

► TIME TO PERSONALIZE PREVENTION

Making Personalized Prevention a
European Life-Science Innovation Strategy





TIME TO PERSONALIZE PREVENTION

Making Personalized Prevention a European Life-Science Innovation Strategy

At the GTIPA Annual Summit in Warsaw, Pietro Paganini, President of Competere.eu, called for personalized prevention to become a priority for European health innovation. Speaking during the session “Policy to Drive Life-Science Innovation in Europe,” he outlined how this approach could help people stay healthier for longer while opening a new frontier for European life sciences.

Europe is entering an era of increasingly personalized medicine, yet prevention remains largely standardized. This mismatch is particularly evident in cardiometabolic health, where individual risk emerges from complex interactions among genetics, metabolic status, physical activity and fitness, nutrition, sleep, body composition, environmental exposures, and behavior.

Advances in artificial intelligence, wearable technologies, biomarkers, and longitudinal health data create an opportunity to move beyond episodic health assessment and population averages toward individual risk trajectories. The objective is not simply to collect more data, but to transform relevant signals into actionable intelligence that can support earlier and more adaptive interventions.

Personalized prevention should not replace population-level public health or medical treatment. It should complement them by extending the life-science ecosystem upstream: identifying risk earlier, adapting interventions to individual characteristics and responses, and connecting lifestyle, behavioral support, diagnostics, and treatment when necessary.

For Europe, this is not only a public health opportunity. It is an innovation policy challenge. Realizing its potential will require interoperable and responsibly governed data, scientifically robust validation pathways, and incentives that reward measurable risk reduction before disease develops.

Personalized prevention can become a distinctive component of Europe’s life-science innovation strategy, shifting the focus from treating disease alone to preserving health for longer.

Prevention Gets Personal – Policy Highlights

Advances in personalized medicine, artificial intelligence, wearable technologies, and biomarkers are creating new opportunities for prevention. For Europe, the policy challenge is to translate these advances into earlier risk identification, effective interventions, and measurable health benefits.

This shift highlights five strategic priorities for European health and life sciences policy:

- Medicine is becoming personalized. Prevention remains largely standardized. Population approaches identify average risks; personalized prevention can add individual trajectories.
- Cardiometabolic risk is multifactorial and dynamic. Genetics, metabolism, lifestyle, environment, and behavior interact differently across individuals and over time.
- AI, wearables, and biomarkers can move prevention from snapshots to trajectories. The goal is not more data, but actionable risk intelligence.
- Information alone is not prevention. Effective personalization must connect data with behavioral science and adaptive interventions: measure, predict, intervene, learn, and adapt.
- Europe has an innovation opportunity. Better data infrastructure, rigorous validation, and incentives for early risk reduction can make personalized prevention part of Europe's life-science strategy.

1. The Personalization Paradox

Life-science innovation is progressively moving toward the individual. Advances in genomics, biomarkers, diagnostics, and targeted therapies are allowing medicine to better identify differences between patients and, increasingly, to adapt treatment accordingly (Pearson TA et al., 2024; Giugni FR et al., 2024). Yet prevention remains largely built around population averages, broad risk categories, and standardized recommendations.

This approach has delivered important public health benefits and remains essential. Population-level evidence helps identify major risk factors, establish general recommendations, and design interventions capable of reaching millions of people. Personalized prevention should therefore not be understood as an alternative to population-based prevention, but as its next layer: adding individual risk and response to what we already know at the population level.

The need for this additional layer is particularly clear in cardiometabolic health. Cardiovascular disease, obesity, and type 2 diabetes are complex, multifactorial conditions. Their development reflects interactions among genetic predisposition, age, metabolic health, blood pressure, blood lipids, body composition, physical activity and cardiorespiratory fitness, diet, sleep, smoking, alcohol consumption, environmental exposures, and socioeconomic and behavioral factors. These factors do not occur in isolation, nor do they affect every individual in the same way (WHO, 2025).

Two individuals of the same age and with a similar body mass index may have substantially different metabolic profiles, fitness levels, lifestyles, and risk trajectories (Berry SE et al., 2020; Asnicar F et al., 2021). The same individual may also move between different levels of risk throughout life as biology, behavior, and environment change.

This complexity also cautions against treating broad food classifications as proxies for individual health outcomes. Categories such as ultra-processed foods encompass nutritionally and functionally heterogeneous products. For prevention, what matters is not classification alone, but how foods contribute to overall dietary quality, nutrient intake, portion, and frequency of consumption, as well as an individual's broader health and lifestyle context (SACN, 2023; SACN, 2025).

This creates a fundamental mismatch. **Risk is dynamic and individual, while much of prevention remains static and standardized.**

The objective is not to abandon general recommendations or to suggest that every established risk factor becomes relative to the individual. Smoking remains harmful; physical activity remains beneficial; hypertension remains a major cardiovascular risk factor. Personalization does not make established science disappear.

Rather, it asks a different question: how can population-level knowledge be translated into the most relevant, timely, and effective intervention for a particular individual?

This distinction matters for policy. Prevention strategies have traditionally been designed to shift risk across entire populations. The emerging opportunity is to complement them with tools capable of identifying how risk is evolving within individuals, potentially allowing intervention earlier, when behavioral and physiological trajectories may still be easier to modify.

**Medicine is becoming increasingly personalized.
Prevention should begin to do the same.**

The challenge for European life-science policy is therefore not to choose between population prevention and personalization. It is to build an ecosystem in which the two reinforce each other: population evidence defining what matters, and individual data helping determine for whom, when, and how to act.

2. From Snapshots to Individual Risk Trajectories

Prevention has traditionally relied on snapshots. A medical visit, a blood test, a blood pressure measurement, or a periodic risk assessment provides valuable information, but only at a particular moment in time. Between these encounters, much of what shapes cardiometabolic health remains largely invisible.

Human biology and behavior, however, are continuous. Physical activity, sedentary time, sleep, heart rate, recovery, diet, and other physiological and behavioral variables change from day to day and interact over time. Individual risk can therefore increasingly be understood as a trajectory rather than only as a fixed category.

Digital technologies are beginning to make parts of these trajectories observable. Wearable devices can already capture longitudinal information on movement, heart rate, sleep, and other physiological signals, while continuous glucose monitoring demonstrates how repeated measurements can reveal patterns that occasional testing may miss. Emerging wearable biosensors may eventually extend this capability to a wider range of biomarkers, although many remain at an early stage of clinical validation (Canfell OJ et al., 2024).

The significance of these technologies lies not in the devices themselves, but in the transition they enable: from episodic measurement to longitudinal understanding.

This distinction is critical. More data do not necessarily mean better prevention. Consumer wearables vary in accuracy, many measurements depend on proprietary algorithms, and data collected outside clinical settings can be noisy or difficult to interpret. Continuous molecular sensing faces additional challenges, including technical limitations, uncertain clinical relevance, and the need for validation across large and diverse populations.

.....

The objective should therefore not be continuous measurement for its own sake.

Rather, the opportunity is to identify which signals – and which changes in those signals – provide meaningful information about an individual's evolving risk (Pearson TA et al., 2024; Giugni FR et al., 2024).

Artificial intelligence can add another layer. By integrating heterogeneous and longitudinal datasets, computational models may help identify patterns that are difficult to recognize through isolated measurements. WHO increasingly recognizes the potential of AI and digital technologies to support data integration, prediction, and more responsive health systems, while also emphasizing governance, transparency, equity, and human oversight (WHO, 2021).

AI should therefore be understood as an augmentation tool, not a substitute for clinical judgment. Its value in prevention will depend on the quality of the underlying data, the robustness of the models, and their demonstrated ability to improve meaningful decisions and outcomes.

The fundamental shift is in the question we can ask.

Traditional assessment asks:

What is your risk today?

Longitudinal personalized prevention can increasingly ask:

Where is your risk heading?

This opens the possibility of detecting meaningful changes earlier and adapting interventions before conventional clinical thresholds are crossed.

The innovation is not the wearable.

The innovation is turning longitudinal data into actionable risk intelligence.

For European life-science innovation, the opportunity is therefore not simply to produce more devices or collect larger datasets. It is to develop scientifically validated systems capable of transforming continuous biological and behavioral information into earlier, better, and more individualized prevention.

3. From Data to Action

Knowing more about risk does not automatically make people healthier. This is one of the central challenges of prevention – and one of the reasons why simply providing more information often produces limited or uneven behavioral change (Canfell OJ et

al., 2024).

Human decision-making is not a purely rational process. Choices are influenced by habits, immediate rewards, emotions, social context, cognitive biases, environmental cues, and the effort required to act. Long-term health benefits must often compete with costs and rewards that are experienced immediately. Knowing that physical activity reduces future cardiovascular risk, for example, does not necessarily make exercising today easier.

This is where neuroscience and behavioral science become essential to personalized prevention. The objective should not simply be to provide individuals with increasingly detailed information about themselves, but to understand how information can be translated into achievable and sustained action.

Personalization can help bridge this gap. Instead of delivering the same recommendation to everyone, interventions can increasingly take account of individual risk, behavior, preferences, response, and context. The relevant intervention may involve physical activity, nutrition, sleep, smoking cessation, reduced sedentary time, stress management, or a combination of these. Importantly, personalization also means learning whether an intervention is working and adapting it when it is not.

This suggests a different model for prevention:

Measure ► Predict ► Intervene ► Learn ► Adapt

Measurement provides relevant biological and behavioral signals. Predictive tools help interpret how risk may be evolving. An intervention is selected according to the individual's needs and circumstances. The response is then observed, allowing the intervention to be adjusted over time.

The feedback loop matters because adherence is not a secondary issue. An intervention that is highly effective under controlled conditions has limited preventive value if people cannot or will not sustain it in everyday life. Personalized prevention should therefore consider not only what could work biologically, but also what can work behaviorally for a particular person (Canfell OJ et al., 2024).

Practicality also matters. Foods and formulated products that are convenient, affordable, accessible, portionable, or designed to meet specific nutritional needs may help some individuals translate dietary recommendations into everyday routines. Processing or formulation should therefore be evaluated in relation to nutritional quality, function, and individual context, rather than treated as a health outcome in itself.

Digital technologies may strengthen this feedback process by making progress more visible, providing timely prompts, and allowing interventions to respond to changing behavior. But they can also generate information overload, anxiety, disengagement, or excessive monitoring. More feedback is not necessarily better feedback. The quality,

.....

timing, and relevance of information matter.

This is also where responsible use of AI may become valuable. Rather than simply generating another score or alert, AI-enabled systems could help determine which information is relevant, when an intervention may be needed, and how recommendations should adapt to an individual's response. Such systems will require rigorous validation, transparency, and appropriate human oversight.

The purpose of personalization is not to tell people more. It is to help them act better.

For prevention policy, this changes the focus from information delivery alone toward adaptive support for individual agency. People remain responsible for their choices, but science and technology can make those choices more informed, relevant, and achievable.

Personalized prevention is therefore not simply a data revolution. It is a behavioral one: using better information, feedback, and adaptation to help individuals translate knowledge into sustainable action.

4. Personalized Prevention as a Continuum

Personalized prevention should not create a new divide between lifestyle and medicine. Prevention, early detection, and treatment are better understood as parts of the same continuum, with the intensity and nature of intervention adapting to an individual's risk, needs, and response over time.

For some individuals, changes in physical activity, nutrition, sleep, smoking, or other behaviors may be sufficient to meaningfully reduce risk. Others may benefit from more structured interventions, targeted nutritional supplementation where supported by individual needs and evidence, closer monitoring, or clinical support (Pokushalov E et al., 2024). For people at higher risk or with established disease, pharmacological treatment may be necessary. These options should not be viewed as competing approaches, but as different tools within an increasingly personalized strategy.

This is particularly relevant in cardiometabolic health. The rapid development of GLP-1 receptor agonists and related therapies has demonstrated the potential of biomedical innovation to change the management of obesity and cardiometabolic risk. Their emergence also illustrates why prevention and treatment should not be framed as opposing choices. Effective medicines can reduce risk and improve outcomes, while lifestyle and behavioral factors remain important before, during, and after pharmacological intervention (Lincoff AM et al., 2023).

Personalized prevention is not an alternative to medicine. It extends the life-science ecosystem upstream.

The objective is to intervene at the appropriate level and at the appropriate time. An individual at relatively low risk may primarily need information, environmental support, and sustainable lifestyle changes. A person whose biomarkers or risk trajectory begin to deteriorate may benefit from more targeted nutritional, behavioral, or clinical interventions. Higher-risk individuals may require diagnostics, medical supervision, and pharmacological treatment.

In this model, personalization does not mean maximizing intervention. It means matching intervention to need.

This principle is also important for nutritional strategies. General dietary recommendations provide a valuable foundation, but individual needs can differ according to age, physiological status, dietary patterns, activity levels, and specific nutritional requirements. Where evidence supports their use, fortified foods, formulated products, or targeted supplements can complement the diet and help address particular needs (Pokushalov E et al., 2024). Their value should be assessed according to evidence, nutritional function, and individual context rather than through assumptions that any single intervention is universally necessary or universally appropriate.

A personalized approach should also be dynamic. An intervention that is appropriate today may become unnecessary, insufficient, or inappropriate as an individual's circumstances and risk profile change. Continuous assessment and feedback can allow prevention to evolve accordingly.

The resulting continuum is therefore not a fixed sequence but an adaptive pathway:



Different individuals may enter this pathway at different points, move between them, or require several interventions simultaneously.

For life-science innovation, this broader understanding of prevention matters. Innovation should not begin only when disease has been diagnosed. It can occur across the continuum – in nutrition, diagnostics, digital tools, behavioral interventions, biomarkers, and medicines – wherever scientifically validated solutions help individuals preserve health or reduce risk.

**The objective is not more intervention.
It is earlier, better, and more appropriate intervention.**

5. Making Personalized Prevention a European Innovation Strategy

Personalized prevention is not only a public health opportunity. It is also a life-science innovation challenge, and potentially an area in which Europe can build distinctive capabilities.

Europe already possesses many of the necessary assets: strong research institutions, sophisticated healthcare systems, biomedical expertise, large and diverse populations, growing capabilities in artificial intelligence, and extensive health data. The challenge is less the absence of individual components than the difficulty of connecting them into an ecosystem capable of translating science into validated and scalable preventive solutions.

Three enabling conditions are particularly important: **data, validation, and incentives.**

Data: from fragmentation to responsible use

Personalized prevention depends on the ability to understand change over time. This requires high-quality data and, increasingly, the responsible combination of different sources: clinical records, laboratory results, biomarkers, and, where relevant, patient-generated physiological and behavioral data.

The European Health Data Space (EHDS), established by Regulation (EU) 2025/327, creates an important framework for improving the availability and use of health data across the European Union (European Parliament and Council, 2025). Its success should ultimately be judged not only by how much data can be accessed, but by whether those data can support better research, innovation, and health outcomes while maintaining strong protections for privacy, security, and individual rights.

Europe should avoid a false choice between data protection and innovation. Both are necessary.

The policy objective should be trusted data use, not simply more data or less regulation.

Interoperability will be particularly important. Personalized prevention becomes far less useful if clinical information, validated biomarkers and relevant longitudinal data remain trapped in separate systems that cannot communicate.

Validation: evidence before scale

The rapid expansion of digital health also creates a second challenge. Not every wearable measurement is clinically meaningful. Not every algorithm predicts risk reliably. Not every personalized recommendation improves outcomes. Europe should therefore maintain demanding standards of evidence.

At the same time, scientific rigor should not become synonymous with regulatory paralysis. Innovators need pathways through which new approaches can be tested, compared, validated, and, when evidence supports them, scaled across healthcare systems.

This is especially important for AI-enabled prevention, where performance may depend on the quality and representativeness of training data and where models need to be evaluated across different populations and real-world settings (WHO, 2021).

A useful principle for European policy is:

Experiment ► Validate ► Scale.

The objective should be neither permissionless innovation nor precaution by default, but an environment in which credible evidence determines which innovations progress.

Incentives: creating value before disease

The third challenge may be the most difficult. Healthcare systems are generally structured around identifiable interventions and existing conditions. They can reimburse a medicine, procedure, diagnostic test, or hospital episode because the intervention and its immediate purpose are visible.

Prevention often operates across longer time horizons. The benefit of an intervention today may be a cardiovascular event that does not occur years later. This creates a fundamental economic problem: who invests today, who captures the benefit tomorrow, and how should that value be measured?

If personalized prevention is expected to generate innovation, payment and incentive systems will need to recognize credible reductions in risk, improvements in adherence, and better health outcomes before advanced disease develops.

.....

If we want innovation in prevention, someone must have an incentive to innovate before the patient becomes sick.

This does not mean paying for every preventive technology or surrogate claim. On the contrary, incentives should be linked to evidence and measurable value. But without mechanisms that reward successful early intervention, innovation will naturally continue to concentrate where healthcare systems already recognize and reimburse value.

From catching up to leading

European debates about life-science competitiveness frequently focus on closing gaps with the United States in biotechnology, investment, commercialization, and scale. These gaps matter and require attention.

But catching up should not be Europe's only ambition.

Personalized prevention offers a field in which European strengths in biomedical science, healthcare, data governance, and emerging AI capabilities could be combined into a distinctive innovation ecosystem (Pearson TA et al., 2024; Giugni FR et al., 2024).

Doing so will require policy to connect areas that are still too often treated separately: public health, healthcare, nutrition, digital technologies, behavioral science, and life sciences.

The opportunity is therefore broader than developing better preventive tools. It is to create an environment in which scientifically validated innovation can move upstream – from treating established disease toward identifying and reducing risk earlier.

Personalized prevention should not be seen only as a public-health strategy. It can become a European life-science innovation strategy.

Conclusion: Time to Personalize Prevention

Life-science innovation has transformed our ability to understand and treat disease. The next opportunity is to apply the same ambition earlier, before risk becomes disease and before individuals become patients.

This does not require abandoning population-level prevention. General recommendations and established risk factors remain fundamental. But they can increasingly be complemented by a more dynamic understanding of the individual: how risk develops, how behavior changes, how interventions work, and how people respond over time.

The direction is clear:

From snapshots to trajectories.

From population averages to individual risk.

From information to adaptive intervention.

From treating disease to preserving health.

AI, wearables, biomarkers, and digital technologies can help enable this transition, but technology alone is not the answer. Personalized prevention will succeed only if better data are translated into meaningful action, interventions are scientifically validated, individual agency is strengthened, and incentives reward measurable improvements in health and reductions in risk.

Europe has many of the scientific, technological, and healthcare assets required to lead this transition. The policy challenge is to connect them.

The ambition should not be to predict everything, monitor everyone, or personalize every decision. It should be simpler: to intervene earlier, better, and more appropriately when evidence shows that doing so can improve health.

Medicine is becoming increasingly personalized. It is time to personalize prevention. And ultimately, the measure of success should not only be how effectively we treat disease or how many years we add to life.

It should be how many of those years people can live in better health.

.....

Bibliography

- Asnicar F, Berry SE, Valdes AM, et al. Microbiome connections with host metabolism and habitual diet from 1,098 deeply phenotyped individuals. *Nature Medicine*. 2021;27:321–332.
- Berry SE, Valdes AM, Drew DA, et al. Human postprandial responses to food and potential for precision nutrition. *Nature Medicine*. 2020;26:964–973.
- Canfell OJ, et al. Consumer Health Informatics to Advance Precision Prevention. *Yearbook of Medical Informatics*. 2024.
- European Parliament and Council. Regulation (EU) 2025/327 on the European Health Data Space. 2025.
- Giugni FR, Berry JD, Khera A, et al. Precision Medicine for Cardiovascular Prevention and Population Health: A Bridge Too Far? *Circulation*. 2024;150(21):1720–1731.
- Lincoff AM, Brown-Frandsen K, Colhoun HM, et al. Semaglutide and Cardiovascular Outcomes in Obesity without Diabetes. *New England Journal of Medicine*. 2023;389:2221–2232.
- Pearson TA, Vitalis D, Pratt C, et al. The Science of Precision Prevention: Research Opportunities and Clinical Applications to Reduce Cardiovascular Health Disparities. *JACC Advances*. 2024;3(1):100759.
- Pokushalov E, Ponomarenko A, Shrainer E, et al. Biomarker-Guided Dietary Supplementation: A Narrative Review of Precision in Personalized Nutrition. *Nutrients*. 2024;16(23):4033.
- Scientific Advisory Committee on Nutrition (SACN). Statement on Processed Foods and Health. UK Government; 2023.
- Scientific Advisory Committee on Nutrition (SACN). Processed Foods and Health: Rapid Evidence Update. UK Government; 2025.
- World Health Organization. Ethics and Governance of Artificial Intelligence for Health: WHO Guidance. Geneva: WHO; 2021.