbeing at all ages. Two often neglected age groups are adolescents (12-19 years) and those considered to be elderly (>65 years). The deterrents for discussion are different between these, discussions of sexual behaviors and health with adolescents are more uncomfortable than with young and middle-aged adults but are even more important for fostering healthy behaviors that influence the overall wellbeing of the individual. Sexual wellbeing goes beyond safe practices and providing the necessary support for teenaged individuals have shown to foster improved wellness in later life (Hancu et al., 2021). In contrast the elderly are often considered desexualized especially women and their sexual health may not be considered as important. Research has shown that women in particular have a heightened enjoyment of sexual activity in the later years, mostly because of the psychological factors involved around menopause and less concern of judgement (Hancu et al., 2021). The

importance of healthy lifestyle behaviors and their influence on sexual health can be illustrated by the detrimental effects of lifestyle related chronic diseases. Maintaining a healthy weight is not only important for self-esteem and body image as it relates to sexual confidence but also for reproductive health (Hancu et al., 2021; Towe et al., 2020). Implementation of healthy lifestyle behaviors has shown to improve sexual health regardless of weight status as the improved health causes physiological benefits in sexual functioning (Hancu et al., 2021). For men, maintaining healthy weight and physical activity levels have a positive effect on testosterone levels and have shown to improve erectile functioning (Hancu et al., 2021). Vascular and endothelial health is essential in the sexual health of men, so much that erectile dysfunction can be used as a predictor for cardiovascular events regardless of comorbidity status (Hancu et al., 2021). In addition to the direct effects of chronic diseases on sexual function in men, medications to treat cardiovascular disorders as well as many psychological disorders are known to cause or exacerbate the dysfunction (Hancu et al., 2021). In women sexual health is also influenced by weight and research have shown that metabolic syndrome contributes to dysfunction (Towe et al., 2020). In women psychological factors appear to have a greater influence on sexual health than physiological factors, which can be exacerbated by the psychotherapeutic drugs (Hancu et al., 2021; Towe et al., 2020). When considering sexual health, it is important not to neglect sexual diversity. Psychological factors are often an important consideration for individuals whose gender identity is different than sex assigned at birth. In addition to the difficulties faced related to their social and cultural pressures environments, research has shown that transgender individuals consider sharing this information with their health care providers important, an opportunity that is not often presented (Hancu et al., 2021). A healthy diet rich in fresh fruits and vegetables, whole grains and olive oil such as the Mediterranean diet has shown positive effects on sexual health by impacting BMI and reducing inflammatory markers (Towe et al., 2020). While exercise has a positive effect on increased virility and possibly arousal in both men and women, too much physical activity has been linked to a decrease in sexual desire especially in women (Hancu et al., 2021). Very high levels of strenuous physical activity in women has been linked to pain and vaginal cramping during intercourse as well as an inability to orgasm during sexual activity (Hancu et al., 2021). Avoidance of smoking also have a beneficial effect on sexual health mostly because of the effect on vascular health. The use of low levels of alcohol has shown to have beneficial effects on arousal and performance, likely due to the anti-anxiety and increased openness that accompanies it. High levels of alcohol consumption and alcohol and opioid dependence have a detrimental effect on sexual

arousal and desire and may also result in gonadal agenesis (Hancu et al., 2021). Performance enhancing drugs may have an initial positive effect on libido however long term use is associated with the opposite (Hope et al., 2023; Kanayama et al., 2009). The use of marijuana in women have a sexual stimulating effect while in men the continued use has been linked to reduced levels of testosterone and erectile dysfunction (Hancu et al., 2021). The importance of sleep in all aspects of life is indisputable and sexual health is no different. There are many sleep disorders that have shown a direct correlation with erectile dysfunction and reproductive problems in women (Hancu et al., 2021; Towe et al., 2020). Likewise, life stressors and family stressors can have a direct effect on the sexual health of an individual and therefore on a couple. At the same time healthy sexual behaviors can have a positive physiological and psychological effect on the brain and mood (Hancu et al., 2021).

### **2.2.5. Mental health**

When considering “mental health” it is tempting to think of mental disorders as classified in the Diagnostic and Statistical Manual of Mental Disorders five (DSM-5), however mental health encompasses a wide range of aspects that play an important role in the overall health of the individual. Mental health is defined as the ability to regulate emotional states, effectively adapt to changes in the environment and deal with stressors without it having a detrimental effect on wellbeing (Merlo & Vela, 2021). In the context of lifestyle medicine, diminished mental health regardless of the severity or cause is considered a noncommunicable disease (Burke & Dunne, 2022; Mechanick & Kushner, 2016; Merlo & Vela, 2021). The epidemiology of suboptimal mental health is closely linked to lifestyle factors and is suggested to have similar factors as that of other non-communicable diseases (Dinoff et al., 2017; Mechanick & Kushner, 2016; Merlo & Vela, 2021). Research have shown the benefits of a healthy diet, particularly the Mediterranean diet on prevention of depression (Merlo & Vela, 2021). This association was particularly strong in individuals who supplemented the diet with nuts and also had diabetes type 2 (Mechanick & Kushner, 2016). Research on the effects of diet on mood and affect have shown that diets high in antioxidants, flavonoids and essential fatty acids have a preventative effect on systemic inflammation and therefore also depressive symptoms (Mechanick & Kushner, 2016). Another association between healthy eating and improved mental wellbeing is the positive influence of consumption of fruits and vegetables on the production of serotonin and tryptophan by the gut microbiome (Burke & Dunne, 2022; Merlo & Vela, 2021). A strong relationship between gut microbiome diversity and mental health has also been investigated.

Studies have indicated that healthy, diverse gut flora as promoted by a healthy diet or use of probiotics reduces anxiety and improves mood. It is considered that the reason behind this may be due to the improved neurotransmitter and hormone production associated with healthy gut microbiome (Merlo & Vela, 2021).

Physical activity has been demonstrated as a factor responsible for maintenance of mental health and cognition by improving mood and decreasing the probability of developing depression (Dinoff et al., 2017). The reasons for this beneficial relationship seems to be as multifold as that of diet and researchers have investigated a variety of factors associated with physical activity to determine the relationship (Burke & Dunne, 2022; Desai et al., 2022; Dinoff et al., 2017; Ekblom et al., 2022; Mechanick & Kushner, 2016; Merlo & Vela, 2021). Functional imaging studies have shown that the part of the brain responsible for learning and memory (hippocampus) increases in size after exercise. Further studies showed an increase in brain vasculature after exercise suggesting improved oxygenation thereby improved brain function (Merlo & Vela, 2021). One of the most well-known effects of physical activity is the post-exercise euphoria, which traditionally was ascribed to the release of endorphins. More recent investigations showed that while the dopaminergic system is involved endorphins may not be the reason for the euphoria (Desai et al., 2022). This euphoric post exercise state improves mood and reduces anxiety levels and can even alleviate pain (Desai et al., 2022). Recent investigations have linked this euphoric state to an increase in endocannabinoids released during exercise. In particular Desai et al. showed consistent increase (with varying levels of exertion) in anandamide (AEA) and 2-arachidonoylglycerol (2-AG) (Desai et al., 2022). Increased levels of endocannabinoids are associated with improved affect, better mood and decreased anxiety levels (Desai et al., 2022). However this post exercise euphoric state is transient following acute moderate to vigorous activity of all exercise modalities indicating that more factors in the health benefits of exercise is likely at play (Desai et al., 2022; Dinoff et al., 2017; Ekblom et al., 2022). Brain derived neurotrophic factor (BDNF) levels in older individuals and those with Alzheimer's and psychiatric disorders have been shown to be decreased compared to young fit individuals without cognitive impairment (Dinoff et al., 2017). Further studies have shown that physical exercise induces secretions of BDNF and improves cognitive function in healthy children and elderly individuals with cognitive impairment. It is considered an important protective factor against mental illness (Dinoff et al., 2017; Ekblom et al., 2022; Merlo & Vela, 2021). In a meta-analysis Dinoff et al. showed a significant increase in peripheral BDNF after an acute exercise session, this was true for both plasma and serum values (Dinoff et al., 2017; Ekblom

et al., 2022). The increased BDNF levels in peripheral blood was associated with both resistance and aerobic exercise sessions and increased with duration of the exercise session (Dinoff et al., 2017). It seems that a greater benefit of BDNF increase is found in males after acute exercise than in females and that cardiorespiratory fitness but not age was also linked to the levels detected (Dinoff et al., 2017). These studies show that exercise may be an effective non-pharmacological treatment for stress and other mood related disorders (Desai et al., 2022). As many psychiatric medications can influence sleep and therefore exacerbate the mental health disorder/illness non-pharmacological interventions in these individuals is paramount (Merlo & Vela, 2021). Physical activity may improve sleep, adequate sleep is essential for mental health as disturbed sleep patterns have been linked to various different mental disorders (Merlo & Vela, 2021). Studies in children and adolescents have shown that getting adequate physical activity and sleep as well as simultaneously reducing screen time has a protective effect against developing depression (Sampasa-Kanyinga et al., 2020). Since early development of depression is predictive of mental health in adulthood this is an important factor to keep in mind (Sampasa-Kanyinga et al., 2020).

Smoking cessation and avoiding alcohol also has a positive effect on mental health and can be as effective as the use of prescription medications (Merlo & Vela, 2021). The right support structure and positive social connections also make a big difference to the wellbeing of individuals. Research from the blue zones indicates that healthy social connections whether through family or community are essential to mental health and quality of life in the elderly (Kreouzi et al., 2022). Being part of the community links to a sense of purpose which has been shown to greatly impact wellness (Kreouzi et al., 2022). What remains undisputable is the association between physical and mental health, the severity of chronic disease can be predicated by the mental health status of the patient (Merlo & Vela, 2021). Since chronic health conditions affect mental health which in turn serves as a deterrent for lifestyle change motivation which can improve the chronic health condition, mental health should always be part of the patient care plan (Merlo & Vela, 2021). An important aspect to remember is that social determinant factors of health must be considered if the individual is to be properly supported to change lifestyle behaviors (Merlo & Vela, 2021). It is well known that certain individuals have a greater risk for stress due to cumulative factors surrounding their social standing and or environment (Merlo & Vela, 2021). When considering the mental health status of the individual one is in fact considering the holistic health of the individual as all the lifestyle medicine pillars are related in one way or another to mental health.

### **2.2.6. Stress management**

Stress is defined as a state that detrimentally effects the balance within an individual causing a disruption in homeostasis (Hegde & Mitra, 2020). More research is needed into the exact mechanism behind the detrimental health effects of chronic stress however, the relationship is indisputable (Kreouzi et al., 2022). Normally acute stress triggers an adaptive response in the individual and when the stressor is removed all systems return to normal. With chronic stress the adaptive capabilities of the body begins to weaken which leads to behavioral changes that provide short-term relief but ultimately increases both physiological and psychological stress (Yau & Potenza, 2013). Some research indicate to chronic inflammation playing a considerable role in the pathogenesis of depression and chronic stress is known to contribute to low grade chronic inflammation (Merlo & Vela, 2021). As with many health-related aspects, stress can be a positive thing (eustress) (Yau & Potenza, 2013), and an adequate level as determined by the hormone cortisol is necessary for optimal health. However too much or even too little cortisol, can cause detrimental effects on health (Kreouzi et al., 2022; Smyth et al., 2020). Research conducted in the blue zones showed that stress reduction was a major contributing factor to the quality of life in centenarians (Kreouzi et al., 2022). Cortisol secretion peaks about 30 minutes after waking time and decreases steadily during the day until evening time where it reduces to its lowest level at sleep onset (Smyth et al., 2020). In fact, studies have shown that a sharp decline of cortisol post the initial release is more beneficial to health than a gradual decrease. This daily cortisol level variation controls the circadian rhythm and often responds to external cues for increased levels (Smyth et al., 2020). In addition to cortisol regulating the wakefulness state it also plays an important role in other bodily functions (Smyth et al., 2020).

The effects of too much cortisol is much better understood than that of too low levels and have led to the initiation of several stress reduction strategies (Smyth et al., 2020). Stress reduction is key not only for improved mental health but also for avoiding physical health problems (Merlo & Vela, 2021). Engaging in activities like yoga, mindfulness, art and music activities as well as socialization activities have shown to be effective measures of stress reduction (Smyth et al., 2020). It has been so effective in improving wellbeing that in the UK social prescription is considered part of psychological health care (Smyth et al., 2020). With the introduction of positive psychology more stress reduction techniques have arose and while the effect on cortisol levels have not yet been established there is tangible evidence of its success (Smyth et al., 2020). The effect of different types of music on cortisol levels have been studied and showed that calming music reduces cortisol levels. Additionally

certain types of music has a anxiety dampening effect and strategies have been developed using this in normally high stress situations (Smyth et al., 2020). Mindfulness based stress reduction interventions have shown great results in reducing perceived stress levels in individuals and through it improving wellness. As with the advent of positive psychology the effect on cortisol has not been established (Smyth et al., 2020). Research have shown that exposure to nature and camping in nature improves overall mood, increases relaxation and stress and provides an increased sense of social interaction (Moore, 2023; Smyth et al., 2020). This correlates both with associated cortisol levels in individuals exposed to more green space (Smyth et al., 2020) and to positive psychology techniques (exposure to nature) which can improve wellbeing through improving mood and reducing stress (Burke & Dunne, 2022). Physiological benefits of nature walking and hiking can be seen in the reduction of blood pressure, increased immunity and improved stress levels (Moore, 2023). Even viewing nature videos was shown to be enough to improve wellness in individuals by lowering heart rate (Moore, 2023). Burke and Dunne (2022) showed that individuals who flourish consistently apply 3 or more lifestyle medicine principles in their daily lives (Burke & Dunne, 2022). Interestingly this is different to studies done using positive psychology interventions where increasing the number of techniques used did not correlate with increased wellbeing (Burke & Dunne, 2022). From what is described above one can elucidate that these stress reduction techniques are effective in reducing perceived stress. While some correlate with a reduction of cortisol levels others have not been studied or show no change, suggesting that the effect may be independent of cortisol levels (Smyth et al., 2020). From the research done it appears that the pattern of cortisol secretion rather than the levels of secretion is more important for health (Smyth et al., 2020). Regular physical activity is associated with better daily cortisol rise and fall and fitness levels have showed a correlation with cortisol release in response to acute stressors. Fitter individuals respond to stressors by producing less cortisol likely allowing them to have better control of their responses compared to unfit individuals (Smyth et al., 2020). Important to note that the stress reduction techniques do not affect males and females equally when comparing cortisol levels. Also since many studies have shown benefits in perceived stress reduction without accompanying cortisol level analysis there may be other factors at play beyond hormonal levels (Smyth et al., 2020). It is also likely that combinations of stress reducing techniques may have better results. There is no one size fits all and individuals need to be provided guidance but, autonomy to make decisions based on their own needs and enjoyment (Smyth et al., 2020). Naturally when individuals enjoy the activity meant to reduce their stress levels,

they are more motivated to start and continue with the activity (Smyth et al., 2020). This emphasizes the importance of shared decision making in the wellness plan of an individual as promoted by lifestyle medicine practices.

### **2.2.7. Social connection**

Research in the blue zones point to social connection and “strong family ties” playing an essential role in the wellbeing of centenarians (Kreouzi et al., 2022). Research has shown that the relationship between the mother and infant plays a crucial role in development of the individual. This relationship is especially important for mental health but also affects the physical health of the growing individual. Children who grow up in loving environments have better health outcomes and relatively little behavioral problems compared to those who don’t (Hegde & Mitra, 2020). This early connection determines how the individual will respond to other social settings and the environment later in life (Hegde & Mitra, 2020). Individuals who have healthy mother relationships also show more resilience later in life as compared to those without (Hegde & Mitra, 2020).

Recent initiatives that utilize group-based or shared medical appointments have yielded positive results by promoting support among individuals with the same condition (Tran et al., 2024). This positive outcome is reliant on a safe supportive setting with well-trained facilitators and understanding of confidentiality (Tran et al., 2024). It has been effective in both conventional medicine, reducing risk factors and improving adherence to care, and psychotherapy (Tran et al., 2024). The group appointments have several advantages including reduction of medical costs which may add to the support for individuals (Tran et al., 2024). Including the family of the individual in the groups also had improved results and adherence to treatment and care plans (Tran et al., 2024).

### **2.2.8. Environmental health**

When considering environmental health there are many aspects to consider, first is the state of the environment a person finds themselves in and how that effects health. The second is the planetary health and how human behaviors and lifestyle affect the health of the planet. They are bidirectional and fairly cyclical and this relationship must be explored if one is to understand holistic health (Neufingerl & Eilander, 2021). The environment people find themselves in at home, work or school and the individuals with whom they share those spaces all play a role in wellbeing (Parkinson, 2018). The community and culture in which individuals live and work determine both the quality of their lives as well as how long they

live (Parkinson, 2018). One of the ways in which environment affects health is by influencing the choices people make and their resulting behaviors. The increased use of technology, both small devices and larger things such as vehicles add to the hazards that comes with modern life. The health effects range from visual problems and phantom ringing to nature deficit disorder which in children mimic attention deficit disorder. Pathologies and injuries that result from seemingly harmless activities and the sequelae of prolonged engagement of internet and gaming use at the expense of sleep, physical activity and nutrition all effect an individual's health (Smyth et al., 2020; Stevens & Egger, 2020). While little direct research has been done on these technologically based environmental factors the absence of them are linked to healthful lives (Stevens & Egger, 2020). Individuals who are surrounded by nature are more prone to exercise while individuals who find themselves mostly in urban areas tend to be more sedentary (Smyth et al., 2020). Workplaces may be more concerned with productivity than employee health, placing stressors on those who work there to thrive in the workplace at the expense of their health (Parkinson, 2018). Healthcare centers and hospitals are good examples of places where the employee needs are not considered (Parkinson, 2018). With the understanding of epigenetics and its influence on health the importance of ensuring a healthy environment to live and work is becoming more widely accepted and practiced (Parkinson, 2018). Since human genes can rapidly adapt to the changes in surroundings more emphasis is being placed on maintaining healthy environments (Parkinson, 2018).

It seems that the early-life environment before an individual is born plays a role not only in the development in-utero but also the development of chronic diseases and health conditions later in life (Hegde & Mitra, 2020). The mother's health and food intake as well as her environment plays a role in how the individual responds to the environment after birth and for the rest of their lives (Hegde & Mitra, 2020). Beyond the prenatal period the early life experiences of an infant and child determines their resilience as well as social interactions (Hegde & Mitra, 2020). Studies have found that physical contact and observation of speech early in life are determinants of how easily an individual adapts to their environment in later life (Hegde & Mitra, 2020). Exposing teenagers to enriched environments filled with stimulatory aspects and positive socialization have the ability to reverse the adverse effects of early life maternal separation (Hegde & Mitra, 2020). Research on enriched environment exposure in Parkinson's and Alzheimer's patients also show a protection to the development of dementia (Hegde & Mitra, 2020).

While it is well established that the circadian clock is an internally timed mechanism its proper function is influenced by environmental factors such as light exposure (Poggiogalle et al., 2018). Surprisingly in addition to its effect on sleep the circadian clock and its proper timing also effects metabolism. Research has shown that insufficient light during the day can cause a reduction in stomach function causing problems with food digestion. The reverse was observed in studies that applied bright light in the morning and found that individuals lost more fat and had better carbohydrate metabolism (Poggiogalle et al., 2018). It has also been shown to reduce insulin resistance, suppress appetite, causes weight loss and improves the lean muscle gain from exercise (Poggiogalle et al., 2018). Further research on the effects of ill-timed bright light showed metabolic disruptions and an increased risk of metabolic disease, unhealthy weight and increased postprandial glucose compared to individuals exposed to dim light in the evenings (Poggiogalle et al., 2018). Increased evening time bright light exposure has also been associated with increased low density lipoproteins (LDL) cholesterol levels and increased risk of developing diabetes type 2 (Poggiogalle et al., 2018). While most studies have shown beneficial effects some reports of individuals with diabetes type II however showed the opposite results (Poggiogalle et al., 2018).

Other studies have shown the effect of environment on health includes blood pressure changes at rest and during sleep depending on altitude (Moore, 2023). Hypoxic conditions at high altitude has been shown to reduce sleep quality through sleep disturbances related to the cardiovascular system (Li et al., 2021). It may also worsen the symptoms of certain diseases, in particular related to glucose metabolism (Li et al., 2021). Elevated blood pressure and disturbances in sympathetic nervous system control has also been shown to be affected by the low oxygen levels at higher altitudes for individuals unaccustomed to the conditions (Li et al., 2021). These high altitude hypoxic conditions were tested and shown to reduce blood pressure complexity as well as interfere with sleep quality due to blood pressure fluctuations (Li et al., 2021).

As discussed above studies on nature exposure have shown improvement in mood, affect, a decrease in anxiety and increased positive thinking associated with activities in nature (Moore, 2023). Wilderness adventure activities for adolescence over 10 weeks showed a significant improvement in social self-esteem and psychological resilience (Moore, 2023). Some research have shown that exposure to nature and greener spaces can be a motivating factor for individuals to engage in physical activity (Smyth et al., 2020). Research also showed that adults who were exposed to nature as children had a better stress response likely due to their heightened connectivity to nature (Smyth et al., 2020).

One of the key factors in the blue zones is that of respect for the planet, individuals in those areas pay attention to the amount of pollutants around them both indoors and in the areas outside their homes (Kreouzi et al., 2022). It is well known that limiting exposure to pollutants and chemicals contributes to health however it seems that being more conscious of it may also contribute to health (Kreouzi et al., 2022). Further research on this is needed.

### **2.2.9. Risky substances and addiction**

Moderate use of alcohol, in particular red wines, and marijuana have shown health benefits when used for short periods of time. Benefits of moderate alcohol usage is related to cardiovascular protection while use of marijuana is associated with decreased anxiety in some (Hancu et al., 2021; Mechanick & Kushner, 2016). The disparity of results in the literature about the effects of both substances is great. Due to the nature of adverse effects associated with excessive use and the possibility of dependency most practitioners advise against them altogether. When discussing the lifestyle pillar “avoiding risky substances” it is often alcohol, recreational drugs, and tobacco that are being referred to (Mechanick & Kushner, 2016). However, one can argue that any substance when used excessively can be classified as a risky substance. Most substances that have the potential to become a dependency for individuals are linked to the biological reward system in the brain referred to as the hedonic system (Kanayama et al., 2010; Yau & Potenza, 2013). This complex of neuronal pathways involves the release of dopamine either directly or indirectly in response to certain substances or behaviors and is considered to reinforce repeat behavior (Hancu et al., 2021; Kanayama et al., 2010; Mechanick & Kushner, 2016; Yau & Potenza, 2013). While the biological aspect of many addictive substances and behaviors is unquestionable, many substance users begin the habit due to an underlying psychological factor. Substance use disorders (SUD) are complex and highly personal and while the behavioral or psychological factors may not always be the cause they often fuel continuation or relapse after cessation. One such group of substances are collectively known as image and performance enhancing drugs (IPED’s). They include among others, androgenic anabolic steroids, and growth hormone which started as athletic performance enhancing substances but in recent years have been used increasingly as appearance enhancements by non-athletes (Hope et al., 2023; Kanayama et al., 2009, 2010). Moderate use of anabolic steroids can have beneficial effects on lean muscle mass and psychological health in men (Kanayama et al., 2009). However, the continued use of anabolic steroids is considered causative of reproductive problems related to the decrease in testosterone production in male users.

Additional consequences include cardiomyopathies, body dysmorphia and depression as well as infections due to reuse or sharing of needles (Hope et al., 2023; Kanayama et al., 2010). Because they are linked historically to our survival behaviors such as eating and sexual activity are also tied to the hedonic system (Dakanalis et al., 2023; Hancu et al., 2021). As such food addiction and other eating disorders as well as certain behavioral patterns can also be considered under substance use disorders (Ohayon & Roberts, 2021; Wardle et al., 2019). There may also be a commonality between the reason for initiating excessive consumption of food and starting to take drugs (Yau & Potenza, 2013). The psychological wellbeing of an individual seems to be greatly related to the possibility of developing eating disorders. In return the resultant obesity feeds back into the depressive and unhealthy psychological and physical state of the individual potentially worsening the eating disorder (Dakanalis et al., 2023; Yau & Potenza, 2013). While acute excessive stress may lead to depressed appetite and under eating, chronic stress is more likely to be associated with overeating, but individual differences are common (Dakanalis et al., 2023). Research indicates that emotional eating is a behavioral symptom of underlying psychological, stress and circumstantial factors rather than being a disorder. This emphasizes the importance of determining and managing the mental health and psychological stressors effectively in individuals who over or under eat (Dakanalis et al., 2023). Behavioral addictions such as internet gaming and pathological gambling disorder are also associated with adverse health effects. In addition to the sedentariness and physical health problems of excessive online gamers there is a significant increase in associated mental disorders such as bipolarism and suicidal ideation as compared with individuals who don't have gaming disorder (Ohayon & Roberts, 2021). Excessive gambling is becoming an increasing concern and is considered amongst the addictive behavioral disorders. The impact of gambling disorder on the individual is overshadowed by the impact on society and those close to the gambler (Wardle et al., 2019). It has been suggested that gambling in general even in the absence of pathological gambling disorder has a negative effect of individual and societal health and should be closely monitored (Wardle et al., 2019).

#### **2.2.10.Spirituality**

More and more research, including that conducted in the blue zones are showing the importance of faith, religion and spirituality in maintaining wellness. Both religion and spirituality have shown a positive effect on social and behavioral regulation by promoting techniques such as meditation and prayer for self and emotional wellbeing (Hill et al., 2000).

For individuals in the blue zones having faith and or religious and spiritual practices is of paramount importance and some studies have shown that there is a link to purpose in life (Kreouzi et al., 2022). Research have shown that individuals who adhere to religious or spiritual practices are happier and have more availability to healthy practices and are generally healthier (Jackson & Bergeman, 2011). Some research have shown that having a greater sense of spirituality may be associated with a higher degree of resilience and more effective coping mechanisms (Jackson & Bergeman, 2011). It has been proposed that religion and spirituality play a role in the mental health of individuals however, this may not always be a positive effect. Other lifestyle health behaviors including risky sexual practices and substance use are lower in individuals who are part of a religion (Hill et al., 2000). It is important that religiosity and spirituality not be considered the same construct, while they share many commonalities and are often practiced in combination there are important differences. Religion is considered more focused on following institutionalized guidelines and being part of a community, spirituality is a more personal and self-driven concept where each individual is seeking their own connection to the divine (Hill et al., 2000). Much of the prior research on the effects of religion and spirituality have considered them as the same construct making inferences of how much each affect wellness difficult. More research is needed into these aspects as it appears both have positive influences on health through different mechanisms (Jackson & Bergeman, 2011; Kreouzi et al., 2022). Perceived control has been associated with improved self-reported (subjective) wellbeing, and that for older individuals (>50 years) this is associated with religiosity and spirituality. This highlights an important consideration when reviewing results from interviews conducted in the blue zones (Jackson & Bergeman, 2011; Kreouzi et al., 2022). Hill et al. (2000) also points to the development of an individual's religiousness and spirituality over time, changing and evolving as the individual walks through their life journey (Hill et al., 2000). Previous research have shown that being part of a religious or spiritual community is particularly helpful in maintaining physical and mental health in elderly individuals (Hill et al., 2000). In a review of systematic reviews on the effects of religious attendance on reduction of NCD mortality rates it was shown to have similar effects than other primary prevention mechanisms (Lucchetti et al., 2011). For some diseases the effect of religious attendance was greater (although not significantly so) than for preventative measures such as screening (Lucchetti et al., 2011). Faries et al (2023), and others showed that while factors such as smoking and excessive alcohol consumption was positively correlated with religiosity factors such as healthful eating and physical activity had no or a negative correlation with

self-reported religiosity (Faries et al., 2023). From their research it appears that having more religiosity and being active in one's religion has a weak positive correlation with the belief that lifestyle factors such as diet and exercise are important. However, this was based on self-reported belief, not practice of the health-related behaviors. Faries (2023) argues that as with the inclusion of non-smoking promotion into church culture changing the culture surrounding food consumption and activity will also have a positive effect on the health of the individuals (Faries et al., 2023). This consideration poses a controversial question on whether this will be healthy and thereby improve the health of individuals who engage in regular religious activities and consider themselves of a particular religious group. The self-determination theory speaks to internalization of health behaviors not being compliant to rules and regulations due to external motivators (Faries et al., 2023). As Hill pointed out some of the institutionalized rules have a negative effect on the mental health of religious people and as such careful consideration must be taken before such steps (Hill et al., 2000). Hill et al. (2000) also cautions against the use of the term spirituality to refer to ideologies, they state that for something to be considered spiritual it must have a linked to the sacred. It is not to be confused with having a strong belief in particular lifestyles or finding enjoyment in some activity. The way of life should serve a "higher purpose" to be considered spirituality (Hill et al., 2000). This links to prior research that showed the potential reason why individuals who practice religion or spirituality are happier and healthier is linked to a "sense of purpose" (Kreouzi et al., 2022).

### **2.3. Lifestyle medicine tools:**

While lifestyle medicine may not require special physical tools for diagnosis and treatment it does require a specific toolbox for practitioners. In addition to having the ability to identify a patient's readiness to change they also need the ability to convince that change is important (Mechanick & Kushner, 2016). Lifestyle medicine and the successful implementation thereof also requires the art of motivation and coaching. For a lifestyle specialist to be effective they need to be able to convince the client that it is in their best interest to change and have the client determine the how and when (Egger, 2019). This is a delicate skill and surpasses the basic communication skills of a physician. Through motivational interviewing one can achieve such goals however it is a skill that requires practice and a process of unlearning the ways of clinical history taking (Egger, 2019). Part of the "art" is that lifestyle medicine focusses more on the factors that determine the possibility of change rather than on the disease the individual is inflicted with. Counselling

and self-management for the individual is of paramount importance in the successful outcome. There may be a necessary process of weaning of unnecessary medications while carefully monitoring the need for pharmaceuticals along the way. Despite the emphasis of lifestyle modifications, the principles of lifestyle medicine does not condemn pharmaceuticals, rather it emphasizes the importance of balance in order to obtain maximal benefit (Egger, 2019). In addition to the tools available to monitor health parameters such as blood pressure and glucose, there are many user friendly wearable devices and smartphone apps that can assist an individual with not only monitoring their progress but also have tangible data of the effect of their activities (Egger, 2019). The list of lifestyle medicine specific procedures; Self-management training, Shared medical appointments, social prescription peer-to-peer learning, telephone triaging and programmed shared medical appointments, have been shown to be effective in improving motivation and compliance as well as alleviate the time constraints set by traditional medical consultations (Egger, 2019).

Effective practitioner patient communication is key to successful intervention. Stewart, 1995 showed that improved communication between physician and patient with focus on agreement on the presenting problem, emphasis on patient understanding of the problem and its consequences and physician empathy greatly impacted the success of the treatment (Stewart, 1995). The active participation of the patient in the process of decision making plays the most significant role in how effective the treatment is, regardless of the nature of the presenting problem (Stewart, 1995). For 30 years there has been no doubt that physician patient interactions are important and yet we still see non-compliance in NCD treatment as a major barrier to managing these conditions. In fact, lifestyle medicine and the interaction between patient and physician is structured in such a way that the word compliance should not be discussed. It is proposed that this suggests a patient doing what they are told rather than taking ownership of the changes they are responsible for, what replacement term is to be used is up for debate (Mechanick & Kushner, 2016). In lifestyle medicine the patient following the agreed upon behavioral change is the determinant factor of health improvement and as such the physician-patient interaction become all the more important in ensuring that this occurs (Mechanick & Kushner, 2016). The role of the practitioner is there to facilitate and support the change and assist in overcoming obstacles not to judge the patient for not following the agreed upon plan. For this the Five A's are used, simply Asking the patient for permission to discuss a health related issue, providing Advice on what can be done, Assessing the patient's readiness for change, then assisting in the development of a plan and finally arrange for the necessary support so that the patient may easily execute the

plan (Mechanick & Kushner, 2016). A useful tool that provides both information to the practitioner and assesses as well as increases the motivation of the patient is motivational interviewing. It places the emphasis on what the patient thinks, wants and feels. During the interview the patient's readiness to change is assessed, by balancing the desire for change with their resistance to change (Mechanick & Kushner, 2016). It's important to note that readiness to change not "willpower" determines the outcomes and success of the plan. Motivational interviewing employs strategic open ended questions to assess what opportunities there are for assisting the patient in their readiness and confidence to change (Mechanick & Kushner, 2016). Important to consider that the lifestyle medicine practitioner is a counsellor more than anything else, they do not make decisions for patients they simply guide the patient to make the decision for themselves. One of the tools used in lifestyle medicine is that of assisting a patient to develop internal motivation to change rather than having an external motivation. The concept is referred to as self-determinization and is the most effective motivator for change (Mechanick & Kushner, 2016). Regardless of which model or strategy is used it is important to remember that all factors should be considered. The patients internal motivation but also the environment in which they find themselves and the support around them that would assist in or deter from change (Mechanick & Kushner, 2016).

Readiness to change scale and the five A's technique are both effective tools for promoting smoking cessation as well as increasing physical activity (Mechanick & Kushner, 2016). The readiness to change scale can be applied to all behaviors that require changing. It simply asks the question of how ready an individual is on a five point scale; precontemplation – not even considering, contemplation – considered but not motivated to begin, Initiation – decided to change but have not started the change, action – started the change (1 – 3 Months into change), maintenance – have successfully maintained the change for at least 6 months (Mechanick & Kushner, 2016). Tools for counselling patients such as the 5 A's; Assess, agree, advise, assist, arrange, are effective in helping patients make the decision to change however it requires time, something not all primary care physicians have an abundance of (Mechanick & Kushner, 2016). In cognitive behavior therapy the patient or client is first asked how the therapist can be of assistance. This helps the patient share their aim and provides the means to continue toward assisting the patient in setting a realistic and achievable goal (Mechanick & Kushner, 2016). The role of the therapist is to assess the patient's goal and help them strategize the realistic achievement of that goal. Setting unrealistic goals often lead to early abandonment of the behaviors that will lead to the goal.

Setting small, yet challenging, short term goals leads to improvement of self-esteem and improves adherence to the behaviors (Mechanick & Kushner, 2016).

Use of the PLISSIT tool and newly revamped EX-PLISSIT tool has shown efficacy in increasing physician patient comfort with talking about sexual health and wellness (Hancu et al., 2021). The tool shares aspects of motivational interviewing in that it relies heavily on the interaction from the patient to be effective and that the guidance provided is not done in an authoritative way (Hancu et al., 2021; Mechanick & Kushner, 2016). As with motivational interviewing it starts with asking permission to discuss, it then is followed with provision of limited information regarding sexual health. Specific suggestions are then provided, and an intensive therapy is planned and executed. As research has shown by simply asking the practitioner opens the door, having a gentle structured approach to a delicate subject paves the way to openness and better health (Hancu et al., 2021).

The 5R's approach for motivating behavioral change especially in individuals with addictive and substance abuse disorders have been shown to be effective. It involves the practitioner taking time to discuss how cessation is relevant to the patient, the risks and rewards associated with cessation (or not), exploring the roadblocks the patient has for not being able or willing to cease the habit/behavior and lastly creating space for future discussions (Mechanick & Kushner, 2016).

There appears to be a general misconception regarding the use of pharmacotherapy or rather the lack thereof in lifestyle medicine interventions. While in some chronic disease conditions there is an aim to reduce the required dose of medications used it is often not possible to eliminate them entirely. The use of pharmacotherapy in substance abuse cessation treatment is often required due to the nature of the withdrawals and the potential relapse that in some instances, such as opioid users, can lead to a fatal event. In other instances, such as individuals with high blood pressure and very high fasting glucose, physical activity and discontinuation of insulin use are contraindicated regardless of lifestyle intervention benefits. Often the willingness of a practitioner to prescribe a medication asked for by the patient assists in the motivation for the patient to change their behavior and as such there should be openness to discuss. On the contrary patients who do not wish to take medications for their conditions should be carefully advised of the dangers of not doing so despite their engagement in lifestyle changes (Hancu et al., 2021; Mechanick & Kushner, 2016).

### 3. Conclusion:

From review of the literature both on healthy individuals and studies involving lifestyle interventions in chronic disease it is clear than no single Lifestyle Medicine pillar is more important than another. What comes to light very clearly is the multidirectional interplay between all lifestyle factors. It is true that for a short while increased attention to one factor may compensate for lack of emphasis in another however, for optimal health careful balance of all is required. While the focus of lifestyle medicine is health not disease, and despite reports claiming otherwise, most of the recent research in the field is on individuals who already suffer from one or more chronic conditions. One cannot criticize this approach as studying healthy individuals only provide part of the story.

Since 1990 when the true causes of mortality were linked to lifestyle factors, recommendations for healthy behaviors have been made. Interestingly traditional allopathic (and some complimentary) medicine seems to have turned (or retained) their focus toward managing symptoms. On the contrary, Lifestyle Medicine is determined at identifying the root cause of disease and eliminate it. This, and evidence from healthy centenarians was the basis for establishing the lifestyle medicine pillars. Evidence based medicine shows which behaviors are related to which factors and intervention studies have highlighted the benefits of changing the behavior to improve health. It seems then easy to identify which of the pillars an individual is paying inadequate attention to and therefore easy to identify the cause of the disease. Or so one may think, however, that approach is no different to the treatment of a symptom approach. From that discussed above it is clear that the underlying cause for the unhealthy behavior may be psychological, meaning that no amount of physical intervention will be permanent. Instead, the underlying psychological issue acting as a deterrent to healthy behavior needs to be address first thereby eliminating the “root cause”.

One of the most important considerations is that every individual should be treated as a whole. That includes their physical, mental and emotional self as well as their physical, social and economic environment. It is easy and tempting to consider only the person and not their circumstances however more research is showing the importance of also considering the social and environmental factors contributing to health behavior. There is clearly no “one-size-fits-all” approach to healthy living and trying to sell it as such will only lead to frustration for those trying to make a change. The depersonalized approach is likely the reason why chronic disease prevalence worldwide has increased despite publicly available information on what healthy living should include. The good news is that almost

all of the Lifestyle Medicine pillars described have benefits for the physical, mental and emotional wellbeing of an individual. This allows for a stepwise approach to changing behavior based on the individual's immediate desire or need. It is also likely that as health improves due to one behavior change the willingness for more changes will increase. Another benefit of Lifestyle Medicine interventions is that, except for very rare cases, there are no associated adverse effects to implementation and any adverse effects that may occur would be temporary.

By providing a compassionate and empathic space for honest conversations around health and behavior, the health and fitness lifestyle medicine adviser can support individuals who are ready to change their health. Making the patient a partner in developing an individualized health and wellness plan with consideration of cultural, social and economic barriers to health can be an effective way of health improvement. Throughout the literature it is clear that social support is a determinant factor for successful sustained behavior change. Patient centered health care is what sets a Lifestyle Medicine center or organization apart from a traditional hospital or clinic.

## **4. Business plan**

### **4.1. Executive Summary**

The Grenada lifestyle medicine corporation (GLMC) is a non-profit organization affiliated with St George's University. It is aimed at prevention, treatment and reversal of chronic diseases in the country of Grenada, West Indies. Its main operation is based on externally funded interventional research projects for health and quality of life improvement for individuals diagnosed with chronic illnesses. The initial phase of operations has two tiers, both of which will be targeted towards individuals who already have or are at risk of developing chronic diseases such as diabetes type 2, hypertension, cardiovascular diseases and cancer. Tier 1 of the initial phase will not have customers in the traditional sense as they will be participants in the interventional research. Tier 2 will have a client base of individuals who have chronic diseases who do not wish to participate in the research projects, those at risk of developing chronic diseases, or healthy individuals who are interested in preventing the development of chronic diseases. As the corporation grows it is expected to reach a wider audience and include all age groups.

The corporation will operate mainly online during the first phase with offices located on the Charles Modica Campus in True Blue, St George's, Grenada. This location is chosen because the infrastructure already exists, and the corporation is tied to St George's University. Online infrastructure will consist of a website containing relevant information related to culturally appropriate lifestyle modifications for improved health. The website will offer visitors the chance to explore the pillars of lifestyle medicine and its ability to improve lives, make an appointment with the lifestyle medicine health and fitness adviser or join as participants in the research projects being offered. Subsequent phases will have a physical structure located in the Grand Etang rainforest. The rainforest provides a beautiful setting with rivers, forest space and nature surrounding it. This is the ideal setting for a center that promotes wellness. It will consist of a large building constructed mainly of wood and glass to allow for the use of natural sunlight and fresh air to provide temperature regulation and illumination. It will be two story with the ground floor as the reception area and health provider offices and the top floor as a fitness, yoga and meditation space. An outside meditation space and Zen Garden will also add to the wellness activities offered.

GLMC have three factors that set it apart, the first is that it will first collect baseline population health data for the country and use that to design culturally appropriate

interventional projects aiming at improving lives and possibly reverse some of the chronic diseases plaguing the nation. The second is that as a corporation that contracts all relevant healthcare practitioners the client will receive a single health improvement plan of which they are an active decision maker. The third aspect that makes GLMC unique is that it will not only serve specific sociodemographic groups who are able to afford such services but rather have a payment scheme that is all inclusive. We believe that access to funds should not prevent access to wellness services.

As a nonprofit organization there will be a board for decision making consisting of the following members: President, Vice-president, Secretary, treasurer and two council members. The organization will employ an administrator and a Lifestyle medicine health and Fitness adviser to oversee the research project execution, funding applications and conduct the research. Volunteer workers will be recruited for assistance in project execution as necessary. SGU students interested in Lifestyle Medicine will be involved as research assistants offering them an opportunity to be involved with research.

For the initial phase there will be no setup costs other than that required for legal registration at the Government of Grenada offices. Operational costs and office space/equipment will be provided by St George's University and are already in place. Estimated cost of supplies and operational cost for initial research project to estimate population health and needs is US\$431355, when including personnel costs an additional US\$28164 is required. Research funding will be applied for through organizations such as the International Diabetes foundation, Pan American Health Organization, United Nations Development Project, Bill and Melinda Gates Foundation and other entities offering relevant funding opportunities. Additional funding to cover the administrator position and cost of infrastructure in later phases will be sought through crowdfunding. The corporation will make use of financial investments to ensure long term financial stability and continual operations even when grant funding sources are limited. The growth of the organization is predicted to take 4 main phases, with short- and long-term projections, some of the timing of the phases overlap and implementation will depend on the results from the research projects.

Once the physical location has been established the corporation will function as a health center offering retreats for those interested in learning more about lifestyle medicine. The revenue accrued from the retreats will be fed back into operational funds or be invested to further ensure financial stability.

## **4.2. Company description**

The Grenada Lifestyle Medicine Cooperation (GLMC) is a non-profit organization that serves the entire country.

### **4.2.1. Mission Statement**

Our mission is to provide an affordable holistic wellness solution to all citizens of Grenada, regardless of socioeconomic status.

### **4.2.2. Vision statement**

To reverse, prevent and eliminate chronic diseases, in Grenada through lifestyle medicine interventions.

### **4.2.3. Organization overview**

GLMC is a health care related organization created to support the community through research on topics related to chronic diseases. It aims to address the public health burden of non-communicable diseases currently faced by many who live in the region. Our operations are rooted in evidence-based medicine which is the driving force behind research forming the foundation of the operations. GLMC will be first and foremost research driven. While much research has been conducted on lifestyle interventions and their effect on the quality of life for individuals with chronic diseases none exist for the small island states. It is well known that there are environmental and cultural differences between these nations and that of the US and UK. GLMC aims to address this by conducting research and developing and testing culturally relevant interventions for these unique populations.

It is understood that the country of Grenada has long faced a high incidence of Type 2 diabetes and hypertension however, the exact statistic is unknown. While many would expect these high incidences to be linked to an elderly population a great number of individuals suffering from hypertension are young adults as are those with diabetes which even include children. These two conditions are considered lifestyle related and preventable, yet many of those who suffer from it find it difficult to control the symptoms. This leads to development of other chronic conditions and disability and places a burden on the healthcare system and economy. The first service that will be offered by GLMC is the collection of baseline health data, currently not available for Grenada, by means of the World Health Organization (WHO) STEPS (Stepwise approach to surveillance) analysis. This consists of

three aspects, collection of demographic data via an interview led survey, collection of biometric data and finally collection of biochemical data. The STEPS study has been successfully used in many countries to assess the health status of the public and reveal the true chronic disease burden. The WHO started the STEPS analysis in Grenada in 2010 but never completed the third phase. The report from phases one and two were released a decade later in 2020. For any intervention to be successful one must know the starting point, the STEPS analysis provides just that.

The STEPS analysis results will determine the order in which the health concerns are addressed through interventional research studies. However regardless interventional studies with cultural sensitivity and considerations will be designed and implemented in partnership with the Ministry of Health and Department of Public Health and Preventative Medicine at SGU. These studies will build on the results of successful clinical trials in over countries with modifications that ensure adherence to the interventions in a local setting. The current projected target conditions are, Diabetes type-2 and Hypertension with expansion to cardiovascular diseases in general.

While the research is ongoing the corporation will also offer individuals the opportunity to receive a lifestyle medicine consultation. The lifestyle medicine health and fitness adviser (LMA) is qualified to provide a consultation and determine which other specialists would be needed to provide holistic care. The outcome of the first consultation will determine which of the following specialists will be contacted by GLMC on behalf of the patient; specialist physician, nurse, physiotherapist, psychologists, fitness instructor, nutritionist, sleep expert, sexual and reproductive health specialist. Once the client has met with each specialist (which may be in person or virtual), the group of health care providers will meet to discuss the client and make recommendations for a wellness plan. The LMA will then meet with the client, discuss the options and help them with a plan. All follow-up sessions, unless there are unforeseen circumstances, will be between the LMA and the client. The role of the LMA is to provide the necessary education to the client and use motivational interviewing as the means of communication. In this way the client receives a single set of advice and takes an active role in their wellness plan which has been shown through research is the most effective way to ensure adherence.

Payment structure for these services will be subscription based as the goal is to follow the client long term. Support is important and as such each client will have their subscription determined based on their household income and number of dependents. Subscription will be paid monthly or yearly and will cover all subsequent consultations and use of the facilities.

Costs for specialists will be based on pre-arrangement between GLMC and the provider, individual consultations will be paid for by individual medical insurance coverage. If the client does not have individual medical insurance, cost of consultations will be covered by GLMC from donation funds.

Additional services provided are wellness seminars at community centers, teaching kitchens, weekly fitness classes and weekly meditation and mindfulness classes. These sessions will be provided in every parish and will take the form of training sessions so that participants can continue these practices in between classes. All sessions will be offered on a “pay what you can” payment scheme subsidized by donations.

GLMC is the only healthcare provider that considers every aspect of individual health according to the pillars of lifestyle medicine; nutrition, physical activity, mental health, sexual health, environmental health, sleep hygiene, substance use, stress management, social interactions and spiritual health as well as financial considerations before the treatment/wellness plan is developed.

The organization will employ a certified Lifestyle Medicine Health and Fitness adviser who will serve as the head of operations and Lead researcher. For the initial phase, health care providers will be contracted in however it is expected that as the corporation grows it will employ these specialists full time. The Lifestyle Medicine Center will employ a nurse, physiotherapist, physician, fitness coach or exercise physiologist, psychologist or counselor, nutritionist or dietician and any allied or complimentary medicine specialists deemed necessary to the functioning of the center. All the healthcare providers will be registered at either the Grenada Medical and Dental council or the Allied health practitioner’s council.

#### **4.2.5. Services offered**

The main objective is promoting and assisting in implementing healthy lifestyle choices to underserved communities on the Island of Grenada. It will operate mainly through research projects in the community aimed at enriching the lives of the participants directly, while serving to collect data to be utilized for wider distribution in the eastern Caribbean states.

##### **4.2.5.1. *Online educational platform***

One of the first initiatives would be establishing an online presence starting with a website. The website will host culturally appropriate educational material related to the

prevention (and treatment) of chronic diseases and the implementation of healthy lifestyle habits for improvement of existing conditions.

Additional information will be available as per the list below:

- Information about the corporation and its mission
- information about what lifestyle medicine is and how it can improve the quality of one's life with or without the presence of chronic disease
- Information about the research projects being conducted in the community and how individuals can get involved as participants
- Information on results of research conducted in the community and how that informed recommendations and other health strategies in the country
- Links to other organizations such as the Grenada Nutrition Council, diabetes foundation etc.
- Information on food substitutions and portion size determinants that can be made to improve healthy living
- The website will have a section for recipes of healthy alternatives for deserts

#### **4.2.5.2. *Community research studies***

Since the organization aims to reach the underserved through interventional research, the research projects will form the cornerstone of the corporation. Projects will be added as needed and information becomes available from research project results. The most important research would be to establish the current state of health regarding non-communicable diseases. For this the STEPS analyses will be the first research project run from the organization. The results from the STEPS analysis will inform the areas to target with interventions and will determine the scope and sequence of intervention studies.

A second study which is also considered informative is the assessment of sarcopenia risk among young individuals with Diabetes type-2.

Additional project ideas are listed below:

- An interventional study on the effectiveness of dietary changes on HBA1c levels in individuals with diabetes type 2 who are on medication (not insulin users)

- Implementation of physical exercise for individuals undergoing hemodialysis
- Prevention of heatstroke for construction workers in Grenada
- An interventional study on the effectiveness of physical activity and diet on individuals with hypertension
- The effect of healthy meals provided at schools on the physical and mental wellbeing of students – for this we will partner with the school feeding program to support more schools

#### **4.2.5.3. *Lifestyle medicine Consultation services***

Lifestyle medicine consultations, including needs assessment of the client, goal setting and implementation of a wellness plan to achieve the goals

- The first consultation is with the Lifestyle Medicine Health and Fitness advisor (LMA) who will assess the client's overall health and health goals through motivational interviewing and biometric analysis
  - Biometric analysis: Height, weight, waist circumference, physical activity frequency and duration, sleep patterns, diet, quality of life, social life, sexual health
- The consultation will include giving advice on what steps can be taken and determining which other health care practitioners should be consulted before establishing a plan
- Once the client has met with the necessary specialists the LMA will meet with the health care providers to discuss the client's needs
- The LMA will then meet with the client to discuss the recommendations and devise a wellness, this is done so the client receives a single set of recommendations and is involved in the creation of the plan

- The LMA will meet with the client regularly to discuss progress and necessary changes to the plan or medications
- The LMA will serve as liaison and educator between the client and the health care practitioners

#### **4.2.5.4. *Community outreach projects***

- Teaching kitchens with recipes that are culturally friendly, cost effective and aligned with the best practices recommendation by both the ACLM and ELMO will be hosted in the community
- Community fitness classes at community centers and churches – these sessions will include a combination of cardio and resistance training tailored for level of difficulty as needed by the individuals of that community
- Community mindfulness sessions at community centers
- Seminars delivered at community centers and churches on topics related to lifestyle medicine and health

#### **4.2.5.5. *Lifestyle Medicine center***

One of the organizational goals is to establish a physical lifestyle medical center to cater for the population needs. The center will be located in the Grand Etang rain forest to ensure optimal health benefits through its serene location and being easily accessible from various parishes. It will consist of a large building constructed mainly of wood and glass to allow for the use of natural sunlight and fresh air to provide illumination and temperature regulation. It will be two story with the ground floor as the reception area and health provider offices and the top floor as a fitness, yoga and meditation space. The following facilities will be included on site:

- Lifestyle medicine friendly fitness center that caters for individuals who are timid going into regular gyms
- Outdoor Meditation space and Zen garden
- Yoga studio

- Energy healing/physical therapy room(s)
- Sleep lab where individuals can be assessed for sleep related issues and receive the necessary care
- Health food store that sells healthy grains and other health foods using a differential pricing scheme, in other words those who can afford to pay full price absorb the deficit in price for those who can't afford to pay full price. The goal of the store is to break even (including overhead costs) not make a profit. The primary goal is to enable individuals access to healthy alternatives to white rice and enriched white flour

### **4.3. Pricing strategy**

The pricing strategy of the organization will be subscription based, and the fee will be calculated for each individual at their first consultation visit. Subscription fees are paid annually and will provide access to a personalized health and wellness plan, unlimited follow-up visits with the LMA, telephone (or WhatsApp) support, fitness classes and access to the fitness center. The subscription fee will also allow the client to receive discount at the health food store.

Payment to individual contracted practitioners will be done directly through the individual's health insurance, if they do not have health insurance a plan will be worked out to ensure they still have access to the care they need regardless of affordability. The credit controller will be responsible for determining if the client qualifies for the assistance with the payments to the practitioners.

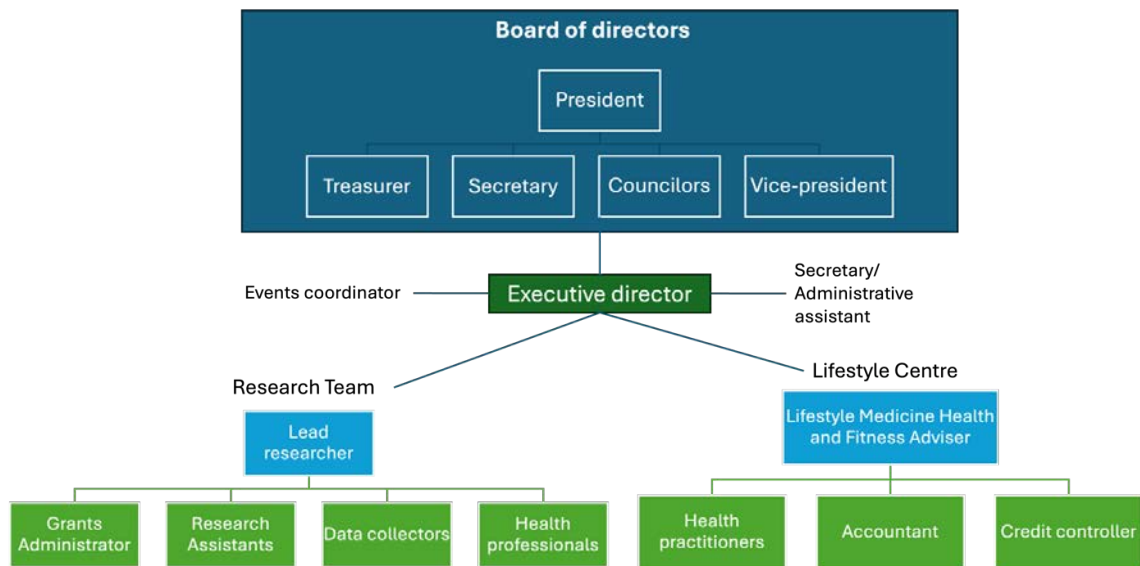
The health food store will offer products at reduced cost, profits will be recycled into the store to subsidize the cost for individuals who can't afford to pay the regular price.

There will be no participation cost to individuals who participate in the community research projects. All costs will be covered by the research grant for the project.

### **4.4. Organizational structure**

The overall organizational structure for the Grenada Lifestyle Medicine Corporation is given in the chart below. The constitution (founding document/bylaws) outlines the principles and guidelines by which the organization will be governed and function as well as the roles and privileges assigned to each role.

The structure and remuneration of the individual appointments may change over time depending on the growth of the organization. The board of directors will not be remunerated (see constitution), the lead researcher (unless contractually employed solely by the organization) may not receive any remuneration for conducting the research unless for reimbursement of expenses (see constitution). The organization will not have a voting membership however all members of the organizational structure will have input to the running of the organization.



**Figure 4.2. Organizational structure of the Business**

#### 4.4.5. Board of directors:

This group of individuals oversee the running of the organization and approve the implementation of new operations as proposed by the executive officer, research team or lifestyle center. The board of directors do not have any involvement in the development or execution of the research projects but does ensure by biannual review that operations are running smoothly and that grant funds are used appropriately. Board members do not receive any form of remuneration. Board members will consist of; President, Vice-president, Secretary, treasurer and two council members. No person may serve as a board member if they hold another position in the organization.

#### **4.4.6. Full time personnel:**

##### **4.4.6.1. Salaried positions**

Executive director: This position may be held by the same person as lead researcher and Lifestyle Medicine Health and Fitness Adviser. They report to the Board of directors and serve as liaison between the research team and lifestyle center and the board. They oversee operations of all activities. The executive director is also responsible for soliciting operational funds through fund raising initiatives.

Secretary/administrator: this person will perform regular secretarial and administrative duties, including but not limited to communication with different members, copying and record keeping of personnel and their individual roles. They will serve the same role with both the research team and the lifestyle center.

Events coordinator: The sole responsibility of the events coordinator will be to plan and organize the fundraising events as directed by the executive director.

Lead researcher: the lead researcher is responsible for development, ethical conduct and oversight of all research projects. They are also responsible for completing the academic portion of grant applications. Will receive a salary only if not employed by St George's University.

Lifestyle Medicine Health and Fitness advisor or consultant (LMA): This position may be held by the same person as the lead researcher. Must be certified with either the European Lifestyle Medicine Organization (ELMO) or American College of Lifestyle Medicine (ACLM).

Grants administrator: is responsible for the submission of and administration of grants received and allocate funds to the different resources. They are responsible for developing the research budget for each project and for tracking the grant usage and preparing the report to submit to the granting bodies.

Accountant: responsible for keeping the books of the Lifestyle Medicine Center and the health food store as well as paying the overhead costs and other bills. The accountant reports directly to the treasurer and the LMA.

Credit controller: responsible for ensuring that fees are paid on time and does the determination when a client applies for assistance to pay the health care providers.

Health care providers: the Lifestyle Medicine Center will employ health care providers are competitive salaries. These providers will not be involved in the research projects.

#### **4.4.6.2. Non-salaried positions**

Health care professionals: health care professionals required for each research project will be contracted in for the purpose of participation in that project. They may be provided a stipend but are not paid a salary and will perform duties as related to their profession.

Volunteers/research assistants: research assistants are recruited on volunteer basis and are students of SGU interested in conducting research. They will not be paid but will gain valuable skills, knowledge and experience through participation in the projects.

Data collectors – these are SGU students in the Nursing or Public Health programs that need field experience. They may be given a stipend and transportation costs will be covered for them.

### **4.5. Legal Structure**

This is a non-profit organization. Funds will be utilized on community-based research projects bringing lifestyle medicine services to the community. The constitution (founding document/bylaws) Appendix 7.1. outlines the principles and guidelines by which the organization will be governed and function.

#### **4.5.1. Regulations**

As a Non-Profit Organization Grenada center of lifestyle medicine must meet all governmental regulations for Non-profit organizations. Particularly the Companies Act No. 35 of 1994 which is contained in the Continuous Revised Edition of the Laws of Grenada, 2010, Cap 58A and the Companies (Amendment) Regulations SRO No. 36 of 2014. By Grenada Law the organization must have in the name either Incorporation or Corporation as the last part of the name.

The articles of corporation must be approved by the Attorney general chambers prior to registration as a business. The Grenada lifestyle medicine corporation complies with the following conditions set by the Attorney general for registration of a non-profit; philanthropic, educational and scientific. In addition, Grenada regulations on providing health services requires individual registration with the Grenada medical and dental council or the Allied health providers council before any services may be offered.

##### **4.5.1.1. Intellectual property**

All intellectual property rights will be to the Organization, the publications that are generated from the research projects will be authored by those directly involved in the

research, but no intellectual property rights are conferred to individuals. All individuals involved in research projects will sign a confidentiality agreement for the specific research project they are working on.

## **4.6. Funding model**

The Grenada lifestyle Medicine Corporation will mainly utilize two funding models administered independently from each other. As there are two major components, daily operations and research project initiatives, the organization will keep the two funding streams separate. The big bettor and member motivator funding models as described by Foster et al. (2009) will be used (Foster et al., 2009).

### **4.6.1. Operational costs**

The Member Motivator funding model will be used to gain income for operational costs. This will consist of subscription-based fees for individuals who benefit directly from the services provided by the organization, hosting of special events and soliciting of major gifts from members who may have benefitted from the services in the past. The funds raised through this model will go towards operational costs such as utility bills, salaries and infrastructure. A portion of the funds will also be used to open an investment account into which funds will be deposited monthly to ensure growth and savings for future operations. The executive director will be responsible for planning the initiatives through which the funds are raised. The events manager will assist in the arrangements of the events. The accountant will be responsible for the fund allocations and financial managing.

An annual fundraising Gala will be hosted for all members as well as prominent health officials and ministers. Community health awareness walks will be hosted quarterly as an additional means of fundraising.

### **4.6.2. Community research studies**

To fund the community research studies the source of income will be through application of research grants. Each project will be funded independently through the grant obtained specifically for that project. The funding model utilized here is the Big Bettor as described by Foster et al. (2009). Searching and applying for grant opportunities will be the responsibility of the Lead Researcher. Grant applications will be completed by the Lead Researcher and the Grants administrator. All grant funds will be administered by the grants

administrator. Renumeration of research assistants and data collectors will be included into the grant applications.

The following grant funding organizations will be applied to as they share a mutual interest to the Grenada Lifestyle Medicine Corporations mission and Vision.

Global Alliance for chronic diseases: <https://www.gacd.org/funding/future-gacd-funding-call-topics-2025-to-2027>, pcori – Patient-Centered Outcome Research Institute: <https://www.pcori.org/funding-opportunities/what-who-we-fund/research-project-agenda-topic-themes-inform-focused-funding-opportunities/2025-research-project-agenda-topic-themes>

Bill and Melinda Gates foundation:

<https://www.gatesfoundation.org/our-work/programs/global-development/primary-health-care>

Welcome trust: <https://wellcome.org/research-funding/schemes>

UK Research and Innovation:

[https://www.ukri.org/opportunity/?keywords=&filter\\_funding\\_type%5B%5D=16&filter\\_status%5B%5D=open&filter\\_status%5B%5D=closed&filter\\_status%5B%5D=upcoming&filter\\_order=publication\\_date&filter\\_submitted=true](https://www.ukri.org/opportunity/?keywords=&filter_funding_type%5B%5D=16&filter_status%5B%5D=open&filter_status%5B%5D=closed&filter_status%5B%5D=upcoming&filter_order=publication_date&filter_submitted=true)

#### **4.6.3. Additional funding sources**

In addition to the above-mentioned funding models crowd funding will be sourced through Donor Box to gain funds for starting the organization. These funds will be used to pay for registration of the organization, opening of the bank and investment account, designing and hosting of the website, a launch event to make individuals and officials aware of the organization. Community education initiatives will also be funded with the crowd sourced funds; teaching kitchens, seminars as well as community mindfulness sessions will be funded this way. The crowd funding will also be used to supplement payment to health practitioners for individuals who do not have private health insurance and are not able to pay the fees of the health professionals they need to consult. The founder will be responsible for opening the Donor Box account and arranging the details to source the funding through this means.

After 3 years of operation the Lead Researcher and the Executive director will assess the success of the funding models and revise if necessary. This process will be repeated every 3-5 years to ensure sufficiency of the funding models and continual financial stability of the organization.

## **4.7. Market Research**

Grenada also known as the Isle of Spice, is a tri-island state in the eastern Caribbean and the most southern tip of the Windward Islands, the total land area for all three islands is 344 km<sup>2</sup>. It is divided into parishes the southernmost parish, St George, also hosts the capital city by the same name. In 2024 the population of Grenada stood at 107451 and is expected to rise with an estimated population growth of 10% or less (PAHO website accessed 8 March 2025). The non-working population contributes 12.2% for retired and 19.5% children under the age of 15. The United Nations development programme (UNDP) classifies Grenada as a highly developed country with a human development index (HDI) of 0.793 (Nations, 2024) and a world bank classification since 2015 as upper middle income (World Bank Country and Lending Groups – World Bank Data Help Desk, 2023). This however paints a deceptive picture as the income disparity and living conditions between the fortunate and less fortunate is relatively large. The country is resource poor except for agricultural products such as spices which is what the island is famous for. The country has a religious culture with Christianity and Adventist being the most practiced religions. This culture drives many aspects of the country and is supported by the Government in many aspects.

### **4.7.1. Industry**

The Grenada Lifestyle Medicine Corporation adds to the existing health care system of the country in a unique way. Shortly prior to and after the Covid-19 pandemic, there has been a growing attention to preventative medicine particularly regarding certain cancers. Despite limited reliable information it appears that noncommunicable diseases and cancers are on the rise. Anecdotal evidence shows that many Grenadians suffer from chronic diseases with diabetes type II and hypertension being the two most common. Frequently these conditions are not well controlled, and individuals end up with limbs amputated due to gangrenous ulcerations or stroke due to compromised cardiovascular systems. There is little support for individuals beside prescription of medication and mention of improved lifestyle without proper guidance or support on how to achieve it in a healthy way. Investigation into the state of health of Grenadians reveals that there is no reliable data on the burden of communicable diseases in the country. The last, and only analyses done was in 2010 however, the study was incomplete, and the report was never shared with stakeholders it was publicly released only in 2020.

While there may be no direct competitors to the Grenada Lifestyle Medicine Corporation, there are various health and wellness services to consider which may be considered indirect competitors. These indirect competitors can be classified according to the categories of service they provide:

**Fitness centers/gyms:** There are several fitness centers in the country, these centers often offer fitness advice and are run by professional athletes or fitness trainers. These centers frequently are not equipped for individuals who have limited physical ability or who find fitness centers intimidating. Many of the fitness centers offer fitness classes and in general the membership fees are reasonable. These centers will be a good compliment for individuals who have gained some confidence in their abilities after improving their lifestyle.

**Spas:** There are several spa facilities on the island many of which are associated with hotels and resorts. Most of these spas are in the south of the island and therefore not easily accessible to everyone. These facilities are excellent and provide a range of services such as massages and various body treatments. Some also offer complimentary health services such as craniosacral therapy and colonic cleanses. Unfortunately, these services do not provide health assessments and are often expensive.

**Grenada food and Nutrition Council:** The Grenada food and nutrition council supports healthy living through providing information on nutrition and healthy recipes weekly on their website. They offer nutrition education and counseling at affordable prices and host community events that promote healthy eating. One concern regarding their operations is that the recommendations do not seem to be according to the current best practices. The most recent update on nutrition recommendations was in 2020.

**Health and wellness advising:** There are a few health and fitness advisors who offer services such as consultations, wellness packages and wellness events. These events are marketed on social media and by word of mouth and reach an exclusive audience. It is not uncommon that the same individuals will attend these events repeatedly and participation is relatively poor considering the size of the population. These businesses attract health-conscious individuals who are already on a wellness journey. These events can range in price but are often not accessible to those with lesser means.

**Yoga Instructors:** There are several yoga instructors on the Island who provide a range of different options for interested parties to join. Many of these promote health and wellness through practices and some also offer community classes which offer a pay what you can feature. Most of the yoga classes are reasonably priced and accessible to most. Since yoga

is seen as a religious practice by many who are unfamiliar with it many Grenadians do not utilize these as it is considered against their religious beliefs.

**Pharmacies:** In Grenada some pharmacies also offer basic health services such as blood pressure measurements and glucose tests. Pharmacists may offer basic health advice free of charge to elderly individuals who have chronic diseases. While this is a good initiative, often the advice provided differ from that of the physician causing distress for the individual.

**Hospitals and clinics:** Grenada has three public hospitals, two on the main island and one on the bigger of the two sister islands, Carriacou. It also has one private hospital and a psychiatric hospital which is government owned. In addition to the hospitals there are over 30 medical centers and private clinics across the country. Primary healthcare at any public facility is free and the national insurance scheme (NIS) which is funded by employers and taxpayers, covers services related to cardiovascular health, hospital stays and work-related injuries (Global Citizen webpage). It should be noted however that specialized care for cancer treatments and other chronic illnesses is not available at any of the health facilities. While in theory this seems to be an excellent healthcare system it is limited by poor resources. In the public sector facilities such as x-rays, sonograms and other basic services are often not available due to high demand or malfunctions.

The ministry of Health, the Prime Minister and health practitioners promote healthy living to prevent disease with emphasis on healthy diet, physical activity and frequent screening for diseases such as cancer. However, there is currently no organization that provides support in all aspects of lifestyle medicine and those that offer one or two aspects do so independently of other health care professionals. The aim of the Grenada Lifestyle Medicine Corporation is not to replace the currently existing services but rather to bring them together. The approach is holistic health which relies on all health care providers as well as active participation in health by individuals. Of great concern is that the individual wellness services being offered are not affordable to those who need it most and for those who can't afford to follow a special diet advice for healthy living causes further stress leading to even more unhealthy practices. While the above-mentioned specialized services capture the attention of some individuals most Grenadians with chronic diseases need more basic care and adequate support along their journey.

#### **4.8. Beneficiaries/ Customers**

Due to the nature of the organization structure and mission there are three categories of individuals who will benefit from the organization.

#### **4.8.1. Ministry of Health**

The first beneficiary is an office rather than a group of individuals. There is a paucity of, and discrepancy in, the available data for the state of health in Grenada. While this pertains to all health parameters it is of particular importance in non-communicable diseases and their impact on the quality of life. While some attempts have been made by individuals to improve record keeping and thereby availability of data, there is no national drive toward improving the record keeping at any of the public health facilities. The World Health Organization (WHO) conducted STEPS 1 and 2 of the STEPS analysis in Grenada in 2010, but there has been no repeat or follow-up since. The results of this analysis showed an incomplete picture and was never disseminated to the stakeholders. The first initiative of the Grenada Lifestyle Medicine Corporation is to repeat the STEPS analysis with a representative sample of Grenadians. This will inform the Ministry of Health and other stakeholders on the true state of health in Grenada and enable the organization (GLMC) and the Ministry to develop strategies for improvement of health across the nation.

#### **4.8.2. Beneficiaries**

The initial community-based research projects will be targeted towards individuals with diabetes and hypertension of all ages. Several interventions are planned and adult individuals (18+ years) with confirmed diagnosis of Diabetes Mellitus type 2 will be the first group to benefit. All individuals will be included regardless of socioeconomic or working status and individuals from all parishes will be included. The lifestyle medicine interventions are aimed at improving health for these individuals and they are expected to benefit directly. The participant list will be compiled from information obtained from the Grenada General hospital, health clinics in other parishes, the Grenada Diabetes foundation and through participants attending health fairs hosted by St George's University (SGU) student organizations. Advertisements will also be placed on the organization webpage inviting individuals to participate in the research study. It is anticipated that the initial interest in participation will be low however as individuals learn of the benefits it is expected to increase.

Individuals with hypertension will also benefit directly from the intervention research studies. Adults (ages 25 and above) with confirmed diagnosis of hypertension will be recruited. The participants are expected to benefit directly from the health interventions. Contact information will be obtained from the Grenada general hospital, Saint Augustine's

Medical Center, health Clinics in parishes across the country and participants in health fairs hosted by student organizations from SGU. Information on how to participate in the research studies will also be made available on the organization website.

Further community projects will be targeted at individuals undergoing Hemodialysis, these individuals will be access through communication with the Hospital and clinics and by visiting the hemodialysis units.

#### **4.8.3. Customers**

The target customers for lifestyle medicine consultations are working adults, ages 25-65 with an interest in improving their health and wellbeing. The customers will be reached through marketing strategies including radio and TV advertisements as well as information on the organization website. Information leaflets and advertisements will also be posted at the hospital and health clinics across the country and at laboratory service centers. It is expected that many of the customers will have participated in one of the research projects and wish to continue their health journey after project completion.

#### **4.9. Company Advantages**

The Grenada Center for Lifestyle medicine (GCLM) offers services to the community through carefully constructed mechanisms that are meant to build on each other. Using Evidence based medicine as the cornerstone of operations, using research to gather data and provide access to interventions for individuals affected by chronic diseases. This approach can lead to a stronger foundation and by extension long term success through development of carefully tailored programmes that are population specific and culturally sensitive. The center's approach to development and implementation of research projects is based on the needs of the population but ultimately includes all aspects of wellness.

To ensure the success of the center the following steps are being utilized:

- Ensuring that the Lead Researcher has an MD or PhD degree and substantial experience in developing and conducting research.
- Ensuring that the Lead Researcher is certified in Lifestyle Medicine either through the European Lifestyle Medicine Organization (ELMO) or the American College of Lifestyle Medicine (ACLM).
- Providing funds necessary for the Lead Researcher and other senior members of the research team to attend and participate in lifestyle Medicine conferences annually.

- All associated health professionals are registered at the Grenada Medical and Dental Council, the Grenada Nurses Association or the Grenada council for Allied Health Professionals.
- All activities are conducted ethically with approvals from the necessary regulatory boards and ministry of Health
- All interventions are carefully designed taking into account population and cultural specific needs
- Working with local associations and councils to develop better support strategies for prevention and treatment of lifestyle related chronic diseases

The organization also intends to include the existing healthcare facilities and practitioners as part of their operations. Since the ultimate goal is health of the Nation, collaboration rather than separation is the driving force.

#### **4.10. Marketing**

The organization will be introduced to the beneficiaries, other health care service providers, ministries and other prominent figures through a launch event. During the event the pillars of lifestyle medicine will be discussed and how adopting a healthy lifestyle can lead to improved health and wellness. The launch will showcase the organization and what it offers to the community and the country and incorporate a call to action. A call for collaboration among all health care sectors will be invited.

To gain the attention of potential customers and research participants alike several marketing strategies will be utilized. Radio and television advertisements will be utilized to share information regarding the organization and its mission. Community seminars will be hosted in each parish at community centers and churches to make individuals aware of the organization and what it offers and to ensure that a wide audience is captured. Information sessions will also be hosted at St George's University as it is the largest single employer of Grenadian citizens. Additional marketing will take the form of community walks, fundraising annual Gala's and a well-structured website.

Marketing of the research projects to recruit participants will be done through community seminars and direct communication to potential participants. The lead researcher will visit organizations such as the Grenada Food and Nutrition council, The Grenada Diabetes Association, Health clinics, Health Fairs and the hospitals to share information about the

research projects. Participant lists will be sourced from all these organizations and participants will be contacted to enlist their participation.

The marketing strategy will be revised after 3 years for effectiveness and reach, and changes will be made as needed.

#### **4.11. Growth Strategy**

The organization growth will be measured by the number of community members reached through research projects and impact on national health status. Growth will also be measured by the number of clients who sign up for the consultation services. As a nonprofit organization the growth is measured by impact and that is number of individuals who benefitted from the projects and services. Financial growth of the organization is expected to rise steadily as we utilize two funding models. Investment accounts are a key feature of the organization's financial stability and growth and is expected to rise steadily.

As the impact of the organization rises and become more known it is expected that grant funding will become more accessible. This is expected to take approximately 3 years and is the benchmark used to re-evaluate the organization in all its aspects. More research projects will be added continually as needs are identified.

## **5. Potential barriers to the success of the business (Strengths & Weaknesses)**

There are three main areas that can cause potential barriers to success in the business as proposed in the plan.

The first and most substantial of the three relates to uninterest from the population to participate in the research projects. The STEPS analyses requires many participants (1980 based on current population size) to commit a substantial amount of time and personal information in order for it to be successful. This is of particular concern as a similar study was conducted in 2010 by the WHO with no results shared with stakeholders or the public until 2020. By this time the information was out of date and no longer usable. It is expected that the individuals who are now in the youngest age group included in the study and who would not have been part of the original study 14years ago would form a significant portion of the study participants. Although the STEP analyses is typically done on individuals between the ages of 25 and 65 our study aims to include individuals as young as 18 as they too are subject to chronic diseases in the region. The STEP study is the first and most important of the planned projects however should a sufficient statistically valid sample not be reached the data will still be analyzed for internal use and validated by what is currently known on the health status of the population. This information can still inform the order and design of future studies even if sufficient power is not reached. Because of the nature of the additional studies and the aim that participants will directly benefit from the research the concern regarding participant recruitment is less for subsequent studies. However, the educational aspect of the organization, hosting seminars in the community sharing information via the website etc. will be used to show potential participants that the research conducted is to their benefit. This will require cooperation with the Ministry of Health and community leaders. In recent years there has been many campaigns for improved health in some of the pillars of lifestyle medicine; physical activity, diet and mental health, and as such this is not considered a barrier.

The second potential weakness is lack of funding. As a non-profit organization the functioning and implementation of community-based research studies depend on adequate funding. To ensure financial stability the organization utilizes two main funding models and have split the costs into operational and research to ensure investors know where their investments are going. The research activities will be funded through grants from organizations who have an invested interest in global health improvement. Funding from the

USA NIH was deliberately excluded from the planning as the current political environment in the USA is unstable. Despite being potentially, the largest and most convenient funding source, NIH funding is typically not allocated to these types of projects and there is no benefit to the USA for studies done offshore. An additional measure to ensure financial stability is to invest a portion on funds collected during the startup phase. Investment accounts will be added to regularly to gain interest and have a backup for times where funding sources are less available. The funding models used will be reassessed after 3 years in case any adjustments need to be made.

The third and final potential barrier to success is the population interest in utilizing the Lifestyle Medicine clinic. Grenadians are not overly concerned with their health until something goes wrong and culturally very few attend annual physician wellness checks. It is for this reason that the research-based non-profit structure was chosen for the organization. It is anticipated that individuals and/or their families who participate and benefit from the research will become the clients at the Lifestyle Medicine Center. It is important to acknowledge that this constitutes a conflict of interest. This will be disclosed during the informed consent, and at every other necessary step, of the research study to ensure transparency. The non-profit nature of the organization was also chosen to eliminate any financial gain to the researcher or other employee. The Lifestyle Medicine Center is a future goal rather than the main goal. The vision of the organization is for healthier people through Lifestyle Medicine and the mission to reach everyone regardless of socioeconomic status and means.

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## 7. Appendices

### 7.1. Appendix I – Organization Constitution

#### Article I NAME

Section (1) The name of the organization shall be Grenada Lifestyle Medicine Corporation

*No person, group or organization may use the name of the organization in any manner unless referring to and utilized as part of the name of a research project or publication.*

#### Article II MISSION AND VISSION

The purpose(s) of this organization shall be to provide an affordable holistic wellness solution to all citizens of Grenada, regardless of socioeconomic status. (Mission)  
To reverse, prevent and eliminate chronic diseases, in Grenada through lifestyle medicine interventions. (Vision)

#### Article III MEMBERSHIP

Section (1) The organization shall not have a paying membership

#### Article IV DUES & TREASURY

Section (1) There will be no membership dues to the organization

Section (2) Subscription based membership to the Lifestyle Medicine Center will be calculated on an individual basis.

Section (3) In the case of organizational dissolution, the organizational funds will be donated to the Grenada General Hospital as part of a Trust Fund focused on promotion of Lifestyle Medicine

#### Article V LEADERSHIP

Section (1) The elected officers of this organization shall include:

- A. President
- B. Treasurer
- C. Vice-President
- D. Secretary
- E. Councilors

Section (2) Other appointed leaders of this organization shall include:

- A. Executive Director
- B. Events Coordinator
- C. Secretary/Administrative Assistant
- D. Lead researcher

- Grants administrator
  - Research Assistants
  - Data Collectors
  - Health Professionals
- E. Lifestyle Medicine Health and Fitness Advisor
- Health Practitioners
  - Accountant
  - Credit controller

Section (3) Nominations will be held in September every 5 years or when a vacancy opens.

Section (4) Term of office shall be for 5 years Elected officers are eligible to hold the same position no more than 2 time(s).

Section (5) Any officer (elected or appointed) may be removed from office by the founder *in consultation with the staff for failure to fulfill the roles and responsibilities outlined in Article VI.*”

Section (6) Should an office become vacant in mid-term, a new officer shall be chosen by the founder.

Section (7) Requirements to be an officer include being a supporter of Lifestyle Medicine and either currently practicing or retired physician.

Section (8) A current, full-time employee of SGU will be selected to serve as Lead Researcher by the founder based on an interview process and required qualifications. The Lead researcher must be a certified Lifestyle Medicine Health and Fitness Adviser or an American Lifestyle Medicine Board certified physician.

#### Article VI DUTIES OF LEADERSHIP

Section (1) The (president) shall serve as head of the organization and be responsible for scheduling and *presiding over all meetings, serving as the* spokesperson and point of contact for the organization, voting only in the case of a tie. S(h)e shall liaise with the Executive director regarding matters related to the planned research projects and Lifestyle Medicine center.

Section (2) The vice president shall serve in absence of the president and shall perform such duties as assigned by the president.

Section (3) The secretary shall be responsible for maintaining all records of the organization (e.g. constitutional amendments, meeting minutes, membership rosters, attendance), and for recording the minutes of all meetings and communicating with staff on behalf of the executive committee.

Section (4) The treasurer shall be responsible for managing the organization's finances.

Section (5) The councilors shall attend all meetings and participate in matters requiring a vote.

#### Article VII STAFF DUTIES and privileges

Section (1) Executive director: This position may be held by the same person as lead researcher and Lifestyle Medicine Health and Fitness Adviser. They report to the Board of directors and serve as liaison between the research team and lifestyle center and the board. They oversee operations of all activities. The executive director is also responsible for soliciting operational funds through fund raising initiatives.

Section (2) Secretary/administrator: this person will perform regular secretarial and administrative duties, including but not limited to communication with different members, copying and record keeping of personnel and their individual roles. They will serve the same role with both the research team and the lifestyle center.

Section (3) Events coordinator: The sole responsibility of the events coordinator will be to plan and organize the fundraising events as directed by the executive director.

Section (4) Lead researcher: the lead researcher is responsible for development, ethical conduct and oversight of all research projects. They are also responsible for completing the academic portion of grant applications. Will receive a salary only if not employed by St George's University.

Section (5) Lifestyle Medicine Health and Fitness advisor or consultant (LMA): This position may be held by the same person as the lead researcher. Must be certified with either the European Lifestyle Medicine Organization (ELMO) or American College of Lifestyle Medicine (ACLM).

Section (6) Grants administrator: is responsible for the submission of and administration of grants received and allocate funds to the different resources. They are responsible for developing the research budget for each project and for tracking the grant usage and preparing the report to submit to the granting bodies.

Section (7) Accountant: responsible for keeping the books of the Lifestyle Medicine Center and the health food store as well as paying the overhead costs and other bills. The accountant reports directly to the treasurer and the LMA.

Section (8) Credit controller: responsible for ensuring that fees are paid on time and does the determination when a client applies for assistance to pay the health care providers.

Section (9) Health care providers: the Lifestyle Medicine Center will employ health care providers are competitive salaries. These providers will not be involved in the research projects.

#### Article VIII AMENDMENTS

Section (1) no amendments are permitted to this document.

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(Signature of the President)

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(Signature of Secretary)

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(Printed name of President)

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(Printed name of Secretary)

## 7.2. Appendix II: Copyright Statement

### Affirmation

The undersigned [Maira du Plessis] postgraduate student of the Postgraduate Program "LIFESTYLE MEDICINE" of the University of Thessaly

I declare responsibly that I accept the following terms concerning:

(a) the copyright of my Master's Thesis entitled "[ESTABLISHING A NON-PROFIT COMMUNITY-BASED RESEARCH DRIVEN LIFESTYLE MEDICINE ORGANIZATION]"

(b) the management of the research data I will collect in the course of its elaboration:

1. The copyright of the resulting volume of the master's thesis will belong to me. I will follow the instructions for writing, printing and depositing copies of the dissertation in the relevant repositories (in printed and/or electronic form).
2. The management of the dissertation data belongs jointly to me and the Director of Studies/Main Supervisor.
3. Any scientific publication or announcement (posted or oral), or reference derived from the material/data of this work will be made with authors myself, the main supervisor and/or other researchers (such as a member of the three-member advisory committee), depending on their contribution to the research or the writing of the research paper(s).

4. The order of names in scientific publications or scientific announcements will be decided jointly by me and the main supervisor (DOS) of the project before it begins.

This decision will be certified in writing between myself and the main supervisor.

**Finally, I declare that I am aware of the rules on plagiarism and intellectual property and that I will strictly follow them throughout my studies, I will attend to the educational obligations arising from this MSc, as well as will attend the publication procedures that will arise after the completion of my studies.**

13 June 2025

Maira du Plessis