

The journey towards health improvement in Argentina

A roadmap for precision medicine



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About this report

Precision medicine is an innovative approach that tailors disease prevention and treatment to the individual's genes, environments and lifestyles. To provide tailored patient care, features of the individual are analysed to better guide therapeutic interventions.

This report provides a clear call to action to key stakeholders in Argentina to strengthen the environment for precision medicine, manage barriers and identify opportunities. While interest, initiatives and policy action in precision medicine have grown over the last several years in Argentina in recognition of its potential benefits, much needs to happen to encourage widespread adoption and equitable access. This report evolved through three research phases, described below.

Phase 1 of the research involved a literature review that (1) evaluated scientific articles from the indexed journals and grey literature; (2) sought to understand the barriers and opportunities associated with precision medicine; (3) evaluated the current state of precision medicine in Argentina, including adoption and implementation among various stakeholders; and (4) reviewed current clinical pathways and policy development that fosters the implementation of precision medicine, highlighting best practices both globally and locally that can be scaled across Argentina.

Phase 2 focused on a qualitative analysis of the current stage of precision medicine in Argentina by engaging stakeholders through primary interviews to refine initial insights and draw key conclusions. We would like to thank the following individuals for sharing their insight and experience:

- **Dr Adolfo Capó**, director, Provincial Oncological Program of Mendoza, Argentina
- **Dr Andrea Llera**, researcher, National Scientific and Technical Research Council and Fundación Instituto Leloir, Argentina
- **Florencia Braga Menéndez**, co-founder and project manager of the Argentine Alliance of Patients
- **Dr Georgina Sposetti**, founder, Un Ensayo Para Mí, Argentina
- **Dr Luis Fein**, president, Argentine Group of Clinical Research in Oncology, Argentina
- **Dr Ricardo Mastai**, health economics professor, San Andres University, Argentina
- **Dr Ruben Torres**, president, Latin American Hospital Federation and ex rector, ISALUD University, Argentina

Phase 3 of the research consisted of analysing the insights collected in the prior phases to write this report.

Bayer commissioned this study, which was independently conducted by the Economist Impact team. Economist Impact bears sole responsibility for the content of the report. The findings and views expressed in the report do not necessarily reflect the views of the sponsor or interviewed experts.

The research was led by Maryanne Sakai, with input from Carolina Zweig, Lucia Celay and Tomás Cabachieff. The report was written by Carolina Zweig and Maryanne Sakai, with contributions from Amanda Stucke and Marcio Zanetti, and was edited by Melissa Lux.

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Executive summary

Precision medicine can contribute to many areas of medicine, and is frequently used in oncology, neurology, pneumology and rheumatology. In precision medicine, patient care is tailored to the individual's genes, environment and lifestyle. This method can identify the most effective treatment for each person. Precision medicine can increase the value of care for patients and payers since identifying and using the most effective treatment for each case can reduce healthcare expenditures. Through genome-guided care, prevention and treatment can also be more effective, ensuring a better and earlier chance of treatment success. As a result, life expectancy and quality of life for patients may increase.

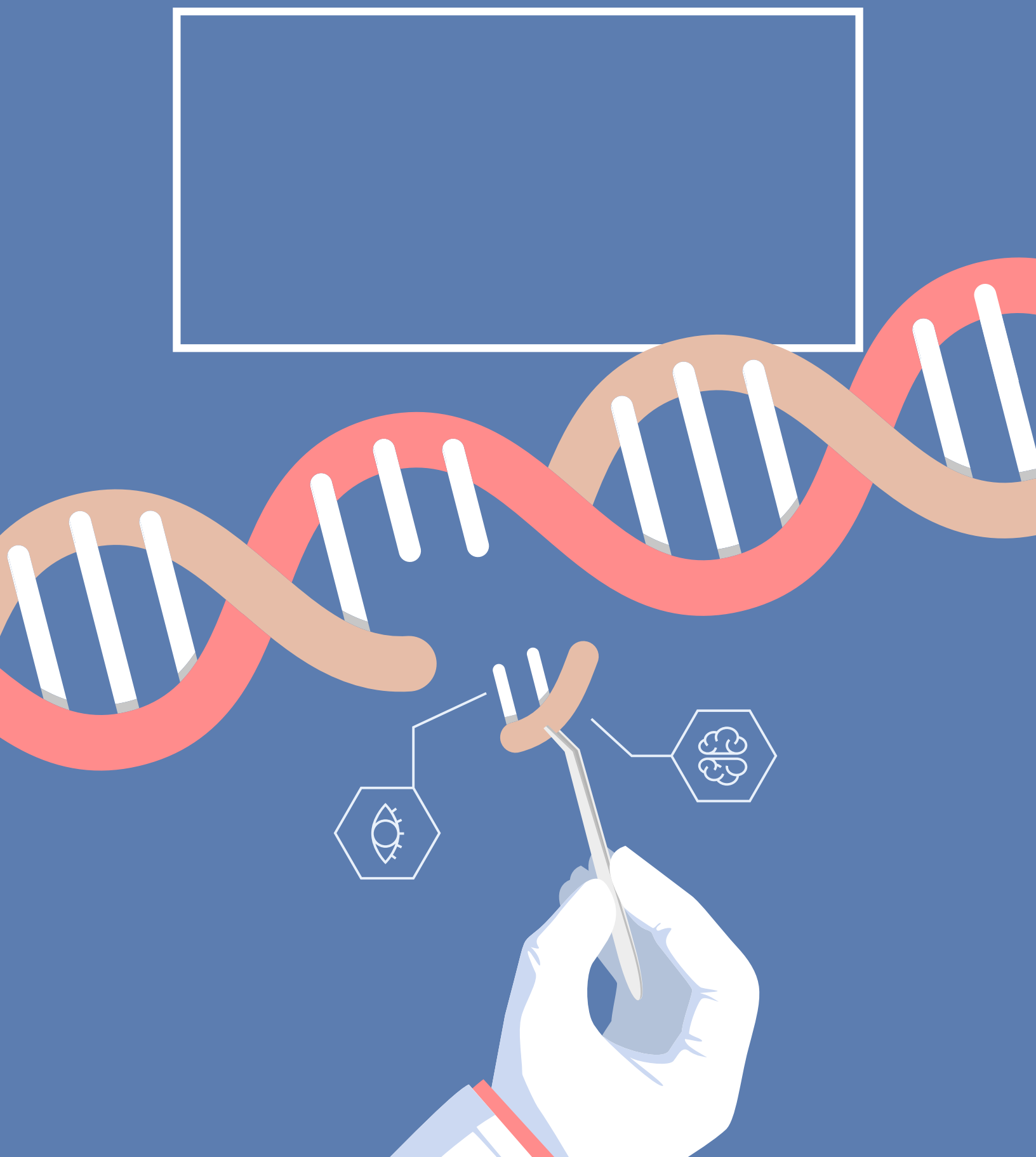
The landscape of precision medicine in Argentina is still in its early stages. Increasing access would benefit patients with both rare and common diseases and improve the sustainability of the healthcare system. As the resources that were committed to fighting the covid-19 pandemic become available for other healthcare priorities, there is an opportunity for a wider and more equitable implementation of precision medicine in the country.

To realise these benefits and strengthen the implementation of precision medicine in Argentina, the country must address significant barriers to access, including insufficient education, collaboration and policy prioritisation. The first obstacle affects every stakeholder in the healthcare system and can be tackled with awareness-raising activities, training and communication. The second

obstacle relates to the country's highly fragmented healthcare system. In this environment, difficulties in sharing information hinder stakeholders from working in an integrated manner, resulting in a negative impact on the system's efficiency. The third obstacle concerns the lack of continuity in strategic planning in health policymaking. This difficulty is aggravated by the first two, making it imperative to develop resilience mechanisms for evidence-based health policies.

Argentina has ongoing initiatives to foster precision medicine at the provincial and national levels. Such initiatives include generating a genomics biobank, sequencing and analysing exons of patients with rare diseases, developing a panel of precision genomic oncology, and others. Each effort outlined in this report attempts to address at least one of the obstacles. Taken together, these initiatives show how different stakeholders may contribute to improving health in Argentina.

To foster wide and equitable access to precision medicine, we propose a roadmap with short-, medium- and long-term milestones. In the short term, education plans should be put in place, along with the development of registry tools and investment in bioinformatics capacity. In the medium term, it is important to regulate the use of data, develop sustainable financing mechanisms and implement a pilot study of a national policy. In the long term, Argentina should aim to generate a national database, a generalised understanding of precision medicine and a national strategy that is tailored to regional specificities.



The current landscape of precision medicine in Argentina

Precision medicine can be defined as “an emerging approach for disease treatment and prevention that takes into account individual variability in genes, environment, and lifestyle for each person”.¹ Different types of data can be used to tailor care to the individual, for example, genetic information, microbiome composition and health history.² This approach can contribute to a variety of areas, such as oncology, neurology, pneumology and rheumatology.³⁻⁵ Precision medicine diverges from the traditional approach in terms of methodology throughout the care pathway. While the traditional approach to medicine consists of evaluating visible properties in disease and health, precision medicine applies classification by risk and facilitates surveillance for preclinical diseases. From the perspective of the industry, precision medicine can identify alternative treatments for patients who do not respond to conventional therapies.⁶

Precision medicine can bring welfare-improving and cost-effective alternatives to pathologies that may or may not have a treatment yet, avoiding over- and misutilization of care. For example, precision medicine initiatives often direct resources toward rare diseases, which could directly impact 3.2m people in Argentina.⁷ Dr Ruben Torres, president of Latin American Hospital Federation and ex rector of ISALUD University, sees a great potential for precision medicine for these pathologies: “Clinical studies for rare diseases often

cannot recruit the necessary number of individuals, which delays the assessment of possible therapies and the measurement of their effectiveness”.

The large amount of data that is generated in the health system can be used to provide personalised care to patients all over the country. The organisational and governance infrastructure built for the implementation of precision medicine can also benefit the healthcare system in general. To succeed, Dr Torres explains that the regulatory framework for the use of data would also have to improve: “Patients are concerned about data confidentiality”. Argentina is currently updating its law on handling personal data with a chapter devoted to genomic information. Therefore, researchers are encouraged to obtain consent for future use and broad sharing of genomic and phenotypic data, balancing the responsibility of protecting participants’ interests with the potential loss of opportunities for future research.⁸

Precision medicine is also centred on optimising the efficiency of care, which can reduce national healthcare expenditures through the timely and reliable selection of effective therapies for patients, avoiding the costs associated with ineffective treatment and adverse events.⁹ In Latin America and the Caribbean, the size of the precision medicine market was worth US\$5.66bn in 2021 and is projected to reach \$10.11bn by 2026, at a

compound annual growth rate of 5.66% during this forecast period, due to the expected demand for customised medical solutions.¹⁰ In Argentina, this growth is driven by the most affluent shares of the population.¹¹ As the country recuperates growth and prioritises healthcare spending, there is a window of opportunity to make choices that improve healthcare by fostering resilience and innovation.¹¹

Efforts to implement precision medicine in Argentina must target barriers to access. New agents remain unapproved by national health regulatory agencies for long periods due to complex bureaucracy.¹² The country's inability to cover cancer-targeted therapy in the public health

systems once the regulatory agencies approve them hinders their inclusion among covered therapies. The main stakeholders pushing towards improvement in access have been patient advocacy groups, which have asked for a permanent interministerial roundtable to develop specific policies on precision medicine.

This report provides a clear call to action to key stakeholders in Argentina to strengthen the environment for precision medicine, manage barriers and identify opportunities. While interest, initiatives and policy action in precision medicine have grown over the last several years in Argentina, much needs to happen to encourage widespread adoption and equitable access.



Benefits of precision medicine

Precision medicine plays an essential role in improving the accuracy of prognosis and in predicting the response to disease treatment.¹³ Its value begins in prevention efforts. Although precision medicine is already established in oncology, it can benefit all chronic pathologies, especially hereditary ones. Family health history is a predictor of how likely a person is to develop a certain disease.¹⁴

Identifying molecular profiles of tumours should also result in more effective treatment protocols.¹⁵ Dr Adolfo Capó, director of the Provincial Oncological Program of Mendoza, believes that, in the future, chemotherapy may not be used

as a treatment for cancer owing to precision medicine advances in the use of biological treatments. Patients would undergo less risky and more beneficial treatments that are tailored to the genetic characteristics of the tumour. Thus, precision medicine can not only improve the quality of care but also patient wellbeing and quality of life.

Though genomics enables healthcare professionals to better understand, treat and predict diseases, it can impact patients' behaviour too. Dr Andrea Llera, researcher at the National Scientific and Technical Research Council, argues that "people who know their risk factors and genetic factors can be in charge of their life choices".



“People who know their risk factors and genetic factors can be in charge of their life choices”

Dr Andrea Llera, researcher at the National Scientific and Technical Research Council

As decision making can be improved when people are provided with better information and guidance, patients directly benefit from high-quality data. Having biobanks and reliable databases is key to improving decisions that impact patients' health and quality of life.¹⁶ If precision medicine becomes more widely implemented, a large amount of patient and clinical data is expected to be generated. To keep the security of the data that is shared among hospitals and ease the use of new technologies, blockchain can provide a secure tracing system.¹⁷ The provenance and enforceable governance that blockchain provides are also expected to reduce distrust among healthcare professionals.¹⁷

Furthermore, genome-guided treatment modalities are expected to reduce healthcare expenditures.¹⁸ For Dr Ricardo Mastai, health economics professor at the San Andres University, this is an important

benefit for Argentina: "Precision medicine will directly impact the quality of health systems in a very positive way. It can improve the cost-efficiency of every process in the future". Dr Llera adds that precision medicine can help tackle medical staffing overload in the country through innovations that optimise processes in the healthcare system.

The possibilities for precision medicine in Argentina are manifold. Through various channels, it could impact patients with both rare and common pathologies. For example, the use of data can help reduce the burden of breast cancer, the leading cause of death of women in Argentina¹⁹: "Precision medicine can bring impact through two channels: it could improve these patients' life quality and survival rates and the sustainability of the system through the reduction of financing costs", says Dr Torres.

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Obstacles to wide and equitable access to precision medicine

The implementation of precision medicine is challenging for any health system. The volume and complexity of data are key barriers, followed by institutional, legal, technological and human barriers.²⁰ These obstacles translate into the absence of local availability, reduced speed of obtaining results, cost, lack of infrastructure, lack of technical expertise and lack of access to new drugs.^{12,21} Argentina also faces specific difficulties that hinder innovation. Opportunities to overcome these barriers are presented later in this report.

Insufficient education

The consolidation of precision medicine in Argentina depends not only on public and private investment but also on the preparedness of human resources.²⁰ According to experts, lack of information is an obstacle from the perspective of every stakeholder involved in the care pathway. Low awareness reflects the insufficient level of research, education and expertise available: in Latin America, there are very few research centres that can facilitate genomics research and education that translate into a benefit for patients.²² As a result, tools are still widely seen as experimental.

Technology can provide physicians with valuable data points to make informed decisions, but healthcare professionals are not trained to use precision medicine tools. University curricula do

not include genomics or other topics related to precision medicine, and physicians do not have many opportunities to learn about it during clinical practice. According to Dr Llera, many physicians are poorly trained in evidence-based medicine. One of the consequences of disinformation about precision medicine is the fear that it threatens physicians' fundamental role as providers of care.

Educational reforms are suggested to prepare physicians for the age of genomic medicine. These include making genetics a core competency, introducing students to computational methods for genomic analysis and creating a genomic specialisation pathway.²³ While experts disagree on how precision medicine could be addressed in medical education, it is widely agreed that training must be accessible to healthcare professionals throughout their careers.

Providing healthcare professionals with tools and knowledge is not enough to foment personalised medicine: tailoring care also requires excellent communication between physicians and patients. Evidence suggests that physicians often underestimate the willingness of patients to participate in discussions about their care pathway.²¹ Educating patients provides an opportunity for better communication and a greater willingness to participate in a more effective, personalised treatment strategy. This can

be addressed in a patient-centric environment with contributions from other healthcare professionals.

Finally, raising awareness of precision medicine goes beyond patients and health practitioners. Dr Torres warns that a limited understanding of precision medicine raises the false belief that it might increase the financing cost of the health system. Payers, providers and hospital directors must be well informed to give the appropriate approvals for care provision and coverage. Dr Mastai highlights that government authorities must have a clear picture of the subject to understand its importance and regulate it appropriately. Therefore, educating the population is a fundamental step to generating an enabling environment for precision medicine.

Low collaboration

Collaboration among policymakers, academics, healthcare professionals, pharmaceutical companies, healthcare organisations and payers is a challenge in Argentina. Multilevel engagement requires connectedness and incentives, but Argentina's highly fragmented health system is a significant barrier. For experts such as Braga Menéndez this is a critical factor because it is not possible to do precision medicine without teamwork. This means collaborating with other specialities and working together towards a common goal.

A regional Latin American strategic plan based on teamwork and networking among academic/

research universities, medical associations, public/private healthcare institutions, industries and governments is needed to develop national personalised medicine models.²⁴ Such a plan could follow the structure of the Latin American Consortium for Lung Cancer Research and leverage lessons from the European Alliance for Personalised Medicine (EAPM).^{25,26} Experts also emphasise the potential of better empowered patient advocacy groups in designing and implementing policies oriented towards precision medicine.

Stakeholders must be able to converse, but so should data sets. An effort to standardise data would improve the efficiency of use. An example of nonstandardization is how diagnostics through images are treated differently in the public and private sectors in Argentina, meaning that medical reports could range from a variety of images (printed or in CD) to a simple report without any image.²⁷ Likewise, Argentina needs to create capacity for an adequate information generation and management process in a highly complex context such as the Argentinian health system.¹⁷ This is particularly important in precision medicine, a field in which concerted efforts can gain power from the collaborative use of the large, unstructured data constantly generated in healthcare facilities. "One of the benefits of precision medicine is to enable local action when, in fact, what it does is globalise information", explains Dr Capó. Argentina must work further on its digital infrastructure and regulatory framework to enable data points to be leveraged within and outside of those organisations to provide more accurate care to patients.

Lack of policy prioritisation

As the covid-19 pandemic eases, Argentina has a window of opportunity to revisit its health priorities. After the redirection of attention and resources from the public health emergency, precision medicine can contribute to tackling

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Dr Adolfo Capó, director, Provincial Oncological Program of Mendoza, Argentina

problems such as the rise in cancer cases.²⁸ Educating policymakers on the importance of precision medicine and engaging stakeholders, especially patient advocacy groups, in developing a national precision medicine model are key to raising interest in the topic. To proceed with a sustainable approach to precision medicine, Argentina will need to further address how health policies are developed and implemented.

Healthcare policymaking in Argentina is structured according to the conventional medical approach, but an innovative aspect of precision medicine is to identify potential health risks earlier. Genomic tests make it possible to identify people at risk of having a particular pathology in the long run so that prevention can begin in the present. One-time treatment alternatives, as opposed to chronic therapies, have the potential to reduce the overall economic burden to the payer and improve the quality of life for the patient.²⁹ Therefore, policies that do not consider long-term benefits cannot acknowledge the overall potential of implementing precision medicine.

Various factors could be hindering a lifetime approach to health policies. Dr Mastai argues that medium- and long-term objectives do not receive enough attention in the country. Florencia Braga Menéndez, co-founder and project manager of the Argentine Alliance of Patients, highlights the lack of continuity in the strategic planning of governments: “The alternation of political administrations with opposite objectives does not generate the necessary incentives for policymakers to choose expensive one-shot gene therapy treatments or other short-term strategies. Instead, the incentives are to cover cheaper chronic treatments that will have less impact on their own budgets and burden future administrations”. Argentina must develop mechanisms to ensure the sustainability of precision medicine policies.

Even when interest in addressing barrier of policy prioritisation emerges, the complexity of the health system makes it difficult to align the actors involved in designing and implementing policies. Dr Llera recalls the fragmentation of the health system as a significant obstacle: “Each province manages its healthcare system, some are aligned with the federal government, but others are not. It is hard to develop a comprehensive policy in this context”. Provincial management of health policies also hinders the integration of information systems, which, under strong data regulation, could provide large amounts of relevant clinical information.

One of the main benefits of precision medicine is to foster clinical research that benefits other patients in the future, but this is also not considered in health policies. In Argentina, 65% of clinical trials are sponsored by the pharmaceutical industry.¹² Dr Georgina Sposetti, founder of Un Ensayo Para Mi, explains that there are many precision medicine clinical trials in Argentina and in Latin America, but there could be many more. Neither public nor private hospitals are prepared to perform clinical research, and the bureaucracy to get approvals deeply affects their timelines.³⁰ Dr Sposetti notes that underinvestment circles back to the limited understanding of the topic: “Precision medicine and clinical trials are often seen as costly. The first thing that we need to educate those stakeholders is that there is a large saving potential if things are done correctly. That’s also the point of precision medicine. So it’s not just about having the numbers, but about getting those numbers to decision-makers”.

Fostering precision medicine in Argentina: real-world examples

The section below identifies examples of provincial, national and international initiatives.

Provincial initiatives

In Rosario, two companies, CIBIC and INDEAR, established an alliance to invest in Héritas, a genomics company focused on treatment and prevention for oncologic, cardiologic and rare diseases, among others. The objective of Héritas is to develop a platform to generate a database of diseases based on genetics.³¹ Though the initiative is a collaboration of two actors in the private sector, the investment is done through the Program for the Promotion of Entrepreneurial Investment in Technology of the Ministry of Science, Technology and Productive Innovation.³¹

In Mendoza, precision medicine has received public support. The Programa Oncológico Provincial (POP) is an example. It is intended for residents in Mendoza who have been diagnosed with cancer and do not have medical assistance coverage. The program aims to provide treatment drugs, treatment therapies, exams and tests, such as molecular tests and immunoassays. The POP also aims to incorporate new technologies for diagnostics and therapy, which may foster the development of precision medicine in the province.³² In addition, a law established a

hereditary cancer prevention centre in the province of Mendoza, which makes the initiative stable across political cycles.³³

In La Rioja, advances have been made in the integration of clinical data. Since 2009, primary care professionals in the province can access the electronic medical records of their patients. This project was developed by the provincial government to improve care and economic sustainability in the health system.^{34,35} This initiative was highlighted by Dr Torres because it involved healthcare professionals doing data collection for primary care: “Given that precision medicine is patient-centric, it can be particularly valuable for general medicine. The integration of data could enable general practitioners to improve the resolution capacity of primary care”.

Healthcare providers such as hospitals can also be directly involved in precision medicine programs. For example, Roche has an agreement with Fundación Garrahan (Buenos Aires) to implement a precision centre focused on paediatric oncology. The agreement comprehends that personalised medicine should be fostered by expanding its access and by generating clinical evidence through registries.³⁶ This is another example of public-private partnerships in the field.

National initiatives

Most efforts to implement precision medicine in Argentina are not limited to provinces. The most renowned national-level initiative, PoblAr, is discussed below.

Case study: PoblAr

PoblAr, known as the Argentinian population's reference and genomics biobank program, was established in 2014 and consists of an initiative to implement precision medicine.¹⁶ PoblAr aims to foster genomics in biomedical research with the Argentinian population, indicated in a letter of intent signed by Conicet, Administración Nacional de Laboratorios e Institutos de Salud (ANLIS) and the Universities of Córdoba, Jujuy and Misiones.³⁷ The letter commits to creating a national reference centre and biobank.

PoblAr's core objective is to create an open biobank that should be the reference for any genomics research related to the population in Argentina. The initiative's purpose was to populate databases to evaluate the most prevalent genomic variants so as to assess genetic risk factors. In addition, PoblAr aims to establish a link between the public and private sectors concerning the development of drugs and precision medicine therapies based on genomics.¹⁶ Experts believe that PoblAr could be used to perform genetic analysis in rare diseases.

Although the initiative managed to involve governmental ministries and the Senate, including a bill that was presented by Senator Nancy Gonzalez in 2018, the implementation of a national reference centre has not evolved. Some of the reasons that prevented the initiative from advancing include a lack of financing and a lack of political will. In that sense, some experts argue that, when PoblAr was launched, it lacked the necessary actionable content to be considered a national precision medicine program.

According to Dr Llera, there is currently a resurgence of the PoblAr initiative. There is ministerial support to finance the implementation of units to perform collection at a federal level so that the units may be equipped to extract and evaluate the quality of the DNA collected. Also, they are seeking a physical location for the biobank and qualified staff to work with data. For 2022, PoblAr aims to gather data from volunteers to have their genetic profiles and information regarding their family health history and lifestyle of the person.³⁸ To keep up with PoblAr, the government is investing in sequencers to perform genetic profiling. In parallel, there is currently a bill to be approved regarding genetic tests free of charge for people who have cases of hereditary cancer in their family. The objective of the bill is to identify cancer at an early stage to offer more effective treatment.^{39,40}

National-level initiatives might also include nongovernmental actors. In 2019 AstraZeneca signed an agreement with the government to foster research, development and innovation for precision medicine.⁴¹ The objective was to cover the detection of genetic markers for cancer. AstraZeneca moved resources to implement a public healthcare centre. The project started shortly before a change of government, and the Alianza Argentina de Pacientes (ALAPA) has advocated for its continuity. However, there is no evidence of the current status of this initiative.

Alongside pharmaceutical companies, academic institutions can play an important role in nationwide projects. For example, Bitgenia and the University of Buenos Aires launched the campaign “100 exomas” for the sequencing and analysis of exons of patients diagnosed with rare diseases in 2016.⁴² During the campaign, the group processed and analysed 129 exons that represented 100 cases analysed in more than ten provinces in Argentina. The project presented positive results, stating that it is possible to have molecular diagnostics based on next-generation sequencing (NGS) at a local level in Argentina. Interdisciplinary work was highlighted as crucial for the success of the campaign.⁷ This campaign also enabled the assessment of local capacities, with their virtues and difficulties, for the implementation of these technologies in contexts of scientific research and clinical innovation, and comparison of those capacities with experiences carried out in developed countries.

Mapa de la Accionabilidad Genómica Tumoral de Argentina (MAGenTA) is also a public–private partnership. It was launched in 2017 in collaboration with Conicet, Hospital Italiano and Instituto Multidisciplinario de Biología Celular (IMBICE). It is a massive sequencing platform for the development of a panel of precision genomic oncology. It comprises a new sequencing methodology that allows one to simultaneously

study many molecular alterations in the same sample, with greater efficiency.⁴³ The objective is to generate a database of incidence and frequency regarding molecular variations that are related to common types of tumours.⁴³

Finally, successful Argentinian initiatives can expand beyond the country’s borders. Recently, AstraZeneca along with Bitgenia developed a platform called ColGenBio as part of the A.Catalyst Network hub in Argentina.⁴⁴ The platform is a collaborative genomics and biobank platform that was originally focused on Argentina, but the parties involved are expanding it to Latin America.⁴⁴ It provides an urgently needed source of data for researchers looking at specific biomarkers for diseases. It is designed to strengthen data collection and promote research collaboration among laboratories, reducing the overlap of efforts. It is also expected to accelerate the adoption of approved and in-development biomarkers, help to identify populations for new indications and facilitate translational research.⁴⁴

Learning from its peers: international initiatives

Lessons from Latin American countries can be leveraged when designing policy for Argentina. For example, Peru has shown success in tackling its own educational barriers regarding precision medicine. In this case, genomics was included as a core competency in the medical curriculum in 27 medical schools, in the public and private sectors.²³ This is the sort of educational reform that Dr Torres finds appropriate: “Precision medicine is a horizontal tool; it can improve the median formation of physicians in general”.

Some Mexican initiatives raised awareness of genomics in civil society. The National Institute of Genomic Medicine developed a comic book series on the topic. The institute is a model of capacity-

building effort to create educational activities and foster research infrastructure for genomic medicine in the region.²²

The Centre for Excellence in Precision Medicine (CEPM) in Chile is a successful case of co-financing between the national government and a pharmaceutical company (Pfizer).⁴⁵ The CEPM was inaugurated in 2015 with the objective of becoming a research, development and innovation centre with the primary focus on non-small cell lung cancer (NSCLC).⁴⁶ Thermo Fisher has also partnered with CEPM to provide the necessary equipment to sequence the DNA.^{46,47}

Latin American countries have had positive experiences of collaboration towards a common goal. For example, Dr Llera highlights a multicountry study in Latin America that was able to generate a local biobank, following protocols and procedures. Clinical, pathological and transcriptomic data were collected. The result of the study was a set of high-quality data, including clinical, pathological and molecular data.⁴⁸ Furthermore, Uruguay and Ecuador have advanced in the field of regulatory frameworks for the use of data in medicine.^{8,22}

Experiences in developed economies must also be closely examined. France offers an example of a breast cancer genomic platform. The platform is used to determine whether the patient should be treated with chemotherapy according to the risk. Additionally, the genomic platform can identify the patients who would benefit from chemotherapy treatment. This initiative is also present in Italy.⁴⁹ Spain is also considered a role model in precision medicine policymaking. In 2020, the government announced that an amount of €77.3m would be allocated to create a national centre of advanced therapy.⁵⁰ The objective is to provide adequate infrastructure to foster precision medicine capacities, including implementing it in the National Health System.⁵⁰

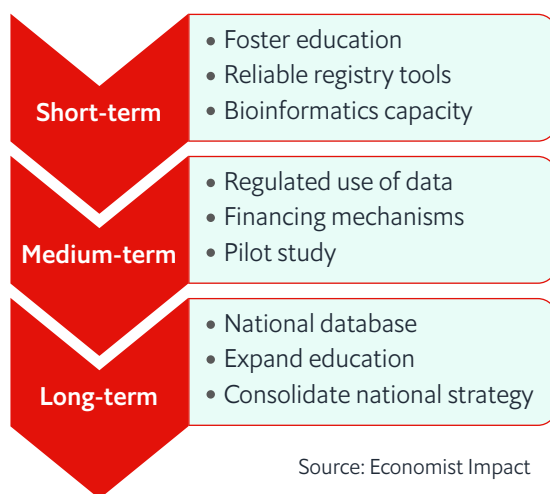
Finally, there are initiatives being implemented at a multinational level in the private sector. A group of pharmaceutical companies (Bayer, GlaxoSmithKline, Novartis and Roche) have entered into a consortium called Precision Cancer Consortium (PCC) to foster precision diagnostics. PCC's objectives are to expand the accessibility of genomic testing and increase the ability to understand the results of the tests in order to provide better patient care.⁵¹



Outlook and call to action

Precision medicine can transform healthcare in Argentina. It is imperative that stakeholders overcome barriers and promote opportunities for decision-making around precision medicine. To be successful in this endeavour, we recommend Argentina to pursue short-, medium- and long-term objectives, summarised in Figure 1.

Figure 1. Call to action



Short term: building the fundamentals

- **Educate stakeholders on precision medicine.** Implementing an education plan takes time, as does learning a new field. The creation of

opportunities to get informed on genomics and the use of data to tailor care must be addressed in the short term to achieve results in the long run. Addressing the knowledge gap will enable actors across the country to collaborate towards the implementation of precision medicine. The scope of such an initiative must be comprehensive, as not only patients and healthcare professionals but also policymakers and payers must make informed decisions concerning healthcare.

- **Develop reliable registry tools that enable confirming, validating and sharing clinical results.** Data collection and analysis are fundamental to the success of precision medicine. To have a truly large and representative sample, appropriate data management is needed. The use of blockchain technology is recommended for protecting this information, which should help in easing the resistance to the new distributed technology among healthcare workers because it provides both provenance and enforceable governance.
- **Invest in bioinformatics capacity.** Health institutions that aim to have precision medicine tools must be able to use computational techniques to store, organise and aid in the analysis and interpretation of large-scale data obtained from biological systems.⁵² This initial

effort would provide the foundations to have a national biobank, contributing to research and clinical care.

Medium term: illuminating the possibilities

- **Regulate the use of data in precision medicine.**

Digitalization has greatly advanced throughout the covid-19 pandemic, and this will be a pillar for the future of medicine. While the general use of data is regulated, a regulatory framework for precision medicine is to be further developed. Once there is a registry and regulatory infrastructure in place, existing efforts to make databases connectable and create virtual health identification can further progress and directly benefit patients.

- **Develop plausible and sustainable financing mechanisms.** The high cost of precision medicine does not have to be prohibitive. Payers, in collaboration with other stakeholders, must develop ways and tools to finance precision medicine, recognizing that the benefits lay in targeted treatment that directly benefits a small group of patients per pathology in a lifelong way. This would not only impact access to and equity of innovative treatments but also ensure that the enabling environment becomes sustainable in the long run.

- **Implement a pilot study to have concrete examples of impact.** Local, national and international initiatives provide great examples of the many facets of precision medicine and how it can be implemented in different contexts. They also provide valuable lessons on what could be improved for a more effective policy. A pilot study of a national program in Argentina can provide further evidence of the specific benefits precision medicine can bring to a particular region of the country.

Long term: aiming for impact

- **Establish a national database that connects disparate sources of information.** Regardless of the type of genetic variation that is involved in a disease or the current status of databases, Argentina must also act to generate biobanks that collect biological samples if it wants to guarantee a beneficial and equitable health system for its citizens. The country should also carry out follow-ups with a periodic collection of new data; discover novel genetic variants; register the different lifestyles of their citizens in relation to risk factors such as smoking, education and access to health; and collaborate on major projects with other countries in the world for the benefit of all.
- **Expand the educational strategy.** Knowledge of genomics and precision medicine tools can be expanded for individuals who could also become key stakeholders in this environment. Examples from developed economies include training advanced practice nurses to discuss the benefits and implications of precision medicine by assisting in health literacy and interpretation of genetic test results.⁵³ Clinical nurses could also address questions or uneasiness regarding genetic testing.⁵³
- **Consolidate a country-wide strategy tailored to regional specificities.** Joint efforts from public, private and non-profit organisations can contribute to fostering precision medicine care and research in Argentina, but a long-lasting impact requires a resilient and sustainable channel of action. Having technical decision-makers that remain stable despite political cycles can reinforce the continuity of health policies. Nonetheless, flexibility in local or regional variation must be preserved to have a truly tailored approach.

“Precision medicine came to give us a wake-up call: it makes us work together, it tells us basic information is essential and it reminds us that health is not only about solving an immediate problem. Precision medicine is also about prevention. Precision medicine will impact care overall and will even change how we face healthcare and health specialities.”

Dr Ricardo Mastai,
San Andres University

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