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MODERN ASPECTS OF PRINCIPLES FOR IMPROVING THE PREVENTION AND TREATMENT OF CARDIOVASCULAR DISEASES

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Abstract. The 2025 American Society for Preventive Cardiology meeting showcased new approaches to preventing cardiovascular disease, including risk models based on established risk factors, new biomarkers, innovative treatments, and advancements in digital health. Important topics of discussion included inflammation and lipoprotein(a) [Lp(a)] as causal risk factors, their clinical management, and preparedness for targeted therapies; the best systolic blood pressure targets based on recent RCTs; and the continuing controversy over apolipoprotein B versus low-density lipoprotein cholesterol (LDL-C) as the main lipid target. Digital health advancements focused on wearables' expanding importance, health equity in technology, and prevention using artificial intelligence. Sessions emphasized the importance of imaging in risk assessment, tracking treatment response, and improving preventative tactics, particularly for young adults. Women-specific risk factors and the shortcomings of existing risk prediction algorithms were highlighted in sessions on women's cardiovascular health. The use of polygenic risk scores in young individuals and methods for universal screening with LDL-C, hsCRP, and Lp(a) were also discussed. With a focus on stage-based risk assessment, early detection of subclinical disease, and focused therapies to avoid progression to symptomatic heart failure, heart failure prevention was identified as a crucial frontier. Renal denervation's safety, effectiveness, and longevity as an adjuvant treatment for resistant hypertension were confirmed by updates. When taken as a whole, these highlights show how quickly preventive cardiology is developing, incorporating new treatments, digital tools, and precise risk assessment into standard therapy.

Keywords. Prevention of cardiovascular disease; American Society for Preventive Cardiology; Women's health, cardiovascular risk factors, hypertension, lipoprotein (a)

Introduction. The 2025 American Society for Preventive Cardiology (ASPC) meeting, which drew over 600 attendees and featured over 50 eminent faculty speakers, was a significant event for the organization. 15 early-career professionals attended a special Training Academy to kick off the week, demonstrating ASPC's dedication to developing the future generation of preventive cardiology leaders. The program included a joint session with the European Atherosclerosis Society, the 4th Women's Cardiovascular Health Symposium, and, for the first time, live patient stories that added a fascinating personal aspect to the talks. Key highlights from ASPC 2025 are summarized in this review. These highlights include: (1) updated perspectives on lipoprotein(a) [Lp(a)] and inflammation as targets for emerging therapies; (2) expert insights on evolving blood pressure (BP) targets and the role of renal denervation; (3) debates presenting expert perspectives on apolipoprotein B (apoB) and low-density lipoprotein cholesterol (AI)-driven opportunistic prevention; (5) special considerations in cardiovascular risk assessment for women and younger adults; (6) the role of imaging and biomarker screening in contemporary prevention; and (7) heart failure (HF) prevention through stage-based risk stratification and targeted intervention [1-5].

When taken as a whole, these subjects show how quickly the field of preventive cardiology is changing, becoming more accurate, technologically advanced, and patient-focused. Globally, cardiovascular disease (CVD) continues to be the primary cause of morbidity and mortality. The worldwide burden of CVD is still high despite tremendous advancements in diagnosis and treatment, highlighting the critical need for more thorough and efficient preventative measures. The purpose of this narrative summary is to assess the existing cornerstones of cardiovascular prevention critically, point out areas where current methods fall short, and suggest possible future paths. The growing significance of non-traditional and emergent risk factors is examined, along with difficulties and obstacles in medication management and lifestyle adherence [6-11]. Future directions include integrating public health policies for population-level interventions, utilizing precision medicine to improve risk stratification, and optimizing the value of digital health to enhance patient involvement and adherence. In order to optimize cardiovascular prevention and ultimately lessen the worldwide burden of CVD, a multi-level strategy that combines therapeutic techniques with individualized solutions and environmental policies is needed. The fact that CVD is still a worldwide health issue emphasizes how inadequate or poorly executed current methods are. Even with the significant advancements and growing use of preventive cardiology in contemporary cardiovascular medicine, there are still significant gaps in the application of evidence-based therapy. Global inequality and healthcare system constraints continue to be significant obstacles, and more individualized treatments must to be put into place. As the great majority of ASCVDs are preventable due to modification of traditional risk factors, accurate prevention is essential to overcome the consequences of these diseases. However, unhealthy lifestyles and modifiable cardiovascular risk factors are nonetheless very common and frequently receive insufficient treatment [12-19]. Early CVD discovery or diagnosis, accurate risk stratification, tailored therapies, and ongoing evaluation to maximize long-term results should all be key components of successful CV prevention. Improved CV risk stratification and prompt implementation of preventive and therapeutic measures could result from the integration of emerging determinants and risk markers, such as genetics, circulating biomarkers, imaging, and environmental characteristics, supported by digital technologies and incorporating artificial intelligence (AI). When combined, these tactics increase the uptake of precision medicine and make it possible to incorporate innovative pharmacological medicines. To address the difficulties of people who are at risk or who already have CVD, care pathways and multidisciplinary methods throughout the continuum of CV prevention are crucial. In the near future, improving this strategy could change how CVD is perceived and treated. Thus, the purpose of this narrative summary is to look at the fundamental elements of CV prevention, identify the main gaps that still exist in current practice, and talk about promising directions that could direct future research goals and clinical application [20-29].

The main purpose of the presented manuscript is to provide a brief analysis of promising research on modern aspects of improving the principles of prevention and treatment of cardiovascular diseases based on the results of authoritative scientific works.

Search for Literature and Methodology. A structured search of the PubMed database was used to find pertinent literature for a narrative review, which focused mostly on research published in the recent ten years (1 January 2015 to 1 November 2025), with a special emphasis on evidence from the previous five years. Original research articles, narrative reviews, systematic reviews, meta-analyses, and opinion pieces judged relevant to the subject were all included in the search. Furthermore, the latest American and European clinical guidelines for cardiovascular (CV) prophylaxis were explicitly examined and incorporated into the analysis. Titles and abstracts were checked for relevancy after duplicates were eliminated, and then possibly acceptable publications

were evaluated in full. Backward citation searches and manual cross-referencing were used to find additional references as necessary. Current approaches to CV prevention, frequently used risk scores, lifestyle and pharmacological preventive strategies, traditional and overlooked CV risk factors, real-world obstacles and limitations in this field, potential future approaches, new directions, methodologies, and tools to improve CV prevention were among the primary topics of interest [3-13]. Since it is a narrative review, the literature was chosen and synthesized according to its applicability to the study's goals and the authors' critical evaluation of the available data. Terms pertaining to CV prevention (such as "cardiovascular prevention," "cardiovascular risk factors," "traditional cardiovascular risk factors," "neglected cardiovascular risk factors," "cardiovascular risk stratification," and "cardiovascular risk modifiers") were combined with terms pertaining to challenges and future directions (such as "gaps," "barriers," "limitations," "new tools," "challenges," "future directions," "digital tools," and "artificial intelligence").This study has inherent limitations because it is a narrative review. Its lack of a systematic technique for literature selection, in contrast to systematic reviews, may introduce selection bias and hinder reproducibility. However, in order to offer a thorough summary of present gaps and potential future approaches in CV prevention, studies were carefully chosen based on their relevance to the research aims and critically evaluated by the authors [14-22].

Myths, misconceptions, management, and new treatments for lipoprotein (a). An independent causative risk factor for calcific aortic valve stenosis and atherosclerotic cardiovascular disease (ASCVD), lipoprotein (a) [Lp(a)] is a genetically determined, highly atherogenic lipoprotein. Its inclusion into standard preventive cardiology testing is still uneven despite growing recognition, mostly because of enduring misconceptions about testing, interpretation, and clinical actionability in the absence of currently approved targeted treatments. A solid basis for the therapeutic value of assessing Lp(a) is provided by recent epidemiology research, Mendelian randomization analysis, developing randomized controlled trial data on new medicines, and updated international guidelines. All of these results demonstrate that Lp(a) evaluation is a crucial part of contemporary preventive cardiology rather than just an academic exercise. It promotes family screening, directs therapy intensity, informs thorough risk assessment, and prepares for the incorporation of new Lp(a)-lowering treatments that are presently in late-stage clinical development [2-8]. Modern suggestions are based on a number of principles. First, as 20% of adults have Lp(a) values linked to an increased risk of ASCVD or calcific AV stenosis, universal screening is becoming more and more recommended. Second, current results from population-based cohorts and clinical trials show increased intra-individual variability, enabling serial measurement in specific therapeutic circumstances, even though levels are mostly genetically fixed. Third, because apolipoprotein(a) [apo(a)] isoform size variation causes improper conversion between nmol/L and mg/dL, reliable Lp(a) evaluation needs molar units (nmol/L) utilizing standardized assays. Nonetheless, mass tests are typically dependable and applicable in the majority of clinical contexts. When combined, these ideas support the crucial role that Lp(a) measurement plays in contemporary preventive cardiology and refute antiquated beliefs that restrict its clinical application. Putting these suggestions into practice guarantees more precise risk assessment, permits focused preventative measures, and makes it easier for physicians to use cutting-edge Lp(a)-lowering treatments when they become accessible [11-21].

Heart failure prevention. The best therapy is still the only intervention that has an unrestricted impact on morbidity and mortality—prevention—despite advances in clinical science and the creation of successful treatments that have changed the natural history of heart failure. Studies conducted after the new HF staging system was implemented in 2002 revealed the startling

differences in outcomes across the spectrum, from people without risk factors to those with risk factors or asymptomatic left ventricular dysfunction to patients with symptomatic illness or frequent hospital stays. The size of these variations emphasizes how crucial prevention is to changing the course of HF. The crucial shift from asymptomatic to symptomatic ventricular failure has significant pathobiological ramifications for ventricular remodeling and neurohumoral activation. The actions required to stop the start of left ventricular dysfunction receive precedence because this is the most significant theorem addressing the progression of the disease. Since various tactics are relevant for Stage A (risk factors only) and Stage B (asymptomatic LV dysfunction), the confluence of preventative efforts with the stages of HF is crucial [6-16]. Theoretically, Stage B2, or asymptomatic LV dysfunction with risk augmentation, is as relevant and again suggests a different set of therapies, even though it is not formally included in the ACC/AHA hierarchal staging approach. Biomarkers, urinary albumin-to-creatinine ratio, global longitudinal strain by echocardiogram, early fibrosis by cMRI, and other known significant prognostic indications are examples of risk enhancers. The most significant contributor to heart failure among modifiable risk factors is hypertension. Numerous outcomes-based hypertension trials, most notably the seminal SPRINT study, showed that careful blood pressure control significantly reduced the incidence of heart failure in people at higher risk for cardiovascular disease. Patients with type II diabetes who receive sodium glucose co-transporter 2 inhibitors also see a nearly 30% reduction in the risk of heart failure. The opportunities for risk assessment, prediction, and intervention for Stages A and B now match the significant advancements in the therapy of all phenotypes of clinically symptomatic HF (Stage C & D). All doctors and other healthcare professionals should act without reluctance to prevent heart failure because it is a clinical reality [19-29].

Innovative Approaches and Prospects. Significant gaps still exist in the application of guidelines, risk communication, and fair access to care, despite notable advancements in CV prevention. A comprehensive strategy that incorporates patient-centered tactics, collaborative decision-making, and therapies customized to individual traits including sex, age, race, mental health, and socioeconomic background is needed to address these issues. Future research and practice must prioritize enhancing risk communication, promoting shared decision-making, optimizing screening techniques, and identifying successful mental health therapies within CV care. To improve early detection, tailor treatment, and increase long-term adherence, novel strategies are being investigated, such as genetic testing, sophisticated risk stratification techniques, digital health technology, and developing pharmaceutical and behavioral therapies. In order to maximize engagement and achieve significant reductions in disease burden, interventions must be tailored to individual circumstances. A static approach is unlikely to fulfill the multiple demands of persons at increased CV risk. the primary new approaches to improve CV prevention in the future. The effectiveness of these strategies depends critically on developing a structured shared decision-making process and boosting CV health literacy [12-23].

Discussion. CV prevention is changing as a result of the digital revolution, which presents previously unheard-of chances for patient-centered care, risk assessment, and early identification. Continuous remote monitoring of vital signs, physical activity, sleep patterns, and other behaviors is made possible by wearable technology, mobile health apps, and telemedicine platforms. This real-time data can help with prompt and customized therapies. Wearable technology, for instance, can continually track blood pressure, heart rate, or physical activity and immediately notify medical professionals if anomalous patterns are found, allowing for fast assessment and treatment. Otherwise, early detection of subclinical disease, such as asymptomatic atherosclerosis and vascular dysfunction, is made possible by digital instruments, which is essential for starting

preventative treatments. Crucially, these instruments can both lessen and worsen disparities in access to healthcare. While instructional initiatives in digital applications can enhance health literacy and encourage the adoption of lifestyle changes, telemedicine and mobile platforms can expand preventative treatments to underserved populations, including rural communities and low- and middle-income nations [6-12]. Digital solutions may improve patient engagement and promote long-lasting behavioral change by offering personalized feedback and interactive coaching, filling a crucial gap in preventative care. With medication classes like PCSK9 inhibitors and RNA-based treatments that provide strong reductions in LDL-C and other atherogenic lipoproteins, recent developments in pharmacotherapy have greatly broadened the toolset for CV prevention. Investigations into other novel therapeutic targets, including as Lp(a), chronic inflammation (e.g., IL-1 inhibitors), and gut microbiome regulation, may provide new ways to minimize residual CV risk outside of conventional lipid-lowering and blood pressure control. For instance, once licensed, Lp(a)-lowering treatments might be integrated into clinical pathways by giving priority to people who have been recognized as high-risk due to increased baseline Lp(a) levels, polygenic risk scores, or family history. This would allow for focused preventative interventions. Similar to this, biomarker profiling (such as hs-CRP) could be used to direct anti-inflammatory treatments in order to determine which individuals would benefit most from further treatment [14-22]. Telemedicine, community-based initiatives, and digital health technology provide ways to increase underprivileged people' access to preventative care. Free physical exercise programs, mobile health screening units, and public education campaigns are a few examples of community-based initiatives that can improve adherence to preventive behaviors, especially in rural or resource-constrained areas. For these advances to be implemented sustainably, governance, legal frameworks, and reimbursement plans are crucial. To synchronize plans, track effects, and scale successful interventions, international agencies, governments, and healthcare systems must collaborate globally. In the future, strategies that combine adaptive risk-reduction initiatives with precision public health could maximize CV prevention at the individual and population levels while resolving systemic injustices and resource constraints [23-29].

Conclusions. There are still gaps in the practical application of clinical guidelines, despite notable advancements in CV prevention. Promising opportunities for early identification, customized treatments, and improved adherence are presented by the integration of conventional and emergent risk factors with cutting-edge approaches, such as digital health, precision medicine, novel pharmacotherapies, and population-level interventions. Maximizing preventative outcomes requires removing obstacles at the system, clinician, and patient levels while also promoting shared decision-making and fair access to healthcare. CV prevention can advance toward a more accurate, inclusive, and globally impactful paradigm with the potential to lower the global burden of CVD by grounding these strategies within implementation science and health equality frameworks. The ASPC summit in 2025 marks a turning point in the field of preventive cardiology. Digital health tools, sophisticated imaging, and emerging biomarkers are enhancing risk assessment and directing customized interventions. When taken as a whole, these developments point to a time when everyone will have access to patient-centered cardiovascular care

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