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From one-size-fits-all treatments to personalised care: the revolution in precision medicine

The new AIFA report examines the clinical and economic impact of targeted therapies and prescriptomics

Medicine is undergoing a profound transformation: we are moving away from a standardised approach based on the 'average patient' towards a person-centred model capable of tailoring diagnoses and treatments to the genetic, clinical and environmental characteristics of each individual. This is the paradigm of precision medicine, which forms the focus of the AIFA report, analysing the impact of this evolution on both clinical practice and sustainability of the National Health Service.

Over the last twenty years, advances in genomics and digital technologies have highlighted a limitation of traditional medicine: patients with the same condition can respond very differently to the same treatment. This has given rise to the need for a more targeted approach, capable of identifying the most effective treatment for each individual, thereby avoiding unnecessary or potentially harmful therapies.

In clinical practice, this model is implemented through the use of innovative tools: genomics and pharmacogenomics enable the analysis of DNA to identify variants that influence the response to drugs; transcriptomics, proteomics and metabolomics allow us to observe the biological activity of cellular systems; epigenetics studies changes linked to the environment and lifestyle; whilst bioinformatics and artificial intelligence integrate large amounts of data to support clinical decision-making. Thanks to these technologies, it is possible to predict drug responses, identify patients at risk of side effects and select targeted treatments based on the molecular characteristics of the disease.

"*Precision medicine is not a luxury for the few, but a right for everyone,*" emphasises **AIFA President Robert Nisticò**. "*It is the most ethical and effective way to treat patients, because it avoids unnecessary treatments and truly puts the individual at the centre*."
This shift is particularly significant in Italy, one of the countries with the highest life expectancy in the world. An ageing population leads to an increase in chronic conditions and so-called polypharmacy. Living with multiple conditions means having to take more medicines and it represents one of the main clinical and social challenges of our time: 68% of those over 65 are prescribed at least five different medicines, and 28.5% take ten or more.

This situation exponentially increases the risk of drug interactions, treatment errors and adverse reactions, but it also has a significant social impact: it reduces the independence of older people, complicates the lives of carers and generates direct and indirect costs for the healthcare system. The so-called 'cascading prescribing' is a real risk: a drug is prescribed to treat a side effect caused

by another, triggering a vicious circle that leads the patient to take an increasing number of medicines.

"*We can no longer allow polypharmacy to become a burden for the elderly*," Nisticò points out. "*The challenge is to prescribe better, not more, by using genetic and clinical information to avoid unnecessary risks*."

This is where prescriptomics comes in, a discipline that applies the principles of precision medicine to the management of drug therapies, with the aim of optimising prescriptions and reducing drug interactions.
"*Prescriptomics is the bridge between genetic knowledge and everyday clinical practice,*" adds Nisticò. "*It means moving beyond trial-and-error medicine and offering safer treatments, especially to the most vulnerable patients*."

One area where this revolution is already a reality is oncology. For decades, chemotherapy has been the mainstay of cancer treatment, indiscriminately targeting both cancerous and healthy cells, with significant side effects. Targeted therapies, on the other hand, recognise and block specific molecular mechanisms in cancer cells, making them more selective and generally better tolerated.

The main categories of targeted cancer drugs include:

- Tyrosine kinase inhibitors (TKIs): these work by blocking enzymes that are essential for tumour growth. They have revolutionised the treatment of certain leukaemias and are used in lung and gastrointestinal cancers.
- Monoclonal antibodies: molecules designed to recognise specific targets on cancer cells. Anti-HER2 drugs, for example, have changed the prognosis for HER2-positive breast cancer.
- Immunotherapies: drugs that activate the immune system against the tumour, such as immune checkpoint inhibitors, now used in numerous advanced cancers.
- Antibody-drug conjugates (ADCs): these combine monoclonal antibodies with cytotoxic agents, delivering the drug directly to tumour cells and reducing the impact on healthy tissue.
- Therapeutic vaccines: still in development, these aim to train the immune system to recognise and selectively target tumour cells.

Biomarkers play a central role: in order to select the most effective treatment, knowing the tumour location is not enough but it is necessary to analyse its molecular profile. Mutations in genes such as EGFR, ALK or ROS1 guide treatment choices, shifting the focus from the tumour's anatomical location to the disease's 'genetic code'. Precision therapies have significantly improved the prognosis for many cancers, but they still have significant limitations: the development of resistance, high costs and uneven access to molecular testing.

"*In oncology, precision medicine is already a reality, but it requires a paradigm shift*," Nisticò observes. "*We must move from an organ-based approach to one based on the molecular characteristics of the disease*."

Looking to the future, AIFA report highlights the growing role of artificial intelligence and bioinformatics, which will enable the development of increasingly accurate predictive models and the integration of clinical, genetic and environmental data. Among the most innovative

developments is the pharmacogenomic passport, a genetic identity card for patients that could accompany them throughout their lives. "*The pharmacogenomic passport represents a real prospect for improving the safety and efficacy of treatments*," Nisticò concludes. "*It is a challenge that requires governance, fairness and accountability in the use of data*."

Precision medicine therefore represents not only a scientific advancement, but a structural and cultural shift that affects the entire healthcare system. The challenge is to make it accessible, equitable and sustainable, transforming innovation into a tangible benefit for all citizens. The path forward is clear: moving beyond the 'one-size-fits-all' model in order to build a healthcare system that is more effective, more sustainable and truly tailored to each individual.