Risk factors related to population diversity and disparity determine healthy aging

Our study exposes the determinants of healthy aging in Latin America, underscoring the importance of the effects of social and health disparities compared with traditional factors such as age and sex. Our findings highlight an urgent need for more targeted detection of health risks, interventions and policies, particularly in low-income regions.

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The problem

Aging is a universal phenomenon, but it varies substantially owing to genetic and social factors. Despite considerable research on aging populations in the US and Europe, data on aging risk factors in Latin America have been largely overlooked. Given the socioeconomic and health disparities in these regions, the gap in knowledge poses an even more relevant problem, especially considering the high prevalence of dementia in the area, which is forecasted to increase by 150–220% by 2050[1]. This gap is further emphasized by universal models of dementia[2] and brain–phenotype associations[3] that may fail to generalize diverse populations. With the rapidly growing aging population in Latin America, understanding the determinants of healthy aging in this region is crucial for improving public health policy and interventions, thereby enhancing the quality of life for millions. We address this issue by offering comprehensive insights into the primary determinants of healthy aging in Latin America and highlight the pressing need for improved health services.

The discovery

We combined cross-sectional and longitudinal studies (44,394 participants), and analyzed data from several Latin American countries (Chile, Colombia, Costa Rica, Ecuador and Uruguay), using China for some comparisons. We integrated many social and health risk factors, including social determinants of health (SDH; that is, socioeconomic status, education and social isolation), lifestyle (smoking, physical activity and alcohol consumption), health (cardiometabolic factors such as diabetes and hypertension, and falls), mental health symptoms, and demographics (age and sex) to predict healthy aging (cognition and functional ability). The datasets also considered country-level income and were assessed using advanced statistical and machine-learning models. This robust data-driven analysis enabled us to identify complex determinants of healthy aging in Latin America.

Our analysis showed that SDH, physical activity, mental health conditions and cardiometabolic factors were significantly associated with cognition and functional ability but with nuanced variations among different countries (Fig. 1). Healthy aging was influenced by heterogeneous risk factors that were not universally applicable across various contexts. Notably, factors related to disparities in health and SDH (such as education, cardiometabolic conditions and social isolation) influenced cognition and functional ability in aging, had larger effect sizes than classical factors such as age and sex, and deviated from patterns observed in other regions in terms of the top risk factors and interactions between disparity-related risks. These effects were more pronounced in low-income nations (Colombia and Ecuador). The findings offer a comprehensive picture of the multi-level determinants of healthy aging in Latin America, highlighting the crucial need for region-specific, tailored interventions to effectively address healthy aging.

The implications

Our findings have broad implications for public health policies in Latin America. By understanding that factors such as socioeconomic disparities, physical activity and mental health play a crucial but variable part in healthy aging, governments can design and implement targeted interventions. These include improving socioeconomic structures, promoting healthy lifestyles, increasing national plans to control chronic health conditions, and fostering social participation among older adults. The findings can also guide other diverse regions with similar socioeconomic contexts, thereby contributing to improving the health and wellbeing of older populations globally.

Despite our study's strengths, it is important to acknowledge limitations. Our study is region-specific, which may limit the applicability to geographic areas with different socio-cultural contexts. Although our research identified associations in cross-sectional and longitudinal data, it does not establish causality. Further research is needed to confirm these findings and determine the pathways that link SDH and socioeconomic status, physical activity, mental health symptoms, chronic health conditions, and other disparity-related factors to the biological processes of healthy aging and dementia[4].

Future work involves connecting social and health disparities to changes at the biological level, with social epigenomics (how social experiences affect genes expression) and measures of allostatic overload (the cumulative burden of social and environmental stress)[5,6], to aid our understanding of biology–environment interactions. This research can encourage studies in various socio-cultural settings, improving brain health models and stimulating targeted strategies for promoting healthy aging.

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EXPERT OPINION

"The evaluation of the patterns of factors associated with healthy aging in Latin American countries is very interesting, as these factors are poorly studied in this region. Furthermore, the assessment of different socioeconomic levels within Latin America is original and may reveal factors related to inequality, even in more socio-economically developed areas within the region." **Raphael Machado Castilhos, Hospital de Clínicas de Porto Alegre, Porto Alegre, Brazil.**
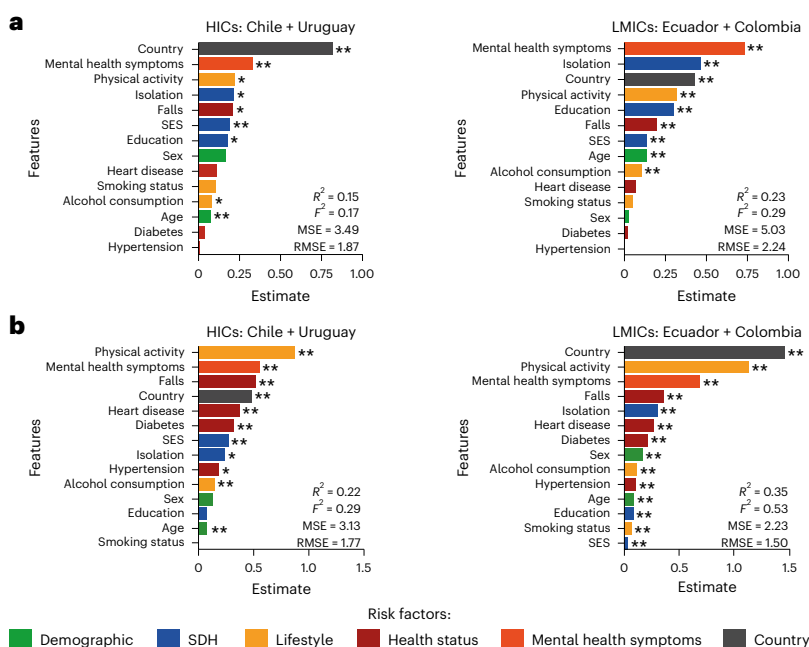
FIGURE

Fig. 1 | Study results. a,b, Results of risk factors associated with cognition (**a**) and functional ability (**b**) in the cross-sectional analyses. H, health; HIC, high-income country; LMIC, low-and-middle-income country; MSE, mean squared error; RMSE, root mean squared error; SES, socioeconomic status. *$P < 0.05$; **$P < 0.01$, two-sided Student's t-test. © 2023, Santamaria-Garcia, H. et al., CC BY 4.0.

BEHIND THE PAPER

For decades, brain health and aging have been understood using universal models, which often overlook the relevance and heterogeneity of diverse populations and socioeconomic disparities. Our research question arose from a determination to counter these longstanding norms. Securing funding and support was challenging, as the novelty of our approach raised eyebrows in traditional circles. Our research was based on global collaboration, bringing together minds from Latin America, the US and Ireland, which strengthened the diversity of our work. The most powerful moments were building large datasets and unveiling how deeply social and health disparities affect cognition and functionality, highlighting the need for tailored and socioeconomically informed models. We hope that in the future, social and health disparities will be systematically incorporated into the biological models[4] of brain health and disease. **A.I. & H.S.-G.**

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FROM THE EDITOR

"Populations in many Latin American areas are increasingly aging, but there is limited epidemiological evidence on the effects of risk factors associated with aging-related morbidity in the region. This study identifies combinations of risk factors (including social determinants of health, cardiometabolic factors and mental health symptoms) associated with aging in Latin American countries spanning different levels of socioeconomic development, which can inform region-specific public health initiatives to promote healthy aging." **Editorial Team, *Nature Medicine*.**