
REVIEW

How to become a centenarian in four weeks? Myths and limits of longevity recipes: a critical review

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ABSTRACT

This critical narrative review examines the widespread belief that exceptional longevity can be achieved through simple behavioral “recipes,” frequently promoted in media and commercial discourse. Drawing on research in demography, epidemiology, gerontology, and genetics, the article reassesses commonly cited determinants of extreme longevity, including nutrition, physical activity, social environment, psychological resilience, and genetic factors. Emphasis is placed on the analytical value of studying populations characterized by unusually high survival at advanced ages, commonly referred to as “longevity Blue Zones.” Whereas studies of individual centenarians provide only limited evidence linking specific behaviors to survival beyond age 100, population-level observation of validated longevity regions offers a complementary and especially informative framework. Analyses of these populations help identify long-term configurations of social, environmental, and behavioral conditions associated with exceptional survival. Recurrent features include lifelong moderate physical activity embedded in daily routines, relatively stable and frugal dietary patterns, dense family and community networks, and culturally embedded mechanisms of stress regulation and meaning. Although none of these factors alone determines extreme longevity, their sustained interaction across the life course appears to increase the probability of surviving to very advanced ages. The review underscores the importance of distinguishing determinants of healthy ageing from those of exceptional survival. Rather than proposing prescriptive formulas, the study of longevity populations provides a population-based observational model for identifying favorable life-course conditions that support extreme longevity. Such insights are valuable for promoting healthier ageing trajectories while acknowledging the multifactorial and probabilistic nature of survival to extreme ages.

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Introduction

At first glance, the very question sounds like a joke, perhaps more reminiscent of Belgian surrealism than of a serious scientific inquiry. The title of this review echoes hundreds of messages circulating daily in the media, on social

networks, and in popular books, where self-proclaimed “longevity experts” confidently promote recipes for extending life expectancy through supposedly simple behavioral changes, even up to 14 years according to Ricordi.¹

Amplified by mass media and digital platforms, such messages tend to obscure the com-

plexity of ageing processes and blur the distinction between scientifically grounded evidence, anecdotal observations, and marketing-driven assertions. Longevity is thus frequently portrayed as a product that can be engineered through standardized recipes, rather than as the outcome of intricate interactions among biological, environmental, social, and historical factors, along with an unavoidable degree of chance. In this crowded landscape, scientific findings, personal narratives, commercial interests, and wishful thinking often coexist without clear boundaries. The desire to live longer and healthier lives is both widespread and legitimate, and the search for factors promoting healthy ageing has mobilized researchers across numerous disciplines, including demography, gerontology, epidemiology, genetics, and the social sciences.

The scientific literature on extreme longevity, however, presents a far more complex and nuanced picture. For more than a century, researchers have attempted to identify common characteristics among those who reach 100 years of age or beyond. This effort has generated an impressive body of work, but also a proliferation of sometimes contradictory conclusions. Centenarians constitute an exceptionally selected subgroup of their birth cohorts. Their survival reflects not only favorable behaviors or environments, but also genetic predispositions, early-life conditions, cohort-specific exposures, chance events, and resilience to adversity.²

In this sense, centenarians occupy a paradoxical position. They are frequently portrayed as living embodiments of healthy lifestyles, yet their own life histories and narratives often diverge from prevailing public health recommendations. Many report behaviors that appear inconsistent with dominant models of “successful ageing,” including unconventional diets, limited engagement in preventive health behaviors, or life courses marked by hardship, deprivation, and stress. These apparent contradictions raise a fundamental question: to what extent can longevity be explained, or even prescribed, through simplified behavioral recipes based on a limited number of specific traits?

Addressing this question requires a clear distinction between individual longevity and

population longevity. This distinction is crucial because the behavioral recipes promoted in popular discourse are often presented not only as determinants of individual survival, but also as explanations for exceptional longevity observed in certain geographic areas commonly described as “Blue Zone.”³ While individual longevity focuses on exceptional persons, population longevity concerns the survival patterns of entire birth cohorts within defined geographic areas. An exceptionally long-lived population cannot be identified solely by the presence of a few very old individuals. Instead, it requires evidence that individuals born in a specific area have a significantly higher probability of reaching advanced ages than those born elsewhere. The “longevity Blue Zone” concept was developed precisely to operationalize this population-level perspective.

This article adopts a deliberately critical and reflexive approach. Rather than proposing yet another formula for achieving a longer lifespan, we review a wide range of individual factors commonly thought to contribute to extreme longevity, including nutritional patterns, physical activity, family environment, gender, social relationships, psychological resilience, and genetic background. The presumed impact of these factors is examined at three analytical levels: first in the literature on healthy ageing, second in research on individual centenarians worldwide, and third through empirical observations drawn from populations living in Blue Zones. Our aim is to highlight the limits of reductionist approaches to longevity and to question the widespread belief that reaching the age of 100 merely requires following a set of specific behavioral prescriptions.

This narrative review is based on a structured exploration of the literature using PubMed, Web of Science, and Scopus, focusing on studies addressing healthy ageing, centenarians, and population longevity. Priority was given to peer-reviewed reviews, large cohort studies, validated centenarian investigations, and demographic analyses. References were selected for methodological robustness and relevance to the conceptual distinction between healthspan and exceptional longevity.

The authors confirm that this article does not report any studies involving human participants conducted by the authors. The authors confirm

that this article does not report any studies involving embryos, gametes, and human embryonic stem cells conducted by the authors. The authors confirm that this article does not report any studies involving animals conducted by the authors.

Diet, healthspan, and the limits of nutritional determinism

Nutrition has acquired a central role in both scientific research and public discourse on healthy ageing. Diet is often presented as one of the most accessible and powerful levers for influencing the ageing process and extending life expectancy. Large-scale epidemiological studies consistently show that dietary patterns rich in fruits, vegetables, whole grains, and unsaturated fats, and low in ultra-processed foods and excessive red meat, are associated with lower risks of cardiovascular disease, cancer, and premature mortality.⁴ These associations translate into longer life expectancy and, importantly, into more years lived in good health.

Modelling studies reinforce this population-level perspective. Fadnes *et al.*⁵ estimate that a sustained shift from a typical Western diet toward healthier dietary patterns, initiated in early adulthood, could increase projected life expectancy by up to approximately ten years. While inherently model-dependent, such estimates illustrate the substantial impact of nutrition on population health and healthspan rather than on maximal lifespan.

Interventions such as caloric restriction and intermittent fasting further support this distinction. Experimental studies in animal models consistently show delayed ageing and lifespan extension.⁶ In humans, however, these interventions have not been shown to extend maximal lifespan; their documented benefits relate primarily to improved metabolic profiles and reduced cardiometabolic risk.^{7, 8} In other words, they contribute to healthier ageing rather than demonstrably increasing the probability of surviving to extreme ages.

Associations reported for specific foods and beverages illustrate the limits of causal inference. Moderate coffee consumption has been linked to modest gains in life expectancy at older

ages, largely through reductions in cardiovascular mortality.⁹ Moderate wine consumption has also been associated with reduced mortality in certain historical European cohorts and with longer life expectancy in some studies.¹⁰ However, once socio-economic status, lifestyle factors, and baseline health are carefully accounted for, many of these associations are attenuated or disappear.¹¹ Such dietary markers often capture broader social and behavioral profiles rather than exerting independent causal effects.

When attention shifts from healthy ageing to survival into extreme old age and centenarians, the evidentiary base becomes markedly weaker. To date, no prospective cohort study has demonstrated that adherence to a specific dietary pattern significantly increases the probability of becoming a centenarian. A systematic review by Poulsen *et al.* found no longitudinal study with sufficient duration and design to directly address this question.¹² Available evidence suggests that centenarians themselves report highly heterogeneous dietary histories, characterized more by moderation, frugality, and lifelong adaptation than by sustained adherence to any clearly defined “optimal” diet.

Studies focusing on individual centenarians indicate that exceptional longevity is associated less with strict dietary prescriptions than with long-term exposure to environments that avoided both chronic overnutrition and severe malnutrition. Reviews of centenarian populations show that available human data do not support a direct causal effect of intentional caloric restriction.^{13, 14} Rather, they point to lifelong dietary moderation and relatively stable eating habits embedded within specific social and economic contexts.

Cohort data further suggest that abstinence is not a systematic defining characteristic of centenarians. Lifetime alcohol consumption among cognitively healthy centenarians is often broadly comparable to that of their birth cohorts, indicating that moderate consumption is not incompatible with survival to extreme ages while not constituting an explanatory factor.¹⁵ Wine and coffee consumption therefore appear as ordinary, culturally embedded practices compatible with observed longevity but not interpretable as specific causal determinants.

Observations from Blue Zone populations lead to broadly convergent conclusions. Field investigations describe traditional diets characterized by low energy density, long-term stability, and embedding within favorable social and environmental contexts. In Okinawa, analyses have documented low caloric and protein intake, a predominantly plant-based diet, and lifelong low body mass index,¹⁶ while other work emphasizes the importance of macronutrient balance and long-term dietary patterns.¹⁷ Many of the oldest old in Okinawa also experienced prolonged periods of food scarcity and hardship earlier in life, underscoring the importance of resilience and lifelong adaptation rather than sustained dietary optimization.¹⁸

Across other Blue Zones, reviews highlight the absence of evidence for strict voluntary caloric restriction and instead point to recurrent frugality, traditional fasting practices, and chronically low exposure to overconsumption.^{19, 20} Contrary to popular representations, meat consumption was historically present in several longevity regions, though often in modest quantities.²¹ Claims regarding the universal superiority of vegetarian diets in these contexts remain weakly supported and often methodologically biased.²²

With respect to beverages, moderate wine consumption in Sardinia²³ and the widespread consumption of boiled Greek coffee in Ikaria,²⁴ sometimes associated with favorable cardiovascular profiles,²⁵ should be interpreted as culturally embedded practices compatible with longevity but not constituting isolated causal determinants.

Taken together, these findings underscore a fundamental distinction. Nutrition plays a major role in promoting healthy ageing and reducing the burden of chronic disease at the population level. However, evidence that diet alone determines survival to extreme ages remains limited and indirect. Neither epidemiological modelling, centenarian narratives, nor observations from Blue Zones support the existence of a universal dietary pathway to exceptional longevity.¹⁹

Physical activity: a determinant of ageing well, not of becoming a centenarian

Among lifestyle factors, the benefits of physical activity are among the most consistently and

robustly documented for healthy ageing. Regular physical activity improves cardiovascular, metabolic, musculoskeletal, and cognitive function, delays functional decline, and reduces the incidence of major chronic diseases.^{26, 27} Large prospective cohort studies and pooled analyses consistently report lower all-cause mortality and modest but reproducible gains in life expectancy, generally in the range of two to five additional years, associated with moderate levels of activity.²⁸

Critical reviews suggest that these gains may even be underestimated because physical activity favorably influences multiple risk factors simultaneously.²⁹ At the population level, the observed increases in life expectancy primarily reflect a reduction in premature mortality and a compression of morbidity rather than an extension of the maximum human lifespan. Physical activity therefore acts as a central determinant of how individuals age, extending both life expectancy and healthspan, while exerting limited influence on the upper boundary of human longevity. As with nutrition, the causal evidence is strong for healthier ageing but far weaker for survival into extreme old age.

When attention shifts specifically to centenarians, the evidentiary base becomes markedly thinner. Direct prospective evidence linking lifelong physical activity to the probability of reaching age 100 remains limited. Observational studies suggest that maintaining physical activity at very advanced ages is associated with a higher likelihood of surviving into very old age, but these associations are difficult to interpret causally. Physical activity levels often decline with age and may themselves reflect underlying health status, introducing potential reverse causation.³⁰

Studies focusing on centenarians indicate that physical activity at extreme ages is best interpreted as a marker of retained physical functioning rather than as a determinant of additional survival once extreme ages are reached. While maximal exercise capacity inevitably declines with ageing, continued engagement in low-intensity daily activities appears to support functional independence and quality of life among the oldest old.³¹ Recent research using accelerometry further shows that centenarian activity patterns

are typically low in intensity, fragmented, and poorly captured by standard adult measurement thresholds, reinforcing the need for age-appropriate metrics.³²

The Blue Zone framework provides a complementary population-level perspective. Across these regions, individuals who reach very advanced ages are typically exposed throughout the life course to continuous, moderate-intensity physical activity embedded in daily routines. This activity is rarely structured as formal exercise. Instead, it is associated with occupational demands, walking, domestic tasks, and local modes of transportation. Such patterns reflect broader social and environmental conditions rather than individual adherence to exercise regimens.³³ Walking emerges as a central modality across regions and has been consistently linked to favorable health outcomes across multiple physiological systems.³⁴

In some Blue Zone regions, exceptionally low levels of sedentary behavior have been observed among nonagenarians and centenarians, reflecting sustained engagement in daily activities shaped by terrain, occupational demands, and social organization.²⁴ In the Sardinian longevity area, differences in daily occupational roles and levels of lifelong physical activity between men and women have been proposed as partial explanations for reduced gender gaps in mortality at very advanced ages.³⁵ Ecological analyses further suggest that variations in physical activity between longevity regions and surrounding areas may reflect broader living conditions such as pastoralism, mountainous terrain, and long-term occupational structures rather than isolated behavioral choices.³⁶ In these contexts, sustained engagement in agriculture, animal husbandry, and outdoor activities across the life course may contribute to high levels of physical fitness well into advanced ages.³⁷

In Okinawa and Ikaria, high activity levels reported among the oldest old are often inferred from preserved functional capacity and self-reported activity, raising concerns about reverse causation.^{38, 39} In the Nicoya Peninsula, the initially observed male survival advantage appears to have weakened in parallel with rapid lifestyle changes, suggesting that physical activity oper-

ates as part of a broader constellation of favorable social and environmental conditions rather than as an isolated determinant.^{40, 41}

Across Blue Zones, physical activity therefore appears as a life-course marker of sustained functional engagement, interacting with walkable environments, occupational structures, social integration, diet, and biological robustness. As with nutrition, physical activity contributes decisively to ageing well and to reducing premature mortality at the population level. However, available evidence does not support the idea that any specific type or quantity of physical activity directly determines who will become a centenarian. Exceptional longevity appears instead to emerge from the cumulative interaction of multiple favorable conditions across the life course rather than from any single behavioral factor.

Marital status, household trajectories, gender, and survival to extreme ages

Marital status and related living arrangements have long been associated with differences in mortality and healthy ageing. A large demographic and epidemiological literature shows that married individuals, especially men, tend to experience lower mortality and better health outcomes than their unmarried counterparts.⁴²⁻⁴⁵ These advantages are commonly attributed to spousal support in daily functioning, regulation of health behaviors, emotional support, and economic stability. At the population level, marriage thus operates as a protective social institution that contributes to longer life expectancy and extended healthspan.

However, evidence increasingly suggests that living arrangements and household context may be more informative than marital status as a legal category. The health benefits associated with marriage appear to be mediated largely by actual co-residence, social support, and the availability of care rather than by marital status per se. This distinction becomes progressively more important as individuals age and household configurations diversify. Living arrangements in later life are often dynamic, shaped by widowhood, health deterioration, migration, and institutionalization. Residence in collective households such as nurs-

ing homes is frequently associated with higher mortality, partly reflecting selection processes related to frailty and health status.⁴⁶

When attention shifts to survival into extreme old age, the analytical focus changes further. Evidence from centenarian studies indicates that marital histories and household trajectories are more informative than marital status at a single point in time. Many centenarians have experienced widowhood decades before reaching age 100. Research on Belgian centenarians shows that both marital histories and household composition are associated with survival to extreme ages, but in complex and gendered ways.⁴⁷ Men appear to benefit from remaining married and co-residing with a spouse into advanced old age, likely through sustained spousal support in daily activities, health management, and social regulation. By contrast, women more often survive long periods of widowhood and may live alone at advanced ages without experiencing increased mortality. Male centenarians are also more likely to remarry, sometimes at very advanced ages and often with younger partners, potentially contributing to continued social and practical support. Other studies, including research on Chinese centenarians, indicate that not being married or living alone does not necessarily reduce the probability of reaching age 100.⁴⁸

Research on Blue Zone populations provides additional perspective. Comparative analyses of Sardinian and Ikarian longevity regions suggest that older adults in these areas are more likely to be married and co-residing with a spouse than in national comparison populations.⁴⁹ In some regions, living alone is less frequent, although strong family and community ties may compensate for solitary living arrangements.

Several Blue Zones display atypical sex ratios among centenarians, suggesting that local social environments may attenuate the usual male disadvantage in survival. In the Sardinian longevity region, for example, men reach extreme old age in proportions rarely observed elsewhere, with some villages approaching parity between male and female centenarians.³⁵ These patterns have been linked not only to biological factors but also to long-standing social arrangements and gender roles within family systems, including strong

spousal support provided by women across the life course.

Similarly, in the Nicoya Peninsula of Costa Rica, longitudinal analyses reveal a marked survival advantage among older men compared with the national population, resulting in a higher probability of reaching age 100.⁴⁰ These findings suggest that gendered pathways to exceptional longevity extend beyond individual behaviors to encompass family organization, gender roles, and community embeddedness. Recent attenuation of Nicoya's longevity advantage further indicates that such patterns are historically contingent and sensitive to social and demographic change.⁴⁰

Within Blue Zones more generally, the implications of marital status and living arrangements are shaped by dense family and community networks. Living alone does not necessarily imply social isolation. In Ikaria, for instance, older adults frequently maintain strong social ties, daily interactions, and active participation in community life even when residing alone.^{38, 50} Household composition must therefore be interpreted within a broader social ecology that includes proximity of kin, informal support, and community engagement.

Across healthy ageing populations, centenarian cohorts, and Blue Zone regions, available evidence converges on a central conclusion. Marital status and living arrangements influence survival primarily through their social meaning, functional implications, and gendered life-course trajectories rather than as isolated or universally protective factors. Exceptional longevity appears less dependent on any single household configuration than on the capacity of social environments to provide continuity, support, and autonomy across the life course.

Psychological resilience and survival to extreme ages

Beyond biological and behavioral determinants, psychological and existential dimensions have increasingly been recognized as plausible contributors to healthy ageing.⁵¹⁻⁵⁴ A substantial body of longitudinal research indicates that higher levels of mental well-being including life

satisfaction, optimism, emotional stability and resilience, but also religiosity are associated with reduced morbidity and lower mortality risk.⁵⁵⁻⁵⁸

In a synthesis of prospective studies, individuals reporting higher levels of happiness or life satisfaction tend to experience modest survival advantages compared with persistently unhappy individuals.⁵⁵ Importantly, happiness does not prevent disease in a deterministic way. Rather, it appears to function primarily as a protective resource, particularly among individuals who are already relatively healthy, by reducing chronic stress exposure and its downstream physiological consequences. Similarly, optimism has repeatedly been associated with lower mortality risk and higher odds of achieving exceptional longevity even after adjustment for socioeconomic status, baseline health, depressive symptoms, social integration, and health behaviors such as smoking, diet, and alcohol consumption.^{54, 56}

These findings support an interpretation in which positive psychological dispositions act as psychosocial resources that buffer vulnerability rather than as direct biological determinants. Mechanistic evidence increasingly points to stress-related pathways. Longitudinal analyses indicate that a stronger sense of purpose in life predicts lower allostatic load years later, suggesting that existential meaning may shape cumulative physiological stress across adulthood. Meta-analytic evidence further indicates that purpose in life is associated with lower perceived stress, providing a plausible link between meaning, emotional regulation, and long-term health.

Religiosity represents an additional pathway through which meaning, stress regulation, and resilience may converge. However, associations between religiosity and longevity vary substantially between populations. Some studies report positive associations between religious participation and survival, while others find weak or inconsistent relationships.⁵⁹ Overall, the effects of religiosity appear strongly context-dependent and mediated by social integration and cultural environment.

At very advanced ages, psychological resilience appears to play a particularly salient role. Many centenarians display relatively low levels of psychological distress and maintain emotional

stability despite physical decline and repeated exposure to loss.⁶⁰⁻⁶² This pattern does not imply the absence of adversity. On the contrary, many centenarians have lived through wars, famine, epidemics, economic hardship, and major social transformations. What appears to distinguish them is not immunity to stress but a capacity for adaptation.

Centenarians often describe hardship as a normal and manageable part of life, emphasizing acceptance, routine, and pragmatic coping strategies. Frequently reported strategies include maintaining daily routines, focusing on attainable pleasures, and selectively disengaging from stress-inducing situations.^{60, 63} These coping patterns may reduce chronic stress exposure and help preserve emotional balance at advanced ages.

Recent work has moved beyond broad personality traits toward more specific psychological resources. Studies have identified clusters of characteristics among healthy centenarians, including vitality, perceived control, intellectual engagement, positivity, and resilience.⁶⁴ Evidence on the relationship between resilience and functional capacity or cognitive status at extreme ages remains mixed, but resilient attitudes may support better adaptation to health limitations and life events.⁶⁵

Qualitative studies further suggest that religious belief and practice often facilitate coping, emotional regulation, and life satisfaction among centenarians, particularly in the face of bereavement and uncertainty.⁶⁶

These psychosocial dimensions are also evident in Blue Zone populations, where exceptional longevity is often interpreted as emerging from social and cultural ecosystems that foster both behavioral and psychological resources. Syntheses of the Blue Zone literature consistently identify stress resilience and a sense of purpose in life as recurring elements alongside family cohesion, social engagement, physical activity, and restorative sleep.²⁰

Empirical studies from Ikaria describe lifestyles characterized by strong social integration, slower daily rhythms, frequent social interaction, and restorative practices such as daytime napping, all compatible with effective stress regu-

lation and sustained engagement with life.^{38, 50} In the Sardinian longevity region, comparative studies show distinctive interrelations among life satisfaction, optimism, resilience, and religiosity among older adults, supporting the idea that culturally embedded meaning systems and coping styles contribute to ageing well.^{61, 62, 67} Research on centenarians in the Nicoya Peninsula further reports low prevalence of depression and preserved social functioning alongside mixed physical health profiles, providing a clinically grounded description of psychological and mental health at extreme ages.⁶⁸

Taken together, the evidence supports an integrative interpretation. Psychological resilience and purpose in life may reduce the cumulative costs of chronic stress, promote adaptive behaviors, and sustain social engagement across the life course. These dimensions do not act independently. Positive emotions and psychological resources interact with established behavioral factors such as physical activity, sleep, avoidance of risky substances, and social connection, functioning as additional protective factors.⁶⁹ While they may contribute to ageing well and to maintaining functional capacity at advanced ages, current evidence does not support the idea that specific psychological traits alone determine who will reach exceptional ages. Instead, they appear as components of broader life-course trajectories that shape resilience and survival probabilities without offering deterministic pathways to extreme longevity.

Genetic and epigenetic contributions to exceptional survival

Genetic and epigenetic factors are frequently invoked to explain variation in healthy ageing, often as residual explanations when behavioral or environmental determinants appear insufficient. A large body of demographic and biomedical research has sought to clarify the extent to which genetic influences shape ageing trajectories, survival to advanced ages, and the emergence of exceptional longevity.

At the level of healthy ageing in the general population, twin and family studies have consistently estimated the heritability of human lifes-

pan at roughly 20-30%, with genetic influences becoming more visible at advanced ages.⁷⁰ Familial clustering of longevity provides additional support, as siblings and offspring of long-lived individuals tend to experience delayed onset of chronic disease and lower mortality risks compared with the general population.^{71, 72} Nevertheless, the contribution of genetics to survival beyond average life expectancy remains moderate, probabilistic, and strongly context dependent.⁷³ This view is consistent with broader syntheses emphasizing that longevity results from the combined action of genetic predispositions and life-course environments rather than from either factor alone.^{74, 75}

At the molecular level, genome-wide association studies and candidate-gene approaches have identified numerous variants associated with lifespan variation, involving pathways linked to lipid metabolism, insulin and IGF-1 signaling, inflammation, DNA repair, and cellular stress responses.⁷⁶⁻⁷⁸ However, no single “longevity gene” has been identified. Even the most consistently replicated loci, such as APOE and FOXO3, show modest effect sizes, consistent with a polygenic architecture and strong gene-environment interactions.⁷⁹ Large meta-analyses confirm that many genetic variants contribute small individual effects while interacting with environmental exposures.⁸⁰ In this framework, genetics shapes interindividual differences in ageing trajectories and resilience rather than determining who will reach exceptional ages.

A key conceptual distinction concerns intrinsic longevity – linked to biological ageing processes – and survival influenced by extrinsic mortality conditions such as infections, accidents, or socio-economic environment. Traditional heritability estimates based on total mortality may underestimate genetic influences on intrinsic ageing because they include large extrinsic components. Recent modelling work suggests that when focusing specifically on intrinsic mortality, the heritability of lifespan may be substantially higher.⁸¹ This distinction helps reconcile moderate overall heritability estimates with stronger genetic effects observed among individuals who survive to very old ages.

Evidence from centenarian and supercentenar-

ian cohorts refines this picture further. Individuals surviving to age 100 and beyond represent a highly selected subset of their birth cohorts, and genetic influences may become more apparent at these extreme ages. Yet centenarians are not genetically free of disease-associated variants. Many carry alleles linked to cardiovascular disease or neurodegeneration at frequencies comparable to those observed in the general population.⁸² This suggests that exceptional longevity may depend less on the absence of genetic risk than on the presence of buffering or compensatory mechanisms that enhance resilience across the life course. Research in long-lived populations such as Okinawa similarly indicates that genetic variants associated with longevity operate within specific environmental and cultural contexts rather than acting as deterministic factors.⁸³

Recent genomic analyses have identified rare variants associated with extreme longevity⁸⁴ and new loci emerging from genome-wide association studies.⁸⁵ Other work has shown a depletion of deleterious mutations in centenarians, pointing to protective genetic mechanisms that may contribute to extended survival.⁷⁸ Taken together, these findings support the idea that genetic influences become more visible at extreme ages, particularly with respect to intrinsic ageing processes, while still operating within a broader framework of environmental and behavioral influences.

Epigenetic research provides additional insights. Studies using DNA-methylation-based epigenetic clocks suggest that many centenarians exhibit slower biological ageing than expected for their chronological age.⁸⁶ Some centenarians and their offspring display methylation profiles consistent with delayed ageing trajectories and enhanced physiological resilience. Epigenome-wide analyses have identified distinctive methylation patterns in genes related to immune regulation, stress responses, and metabolic pathways, consistent with the idea that exceptional longevity reflects an ability to maintain homeostatic balance across the life course.^{87, 88} At the same time, favorable epigenetic signatures may both contribute to survival and result from survival selection and lifelong environmental exposures.

These conclusions are directly relevant to the

interpretation of genetic findings in the Blue Zones. Despite frequent popular claims, available evidence does not support the existence of strong or unique genetic determinants underlying the high prevalence of exceptional longevity in these regions. In Sardinia, comparative analyses indicate that variants commonly associated with exceptional longevity are not consistently overrepresented relative to neighboring populations.⁴⁹ More recent work has not identified a distinct genetic signature specific to the Sardinian longevity region.⁸⁹ In Okinawa, associations between FOXO3 variants and longevity suggest involvement of general biological mechanisms rather than region-specific genetic profiles,⁹⁰ while earlier studies highlight the interaction between genetic predispositions and environmental conditions.⁹⁰ In the Nicoya Peninsula, a contribution of genetic ancestry to longevity has been proposed but appears closely intertwined with favorable early-life conditions, reduced lifetime stress exposure, and strong social organization.⁹¹

Across analytical levels, the literature converges on a consistent conclusion. Genetics modulates longevity but does not determine it. Its contribution appears stronger for intrinsic ageing processes than for survival shaped by extrinsic mortality conditions. Genetic and epigenetic factors help explain variation in resilience and ageing trajectories, but they operate within broader social and environmental contexts. Exceptional longevity emerges from the interaction of these factors across the life course rather than from any single genetic pathway.

Discussion and conclusions

The question posed in the title, “how to become a centenarian in four weeks?”, is intentionally provocative. The literature reviewed here justifies this provocation. Across domains as diverse as diet, physical activity, marital status and living arrangements, psychological resources, and genetics or epigenetics, a consistent pattern emerges: factors that robustly predict healthier ageing and reduced premature mortality do not automatically translate into factors that produce centenarians. Much of the popular and media discourse collapses this distinction, transform-

ing population-level risk reduction into individual-level promises and, in doing so, converting probabilistic science into prescriptive narratives.

At the population level, healthy lifestyles and favorable social environments are clearly associated with lower mortality, extended healthspan, and increased life expectancy. Nutritional quality, regular physical activity, social integration, and psychological well-being reduce the burden of chronic disease and delay functional decline. These associations are well established and provide a strong empirical foundation for preventive strategies in clinical and public health contexts. However, survival into extreme old age represents a distinct outcome shaped by strong survival selection processes and by cumulative exposures across the entire life course.

Centenarians therefore constitute a highly selected subgroup of their birth cohorts. At very advanced ages, heterogeneity in biological robustness, life histories, and adaptive capacity becomes pronounced, and the explanatory power of individual behavioral factors is substantially attenuated. Many characteristics frequently observed among centenarians – such as preserved mobility, independent living, or positive affect – are more likely to reflect underlying functional resilience than to act as direct causal determinants of further survival.

The Blue Zone framework provides a complementary population-level perspective on exceptional longevity. Longevity advantages observed in these populations illustrate how specific social and environmental configurations may increase the probability of surviving to very advanced ages. Across different Blue Zones, convergence is observed around lifelong moderate physical activity embedded in daily routines, relatively stable and frugal dietary patterns, dense family and community networks, and culturally embedded mechanisms of stress regulation and meaning. These features appear as interacting components rather than isolated determinants. Gender differences in exceptional longevity thus emerge not as fixed biological outcomes but as socially contingent processes unfolding over time.

However, lifestyle characteristics identified in Blue Zone populations should not be interpreted as universal prescriptions for reaching 100 years

of age. Longevity patterns in these regions are historically contingent and sensitive to demographic, economic, and epidemiological transitions. Genetic and epigenetic evidence further suggests that such patterns are not explained by unique population-specific genetic profiles but rather by interactions between biological predispositions and favorable social and environmental contexts.

Recent work on the spatiotemporal dynamics of longevity regions highlights the importance of continuous demographic validation. Longevity advantages may attenuate or disappear in response to rapid social and epidemiological change. This issue is explicitly raised in recent analyses questioning whether historically identified Blue Zones may be evolving or declining.⁹² Such analyses underscore the need for longitudinal reassessment of longevity hotspots and for caution when translating population-level observations into individual-level prescriptions.

From a translational perspective, initiatives inspired by observations in long-lived populations may be valuable when they focus on promoting healthier ageing rather than on attempting to reproduce exceptional longevity. Encouraging physical activity, social participation, balanced nutrition, and supportive environments can improve health outcomes and reduce premature mortality at the population level. One example is the Living Blue Zone initiative (www.livingbluezone.org), which explicitly positions itself as a platform for disseminating preventive lifestyle principles derived from population-level observations, without claiming to provide prescriptive pathways to centenarian status. The relevance of such initiatives lies in promoting healthier ageing trajectories and reducing premature mortality at the population level, while acknowledging that survival to extreme old age remains the outcome of long-term, cumulative, and largely non-modifiable processes.

Overall, the available evidence supports an integrative model in which behavioral factors primarily reduce premature mortality and extend healthspan, social and psychosocial resources shape resilience and stress regulation, genetic and epigenetic mechanisms modulate individual susceptibility, and stochastic events remain un-

avoidable, particularly at extreme ages. Exceptional longevity emerges from the cumulative interaction of these dimensions across the life course rather than from any short-term intervention or universal behavioral formula.

Limitations and future research

This review has several limitations. Most evidence related to exceptional longevity remains observational, and studies of centenarians are inherently affected by strong selection and survivorship biases. Consequently, findings cannot be generalized to typical ageing trajectories and should not be interpreted as actionable strategies for becoming a centenarian.

The strongest empirical evidence concerns determinants of premature mortality and healthy ageing rather than mechanisms leading specifically to survival at extreme ages. Although research on longevity and populations characterized by exceptional longevity has expanded rapidly, detailed prospective life-course studies and international comparative analyses using harmonized methodologies remain relatively scarce. Reconstruction of early-life exposures, migration histories, and cumulative social and biological stressors remains particularly challenging but essential for understanding the emergence of exceptional survival.

Beyond media exaggeration, the longevity field is increasingly influenced by the amplification of selective or weakly contextualized findings. Simplified messages about longevity determinants often circulate more widely than nuanced scientific conclusions. This environment can encourage overinterpretation and premature translation of complex evidence into individual-level recommendations. Greater methodological rigor and clearer communication of uncertainty are therefore needed.

Future research should prioritize rigorous demographic validation of centenarian datasets and long-lived populations, the development of harmonized international comparisons, and improved reconstruction of life-course exposures using administrative and historical records. Greater attention should also be given to age-appropriate measures of physical functioning, to the interaction between social environments and

biological resilience, and to gene-environment and epigenetic processes across the life course. Progress in the field will depend less on identifying single determinants of longevity than on clarifying how specific configurations of interacting factors contribute to exceptional survival under defined social and historical conditions.

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Both authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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Data availability

No data are available because this study did not generate any datasets.

Ethical approval

Both authors confirm that this article does not report any studies involving human participants conducted by the authors. Both authors confirm that this article does not report any studies involving embryos, gametes, and human embryonic stem cells conducted by the authors. Both authors confirm that this article does not report any studies involving animals conducted by the authors.

Authors' contributions

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