

Success Stories of Africa-Europe Research Collaboration in Personalised Medicine



The Personalised Medicine in North Africa initiative



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1. Executive summary

PerMediNA is an international research collaboration focused on Personalised Medicine (PM) implementation in North Africa (Algeria, Morocco and Tunisia) with the collaboration of research institutions in France and in Poland. The project was launched at the end of 2022 and will run for 2 years.

PerMediNA aims to not only advance scientific knowledge but also to drive transformative progress in PM practice, while addressing broader societal and ethical considerations in the North African region.

It is a successful example of a cross-country collaboration in the field of Personalised Medicine, with participation of institutions from Africa and Europe in a win-to-win partnership. It can be highlighted as both an Europe-Africa successful collaborative project, as well as a North African regional initiative in the field of PM.

Coordinated by the Pasteur Institute of Tunisia, in collaboration with the Pasteur Institute of Morocco and Algeria, the initiative takes advantage of the already existing Pasteur Network, a stable structure that helps its members creating, implementing and coordinating research projects amongst them. The Pasteur Institute of Paris collaborates in management and coordination, as well as supporting the genomic analysis of samples in their BIOMICS Platform. Other European organizations also participate: Gustave Roussy and Institut de Cancerologie de l'Ouest in France and Institute of Genetics and Animal Biotechnology of the Polish Academy of Sciences.

The PerMediNA is funded by the French Ministry for Europe and Foreign Affairs (MEAE) under the FSPI program (Fond de Solidarité pour les Projets de l'Innovation). The project is also supported in part by the Tunisian Ministry of Higher Education and Scientific Research and the Tunisian Ministry of Health.

It is the first PM implementation initiative in North Africa aiming to translate research findings into healthcare practice. For this, the project has engaged with national policy makers (Ministries of Health, Ministries of Higher Education and Research, Ministries of Social affairs) to work together in the elaboration of strategies for the implementation and reinforcement of PM in the region based on the evidence gained by the project work, so that the project is not only contributing to creating scientific knowledge, but also to translate knowledge into practice and facilitate the integration of PM tools in the healthcare systems of the participating countries.

The PerMediNA initiative has brought numerous benefits to precision medicine (PM) research through international collaboration. First, it has significantly strengthened regional ties between North African countries, fostering a sense of unity and shared purpose in advancing PM. By bringing together researchers, healthcare professionals, and stakeholders, the project has enabled valuable knowledge exchange and capacity building, equipping local experts with cutting-edge skills in genomics and personalized treatments. Moreover, the collaboration has facilitated resource sharing, allowing access to advanced technologies and expertise that individual countries may not have had otherwise. The creation of a centralized omics database has been another key achievement, providing a



robust platform for regional research and enabling more efficient data sharing. For patients, the project has been pivotal in advancing personalized treatments tailored to local genetic profiles, ultimately improving the quality of care. The development of a harmonized ethical framework across the region ensures that research is conducted in line with international standards, safeguarding patient rights and data integrity. International recognition of North Africa's contribution to precision medicine has also increased, opening the door to future collaborations and positioning the region as a key player in global PM research. Through these efforts, PerMediNA has not only advanced scientific understanding but also set the stage for sustainable, long-term improvements in healthcare across the region.

PerMediNA is an excellent example of why it is important to connect researchers, policymakers, clinicians and patients to help ensure that any PM research translates into tangible health improvements.

Finally, PerMediNA shows that there are always mutual benefits for European and African researchers to collaborate in PM.

""Collaborating with Africa in precision medicine offers European researchers access to the continent's unmatched genetic diversity, leading to new discoveries in disease mechanisms and biomarkers. It enhances understanding of the interaction between genetics and environment in unique disease patterns, contributing to more inclusive healthcare. These partnerships also promote global health equity by extending precision medicine benefits to underserved populations, while fostering cross-cultural knowledge exchange. Moreover, long-term collaborations strengthen global research networks, increasing the visibility and impact of European research on the world stage"" (PerMediNA participant).

2. Project overview

2.1. Background

The Human Heredity & Health in Africa (H3Africa) consortium has been a major driver in advancing genomic data generation and analysis in Africa. This Pan-African initiative, launched in 2012 has greatly contributed to the continent's research infrastructure, train researchers and clinicians, and carried out the first whole genome sequencing of many African ethnolinguistic groups. However, despite the tremendous efforts of the H3Africa consortium projects, North African cohorts were underrepresented, leading to a gap in data release and analysis in North Africa.

In parallel, The Institut Pasteur International Network provided opportunities for collaborations in the North African region, involving Institut Pasteur of Tunisia, Algeria and Morocco, in collaboration with Institut Pasteur Paris and other French institutions (Institut Gustave Roussy and Institut Marie Curie) which led to important progress in medical and scientific research in the North African region. Important advances have been made on



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local studies on cancer genomics (breast and lung cancer mainly), with high incidence rates in the region, to identify genetic and molecular risk factors in local populations.

Institut Pasteur of Tunisia has also coordinated an EU funded project called Genomedika, on Reinforcing IPT capacities in Genomic Medicine, Non-Communicable Diseases Investigation and international cooperation, with also the participation of Institute Pasteur de Paris.

Morocco and Tunisia have also collaborated in a Tunisian Moroccan Project on breast cancer, funded by Tunisian and Moroccan Ministries of higher education, and focused on the characterization of the epidemiology-genetic architecture of breast cancer in North Africa and the therapeutic and socio-economic impact of this disease in the region. The Pasteur Institute du Maroc has also participated in a EU funded project called LungCARD Project

All of these activities around Personalised/genomic medicine in the three countries and in collaboration with other African research centers (as part of H3Africa) and with Europe (through different European projects), set the basis for setting up the PerMediNA project, a regionally based precision medicine implementation initiative in North Africa in collaboration with European research centers.

""Although much of the PM-related studies in North African countries is currently performed in a research setting, our project has endeavoured to bridge the gap between research and clinical settings using innovative and translational approaches"" (PerMediNa project).

2.2. Goal and objectives

The PerMediNA project has the main goal of assessing the readiness level of Personalised Medicine implementation and reinforcing PM capacities in North Africa. It aims to not only advance scientific knowledge but also to drive transformative progress in PM practice, while addressing broader societal and ethical considerations in the North African region.

The specific objectives of the project are:

1. Assessment and description of PM readiness level in North Africa (Algeria, Morocco and Tunisia).
2. Set-up a pilot project on precision oncology which will constitute the backbone of the PerMediNA initiative.
3. Initiation and training activities on PM in North Africa. The program includes training activities to build a sustainable critical mass of researchers, medical doctors and data curators in North Africa.
4. Drafting a clear roadmap with recommendations for policy makers on the implementation of PM in North Africa.
5. Building an effective North African PM ecosystem
6. Communication, outreach, dissemination, valorisation and sustainability

The PerMediNA initiative includes 4 main work packages designed to achieve the project's goals:

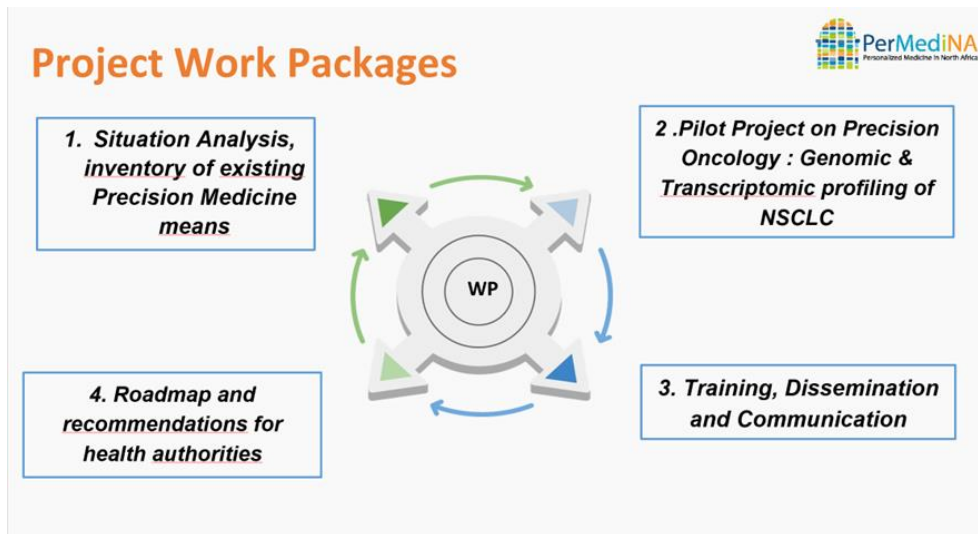


Figure 1. The PerMediNA project is organized around 4 work packages. (Source: PerMediNA).







2.3. Duration

The PerMediNA project is a two-year Initiative: 2023-2024.

2.4. Funding

The PerMediNA is funded by the French Ministry for Europe and Foreign Affairs (MEAE) under the FSPI program (*Fond de Solidarité pour les Projets de l'Innovation*). The project is also supported in part by the Tunisian Ministry of Higher Education and Scientific Research and the Tunisian Ministry of Health.

2.5. Participating organisations

Organisation	Role	Country
 Institut Pasteur du Tunis	Coordinator	Tunisia
 Insitut Pasteur du Maroc	Partner	Morocco
 Institut Pasteur du Algier	Partner	Algeria
 Insitut Pasteur de Paris	Partner	France
 Cancer Genetics Laboratory-Gustave Roussy Hospital	Partner	France
 Institute of Genetics and Animal Biotechnology of The Polish Academy of Sciences	Partner	Poland

3. Main Challenges of the Collaboration

The main challenges encountered by the PereMediNA project were:

- Accomplishing the planned work in the two years of the project was very challenging, with many tasks and multiple teams to coordinate in a very short timeframe.
- International projects that imply sharing of samples and data require the standardisation and harmonisation of the protocols between all participating countries. These need to be established from the start, to ensure that all procedures are being correctly followed to avoid inconsistent outcomes. A proposal to overcome this is that a small group of people be trained at the same location initially, and then deployed to other countries to ensure the experimental pipeline continues smoothly.
- Working with multiple institutions across different countries presented several logistical challenges. One of the main issues was the complexity of coordinating activities across institutions with varied operational frameworks and administrative procedures
- Visa obtention was another significant challenge, particularly for participants traveling for training or internship.
- Administrative burden for the management team. Creating a common understanding among the members of the consortium.

4. Impacts of PerMediNA

Based on the feedback from PerMediNA participants, the most important impacts and gains of the collaboration have been, in order of importance.

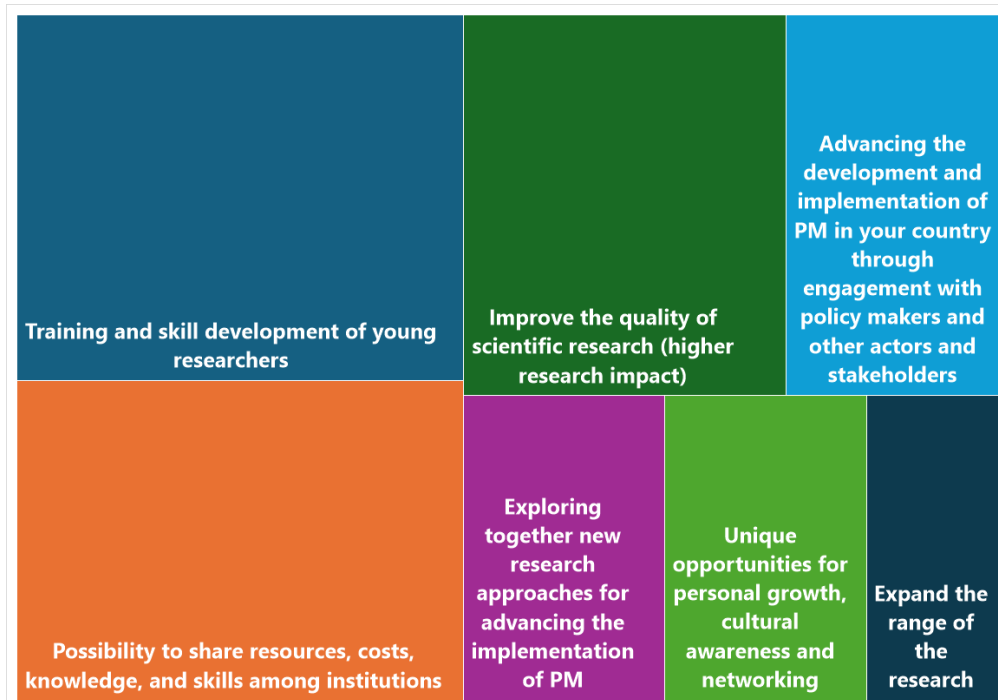


Figure 2. Main impacts achieved by PerMediNA.

There are already some other visible impacts of the project, that can be described based on the type of impact and the changes and/or effects that the project has made.

4.1. Scientific impacts: Advancing Knowledge

Comprehensive understanding of the state of genomics and precision medicine in the North Africa region, including the limitations and challenges needed to overcome for better implementation of PM.

Generating valuable genomic data specific to the North African population.

Creation of new knowledge on the molecular profile of Non-Small Cell Lung Cancer (NSCLC) in North African countries (Algeria, Morocco and Tunisia) that will help to identify novel therapeutic targets). During the pilot action, the teams have collected samples and phenotypic data of more than 450 NSCLC cases. Genomic analysis has been performed and data will be analysed.

4.2. Capacity Building: Development and enhancement of research skills in individual and teams.

Capacity building and training of young researchers is an important objective of the collaboration and many training events and workshops on PM-related topics, have taken place, both in Africa and in Europe:

- A **course on Implementation Research** was organized in collaboration with the World Health organisation Regional Training centre.
- **The Precision Medicine Academy (PMA)** was organized by the Institut Pasteur of Tunisia. The PMA included a series of lectures and practical training sessions led by recognized experts in the field of PM. The Academy included a workshop on OMICS data analysis was organized involving 20 participants from the three Pasteur Institutes.



Figure 3. Announcement of the Second Edition of the Precision Medicine Academy.

- **Internships:** several scholarships were allocated, offering trainees the opportunity to undertake internships within partner institutes, notably the Bioinformatics and

Biostatistics Hub and the Biomics NGS (Next Generation Sequencing) core facility [39]
at Institut Pasteur Paris and IGR



Figure 4. Participant in the Personalised Medicine Academy in Tunisia. (Source: PermediNA).

An important impact of the project has been on strengthening the capacities in terms of wet lab small equipment, reagents, kits, and consumables for Next Generation Sequencing library preparation and sequencing as well as computing infrastructure within the three Pasteur Institutes involved in the project, which will enable to broaden the spectrum of PM services in partnerships with oncologists, pharmaceutical and biotechnology companies in the three countries.

4.3. Informing decision-making, practice and policy

An important impact of the project is expected to be on informing decision-making, practice and policy. The results of the readiness assessment in the three North Africa countries, the strengthening of local research capacities in genomic research, both in terms of better skilled researchers and infrastructure and the engagement with the health care systems, are a first step to advance the setting up or further development of National/Regional Strategies for PM Implementation. Tunisia has already advanced in this regard with the launching of the Tunisian National Strategy for Human Genome and Precision Medicine implementation.

At the level of the health care systems, and with the aim of a future implementation of PM practice in the hospitals, the project has facilitated the setting up of **Molecular Tumor boards (MTBs)**. MTBs are panels of expert physicians, scientists, health-care providers and patient advocates who review and interpret molecular-profiling results for individual patients with cancer and match each patient to available therapies, which can include investigational drugs. Interpretation of the molecular alterations found in each patient is a complicated task that requires an understanding of their contextual functional effects and their correlations with sensitivity or resistance to specific treatments (Tsimberidou, A.M., Kahle, M., Vo, H.H. *et al* 2023). This Boards have an increasingly necessary role in optimizing the allocation of biomarker-directed therapies and the implementation of precision oncology.



Some concrete examples on the impact the project has had on decision making, practice and policy are listed below:

- Based on the experience from the pilot projects on cancer genomics, a guide has been provided to national authorities with recommendations for the collection, processing, and preservation of samples, as well as the handling of data generated.
- In Algeria, the work of the project has supported the approval of a Presidential Decree No. 24-65 of 22 Rajab 1445 corresponding to February 3, 2024 creating the National Commission for the Prevention and Control of Cancer and establishing its organization and operation.

5. Advancing the Field of Personalised Medicine through PerMediNA

From an African Perspective:

- **Access to advanced technologies and infrastructure:** Working together provides African researchers access to state-of-the-art tools and methods in genetics and genomics sequencing tools, data analysis, and bioinformatics.
- **Funding Opportunities:** European research projects typically include substantial funding. Collaboration increases the likelihood of obtaining grants and investments for precision medicine research that might not be available locally.
- **Knowledge Exchange:** Partnerships enable the sharing of knowledge and best practices. African researchers can learn about the latest advancements in precision medicine, while their European colleagues can gain insights into local health issues.
- **Network Expansion:** Collaborating with European institutions helps African researchers develop a global network, which can lead to future partnerships, career opportunities, and access to a broader range of expertise.
- **Clinical Trials and Data Sharing:** Collaborations can create more opportunities for conducting clinical trials, sharing patient data, and understanding diverse populations, ultimately enhancing the effectiveness and relevance of precision medicine strategies.
- **Capacity Building:** Working with established European institutions can provide training and development programs, equipping African researchers with vital skills and knowledge in precision medicine.
- **Higher visibility of African research capacity in PM:** Collaborations increase African researchers' visibility on the global stage, enabling future partnerships, high-impact publications, and participation in global health discussions, all while addressing critical healthcare needs in Africa.

From a European Perspective:

- **The access to Diverse Genetic Data.** Africa is home to a rich diversity of genetic backgrounds that can enhance studies in genetics. Understanding these variations can improve the effectiveness of precision medicine by tailoring treatments to diverse populations, foster innovation and accelerate the discovery of targeted therapies. So collaborating with African researchers can lead to innovative solutions and treatments that benefit not just Africa but the global community. This

partnership also allows for sharing research costs and leveraging complementary expertise from different countries.

- **Learning from African health care context.** Collaborating with African researchers in precision medicine would also enhance research capacity on both sides, allowing European researchers to contribute to and learn from the implementation of precision medicine within different healthcare systems and settings. By joining forces with African researchers and institutions, European researchers can improve their chances of obtaining funding from international organizations that prioritize global health and equity.
- **Improve treatments for African migrants living in Europe.** The main benefits for European researchers to collaborate with Africa in PM include a better understanding of patient care for Africa's diaspora in Europe, which comprises millions of people with various pathologies, some of them specific to Africans people and associated with unique biomarkers.
- **Opening minds and enlarging our understanding of other cultures.** The staff exchanges and intercultural interactions promote open mindedness and foster diverse perspectives. Furthermore, collaborating with Africans allow the enrichment of the overall research experience and promotes global sciences and health. The relationship between Europe and Africa is so close in terms of genetic mix of diversity and geopolitical challenge, that the issues are becoming more and more common in terms of prevention and global public health.

6. Future steps and sustainability of the collaboration

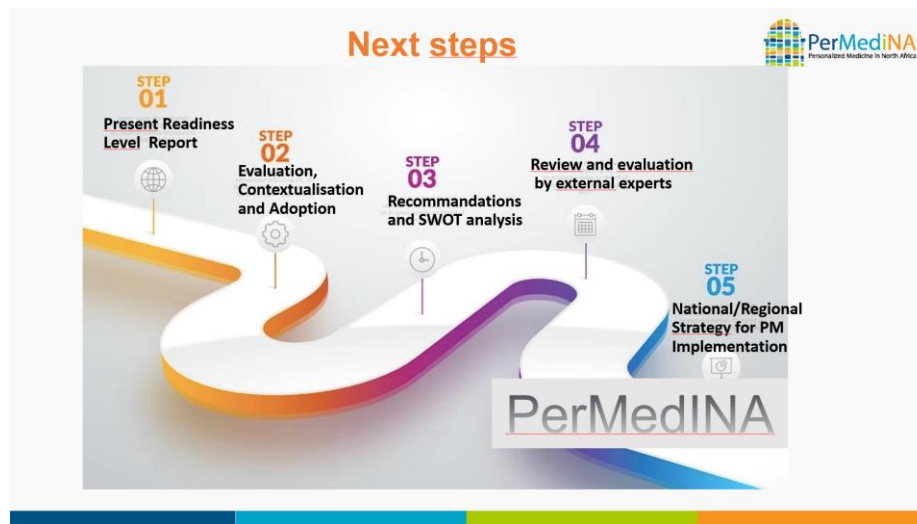


Figure 5. PerMediNA Roadmap and Next steps (Source: PerMediNA).

PerMediNA is setting the base for the preparation of national and regional PM strategies (roadmaps), based on real evidence coming from the Readiness level reports and for a direct and focused engagement with all relevant stakeholders from the very beginning.



7. Acknowledgement

We would like to acknowledge all the PerMediNA team, and most especially Dr. Yosr Hamdi, the coordinator, for their valuable support and contribution for preparing this success story, including the sharing of project information, photos and figures.

8. References

- Hamdi Y, et al. (2024) A regionally based precision medicine implementation initiative in North Africa: The PerMediNA consortium. *Translational Oncology*, Volume 44, June 2024, 101940. <https://doi.org/10.1016/j.tranon.2024.101940>.
- Tsimberidou, A.M., Kahle, M., Vo, H.H. et al. Molecular tumour boards — current and future considerations for precision oncology. *Nat Rev Clin Oncol* 20, 843–863 (2023). <https://doi.org/10.1038/s41571-023-00824-4>.