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PREACT
PRophylactive Education & Actions for Cardiovascular diseases and diabeTes

Cardiovascular diseases (CVD) and Diabetes

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Introduction

Cardiovascular diseases (CVD) loom large as the foremost cause of mortality worldwide, casting a pervasive shadow over global public health. In the unsettling year of 2015 alone, an alarming tally of approximately 17.7 million individuals met their demise due to CVD, constituting a staggering 31% of all recorded fatalities globally [1]. This sobering statistic underscores the immense toll that CVD exacts on human lives, families, and communities worldwide. Yet, the repercussions extend far beyond the immeasurable loss of lives. The economic ramifications of CVD are profound, with the financial burden surpassing a formidable $316.6 billion [2]. This immense economic toll reflects not only direct healthcare costs but also indirect expenses stemming from lost productivity and reduced quality of life for individuals affected by CVD and their caregivers. Disturbingly, forecasts paint an even graver picture for the future, indicating a potential surge in the annual death toll from CVD to nearly 23.6 million individuals by the year 2030 [3]. This trajectory highlights the urgent imperative for intensified preventive measures and improved management strategies to mitigate the escalating burden of CVD-related mortality. Within the European continent, the toll of CVD is equally distressing, claiming over 3.9 million lives each year [4]. This figure accounts for a staggering 43% of all deaths in the region, underscoring the disproportionate impact of CVD on European populations. Furthermore, CVD imposes a significant burden on healthcare systems and economies, contributing to 23% of the overall disease burden within Europe. These statistics underscore the imperative for concerted efforts on a global scale to address the multifaceted challenges posed by CVD. Crucial elements of comprehensive strategies to reduce the devastating effects of cardiovascular disease involve implementing effective interventions that address modifiable risk factors such as hypertension, dyslipidemia, obesity, smoking, and physical inactivity, while simultaneously promoting healthy lifestyles. Additionally, enhancing healthcare infrastructure, expanding access to essential healthcare services, and fostering collaboration between healthcare providers, policymakers, and communities are essential steps towards reducing the burden of CVD and paving the way towards a healthier future for all.

Ischemic heart disease (IHD) and cerebrovascular disease (CBD) stand at the forefront as the primary and secondary leading causes of mortality, respectively, shaping the landscape of cardiovascular health worldwide. As of 2015, Europe bore witness to a staggering populace of over 85 million individuals grappling with cardiovascular disease (CVD), with nearly 11 million fresh cases emerging [5]. This

prevalence underscores the pervasive nature of CVD within European communities, permeating various demographics and socioeconomic strata. Moreover, the impact of CVD extends beyond mere prevalence, infiltrating the fabric of societal well-being through its substantial contribution to disability-adjusted life years (DALYs) lost. In Europe, CVD accounted for a noteworthy 23% of the total DALYs, illustrating the profound burden of disease inflicted by cardiovascular ailments [5]. Financially, the toll of CVD reverberates across the European Union (EU) economy, exerting an estimated annual cost of approximately €210 billion [5]. This financial burden encompasses a spectrum of expenditures, including direct healthcare costs, productivity losses, and the often-overlooked informal caregiving provided to individuals grappling with CVD. Greece, nestled as an EU member state in southeastern Europe, once epitomized a beacon of cardiovascular health during the 1960s, boasting some of the lowest CVD risk rates globally. This commendable feat was largely attributed to the widespread adoption of a heart-healthy dietary pattern, notably the Mediterranean diet, coupled with an uptick in physical activity [5]. However, recent epidemiological studies paint a contrasting narrative, revealing a concerning surge in CVD incidence over the past decades. This resurgence has not only affected both genders but has also encroached upon younger adult populations [8-10], signaling the imperative for renewed efforts in combating the multifaceted challenges posed by cardiovascular disease in contemporary Greek society.

Elevated body mass index (BMI), indicative of overweight or obesity, underscores the intricate relationship between adiposity and cardiovascular health. Excess adipose tissue not only contributes to systemic inflammation and metabolic dysregulation but also elevates the risk of hypertension, dyslipidemia, and insulin resistance, thereby amplifying the risk of CVD. Smoking and excessive alcohol consumption represent behavioral risk factors that significantly impact cardiovascular health. Smoking accelerates atherosclerosis, promotes endothelial dysfunction, and increases the risk of blood clot formation, predisposing individuals to heart attacks and strokes. Likewise, excessive alcohol intake can elevate blood pressure, disrupt lipid metabolism, and contribute to the development of cardiomyopathy and arrhythmias [11]. Poor dietary habits characterized by excessive intake of saturated fats, refined sugars, and processed foods, coupled with inadequate consumption of fruits, vegetables, and whole grains, fuel the progression of CVD. A diet rich in unhealthy fats, sodium, and refined carbohydrates not only promotes weight gain and dyslipidemia but also exacerbates inflammation and oxidative stress, fostering the development of cardiovascular complications. A sedentary lifestyle devoid of regular physical activity further compounds the risk of CVD. Physical inactivity not only contributes to obesity and metabolic dysfunction but also diminishes cardiovascular fitness, impairs vascular function, and heightens susceptibility to CVD-related morbidity and mortality. In concert, these modifiable risk factors exert a significant toll on cardiovascular health, underscoring the pivotal role of preventive interventions

and lifestyle modifications in mitigating the burden of CVD and promoting cardiovascular well-being.

Recent research conducted in Greece has unveiled a concerning trend: a notable uptick in the incidence of cardiovascular disease (CVD) over the past few decades, with impacts extending across both genders and younger adult populations [9, 12]. This surge in CVD occurrence is closely tied to unfavorable shifts in modifiable risk factors, which have emerged as key contributors, accounting for over 70% of disability-adjusted life years (DALYs) lost and incidents of CVD observed during the preceding decade [13, 14]. Insights gleaned from the renowned INTERHEART study, encompassing data from 52 nations, shed further light on the significance of modifiable risk elements in shaping the burden of CVD. Hypertension, dyslipidemia, diabetes, obesity, smoking, physical inactivity, and unhealthy dietary habits are identified as pivotal factors contributing substantially to the population-attributable risk for myocardial infarction. These findings underscore the profound impact of modifiable risk factors on cardiovascular health outcomes and emphasize the urgent need for targeted interventions aimed at mitigating their adverse effects. In Greece, as in many other regions globally, the prevalence of these modifiable risk factors has escalated in tandem with societal changes, including shifts in dietary patterns, declining levels of physical activity, and the rising prevalence of obesity and diabetes. These trends underscore the imperative for comprehensive strategies encompassing health education, lifestyle modifications, and healthcare interventions tailored to address the multifaceted challenges posed by modifiable risk factors and curb the burgeoning burden of CVD. By targeting these modifiable risk factors effectively, there exists a tangible opportunity to attenuate the trajectory of CVD incidence, foster cardiovascular health, and enhance overall well-being across diverse populations. [15].

Over the past three decades, there has been a notable trend of decreasing standardized mortality rates in numerous countries, albeit with varying degrees of improvement. Particularly striking declines, ranging from 50% to 60%, have been observed in nations such as the United States, Japan, and various Northern European countries [5]. These encouraging reductions in mortality rates are attributed in part to concerted national efforts aimed at preventing cardiovascular disease (CVD) by targeting modifiable risk factors. However, amid this global trend of declining mortality rates, Eastern European countries and Greece have experienced contrasting patterns. These regions initially witnessed increases in the incidence of CVD, followed by more modest declines [1, 4]. Such divergent trajectories are thought to be influenced by the adoption of modern lifestyles, characterized by shifts in dietary habits, decreased physical activity, and other factors contributing to the rise in the prevalence of several CVD risk factors. Despite the overall decline in age-adjusted mortality rates, the absolute number of CVD cases continues to rise due to population aging [4]. This rapid demographic shift places considerable strains on various

fronts—human, social, and economic—exerting additional pressure on healthcare and social support systems, particularly amid the prevailing austerity measures across Europe [16]. The confluence of these factors underscores the multifaceted challenges posed by CVD and the imperative for comprehensive strategies aimed not only at preventing CVD through targeted interventions but also at addressing the broader socioeconomic determinants influencing cardiovascular health outcomes. By adopting a holistic approach that encompasses both preventive measures and broader societal interventions, there exists a tangible opportunity to alleviate the burdens imposed by CVD and foster healthier populations across diverse geographical and socioeconomic contexts.

Drawing from data provided by the 2014 Hellenic Statistical Authority, it was revealed that a staggering 40% of fatalities in Greece were attributed to cardiovascular diseases (CVD). The financial upheaval and subsequent implementation of austerity measures in Greece since 2009 have cast a wide net of adverse effects on daily life and health. Notably, there has been an observed increase in myocardial infarctions, a phenomenon believed to be correlated with escalating unemployment rates [17]. Prior to recent advancements, despite several commendable health surveys undertaken in Greece, they often maintained a localized scope, focusing solely on specific regions or high-risk demographic groups. Alternatively, some surveys were conducted as part of broader European initiatives [18, 19, 20–21]. However, comprehensive, nationwide evaluations of chronic ailments like CVD and their associated risk factors are indispensable for the formulation and execution of effective preventive strategies. Enter the National Survey of Morbidity and Risk Factors (EMENO), a groundbreaking nationwide health examination survey meticulously designed to shed light on cardiovascular and respiratory conditions alongside their underlying risk factors. Carried out within a representative sample of Greek adults, EMENO stands as a pivotal initiative aimed at providing accurate insights into the prevalence and determinants of CVD within the Greek populace [22]. By virtue of its nationwide scope and meticulous methodology, EMENO serves as a cornerstone for informed decision-making, facilitating the development and implementation of targeted interventions to combat the burden of CVD and foster cardiovascular health across Greece.

Mapping of Risk Factors in Greece

Hypertension

Hypertension, commonly known as high blood pressure, emerges as a pivotal modifiable risk factor intricately linked to the onset of ischemic heart IHD and cerebrovascular disease CBD [23]. A wealth of research underscores a compelling correlation between elevated blood pressure (BP) levels and the risk of cardiovascular disease (CVD), particularly pronounced among individuals aged 40 to 70. Notably, each 20 mmHg increase in systolic BP or 10 mmHg rise in diastolic BP doubles the risk of CVD, irrespective of BP levels spanning from 115/75 to 185/115 mmHg [24].

Within the Greek context, extensive large-scale cross-sectional studies conducted over the past two decades have provided invaluable insights into the prevalence of hypertension. These studies, predominantly reliant on questionnaire-based assessments, have yielded hypertension prevalence rates ranging from 13% to 27% across diverse cohorts [25-30]. Intriguingly, these prevalence rates exhibit slight variations across genders, with estimates oscillating between 13% and 26% in men and 13% to 28% in women. Noteworthy is the observation from only one cross-sectional survey reporting a hypertension prevalence lower than 10%, specifically confined to individuals under 70 years of age.

Moreover, the temporal aspect is highlighted, as this particular survey was conducted in 2003, suggesting potential temporal fluctuations in hypertension prevalence over time [31]. These findings accentuate the significance of ongoing surveillance and monitoring endeavors aimed at tracking shifts in hypertension prevalence. Such continuous efforts are indispensable for informing targeted interventions meticulously tailored to address the multifaceted challenges posed by hypertension-related cardiovascular complications across diverse demographic groups within the Greek population.

Establishing effective public health strategies and interventions finely tuned to the specific needs and intricacies of hypertension management in Greece remains paramount for ameliorating the burden of this condition and enhancing cardiovascular health outcomes. Efforts should prioritize early detection, lifestyle modifications, and access to comprehensive healthcare services to effectively combat hypertension and its associated complications, thereby promoting overall well-being and reducing the burden of cardiovascular disease in the Greek population.In addition to its impact on cardiovascular health, hypertension has far-reaching implications on various physiological systems. Chronic elevation of blood pressure can lead to endothelial dysfunction, arterial stiffness, and vascular remodeling, contributing to atherosclerosis and increasing the risk of myocardial infarction and stroke. Furthermore, hypertension is often associated with other comorbidities such as diabetes, obesity, and chronic kidney disease, exacerbating its detrimental effects on overall health. Understanding the complex interplay between hypertension and its related comorbidities is essential for developing comprehensive treatment and prevention strategies.

Lifestyle modifications, including dietary changes, regular physical activity, stress management, and smoking cessation, play a crucial role in hypertension management. Additionally, pharmacological interventions targeting blood pressure regulation, such as antihypertensive medications, are commonly prescribed to control hypertension and reduce the risk of cardiovascular events. Promoting public awareness about the importance of blood pressure monitoring, early detection of hypertension, and adherence to treatment regimens is vital for reducing the burden of hypertension-related complications. By fostering a collaborative approach involving healthcare providers, policymakers, and the community, significant strides can be

made towards improving cardiovascular health outcomes and enhancing the quality of life for individuals affected by hypertension.

Data sourced from the Hellenic Statistical Authority (ELSTAT) in 2014 revealed a concerning statistic: one in every five Greeks grappled with hypertension, marking a prevalence of 19% among men and 22% among women. Alarmingly, half of individuals aged 65 to 74 were identified as having hypertension [32]. Comparing these figures with data from 2009, there was a notable uptick of 3.4% in the prevalence of hypertension [20]. Interestingly, studies that employed arterial blood pressure measurements to diagnose hypertension unveiled even higher prevalence rates, ranging from 30% to 44% across various cohorts [33-37].This discrepancy in prevalence rates between questionnaire-based surveys and those utilizing blood pressure measurements may be attributed to the inherent complexities in diagnosing hypertension. In some instances, the condition may be overestimated, where a few abnormal blood pressure readings suffice for diagnosis.

Conversely, there are cases where patients remain unaware of their hypertensive status. The HYPERTENSHELL study shed light on the issue, revealing that four out of ten individuals with hypertension were oblivious to their condition. Additionally, a striking finding was that in 83% of self-reported cases of hypertension, the diagnosis was incidental rather than stemming from symptomatic presentation or routine examinations [34]. The significance of longitudinal studies in understanding the trajectory of hypertension prevalence is underscored by the ATTICA study, which commenced in 2002 with the enrollment of over 3,000 participants. Investigators conducted reevaluations at 5 and 10-year intervals, providing invaluable insights into the evolution of hypertension prevalence over time and its associated implications for public health and clinical management.

As such, longitudinal studies offer a dynamic perspective on hypertension prevalence, allowing for the tracking of trends and patterns over extended periods. This longitudinal approach not only illuminates the magnitude of hypertension burden but also provides valuable data for informing targeted interventions and healthcare policies aimed at mitigating the adverse effects of hypertension on public health. Moreover, understanding the trajectory of hypertension prevalence is essential for anticipating future healthcare needs and allocating resources effectively. By elucidating the evolving landscape of hypertension prevalence, longitudinal studies play a pivotal role in guiding evidence-based strategies for the prevention, early detection, and management of hypertension and its associated complications. Thus, investment in longitudinal studies remains crucial for advancing our understanding of hypertension and optimizing healthcare delivery to combat this significant public health challenge.

At the inception of ATTICA the study, hypertension was identified in 30% of the participants. However, over the course of the initial follow-up period, this proportion surged to 40%, indicating a notable escalation in the prevalence of

hypertension within the cohort. Subsequently, during the second follow-up period, the prevalence of hypertension further escalated to 52%, underscoring a concerning trend of increasing hypertension burden over time among the study participants. This progressive rise in hypertension prevalence highlights the dynamic nature of the condition and suggests a pressing need for proactive measures to address its underlying causes and mitigate its adverse health effects. Moreover, these findings underscore the importance of longitudinal studies in capturing changes in hypertension prevalence and informing targeted interventions to curb its escalating burden on public health. By tracking trends in hypertension prevalence over time, researchers and policymakers can better understand the evolving nature of the condition and tailor strategies to effectively manage and prevent its complications. [9].

Smoking

Smoking represents a significant and independent risk factor for a spectrum of CVD, encompassing IHD, cerebrovascular disease CBD, heart failure, and overall mortality, with a discernible dose-dependent relationship [38,39]. A survey conducted by the Greek National School of Public Health in 2006 unveiled alarming statistics: 46.8% of Greek adults identified themselves as current smokers, while 6.9% reported being former smokers. Among current smokers, 55.4% were male, with an average consumption of 24 cigarettes per day. Intriguingly, there was a noteworthy trend indicating that individuals with higher levels of education tended to smoke fewer cigarettes daily [40]. Subsequent findings from the 2013 Global Adult Tobacco Survey (GATS) shed further light on smoking prevalence among Greeks aged 15 years and older, revealing a prevalence of 38.2% for current smoking, with an average consumption of 19.8 cigarettes per day [41]. In 2014, data sourced from the Hellenic Statistical Authority (ELSTAT) provided updated insights: three out of ten Greeks aged 15 years and older reported smoking on a daily basis, while one out of twenty identified as occasional smokers. Notably, these figures indicated a promising trend, with a 14.4% reduction in the number of daily smokers compared to statistics from 2009 [42]. T

hese findings underscore the importance of ongoing efforts aimed at tobacco control and smoking cessation initiatives to further mitigate the adverse impact of smoking on cardiovascular health and overall public well-being. Implementing comprehensive tobacco control policies, including taxation, advertising restrictions, and smoking cessation programs, is essential to reduce smoking prevalence and prevent tobacco-related morbidity and mortality. Additionally, raising public awareness about the detrimental effects of smoking on cardiovascular health can empower individuals to make informed decisions and adopt healthier lifestyles. By addressing smoking as a modifiable risk factor for CVD, public health authorities can contribute to significant improvements in population health outcomes and reduce the

burden of cardiovascular disease in Greece and beyond. Furthermore, it is imperative to support smoking cessation programs and provide resources to assist individuals in quitting smoking. These programs should be accessible and tailored to address the specific needs of diverse populations, including youth, pregnant women, and individuals with co-existing health conditions. Investing in evidence-based interventions and policies that promote smoke-free environments and encourage tobacco-free lifestyles can yield substantial public health benefits, including reduced healthcare costs and improved quality of life for individuals affected by smoking-related diseases.

Moreover, addressing social determinants of health, such as socioeconomic disparities and environmental factors, is essential for creating supportive environments that facilitate smoking cessation and promote healthier behaviors. Collaborative efforts involving government agencies, healthcare providers, community organizations, and advocacy groups are needed to implement multi-sectoral approaches to tobacco control and ensure comprehensive support for individuals striving to quit smoking. By prioritizing tobacco control as a public health priority and implementing effective strategies to reduce smoking prevalence, Greece can make significant strides towards improving cardiovascular health and reducing the burden of tobacco-related diseases on its population. In conclusion, the multifaceted nature of smoking as a risk factor for cardiovascular disease necessitates comprehensive and sustained efforts towards tobacco control and smoking cessation. Through targeted interventions, public awareness campaigns, and supportive policies, Greece can move towards a future where smoking-related morbidity and mortality are significantly reduced, contributing to improved population health and well-being.

The decrease of 14.4% in the number of daily smokers compared to statistics from 2009 reflects a promising trend in tobacco consumption [43]. This decline is consistent with findings from the renowned ATTICA study, which noted a reduction in smoking prevalence within their study group, dropping from 43% to 33% over a decade-long period [44]. Similarly, various studies conducted in Greece over the past twenty years have reported smoking prevalence rates ranging from 32% to 43%, with more recent investigations indicating a downward trajectory in prevalence rates [45-48]. The financial crisis that gripped Greece may have played a pivotal role in this decline, as hinted by data from the "Hellas Health" surveys. Despite this positive trend, evidence suggests that adherence to the "2009 anti-smoking law" remains deficient among Greeks. According to a survey conducted by the Hellenic Center for Disease Control and Prevention (HCDCP/KEELPNO) in 2011, 45% of respondents reported witnessing people smoking in their workplace within the past three months, while 3 out of 10 admitted to smoking during their last visit to an indoor coffeehouse, bar, or nightclub. The GATS study further corroborated these findings, indicating that a staggering 90% of the Greek population is exposed to tobacco smoke, either through active smoking or secondhand smoke.

These observations underscore the critical need for continued efforts to enforce smoking regulations and enhance tobacco control measures, thereby safeguarding public health and mitigating the pervasive impact of tobacco use on both smokers and non-smokers alike. Implementing stricter enforcement of smoke-free policies in public places and workplaces, coupled with comprehensive smoking cessation programs, can further reduce smoking prevalence and protect individuals from the harmful effects of tobacco smoke exposure.

Moreover, targeted public health campaigns aimed at raising awareness about the dangers of smoking and the benefits of quitting can help shift societal norms and attitudes towards tobacco use. By fostering a supportive environment that promotes smoke-free lifestyles and provides resources for smoking cessation, Greece can continue to make strides towards reducing smoking prevalence and improving the overall health and well-being of its population. Efforts to address tobacco use should also include measures to combat the influence of the tobacco industry, such as restrictions on advertising, sponsorship, and promotion of tobacco products. By implementing evidence-based policies and interventions, Greece can create an environment that discourages smoking initiation and supports smokers in quitting, ultimately reducing the burden of tobacco-related diseases and improving public health outcomes for generations to come. In addition to these measures, research into novel smoking cessation methods and interventions tailored to the needs of diverse populations can further enhance tobacco control efforts. By investing in innovative approaches and continuously evaluating the effectiveness of tobacco control strategies, Greece can remain at the forefront of tobacco control efforts and serve as a model for other countries striving to combat the global tobacco epidemic.

Dyslipidemia

A substantial body of research has accumulated compelling evidence linking hypercholesterolemia to the progression of atherosclerosis, thereby amplifying the risk of CVD [49]. Elevated total cholesterol (TC) levels are estimated to contribute to approximately one-third of cardiovascular events globally [50]. Surveys conducted post-2002 have shed light on the prevalence of self-reported hypercholesterolemia among the Greek population, unveiling rates ranging from 11% to 23% across various studies, with similar ranges observed in both men and women [51-57]. Data from the Hellenic Statistical Authority (ELSTAT) in 2014 indicated that 15% of Greeks reported being diagnosed with hypercholesterolemia, a figure consistent with findings from the 2009 survey [58-59]. However, findings from the ATTICA study, a comprehensive health survey, reported a substantially higher prevalence of hypercholesterolemia, nearing 40%, compared to other studies. This disparity may stem from differences in the study's definition of hypercholesterolemia, which classified individuals with TC levels above 200 mg/dl or those using lipid-lowering medications as hypercholesterolemic [60].

In contrast, the HYDRIA study conducted in 2013-14 reported a prevalence of hypercholesterolemia (defined as TC levels >240 mg/dl) at 13.4%, with the majority of participants having TC levels below 221 mg/dl [61]. Similarly, the Hellenic National Nutrition and Health Survey (HNNHS) conducted between 2013 and 2015, employing the same definition for hypercholesterolemia, reported a comparable prevalence at 16.7% [62]. According to the 2017 guidelines from the American Association of Clinical Endocrinologists (AACE), the recommended target TC level for individuals at risk of atherosclerotic CVD is below 200 mg/dl [63].

These findings underscore the importance of ongoing surveillance and monitoring efforts to accurately assess hypercholesterolemia prevalence and guide targeted interventions aimed at managing lipid levels and reducing the burden of CVD among the Greek population. Efforts to raise awareness about the importance of cholesterol management and promote healthy lifestyle behaviors, such as adopting a Mediterranean diet rich in fruits, vegetables, and whole grains while limiting saturated fats and cholesterol-rich foods, can contribute to reducing hypercholesterolemia rates and preventing CVD complications.

Additionally, healthcare providers play a crucial role in identifying individuals at risk, conducting regular lipid screenings, and initiating appropriate interventions, including lifestyle modifications and pharmacotherapy, to optimize lipid levels and improve cardiovascular outcomes. Collaborative efforts involving government agencies, healthcare organizations, and community stakeholders are essential to implementing effective strategies for combating hypercholesterolemia and reducing the burden of CVD in Greece. Such multifaceted approaches can address the complex interplay of factors contributing to hypercholesterolemia and pave the way for significant improvements in cardiovascular health outcomes across the population. Moreover, longitudinal studies tracking lipid profiles and cardiovascular outcomes over time can provide valuable insights into the effectiveness of interventions and help refine preventive strategies tailored to the evolving needs of the population. These studies offer a dynamic perspective on the trajectory of hypercholesterolemia prevalence, enabling healthcare stakeholders to adapt their approaches and allocate resources effectively to address this critical public health challenge. Continued investment in research, education, and healthcare infrastructure is essential to sustain progress in managing hypercholesterolemia and reducing its impact on cardiovascular health in Greece. By prioritizing preventive measures, promoting healthy lifestyle choices, and ensuring access to quality healthcare services, Greece can mitigate the burden of hypercholesterolemia and improve the overall well-being of its population.

Obesity

Obesity exerts a profound impact on the cardiovascular system, influencing established risk factors such as dyslipidemia, hypertension, and glucose intolerance, while also serving as an independent risk factor for cardiovascular disease (CVD) [64]. This condition is intricately linked to elevated risks of morbidity and mortality,

contributing to a shortened life expectancy [65]. Individuals are typically categorized as obese when their body mass index (BMI) exceeds 30 kg/m² [66]. Data from the Hellenic Statistical Authority (ELSTAT) revealed that nearly 17% of Greek citizens were classified as obese in 2014, a prevalence comparable to that of 2009, with a slightly higher prevalence observed among men than women [67]. Across studies conducted post-2000, obesity prevalence ranged from 12% to 25%, with men generally exhibiting higher rates than women, except among individuals over 65 years old, where the opposite trend was noted [68-71, 72]. However, the HYDRIA study reported an exceptionally high obesity prevalence among the Greek population, reaching 35% [72]. This contrasts starkly with the prevalence of 15.5% reported by the Hellenic National Nutrition and Health Survey (HNNHS), conducted during a similar period [73]. Plausible explanations for this disparity include the HNNHS initially relying solely on self-reported data, a higher proportion of participants with higher educational levels, and a smaller percentage of older individuals (>65 years old) compared to the HYDRIA study.

These findings underscore the complexity of assessing obesity prevalence and highlight the need for standardized methodologies and rigorous surveillance to accurately gauge the burden of obesity within the Greek population. Effective interventions aimed at combating obesity and its associated cardiovascular risks necessitate a comprehensive understanding of the prevailing epidemiological trends and determinants of obesity. Public health initiatives targeting obesity prevention and management should encompass multifaceted strategies, including promoting healthy eating habits, encouraging regular physical activity, and addressing environmental and socioeconomic factors that contribute to obesogenic behaviors. Collaboration among policymakers, healthcare professionals, community leaders, and individuals is essential for implementing sustainable interventions that foster a supportive environment conducive to healthy lifestyle choices and reduce the prevalence of obesity and its adverse cardiovascular outcomes in Greece. Furthermore, addressing childhood obesity is of paramount importance, as it often persists into adulthood and is associated with a higher risk of developing cardiovascular disease later in life. School-based interventions, parental education programs, and community initiatives aimed at promoting healthy lifestyles from an early age can help prevent and mitigate the long-term consequences of obesity in future generations.

Additionally, healthcare providers play a crucial role in obesity management through early identification, personalized counseling, and referral to specialized services such as dietetics, physical therapy, and behavioral therapy. By integrating obesity screening and management into routine clinical practice, healthcare systems can better address this growing public health challenge and improve cardiovascular outcomes for individuals affected by obesity. Overall, addressing the complex interplay of factors contributing to obesity requires a concerted effort from multiple stakeholders across various sectors. By prioritizing prevention, early intervention, and

comprehensive care, Greece can make significant strides towards reducing the burden of obesity-related cardiovascular disease and improving the health and well-being of its population.

Diet

Adopting the Mediterranean diet has demonstrated promising outcomes in reducing the prevalence of conventional cardiovascular disease (CVD) risk factors compared to the general population [74,75]. According to World Health Organization (WHO) guidelines, individuals are recommended to consume over 400 grams of fruits and vegetables daily to mitigate the risk of chronic diseases, including CVD [76]. However, findings from the HYDRIA study conducted between 2013 and 2014 revealed that only 25% of Greek adults met these recommended intake levels of fruits and vegetables. Intriguingly, there were notable differences in preferences between genders, with males showing a preference for vegetables and females favoring fruit consumption [77]. The ATTICA study observed moderate adherence to the Mediterranean diet among Greek adults aged over 18 years.

Data from the Hellenic Statistical Authority (ELSTAT) in 2014 indicated that 55% of the Greek population consumed fruits daily, while 62% consumed at least one portion of vegetables each day [78]. Comparing these figures to those from 2009, there was a 9.4% reduction in daily fruit consumption and a 2.5% decrease in daily vegetable consumption [79]. Furthermore, analyses from the "Hellas Health" survey conducted over three waves demonstrated a significant decline in the proportion of Greek adults reporting daily consumption of at least five portions of fruits and vegetables from 2006 to 2011 (21.2% vs. 7.1%) [80].

Regarding alcohol consumption, the European Society of Cardiology recommends moderate intake, with no more than 2 glasses (20 g) per day for men and 1 glass (10 g) per day for women [74]. However, recent studies have suggested that even light-to-moderate alcohol consumption might have negative implications for cardiovascular health [81-83]. Between 2009 and 2014, there was a 29% reduction in daily alcohol consumption among Greeks aged over 15 years [78,79]. In 2013-2014, the prevalence of daily alcohol consumption ranged from 6.8% to 6.9% (10.4%-11.7% in men and 2.5%-3.8% in women) [78,84]. These trends underscore the importance of promoting healthier dietary habits and lifestyle choices to mitigate the burden of CVD and promote overall well-being among the Greek population. Public health initiatives focusing on increasing fruit and vegetable consumption, reducing alcohol intake, and encouraging adherence to the Mediterranean diet can play a pivotal role in preventing and managing CVD risk factors, thereby improving cardiovascular health outcomes in Greece.

Exercise plays a multifaceted role in the management of obesity, offering numerous physiological, metabolic, and psychological benefits. Regular physical activity is instrumental in achieving weight loss and improving body composition. By increasing energy expenditure and promoting fat oxidation, exercise creates a

negative energy balance necessary for reducing excess adiposity. Moreover, exercise interventions encompassing various modalities, such as aerobic exercise, resistance training, and high-intensity interval training, have been shown to elicit significant weight loss and fat mass reduction in individuals with obesity [85,86].

Beyond weight loss, exercise exerts favorable effects on metabolic health. It enhances insulin sensitivity, glucose utilization, and lipid metabolism, thereby reducing the risk of type 2 diabetes and cardiovascular disease associated with obesity [87,88]. Aerobic exercise, in particular, improves cardiovascular function by strengthening the heart, lowering blood pressure, and enhancing endothelial function [89]. Resistance training, on the other hand, increases muscle mass and metabolic rate, contributing to long-term weight maintenance and improved metabolic outcomes [90].

Psychologically, exercise has profound effects on mood, self-esteem, and cognitive function. Regular physical activity alleviates symptoms of depression and anxiety, which are prevalent among individuals with obesity [91]. Additionally, participation in structured exercise programs fosters a sense of accomplishment and self-efficacy, empowering individuals to adhere to healthy lifestyle behaviors and sustain long-term weight management success [92].

In addition to its direct effects on weight loss and metabolic health, exercise promotes adherence to dietary interventions and facilitates long-term behavior change [9]. Moreover, exercise interventions have been shown to reduce inflammation and oxidative stress, which are implicated in the pathogenesis of obesity-related complications [93-96]. By integrating exercise prescription into clinical practice and promoting physical activity at the population level, healthcare providers and policymakers can optimize health outcomes and reduce the burden of obesity-related complications.

Diabetes

The global prevalence of diabetes mellitus (DM) has witnessed a substantial surge from 4.7% to 8.5% among the adult population between 1980 and 2014, as age-standardized [97]. In 2012, DM contributed to 1.5 million deaths, while elevated blood glucose levels contributed to an additional 2.2 million deaths by heightening the risk of various diseases, including cardiovascular disease (CVD) [97]. The burden of DM continues to escalate globally, with profound implications for public health systems and individual well-being. In Greece, the prevalence of DM has been a growing concern. Findings from the HYDRIA study in 2015 revealed that the average glycosylated hemoglobin A1C (HbA1C) level among adult Greek residents fell within the physiologically normal range at 5.3 ± 0.7% [98]. However, despite this seemingly reassuring statistic, a study conducted by Liatis et al. in 2016, using the electronic prescription database of the National Organization for Health Care Services Provision (EOPYY), identified a concerning prevalence of DM. They found that 7% of Greek patients were receiving pharmacological treatment for DM, with similar rates

observed across genders. Notably, the study highlighted that 3 out of 10 individuals over 74 years old were diabetic [99]. These findings underscore the substantial burden of DM in the Greek population, particularly among the elderly. Furthermore, data from the Hellenic Statistical Authority (ELSTAT) revealed a prevalence of DM at 9.2% in 2014 (8.8% in men and 9.6% in women), marking a 17% increase compared to 2009 [100,101]. Additional studies conducted between 2002 and 2015 reported DM prevalence rates ranging from 4% to 9% (5% to 10% in men and 4% to 8% in women) [102-104, 105-107]. The Saronikos Study, a community-based cross-sectional study, reported one of the highest prevalence rates of DM at 11.1%, indicating a high level of DM awareness and a relatively low proportion of undiagnosed DM among the Greek population, particularly among adults over 45 years old [108]. These statistics reflect the pervasive nature of DM across different demographic groups within Greece and highlight the urgent need for targeted interventions. Moreover, findings from the ATTICA study revealed a 10-year incidence of DM at 13.4% in men and 12.4% in women over the period from 2002 to 2012 [109]. This longitudinal study underscores the dynamic nature of DM prevalence and its relentless progression, necessitating continuous surveillance and intervention efforts. In conclusion, the escalating burden of DM in Greece calls for comprehensive strategies aimed at prevention, early detection, and management of the disease to mitigate its adverse impact on public health. Efforts should focus on promoting healthier lifestyles, enhancing screening programs, and improving access to quality healthcare services for effective management of diabetes and its associated complications within the Greek population.

Approaches to Modifying Risk Factors for Coronary Artery Disease

Lifestyle Modification:

Lifestyle interventions play a pivotal role in CAD prevention and management. Dietary modifications focusing on a heart-healthy diet, such as the Mediterranean diet, have demonstrated significant benefits in reducing CAD risk [109]. This dietary pattern emphasizes the consumption of fruits, vegetables, whole grains, nuts, seeds, legumes, and olive oil while limiting red meat, processed foods, and sugary beverages. Dietary interventions are often complemented by nutrition counseling and education to promote sustainable behavior change. Regular physical activity is another cornerstone of lifestyle modification for CAD prevention. Aerobic exercises, such as walking, jogging, cycling, and swimming, enhance cardiovascular fitness, improve lipid profiles, and promote weight management [110]. Resistance training, involving activities like weightlifting and bodyweight exercises, contributes to muscle strength, bone health, and metabolic function. Integrating physical activity into daily routines and participating in structured exercise programs, such as cardiac rehabilitation, are effective strategies for maintaining an active lifestyle. Smoking cessation is imperative for CAD risk reduction, as tobacco smoke contains numerous harmful chemicals that damage blood vessels, promote inflammation, and accelerate

atherosclerosis [111]. Behavioral counseling, pharmacotherapy (e.g., nicotine replacement therapy, varenicline, bupropion), and support groups facilitate smoking cessation and prevent relapse. Additionally, stress management techniques, including relaxation therapies, mindfulness meditation, and cognitive-behavioral therapy, help mitigate the detrimental effects of chronic stress on cardiovascular health [112].

Pharmacotherapy

Pharmacological interventions are indispensable for managing risk factors associated with CAD. Antihypertensive medications, such as angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, beta-blockers, diuretics, and calcium channel blockers, effectively lower blood pressure and reduce the risk of cardiovascular events [113]. Pharmacotherapy is tailored to individual patient profiles, considering factors such as age, comorbidities, and medication tolerance. Statins are the cornerstone of pharmacological therapy for dyslipidemia, as they lower low-density lipoprotein cholesterol levels and reduce atherosclerotic plaque formation [114]. Other lipid-lowering agents, including fibrates, ezetimibe, and PCSK9 inhibitors, are prescribed based on lipid profiles and statin intolerance. Antidiabetic medications, such as metformin, sulfonylureas, thiazolidinediones, dipeptidyl peptidase-4 inhibitors, glucagon-like peptide-1 receptor agonists, and sodium-glucose cotransporter-2 inhibitors, are utilized for glycemic control and cardiovascular risk reduction in patients with diabetes mellitus [115]. Furthermore, antiplatelet agents, such as aspirin and P2Y12 inhibitors (e.g., clopidogrel, ticagrelor), are prescribed to prevent thrombotic events in patients with CAD or a history of myocardial infarction [116]. These medications inhibit platelet aggregation, reduce the risk of clot formation, and enhance blood flow through narrowed coronary arteries.

Risk Factor Screening and Management

Early identification and management of risk factors are essential components of CAD prevention and risk stratification. Healthcare providers routinely screen patients for hypertension, dyslipidemia, diabetes mellitus, obesity, and smoking status during clinical encounters. Risk assessment tools, such as the Framingham Risk Score, QRISK, and ASCVD Risk Estimator, aid in predicting cardiovascular risk and guiding therapeutic decisions [117]. Comprehensive risk factor management involves implementing evidence-based guidelines and individualized treatment plans. Lifestyle modifications, pharmacotherapy, and risk factor control are tailored to each patient's cardiovascular risk profile, medical history, and treatment goals. Regular follow-up visits, laboratory monitoring, and patient education empower individuals to actively participate in their healthcare and adhere to treatment recommendations. Additionally, cardiac rehabilitation programs provide structured interventions, including supervised exercise training, nutritional counseling, smoking cessation support, and psychosocial interventions, to optimize cardiovascular health and improve outcomes in patients with CAD [118]. These programs promote adherence to healthy behaviors, enhance quality of life, and reduce the risk of recurrent cardiovascular events.

Population-Level Initiatives

Public health initiatives play a crucial role in addressing CAD risk factors at the population level. Tobacco control policies, including tobacco taxes, smoking bans, and anti-tobacco advertising campaigns, are effective strategies for reducing smoking prevalence and exposure to secondhand smoke [119]. Comprehensive smoke-free laws protect nonsmokers from involuntary exposure to tobacco smoke in public places, workplaces, and recreational venues. Furthermore, initiatives aimed at promoting healthy eating habits and physical activity support population-wide efforts to prevent obesity, hypertension, and dyslipidemia. School-based nutrition programs, community gardens, and urban planning initiatives that prioritize pedestrian-friendly environments and access to recreational facilities contribute to creating healthier communities [120]. Legislative measures targeting food industry practices, such as marketing restrictions on unhealthy foods and beverages, front-of-package labeling requirements, and menu calorie labeling mandates, empower consumers to make informed choices and reduce consumption of high-calorie, nutrient-poor foods [121]. Additionally, initiatives promoting workplace wellness programs, incentivizing physical activity, and providing access to preventive healthcare services foster a culture of health and wellbeing in diverse settings.

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Social effect of cardiovascular diseases and diabetes on European citizens

Cardiovascular diseases (CVDs) and diabetes have significant social effects on European citizens, impacting both individuals and communities in various ways.

1. Healthcare system strain

Both CVDs and diabetes are chronic conditions that require long-term management, which places a substantial burden on healthcare systems. This includes the need for ongoing medical care, medications, and hospitalizations. The high prevalence of these diseases in Europe leads to significant healthcare expenditures and can strain public health resources.

In 2020, diseases of the circulatory system were responsible for almost one-third (32.7%) of all deaths. Germany had the highest level of current healthcare expenditure among the EU Member States, valued at €432 billion in 2023.

The World Bank predicts that public expenditure on healthcare in the EU could jump from 8% of GDP in 2000 to 14% in 2030 – a significant financial burden on healthcare systems and government budgets.

CVD is estimated to cost the EU €282 billion annually, with health and long-term care accounting for €155 billion (55%), equaling 11% of EU-health expenditure. Productivity losses accounted for 17% (€48 billion), whereas informal care costs were €79 billion (28%). CVD represented a cost of €630 per person, ranging from €381 in Cyprus to €903 in Germany. Coronary heart disease accounted for 27% (€77 billion) and cerebrovascular diseases for 27% (€76 billion) of CVD costs.

Researchers at Oxford Population Health's Health Economics Research Centre have found that cardiovascular disease cost the European Union (EU) economy €282 billion in 2021. The results of their study were presented at the European Society of Cardiology (ESC) Congress 2023 in Amsterdam, and published in the European Heart Journal.

Key findings:

- Cardiovascular disease accounted for ten million hospital admissions in the EU, representing 22 admissions per 1,000 people. For every 1,000 people, there were 656 visits to GPs and 356 appointments with outpatient consultants;
- Hospital care accounted for 60% of cardiovascular disease-related healthcare costs, followed by drug expenditure, outpatient care, primary care, and emergency care;
- Cardiovascular disease cost the EU health and social care systems alone approximately €155 billion, which is 11% of total health and social care spending. The amount spent on health and social care varied between countries, from €154 per person in Croatia to €505 per person in Austria;

- 7.5 billion hours of unpaid care by relatives or friends were provided to people whose care needs could be directly attributable to cardiovascular disease, representing a cost of €79 billion across the EU;
- The 1.7 million deaths as a result of cardiovascular disease in 2021 represents 1.3 million working years lost and around €32 billion in lost productivity. Ill health as a result of cardiovascular disease resulted in the loss of 256 million working days, representing an estimated cost of €15 billion;
- Overall, cardiovascular disease cost the EU economy €282 billion in 2021. 46% of these costs were due to health care, 28% due to informal care, and 9% due to social care. 17% of these costs were due to productivity losses. This represents an average cost of €620 per EU citizen.

2. Economic impact

These diseases can lead to reduced work productivity and economic output due to illness-related absences, early retirement, and disability. This economic impact is felt not only by the individuals and their families but also by the broader economy through lost productivity and increased healthcare costs.

The Oxford Population Health's Health Economics Research Centre study is the first since 2017 to evaluate the costs of cardiovascular disease in the EU and is the first to be able to accurately estimate health and social care costs, informal care costs, and productivity loss.

Along with the direct impact on the patients there are many patients with CVD or diabetes require help from family members or friends, who might need to reduce their working hours as well or stop working entirely to provide necessary care. This not only affects the income of caregivers but also adds to the economic burden as the opportunity cost of lost wages or career opportunities can be substantial. Thus all that leads to lower tax revenues and lower returns on human capital investments.

Statistics:

- production losses due to mortality and morbidity associated with CVD[b] cost €54 billion in the EU in 2015 and the total cost of providing informal care for people with CVD was almost €45 billion (EHN 2017);
- productivity losses due to diabetes are estimated to cost the EU around 65 billion euros per year

Interesting statistics from 2013, published in 2016:

In the European Union, about 555 000 people aged 25 to 64 died from major NCDs (cardiovascular diseases, cancers, respiratory diseases, and diabetes) in 2013. This corresponds to a rate of about 200 per 100 000 population in this age group (Table 1.1). Premature mortality rates from NCDs among the working-age population were particularly high in Bulgaria, Hungary and Latvia (with a rate at least two-times greater than the EU average). Assuming that these people would have been employed until age 65 at the same employment rate as the rest of the population, the associated potential loss for the economy is estimated to be around 3.4 million potentially productive life years across the 28 EU countries in 2013. This corresponds to a rate of 1 236 productive

life years per 100 000 population in that age group. Based on the average annual earnings of workers in EU countries of about EUR 33 800, this amounts to EUR 115 billion in potential economic loss each year (or 0.8% of GDP in the European Union). Most premature deaths due to NCDs were for people aged 45-64. In 2013, about 508 000 people aged 45-64 died from NCDs in the EU. This corresponds to a loss of some 2.5 million potentially productive life years.

Table 1.1. **Premature deaths and potential productive life years lost related to non-communicable diseases among people aged 25-64, EU countries, 2013**

	Premature NCD deaths		Potential productive life years lost	
	Number	Rate per 100 000 population	Number	Rate per 100 000 population
EU28 total	**555 065**	**201**	**3 412 060**	**1 236**
Austria	7 736	165	47 694	1 018
Belgium	10 307	173	62 115	1 042
Bulgaria	16 828	410	103 766	2 527
Croatia	6 894	293	40 015	1 701
Cyprus	558	116	3 786	789
Czech Republic	14 711	244	79 195	1 316
Denmark	5 177	178	29 755	1 023
Estonia	2 013	280	11 230	1 562
Finland	4 961	174	27 997	980
France	57 318	169	355 707	1 046
Germany	86 545	195	522 522	1 179
Greece	11 325	188	76 390	1 270
Hungary	22 947	411	129 389	2 319
Ireland	3 564	143	24 014	966
Italy	48 231	147	312 026	952
Latvia	4 439	400	29 731	2 682
Lithuania	5 910	372	39 220	2 466
Luxembourg	450	147	2 961	969
Malta	368	159	2 063	889
Netherlands	15 618	173	94 067	1 042
Poland	67 050	305	378 167	1 722
Portugal	9 827	170	66 294	1 147
Romania	40 621	361	247 952	2 203
Slovak Republic	9 148	289	53 324	1 685
Slovenia	2 380	200	13 384	1 122
Spain	38 003	142	256 969	960
Sweden	6 726	138	40 104	821
United Kingdom	55 410	166	362 228	1 084

Note: Non-communicable diseases include cardiovascular diseases (ICD-10: I00-I99), cancers (C00-C97), respiratory diseases (J40-J47), and diabetes (E10-E14). Potential productive life years have been calculated as the difference between the age of death and age 65, using the EU28 average of employment rates for the population aged 25-54 years and 55-64 years.
Source: OECD estimates based on Eurostat data.

StatLink http://dx.doi.org/10.1787/888933430238

Quality of life

Both CVDs and diabetes can significantly impair the quality of life of affected individuals. They may suffer from physical limitations, pain, and other health complications that restrict their daily activities and social interactions. The psychological impact, including anxiety and depression, can also be considerable, affecting mental health and overall well-being. People with diabetes have a worse quality of life than people with no chronic illness, but a better quality of life than people

with most other serious chronic diseases. Duration and type of diabetes are not consistently associated with quality of life.

There are some studies for continents outside of Europe about the quality of life measured using the WHOQOL-BREF questionnaire, which comprises four domains: physical health, psychological aspects, social relationships, and environment. WHO defines Quality of Life as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. There isn't available study in the recent years for the quality of life of people with CVD and/or diabetes in EU.

3.1. Health-related challenges

-> diabetes can lead to various complications that significantly impair physical health, such as cardiovascular diseases, kidney damage, neuropathy (nerve damage), and retinopathy (eye damage), which can lead to vision loss. The need for continuous management, including regular blood sugar monitoring, dietary restrictions, and insulin administration, can also be burdensome and affect daily living.

-> CVD encompasses a range of conditions, such as coronary artery disease, heart failure, and arrhythmias, which can lead to physical symptoms like chest pain, breathlessness, and fatigue. These symptoms can significantly limit physical activity and reduce an individual's ability to perform daily tasks, thus impacting their independence and overall physical health.

3.2. Psychological impact

-> living with diabetes is often associated with emotional and psychological challenges. The constant need for disease management can lead to "diabetes distress," which is the emotional burden and frustration often associated with managing a chronic illness. Moreover, diabetes is linked with a higher prevalence of depression and anxiety, which can further degrade quality of life.

-> living with CVD can have a profound impact on mental health. The constant awareness of having a potentially life-threatening condition can induce anxiety, stress, and fear of mortality. Depression is also more common among individuals with heart disease.

3.3 Social and recreational limitations

-> dietary restrictions and the need for regular medication can make social outings and meals with friends or family challenging. Fear of hypoglycemic episodes can also lead some individuals to avoid certain activities or travel, reducing participation in recreational activities and potentially leading to social isolation.

-> the physical and emotional impacts of CVD can lead to reduced social interactions. Individuals might withdraw from social engagements due to fatigue, physical

limitations, or depression. Additionally, they might fear experiencing a medical emergency while away from home or medical facilities, leading to increased social isolation.

3.4 Employment and economic impact

-> diabetes can affect an individual's ability to work, particularly if the disease progresses to the point of causing physical disability or frequent sick days. Concerns about maintaining employment and the potential for discrimination can be stressful. Additionally, the financial burden of managing diabetes, including the cost of medications, monitoring equipment, and healthcare services, can be significant.

-> the chronic nature of CVD often requires ongoing medical care, which can be costly. These financial pressures, coupled with potential loss of income if the individual is unable to work, can lead to significant economic stress. This is particularly impactful in areas where healthcare costs are partially or fully out-of-pocket, or where insurance does not fully cover all medical needs.

3.5 Access to care and support

-> the level of healthcare support received can greatly influence the quality of life for people with diabetes. Access to specialized healthcare professionals, diabetes education, psychological support, timely and effective treatment, rehabilitation services, and routine monitoring are critical. However, disparities in healthcare access and quality exist across different regions and socioeconomic groups within the EU.

3.6 Self-management

-> effective diabetes management relies heavily on the individual's understanding and ability to manage their condition. Educational programs that empower patients with skills and knowledge about managing diabetes can significantly improve quality of life by reducing complications and enhancing self-efficacy.

-> managing CVD often requires lifestyle changes, such as diet alterations, quitting smoking, and regular physical activity. Adhering to these changes can be challenging but is crucial for managing the condition.

3. Family and caregiver burden

The chronic nature of these diseases often requires that family members or caregivers provide ongoing support and care, which can be emotionally and financially draining. This responsibility can lead to stress and affect the caregivers' health and social life.

- **Emotional stress** -> caregivers often experience high levels of stress due to the ongoing worry about the health and well-being of their loved one. The progressive and sometimes unpredictable nature of CVDs and diabetes can lead to constant concern over potential complications like heart attacks, strokes, or

diabetic crises. This can be emotionally draining and may lead to caregiver burnout, a state of physical, emotional, and mental exhaustion.

- **Physical demands** -> the role of a caregiver can be physically demanding, especially as the patient's condition deteriorates. Activities like helping with mobility, managing complex medication regimes, and performing daily care tasks can lead to physical strain. This is particularly challenging when the caregiver has their own health issues or if the patient requires significant physical assistance.
- **Financial impact** -> the financial burden on families can be severe. Costs include medical expenses not covered by insurance, like certain medications, home care supplies, and specialized treatments. Additionally, caregivers may have to reduce their working hours or even quit their jobs to provide adequate care, leading to a loss of income. Transport costs and modifications needed in the home to accommodate the patient's health needs also add to the financial strain.
- **Social isolation** -> caregivers often sacrifice their social activities and personal time to attend to the needs of their loved one. This isolation can lead to a loss of social contacts and support networks, exacerbating feelings of loneliness and stress. The intensive nature of caregiving can make it difficult to maintain personal relationships or engage in leisure activities.
- **Health risks for caregivers** -> the stress and demands of caregiving can have a direct impact on the health of the caregiver. Studies show that caregivers can experience increased levels of depression and anxiety, higher incidence of physical ailments, and may even neglect their own health care needs. The prolonged stress can also lead to long-term health issues like cardiovascular diseases.
- **Need for support services** -> many caregivers are in dire need of support services, which may include respite care, counseling, and practical training on how to care for someone with chronic conditions. Access to these services can alleviate some of the burdens and provide caregivers with much-needed breaks and emotional support.

4. Social inequality

There is a notable disparity in the prevalence and management of CVDs and diabetes across different socio-economic groups in Europe. Lower socio-economic status is associated with higher rates of these diseases due to factors like poor diet, lack of exercise, and limited access to healthcare. This disparity perpetuates social inequalities in health.

5.1. Socioeconomic status

Lower socioeconomic status is strongly associated with higher rates of both CVD and diabetes. This correlation exists due to multiple factors:

- **Poorer health behaviors** -> lower income and educational levels often correlate with less healthy lifestyle choices, such as increased rates of smoking,

poor dietary habits, and reduced physical activity. These behaviors are significant risk factors for both CVD and diabetes.

- **Stress** -> chronic stress, more prevalent among lower socioeconomic groups, can lead to physiological changes that increase the risk of hypertension, atherosclerosis, and type 2 diabetes

5.2. Access to healthcare

Access to healthcare greatly influences the management and outcomes of chronic diseases:

- **Availability of services** -> people in lower socioeconomic groups often have reduced access to healthcare services, including preventive care, timely diagnostics, and management of conditions. This lack of access can lead to worse outcomes in diabetes control and heart disease management.
- **Quality of care** -> there can be a notable difference in the quality of care received based on where an individual lives, their economic status, or their insurance coverage. Higher quality care tends to be more available in urban centers and less so in rural or economically deprived areas.

5.3. Education and awareness

- **Knowledge and skills** -> education affects an individual's ability to manage chronic diseases effectively. Higher education levels generally lead to better understanding and management of health, enhancing adherence to treatment regimens and lifestyle modifications recommended for CVD and diabetes.
- **Health literacy** -> lower health literacy, which is more common among the less educated, can impede the ability to follow medical advice, understand medication regimens, or recognize the importance of lifestyle changes.

5.4. Employment and working conditions

- **Occupational hazards** -> certain jobs, especially those that are physically demanding or highly stressful, can exacerbate health risks associated with CVD and diabetes. Conversely, more affluent job roles often come with benefits that facilitate better health management, such as comprehensive health insurance and access to wellness programs.

5.5. Cultural and ethnic factors

- **Minority status** -> ethnic minorities and immigrants often experience higher rates of CVD and diabetes. Cultural barriers, language differences, and limited access to culturally competent healthcare can hinder effective disease management and exacerbate health disparities

5.6. Gender disparities

- **Differential treatment** -> research indicates that there can be significant gender differences in the treatment and management of both CVD and diabetes. Women are often diagnosed later than men for certain types of heart diseases and might receive less aggressive treatment.

Resources:

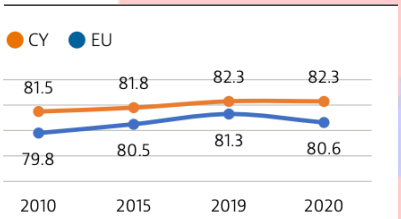
https://health.ec.europa.eu/system/files/2023-12/state_2023_synthesis-report_en.pdf
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10691195/#:~:text=Results,%E2%82%AC79%20billion%20(28%25)
https://www.oecd-ilibrary.org/docserver/health_glance_eur-2016-4-en.pdf?expires=1717682362&id=id&accname=guest&checksum=57AF0BC29EC1A9A90AFE5AD345337883

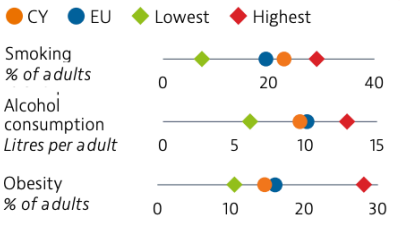
Cardiovascular diseases (CVD) and Diabetes in Cyprus

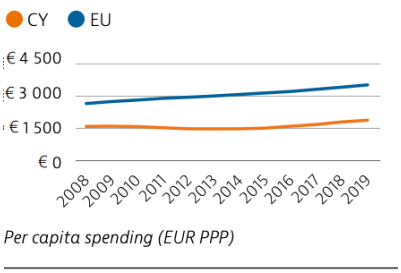
Introduction

Based on the **Cyprus Country Health Profile 2021 (https://health.ec.europa.eu/document/download/e2d79820-3de9-4ddb-a7b7-e58aff98576c_en?filename=2021_chp_cyprus_english.pdf)**, here is a summary focusing on the key aspects related to cardiovascular problems and diabetes in Cyprus:

Health Status and Key Risk Factors







Life Expectancy: Cyprus has a life expectancy of 82.3 years, which is above the EU average. However, the leading causes of death are circulatory diseases, cancer, and diabetes.

Circulatory Diseases: These account for about 30% of all deaths in Cyprus, with ischemic heart disease and strokes being the most prominent causes. Although mortality rates from circulatory diseases have been decreasing, these remain a critical health issue.

Diabetes: Diabetes is a major contributor to the country's mortality rate, causing approximately 5.7% of all deaths.

Risk Factors: Smoking, dietary risks, obesity, and physical inactivity are the primary contributors to cardiovascular diseases and diabetes. About 19% of deaths in Cyprus are attributable to smoking, while poor diet and low

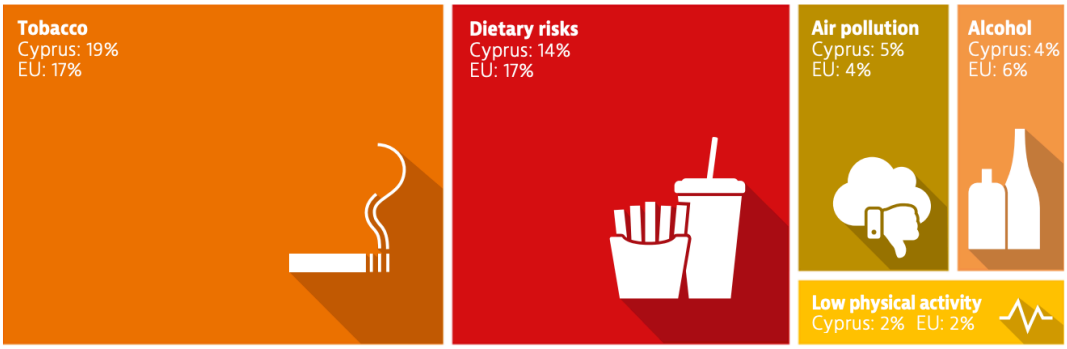
physical activity account for 14% and 2%, respectively.

Challenges and Health System Response

Childhood Obesity: Cyprus has one of the highest rates of childhood obesity in the EU, with 20% of children aged 6-9 years being obese. This is linked to poor diet and low physical activity, which are also risk factors for adult cardiovascular disease and diabetes.

Health System Reforms: Recent health system reforms aim to improve accessibility and affordability, addressing challenges like long waiting times and high out-of-pocket expenditures. These reforms should also facilitate better prevention and management of chronic diseases such as diabetes and cardiovascular conditions.

Figure 4. Tobacco and dietary risks are major contributors to mortality



Note: The overall number of deaths related to these risk factors is lower than the sum of each one taken individually, because the same death can be attributed to more than one risk factor. Dietary risks include 14 components such as low fruit and vegetable intake, and high sugar-sweetened beverages consumption. Air pollution refers to exposure to $PM_{2.5}$ and ozone.
Sources: IHME (2020), Global Health Data Exchange (estimates refer to 2019).

Public Health Interventions

Prevention Focus: Public health campaigns targeting smoking cessation, promoting physical activity, and encouraging adherence to a Mediterranean diet are crucial to reducing the incidence of these diseases.

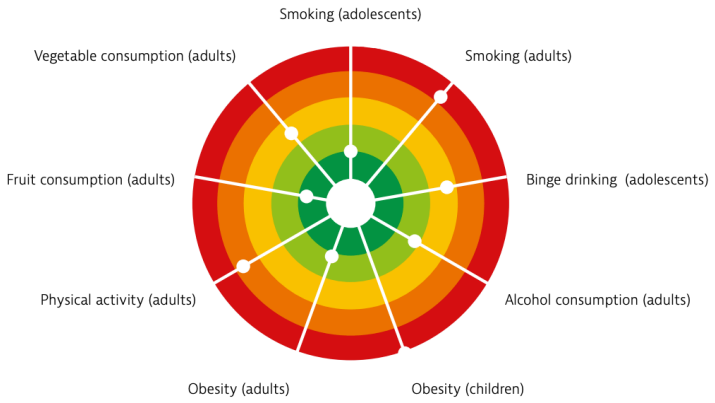
Diabetes and Cardiovascular Health: There is a need for more effective management and early diagnosis of diabetes and cardiovascular diseases to prevent complications and reduce mortality.

This profile highlights the need for targeted health policies in Cyprus that address lifestyle-related risk factors and improve healthcare access for managing chronic conditions like diabetes and cardiovascular diseases(2021_chp_cyprus_english).

ALso, the research titled "The Lifestyle Profile of Individuals with Cardiovascular and Endocrine Diseases in Cyprus" provides valuable insights into the health issues affecting the population of Cyprus, particularly in regards to cardiovascular diseases (CVD) and endocrine disorders like diabetes. These illnesses pose a significant public

health challenge on a global scale, but their impact in Cyprus is distinct due to the region's specific cultural, dietary, and lifestyle factors.

Figure 5. Smoking among adults and obesity among children are important public health issues in Cyprus



Note: The closer the dot is to the centre, the better the country performs compared to other EU countries. No country is in the white "target area" as there is room for progress in all countries in all areas.
Sources: OECD calculations based on ESPAD 2019 and COSI 2015-17 for children and adolescents indicators; and EHIS 2014, EHIS 2019 and national source for adults indicators

The concerning prevalence of CVD and endocrine diseases in Cyprus, even among younger individuals, demands immediate attention from healthcare professionals and public health authorities. The study uncovers numerous lifestyle factors strongly linked to these conditions, including physical inactivity, poor adherence to the Mediterranean diet, smoking, inadequate sleep quality, and obesity. Each of these factors plays a crucial role in the onset and progression of these health issues.

1. Sedentary behavior and its impact on cardiovascular health and endocrine diseases is a major concern highlighted in recent research. A significant portion of individuals with these conditions were found to be physically inactive, which was strongly associated with the prevalence of both diseases. The World Health Organization (WHO) has long stressed the importance of regular physical activity in preventing non-communicable diseases such as cardiovascular disease (CVD) and diabetes. In Cyprus, the sedentary lifestyle is influenced by various factors, including urbanization and increased reliance on motorized transportation. Of particular concern is the lack of physical activity among younger individuals, indicating a potential increase in chronic disease rates in the future. Urgent public health campaigns aimed at promoting physical activity, especially among the younger population, are crucial. Community-based programs that prioritize...

2. The Mediterranean diet is often hailed as one of the healthiest eating patterns worldwide, linked to reduced risks of cardiovascular disease, diabetes, and obesity. Surprisingly, despite Cyprus's location in the Mediterranean, individuals with cardiovascular and endocrine disorders display notably low adherence to this diet. This paradox raises compelling inquiries about the cultural and societal influences on dietary preferences. One possible rationale is the growing prevalence of Western dietary habits, marked by excessive consumption of processed foods, sugary drinks,

and red meat. These eating patterns are linked to elevated rates of obesity, insulin resistance, and cardiovascular ailments. The study's conclusions propose that public health initiatives in Cyprus should prioritize the promotion of the traditional Mediterranean diet, which emphasizes the consumption of fruits, vegetables, whole grains, and...

3. Gender Disparities and Smoking

This study sheds light on the notable gender disparities in smoking prevalence, with a higher likelihood of men indulging in smoking compared to women. Smoking is a widely recognized risk factor for cardiovascular disease and diabetes, particularly in younger males. The elevated rates of smoking among men in Cyprus mirror global patterns, underscoring the necessity for targeted smoking cessation initiatives to address this concern. Apart from heightening the risk of cardiovascular disease, smoking compounds the complications of diabetes by disrupting blood sugar regulation and amplifying the likelihood of adverse outcomes such as heart attacks and strokes. Given the robust link between smoking and chronic ailments, public health endeavors should prioritize reducing smoking rates through comprehensive cessation programs, public awareness drives, and policy measures like augmenting taxes on tobacco products.

4. Sleep Quality and Its Impact on Health

A striking discovery of the investigation is the strong link between inadequate sleep and the occurrence of cardiovascular and endocrine ailments. Inadequate sleep has been associated with a range of health issues, including high blood pressure, diabetes, and obesity. The research revealed that nearly 40% of subjects experienced poor sleep quality, and this was notably higher among those with cardiovascular and endocrine diseases. Sleep disorders, such as sleep apnea, are recognized to heighten the risk of high blood pressure and metabolic disorders. Substandard sleep quality can result in heightened stress levels, which, in turn, can raise blood pressure and contribute to insulin resistance. The findings propose that healthcare professionals should give greater consideration to sleep quality when evaluating patients at risk for cardiovascular and endocrine diseases. Measures aimed at enhancing sleep hygiene, such as stress management...

5. Obesity: An Escalating Concern The study also underscores the impact of obesity on the onset of both cardiovascular and endocrine disorders. Obesity serves as a significant risk factor for hypertension, diabetes, and heart disease, with the results indicating that individuals with a higher body mass index (BMI) faced a considerably elevated likelihood of experiencing these ailments. In Cyprus, as with numerous other nations, the increasing prevalence of obesity is intertwined with sedentary lifestyles and unhealthy dietary patterns. Tackling obesity necessitates a comprehensive approach encompassing the promotion of physical activity, the advocacy for

wholesome eating practices, and the provision of assistance for individuals striving to shed excess weight. Public health initiatives that center on the perils of obesity, alongside initiatives furnishing practical resources for weight management, have the potential to alleviate the burden of obesity-related illnesses in Cyprus.

Policy Implications for Public Health

The outcomes of this investigation carry substantial implications for public health policy in Cyprus. The elevated occurrence of cardiovascular and endocrine ailments, particularly among the younger populace, points to inadequacies in current preventive measures. To tackle this burgeoning health emergency, policymakers must execute all-encompassing actions that home in on the principal lifestyle elements pinpointed in the study.

- Advancement of Physical Activity: Expanding the availability of recreational facilities and establishing secure spaces for physical exercise in urban locales could serve to stimulate greater participation in routine physical activity.
- Nutritional Interventions: Public health campaigns that advocate for the advantages of the Mediterranean diet should be accorded precedence. These initiatives could be buttressed by endeavors to make nourishing foods more accessible and affordable, especially for individuals with limited financial means.
- Smoking Cessation Initiatives: Given the high prevalence of smoking among men, targeted interv entions tailored to address the specific obstacles encountered by smokers in Cyprus could aid in reducing smoking rates.
- Education on Sleep Hygiene: Enlightening the public about the significance of sleep for overall well-being could contribute to mitigating the occurrence of sleep-related health issues, particularly in connection to cardiovascular and endocrine disorders.
- Obesity Prevention Schemes: A nationwide approach to combat obesity, with an emphasis on both prevention and treatment, could assist in alleviating the enduring impact of chronic diseases in Cyprus.

Conclusion: The Path Forward

In summary, the research presents valuable insights into the lifestyle elements contributing to the high occurrence of cardiovascular and endocrine diseases in Cyprus. The results imply that prioritizing lifestyle interventions centered on diet, physical activity, smoking cessation, and sleep quality is crucial for enhancing public health outcomes. Additionally, addressing the escalating problem of obesity is vital for diminishing the risk of both cardiovascular and endocrine diseases in Cyprus. By enacting comprehensive public health policies that address these lifestyle factors, Cyprus has the potential to alleviate the burden of chronic diseases and enhance the overall health of its populace. Subsequent studies should focus on appraising the effectiveness of these interventions and investigating additional approaches for fostering enduring health behavior changes in the Cypriot community.

Kyprianidou, M., Panagiotakos, D., Makris, K.C., Kambanaros, M., Christophi, C.A., & Giannakou, K. (2022). The Lifestyle Profile of Individuals with

Report on Cardiovascular Problems in Bulgaria

Bulgaria faces serious issues with cardiovascular diseases, which are the leading cause of death in the country. According to the latest estimates, cardiovascular diseases (mainly strokes and ischemic heart diseases) accounted for 54.5% of deaths in Bulgaria in 2021 (The Sofia Globe). Strokes are particularly prevalent, representing 15.9% of all deaths, while ischemic heart disease accounts for 11.0% (Health Systems Observatory).

CDs & Ds in Bulgaria

Cardiovascular diseases (CVDs) and diabetes pose significant health challenges in Bulgaria, with lifestyle determinants playing a crucial role in their epidemiology. This report investigates the prevalence and impact of CVDs and diabetes in Bulgaria, focusing on lifestyle factors such as unhealthy diet, physical inactivity, overweight/obesity, tobacco and related product use, harmful alcohol consumption, and other potential determinants. By understanding these factors, policymakers and healthcare professionals can develop targeted interventions to mitigate the burden of these diseases in Bulgaria.

Cardiovascular diseases (CVDs) and diabetes represent major public health concerns globally and in Bulgaria. This section provides an overview of the prevalence and impact of CVDs and diabetes in Bulgaria, setting the stage for the discussion on lifestyle determinants.

Every fifth adult in Bulgaria has cardiovascular problems or diabetes. According to the World Population Review, in Bulgaria, 1,250 people for every 100,000 die each year from cardiovascular disease (CVD). CVDs, including coronary artery disease, stroke,

and heart failure, are major contributors to morbidity and mortality in Bulgaria. It's reported that nearly 60% of all deaths in Bulgaria are related to heart disease. In Bulgaria according to the statistics, around 500 000 have diabetes and 40% from the people don't know that they have diabetes.

Epidemiological trends - The epidemiology of CVDs and diabetes in Bulgaria shows concerning trends, including an increase in cases among younger populations, particularly those aged 30 to 40 years. These diseases are no longer solely affecting older adults but are also impacting younger individuals, suggesting a shift in disease patterns and risk factors.

Factors contributing to CVD and Diabetes are as follow:

- Neglect of these diseases by society.;
- Unhealthy lifestyle choices such as poor diet, lack of exercise, and smoking.

The lifestyle determinants are as unhealthy diet, physical Inactivity, overweight/obesity, tobacco and related product use, harmful consumption of alcohol.

Prevention:

- Implementation of public health campaigns to increase awareness about CVD and diabetes. (World Population Review)
- Encouraging healthier lifestyle choices, including regular exercise and a balanced diet. (Hospital Healthcare)
- Early screening and detection of risk factors. (Hospital Healthcare)
- Promoting access to healthcare services for early intervention and management. (Hospital Healthcare)

Good practices for prevention:

- Implementation of a National Prevention Program focusing on CVD and diabetes (National Program for Prevention). (Ministry of Health, Bulgaria)
- Increase access to preventive care and education about healthy lifestyle choices. (Ministry of Health, Bulgaria)
- Collaborative efforts between healthcare professionals, government agencies, and community organizations to address risk factors and provide support for those at risk. (Ministry of Health, Bulgaria)

Risk Factors

The main risk factors for cardiovascular diseases in Bulgaria include hypertension, smoking, obesity, high cholesterol, and diabetes (Novinite). In addition, air pollution is recognized as a rising risk for heart diseases (Novinite). Poor fruit and vegetable consumption, excessive salt use, and stress also negatively impact cardiovascular health (Novinite). While smoking rates have declined, the legacy of smoking still significantly affects the population's health, particularly in terms of lung cancer deaths (Health Systems Observatory).

Hospital Care and Statistics

Bulgaria holds the highest hospital discharge rate for cardiovascular patients in the EU, with over 3,000 discharges per 100,000 residents in 2021 (European Commission). At the same time, the average hospital stay for circulatory diseases in Bulgaria was 4.1 days, the shortest in the EU, indicating the need for more effective care and better healthcare infrastructure (European Commission). Cardiovascular deaths outside of hospitals remain a significant issue due to the lack of immediate medical care systems and defibrillators (Novinite).

Countermeasures and Strategies

To address cardiovascular diseases, regular monitoring of blood pressure and cholesterol levels is recommended, while annual cardiovascular check-ups are offered free of charge through national health programs (Novinite, Health Systems Observatory). Despite efforts to improve prevention, such as introducing hypertension and cholesterol control programs, the outcomes remain moderate, with the population continuing to experience high rates of cardiovascular diseases (The Sofia Globe, Novinite).

Conclusions and Recommendations

Bulgaria faces significant challenges in cardiovascular health, with high mortality rates and low-quality hospital care. Strengthening prevention programs and early diagnosis, as well as improving immediate medical care systems, are essential to reduce out-of-hospital deaths. Additionally, improving healthcare infrastructure and better managing risk factors like obesity and smoking could help improve the population's cardiovascular health.

Report on Cardiovascular Problems in Ukraine

Cardiovascular diseases (CVD) and diabetes are significant public health issues in Ukraine, with global implications. According to Ukraine's National Health Service, the country continues to face serious challenges with the high prevalence of non-communicable diseases (NCDs), such as cardiovascular diseases and type 2 diabetes.

Background and Challenges

As part of the global effort to reduce NCDs, Ukraine adopted the National Action Plan for Non-Communicable Diseases (2018), aligned with the UN's Sustainable Development Goals. The primary aim is to reduce premature mortality from cardiovascular diseases, cancer, diabetes, and respiratory diseases by one-third by 2030.

Key Goals of the Action Plan

The National Action Plan aims to:

- Reduce alcohol abuse by 10%.
- Decrease low physical activity by 10%.
- Cut salt consumption by 30%.
- Reduce tobacco use to 18.5% of the population aged 15 and older.
- Lower obesity and diabetes rates.
- Reduce road accident deaths by 25%.

Policy Implementation and Prevention Measures

Ukraine has undertaken various prevention and treatment programs to combat cardiovascular diseases and diabetes. One of the earliest was the "Diabetes" program (1998-2001), providing free medication to diabetes patients. Despite limited funding, this program yielded positive results. The "Stent for Life" program (2015) gives

patients with acute myocardial infarction access to immediate stenting treatment, improving survival rates.

The "Affordable Medicines" program, integrated into medical guarantees, allows patients with cardiovascular diseases, type 2 diabetes, and asthma to obtain medications for free or at a low cost. In 2021, approximately 2.1 million patients received medications through this program.

Physical Activity and Cardiovascular Health

Physical activity plays a crucial role in preventing cardiovascular diseases and diabetes. Lack of physical activity is associated with increased hypertension, diabetes, and obesity rates. Ukraine, by ensuring citizen participation in physical activity programs, strives to tackle these issues, recognizing that regular exercise reduces the risk of cardiovascular and other chronic diseases.

Conclusions and Future Prospects

Effective management and prevention of NCDs, such as cardiovascular diseases and diabetes, are essential to reducing premature mortality in Ukraine. Continuous efforts to improve legislation, reduce tobacco and alcohol use, promote healthy diets and physical activity are core strategies for achieving the goals of the National Action Plan. Through these policies, Ukraine aims to reduce the burden of chronic diseases and improve the population's health, despite challenges such as war and economic crises.

Report on Cardiovascular Problems in Greece

In general, the health status of the Greek population is good, with life expectancy higher than the European average. Since 2010, extensive health system reforms have been underway, including the strengthening and expansion of public primary healthcare services. There has also been a renewed focus on prevention and addressing risk factors through a new national public health plan. However, challenges remain in ensuring healthcare accessibility and affordability, particularly due to high direct private payments by patients and the effects of the pandemic.

Health Status

Life expectancy in Greece in 2020 was about half a year higher than the EU average, although it temporarily decreased by six months between 2019 and 2020 due to deaths from COVID-19. The leading causes of death in 2018 were ischemic heart disease, stroke, and lung cancer. Before the pandemic, much of the population perceived their health status as good, although Greek adults reported higher psychological distress compared to the EU average.

Risk Factors

One in four adults in Greece smokes daily, one of the highest rates in the EU. While smoking rates among 15-year-olds are lower than adults, the increasing popularity of e-cigarettes is a concern. Adult obesity rates are in line with the EU average, but childhood obesity is steadily rising. On the other hand, rates of occasional heavy drinking among adults in Greece are among the lowest in the EU.

Health System

Per capita health spending in Greece (€1,603) remains much lower than the EU average. This represents 7.8% of GDP, compared to 9.9% in the EU in 2019. Just under 60% of health expenditure in Greece is public, while a very large proportion (35%) is paid directly by households, primarily in the form of co-payments for medicines and out-of-pocket payments for services not covered by the public system.