CONTENTS

PROLOGUE

Telling tales

Once upon a time, in a land far, far away, was a beautiful country called Eden. And in this land was all the fresh water you could ever drink, all the fruit you could ever eat, all the creatures you could ever hunt and all the fish you could ever fish. The living was easy: the happy couple who lived there wanted for nothing. But, alas, it didn't last: Adam and Eve had to leave that beautiful garden and they, their children and their children's children had to work harder for a living in different, more hostile lands. That, at least, is how the ancient fable goes.

But modern science tells us that something similar did actually happen to the human race: we once lived in small tribes in wild, wide open spaces, walking, running, foraging and hunting, looking for food and water every day. We survived and procreated in tight tribal communities working with or fighting against natural forces that could as easily nurture us as destroy us. That's what our bodies and minds were designed to do, and that's exactly what we did for the first few million years of our ancient lives as 'hunter-gatherers'.

Uncivilised genes

But we have long left that Garden of Eden lifestyle, for today we live in towns with towering buildings, complex transport systems and high technologies. Modern urbanisation is a stunning development, a tribute to our remarkable resourcefulness, adaptability and great intelligence. But towns have only been around for less than 10,000 years, a very short time in the longer cycle of human evolution. By contrast, our ancestral hunter-gatherer regime sustained the human race for three million years or more – far longer than any other known civilisation or empire.

Beyond some relatively minor genetic variations, we have not, as yet, evolved anatomically to better accommodate to these new global urban conditions. Arguably, much of our mindset, emotions, instincts and intuitions are also largely unchanged. Subconsciously, a part of us believes we are still in Eden; physiologically we most certainly are. There is therefore a profound mismatch in the modern age between the urbanised world we are obliged to live in and the one we are genetically, metabolically, physiologically and psychologically better adapted for. Certainly most of us try to adapt culturally to town life: indeed, there are few other viable options. There has been a global expansion of urbanisation: cities are now the civilisation of the future. But

physiologically and psychologically, our genetic make-up remains much as it always was: uncivilised, un-urbanised and much misunderstood. That's not a derogatory comment about our Palaeolithic genome: it's just that urban life, in its present form, is not the environment we are genetically best adapted for. And just one of the direct consequences of this is the alarming rise in the prevalence of 'western lifestyle diseases' and conditions such as type 2 diabetes, sundry heart problems and rising obesity levels: it seems that towns are bad for us.

Building cities for humans

So how can we resolve this challenging conflict and make our own lives healthier and our urban lifestyles better? We cannot un-invent the 21st-century town, but by taking more notice of our Eden legacy, our ancient physiological and emotional roots, and by making good use of it on a daily basis, much could be improved. Various carrots, sticks, nudges and compromises that might be employed to effect such positive behavioural change are discussed in this book. If we could reshape our personal lives and the very fabric of our townscapes by basing the future on our shared past, then urban wellbeing will be significantly improved for all of us. We can't change our genes, but we can change our urban lifestyles to better fit our biology.

For the sake of our health and wellbeing, tomorrow's cities should be built for humans. And there is no time to delay, since by AD 2050, our global population will have risen from 7.2 billion to 9.6 billion (UN-DESA 2015). This book considers why and how we should be planning our modern towns and urban lifestyles, not so much for an uncertain future but on a proven prehistoric past. The better our cities are adapted to our uncivilised biology – the legacy of a lifestyle far older than urbanisation – the better we humans will adapt to them, and the healthier we will be. Our deep hunter-gatherer legacy – our Palaeolithic genome – still determines the quality of our health and much of how we instinctively think and respond, in spite of our new-found desire to be reasonable, logical and cost effective.

Chapter and verse

This book presents evidence-based research that suggests ways in which we can make a positive difference to modern life and town plans through developing and adopting more evolutionary-concordant behaviours and protocols. This book is *not* another celebrity-endorsed fad diet (although ancestral nutritional regimes are discussed in Chapters 4 and 5) and it is *not* another call to reject towns and seek solace in a rural idyll (although there is empathy

with those who are so inclined). It is also *not* a rejection of modernity in favour of an imagined past – on the contrary, we are solidly situated deep within the 21st-century city – but it does offer suggestions as to how urban living might be reconfigured from a human evolutionary perspective.

Our ancient but largely uncivilised genes are introduced in Chapter 1. Culturally, society has changed at a remarkable speed, but anatomically and genetically we remain much as we were long before towns developed or even large-scale farming was adopted (Stringer and Andrews 2011, 236–239). There is consequently an aggressive mismatch between our Palaeolithic genome and the demands of modern urbanised living. Nevertheless, a better understanding of our deep past can materially benefit ourselves and our cities. In this chapter, we also ponder health, happiness and human nature from genetic as well as cultural viewpoints. The differences between the social and evolutionary determinants of health are then debated, insofar as they relate to the seemingly unstoppable increase in western lifestyle diseases. Remarkably, many of these conditions seem to have been rare or non-existent in non-urbanised communities enjoying evolutionary-concordant diets, as the detailed study of the Kitava islanders of Papua New Guinea has shown (Lindeberg 2010). There is thus a high price to pay for ignoring our uncivilised genes, since they seem to hold the key to good health and urban wellbeing.

The scientific archaeological evidence underpinning studies of our long-lived hunter-gatherer lifestyle is laid out in Chapter 2. The undirected evolution of our modern, omnivorous, two-legged upright physiology is plotted – a development that took six million years – and key aspects of the lifestyles of our ancient pre-agricultural, pre-urban ancestors are described. These may be profitably compared with another data set in Chapter 3, studies of non-urban tribal societies that survived into the modern era in environments as diverse as Australia, Africa, South America and the Arctic. These summary reviews of what we now call 'hunter-gatherer' regimes are based on ethnographic and anthropological research.

The next set of chapters detail the evolutionary determinants of health, by taking a particular hunter-gatherer theme, contrasting it with modern urban perspectives and finally offering possible resolutions to the challenges revealed by that mismatch. To open the discussion, Chapters 4, 5, 6 and 7 look at the evolutionary determinants of health and studies of the relatively well-rehearsed (if often misrepresented) nutrition and activity regimes. Moving on to less familiar ground, Chapters 8, 9 and 10 deal with the evolutionary determinants of social behaviour, while Chapters 11, 12, 13, 14 and 15 deal with urban wellbeing from a human evolutionary perspective.

We begin in Chapter 4 by considering archaeological evidence for Palaeolithic and Mesolithic diets as well as data from non-urbanised, hunter-gatherer societies that survived into the modern era. Chapter 5 reviews key

common features of such regimes alongside modern 'western' diets and the diseases and conditions associated with them. Recent medical research is cited in support of the development of evolutionary-concordant nutritional regimes that better fit our unevolved digestive system.

Chapter 6 assesses the evolution of our ancient physiology and the physically active lifestyle of our ancestors. In Chapter 7 this is contrasted with the increasingly sedentary modern world, and suggestions are made for changing our lifestyle, buildings and town plans to better fit our bipedal physiology through the development of evolutionary-concordant activity regimes.

Attention turns to aspects of the hunter-gatherer mindset in Chapter 8, with a consideration of the psychology underpinning leadership and role models and the inclusive nature of ancient tribal societies. These often overlooked issues still resonate today in our huge, seemingly impersonal political conurbations and impact on the concepts of social hierarchy, community and neighbourhood, as well as social inclusion and exclusion.

Chapter 9 extends our study to the other aspects of modern life. For example, some forms of criminal activity, especially the urban gang, are shown to be an unwelcome perverse proxy for the hunting party. Evidence-based research is presented to show how some of its problems can be addressed head on through sport – for example, as in the Midnight Basketball project in the United States and the Kickz football programme in the UK. Both of these are positive, evolutionary-concordant approaches to such antisocial behaviour.

In Chapter 10 we consider how ancient societies communicated through body language, and particularly through rhythm and music, for identity, for emotion, for celebration and for memory. One of the evolutionary determinants of music – the evolution of the human voice box – can be shown to be earlier than the development of spoken language. Music is part of our resilient preliterate hunter-gatherer legacy, a welcome attribute of urban wellbeing in the computer age.

Hunter-gatherers lived in wild, wide open spaces, superficially the very antithesis of a modern town. However, our essential biophilia, the direct connection with 'nature', need not and should not be severed from city life, as research in Chapter 11 reports. A detailed discussion of the role and value of urban greenspace in its many forms is presented, viewed not just as passive one-dimensional landscaping but from deeper physiological and psychological viewpoints. Crucially, microbiological research by Professor Graham Rook and his team is summarised in Chapter 12 – work which has revolutionised our understanding of the active relationship in our physical engagement with the natural world. This concerns the microbiota we have co-evolved with as well as the workings (or, increasing today, the failings) of

our immune system. This paradigm-shifting work shows that parks and pets are just as important to our continuing good health as evolutionary-concordant diet and exercise regimes.

Taking the lessons learned thus far, the next chapters also break new ground, taking a summary look at town planning and urban wellbeing from a human evolutionary perspective. Chapter 13 considers how urban settlements have developed over the centuries from a public health standpoint, with the work of the Roman architect Vitruvius through to Sir Ebenezer Howard's garden cities, New Urbanism and the Healthy Cities movement.

This leads directly to Chapter 14. Here we can do no more than open a discussion on how modern town planning can effectively build on evolutionary-concordant principles to maximise urban wellbeing in the design of tomorrow's cities. The necessary impetus for this study is that a rising population of an extra three billion souls will have to be housed in new towns across the globe within the next 30 years. Among the many issues that must be addressed is the need for cleaner urban air, since our Palaeolithic respiratory systems still cannot cope with toxic fumes and diesel particulates. Some consideration is also given to modern residential buildings, on the importance of windows and rooms with a view, and on how office, schools and hospitals can be designed to be more evolutionary concordant, and thus more effective institutions.

In conclusion, Chapter 15 considers how we, although biologically still broadly Palaeolithic, can nevertheless adapt more successfully to an urbanised modern world. A series of guidelines, the 'Eden Protocol', are suggested, covering personal and institutional health behaviours as well as templates for building design and town planning. Here, the term 'Eden' is used as an abbreviation for the evolutionary determinants of health and urban wellbeing, while 'Protocol' is used to describe a series of suggested procedures designed to encourage evolutionary-concordant behaviour; they are just that, suggestions to open a new debate, and are not directives, regulations or statutes of the realm. Nevertheless, through the development and adoption of such protocols we might make a difference to 21st-century life by adopting ones that are more in tune with our basic physiology, psychology, metabolism and mindset.

This book therefore promotes the concept that human evolutionary concordance is the unifying paradigm underpinning not just personal wellbeing, but also institutional wellbeing and urban wellbeing. Our ancient and uncivilised genes have a real role to play in planning our modern urban futures. But to get there, we need some archaeology, anthropology, microbiology, neuroscience, evolutionary genetics, philosophy, nutritional science, psychology, crime science and common sense. And also an understanding of pets, architecture, town planning, gardening, football, shopping, picnics, bicycles, the sound of music and why there's nothing like an open fire.

Chapter 1

IN THE BEGINNING

This strange message Darwin brings,

… apes and men,

Blood-brethren.

Thomas Hardy (**1840–1928**)

Irreconcilable differences

What did the Romans ever do for us? One of their great cultural and social contributions was towns: they introduced us to the civilising concept of urbanisation. However, that came at a price, since study of their cemeteries in Britain shows that they also provided the first evidence in these islands for scurvy, rickets, osteomalacia, Reiter's syndrome, gout, ankylosing spondylitis, rheumatoid arthritis, psoriatic arthritis, septic arthritis, tuberculosis, osteitis, poliomyelitis and leprosy. None of these diseases or conditions were seen in the prehistoric, largely un-urbanised tribal populations that lived here before the Roman invasion of AD 43. So civilisation seems to have been a mixed blessing.

Today, most of us live in towns, but are modern cities any better for us? There is, unfortunately, clear evidence from the ever growing list of 'western lifestyle diseases' – the alarming increase in obesity, type 2 diabetes and cardiovascular problems to name but a few – that urban life even in the 21st century can actually be bad for our wellbeing. One of the key reasons is that so much of our current urban culture is not concordant with our ancient but largely unchanged basic biology. This evolved over many millennia to support a quite different lifestyle in a quite different environment. This book discusses that seemingly irreconcilable mismatch between modern urban living and our uncivilised genes but, in conclusion, it suggests solutions to this very real challenge.

For most of the long period of human evolution, a period of up to six million years, our race and their direct ancestors lived off the land and not in towns. We humans once shared a common ape-like ancestor with the chimpanzee. But some time between four and seven million years ago those two distinct lineages diverged. After that, over some 300,000 generations, the unique attributes of our human physical form gradually developed, including our upright posture and a larger brain size, as we entered the Old Stone

Age or Palaeolithic period (see e.g. Itan et al. 2010). For most of this time, we were foragers or hunter-gatherers, living off the land in small tribal societies, developing a working (if not always harmonious) relationship with nature. A particular part of our genetic make-up evolved over this long era to support that lifestyle. We have all inherited a complete set of those genes, a bundle of genetic material still encoded in our modern DNA, called here our 'Palaeolithic genome'.

The most significant cultural changes in this long period occurred just some 5,000 to 10,000 years ago, the period often called the Neolithic Revolution. This saw the development of widespread agriculture (large-scale plant and animal husbandry) and then, reliant upon the considerable surpluses produced, the establishment of towns, cities, states and empires. These new developments had a profound impact on all aspects of society, including its organisation and the ownership, acquisition and defence of land and territories. There was also a detrimental effect on human nutrition and health, evident in the bones of those early farmers and town dwellers, and still largely unresolved today. The physiology that had slowly evolved over some 300,000 generations to effectively husband and process the products of a daily hunting and gathering regime has only had about 300 generations to accommodate to the radically new world order. The marked contrast between the breakneck speed with which our urbanised culture is now developing and the glacial pace with which our biology responds to the new demands is producing huge pressure on our wellbeing.

Human nature?

What makes us do what we do, and why do we do it? There are at least four agents involved here: our genetic make-up, our genetic mindset, our culture and our reason. It is hard to estimate which is the greater driver of our daily lives. All four have a significant part to play, although their precedence will vary with time or circumstance. While both the latter two can and do alter each other, both are heavily influenced by the immutable force of the first pair, our genes.

To start with, our genetic make-up and mindset – that is, the physical and behavioural inheritance of our Palaeolithic genome. This dictates not just the colour of our eyes, hair, skin and such 'natural' talents as we may possess – features which vary from family to family – but also a common set of innate, instinctive, basic emotional responses, developed during the long evolutionary period when humans and their immediate ancestors were foragers. The instincts and attributes of our genetic behaviour were developed to facilitate survival and procreation in an uncertain world. They encompass our need for survival, for society, for fight or flight, a capacity for violence, a capacity for love. Many of them could be considered under the commonly

heard phrase 'human nature', but arguably might be better termed 'primate nature', since the origins of such attributes are rather older than humanity. They are acquired from our parents, who acquired them from their parents, ad infinitum, and that same genetically coded bundle will likewise be passed on to our children. Some strong emotions and drives are included in this package, still reflecting those survival instincts embedded in our deep past. They are neither right nor wrong, but in today's very different urban environment, some must be redirected by a moral or cultural compass.

This leads us to the next key influence on our lives, the culture we grew up in. This encompasses the family values we absorbed as children, whatever schooling we had, the social mores, customs, work ethic and lifestyles observed around us, together with the contemporary laws and religion, lapsed or otherwise. These influences are not imposed on a 'blank slate' of a mind, but on top of the instincts, intuition and emotional responses we were born with. All these cultural elements are thus not innate, but acquired part-consciously, part-unconsciously, during our lifetime. As such, they cannot be transmitted to the next generation through our genes, but they can still be passed on to our children, or indeed anybody else (depending on how receptive they choose to be), through education and through the almost universal ability of humans to imitate each other.

The biologist Richard Dawkins, however, has suggested that each concept we learn or adopt could, in the same way as genes, evolve in its own right as it is itself passed on and then replicated by its new host (Dawkins 1976). These units of culture have been termed 'memes', although there is still discussion about the precise definition. That ideas change as they are passed from person to person or from generation to generation is indisputable, but similarities with our current understanding of genetic development is arguably figurative.

Whatever the actual process of cultural transmission might be, it's clear that humans are social animals: living in herds and learning to ape what your successful neighbour does can have evolutionary advantages. But living together in large herds also requires traffic lights to avoid too many collisions, and thus city life needs the imposition of ground rules and regulations upon which such an ever-changing urban culture can evolve. And that brings us to our fourth and final factor, our reason – the human ability to think logically and widely, arguably the one and only measure that separates us from (most of) the animal kingdom. Our ability to think through scientific questions has enabled us to develop the technologies we depend upon, but daily take for granted: we invented the mathematics upon which it is all predicated. We also developed the languages that transmit information at all levels, from the mundane to the highly complex. In the multimedia world we inhabit today, we have ready access to information and ideas on an unprecedented scale.

For much of our daily life there may be little overt conflict between nature and nurture, between our genes and our culture: indeed there is considerable crossover. However, there are situations in which nature may pull in one direction, nurture in another. In theory, we should be able to use our superior brain power to moderate between the two, defining a prudent, socially acceptable, legally correct and morally defensible course of action. But do we? If we did, then brutal wars would never get started. Even at the most mundane level, given a choice of menu, do we select the most nutritious meal, the most attractive, the cheapest or the sweetest? In our 21st-century world, which speaks loudest: our reason, our culture or our Palaeolithic genome?

Genetically speaking, 'happiness' is best seen as part of nature's reward system, an endorphin-charged response to an activity or situation that our Palaeolithic genome regards as good for our survival: eating, socialising, mating and so forth. Alas, it is a system designed for a half-remembered past to sit beside other deep responses, such as fight or flight, survival instincts for an uncertain and unreasonable world. Today, overeating can still elicit the same psychological feel-good feeling in your mind during the meal itself, but this will subsequently be tempered by your Palaeolithic physiology's response to material it cannot sensibly digest.

It is therefore all too possible that our "cultural-inheritance system can run counter to the genetic one", if we develop a lifestyle that is "maladaptive from the biological reproductive success point of view" (Shennan 2003, 19) – that is to say, one that is bad for us from an evolutionary perspective. It is the central assertion of this book that many aspects of our currently evolving urban lifestyles are doing just that: running counter to the demands of our Palaeolithic genome and consequently offering no evolutionary advantages. This mismatch of genetics and culture can be resolved, however, as this book tries to show.

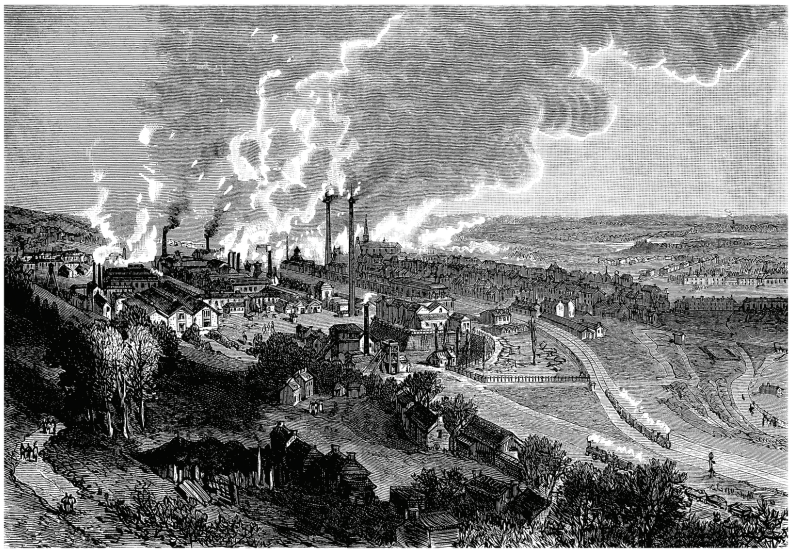
Urban wellbeing: social and evolutionary determinants of health

Complex social, cultural, political and economic factors all contribute to health or ill health in our modern urban societies. As Professor Sir Michael Marmot's social determinants of health initiatives have demonstrated, good health and enhanced wellbeing tends to improve with social class (Rydin et al. 2012, 1). Those living in the most deprived areas of a city such as Glasgow, for example, have a life expectancy that is 12 years shorter than their neighbours in more affluent districts. Addressing the social inequalities of health that people are born into remains a major concern, and still requires political, economic and cultural change (Marmot and Wilkinson 2006, 1).

It is not, however, just differing socio-economic status that leads to poor health. This was shown 60 years ago in a landmark study of London buses (or, rather, their crew) at a time long before one-person operated vehicles were the norm. In 1953, the bus driver would sit isolated and imprisoned in his cab all day. The conductor, by contrast, would move around the bus, up and down the stairs, working the upper deck as well as the lower, interacting with the passengers. For the purposes of the study, the drivers and conductors were all male, were all from the same social class and all worked the same routes. But there were alarming differences in their health profiles, with a significantly higher mortality rate and susceptibility to coronary heart disease among the drivers than the conductors. For example, the immediate mortality rate following a heart attack was twice as high for drivers as for conductors (Morris et al. 1953a, 1953b). Similar studies have been conducted in other countries at other dates but, alas, with similar results (Tse et al. 2006). Regardless of social class, daily exercise (or lack of it) is a key evolutionary determinant of health.

Our concern in this book is therefore with that more fundamental mismatch which exists between our Palaeolithic genome and modern urban living, between the artificially modified Anthropocene world we currently live in (Zalasiewicz et al. 2010; see also 'Brave new epoch', page 12) and the environments we are genetically, metabolically, physiologically and psychologically best adapted for (see e.g. Coward et al. 2015). It is on these related issues that the evolutionary determinants of health programme focuses: facing up to the challenge presented by the alarming rise in western lifestyle diseases and other associated problems. Unlike the social determinants of health, the immutable evolutionary determinants of health that we are all born with – such as the prime need for daily exercise – cannot be changed. It is our towns and urban lifestyles that must be changed instead.

Brave new epoch



Satanic mills: the Industrial Revolution in the 18th century not only transformed society, but also began irreversible changes to the global environment.

Scientists studying the deep past have divided the earth's development into broad eras, subdivided into geological periods, then epochs, then ages, all based on identifiable and significant observable changes in, for example, rock formations, glacial advances, global changes in temperature and sea levels. We humans are living at the very end of the Quaternary period: our direct ancestry can be traced back into the Miocene epoch (over 20 million years ago), through various ice ages into the Pliocene (*c.*3.5 million years ago) and Pleistocene (2.5–1.25 million years ago) and then into the Holocene.

But recent research suggests that we are now entering a new epoch called the Anthropocene. Unlike the previous stages in the earth's development, this time period is not defined by the natural forces and cycles of nature, but by the interference of humans in those cycles. A list of broadly simultaneous global 'markers' can be traced, such as increases in the fallout of particulates from burning fossil fuels and the substantial modification of carbon, nitrogen and phosphorus cycles; widespread changes in vegetation and accelerating rates of extinction of animal species; rates of sea-level rise and the extent of human influence in the

climate system, all significantly exceeding changes noted in the Late Holocene. The future does not look good: indeed a Doomsday scenario, variously termed the Anthropocene, Holocene or Sixth Extinction, has been proposed (Kolbert 2014).

Arguably, the origins of these profound developments might be traced back to the Neolithic period, which saw the beginnings of the movement towards greater population density, clearance of forests for agriculture and transformation of soils for cropping, not to mention the conscious selection of plants for intensive cultivation and animals for breeding stock (Fuller et al. 2015). That said, the developments associated with the increased urbanisation and the 18th-century Industrial Revolution most certainly made their indelible mark. The march of our urbanised civilisations has indeed changed the world, but not quite in the way that was once envisaged. To survive in this new epoch, humanity must now learn to better adapt, not just to urban life but to a changing world of its own making.

An urban advantage?

The so-called 'urban advantage' – the assumption that those living in towns have greater health benefits than their rural neighbours – should not be considered as a foregone conclusion: not only do "rich and poor still live in different epidemiological worlds even in the same city" (Rydin et al. 2012, 1), but different aspects of living (e.g. diet) might be demonstrably more 'healthy' in the country than in modern towns. Indeed, for the new urban populations in expanding 18th- and 19th-century western conurbations, outcomes such as average age at death or levels of infant mortality actually *increased* before sanitary conditions began improving in the later decades of that period. In theory, as income per capita rises, so too should life expectancy, based on a steady reduction in death rates as well as higher birth rates. But the global picture is rather more complex. Although stringent public health measures and much improved health services removed many of the initial scourges of city life, such as cholera and typhoid, those evils seem to have been replaced by an increasing catalogue of diseases and conditions whose presence and profile were far less significant in the previous era. Many of these new villains are a direct product of our current urban lifestyles – that is, they are largely part of a culture of our own making.

Support for such an assertion comes from the work of Dr Staffan Lindeberg and his detailed study of the population of Kitava, an unmodernised community on an isolated island in Papua New Guinea. The causes of death there seem to have excluded diseases and conditions such as coronary and stroke-related conditions, atherosclerosis, type 2 diabetes, obesity,