精准医疗 SINO-EU PerMed

Cooperation between China and Europe in Personalised Medicine


# Policy Brief

## Ethical, Legal and Societal Aspects in relation to Personalised Medicine in a Sino-EU context

*A policy brief with perspectives and recommendations from the Sino-EU PerMed project*

*June 2024*

# Imprint

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# Introduction

Personalised Medicine (PM) approaches bring along significant potential to improve diagnosis and treatment of diseases and prevention strategies by considering individuals' geno- and phenotypes together with biomedical, lifestyle, and environmental data. Good progress in the field of PM has been achieved over the last years and more recently broader implementations of PM-based approaches are seen in healthcare systems, e.g., in France, Germany, Estonia and Spain[1], and is also spreading beyond cancer and rare diseases to other major indication areas. Thus, PM brings along potential to improve health and healthcare for the benefit of patients, people, and society.

Development and implementation of PM is complex and requires national technical infrastructures and collaboration and networking at an international level. There is a need to create sustainable global links to streamline and support the development of PM-based approaches. Addressing these global health challenges is only possible by building and strengthening international dialogues between scientists, decision makers, the private sector and non-governmental organisations (NGOs) including the civil society.

Over the last decade, the European Union (EU) member states together with a number of countries outside Europe have supported the development of PM under the umbrella of the International Consortium for Personalised Medicine (ICPerMed)[2] under which the European Commission (EC) has funded a range of communication and support actions (CSAs) and an ERA Net[3], both to support development of scientific, technical, and policy aspects of PM and to reach out to geographically relevant parts of the world.

The Sino-EU PerMed[4] project is an EC-funded project, which has the purpose of mapping Sino-EU relations and collaborations,[5] to engage with relevant entities and institutions in China, and to establish science and technology networks between Europe and China, all within the area of PM. A further purpose of this project is to discuss aspects relating to ethical, legal, and societal aspects (ELSA) of PM development and implementation from two perspectives: 1) to understand differences and similarities on PM-related ELSA between Europe and China, thereby providing valuable insights between the two regions, and 2) to provide recommendations to address specific ELSA-related challenges and also

1 https://www.icpermed.eu/en/best_practice_examples.php;

2 International Consortium for Personalised Medicine - ICPerMed

3 https://erapermed.isciii.es/

4 https://www.sino-eu-permed.eu/

5 Romagnuolo, I., Mariut, C., Mazzoni, A., Santis, G. de, Moltzen, E., Ballensiefen, W., … D'Errico, G. (2021). Sino-European Science and Technology Collaboration on Personalized Medicine: Overview, Trends and Future Perspectives. Personalized Medicine, 18(5), 455–470. https://doi.org/10.2217/pme-2021-0030

to take advantage of the opportunities offered by ELSA to develop networking and collaborative activities within PM between the two regions.

This policy brief is the result of discussions with the Sino-EU ELSA Expert Task Force, consisting of key experts in various aspects of the ELSA field:

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Besides several meetings, the activities included a workshop and a field trip to China. In addition, the outcomes of a stakeholder workshop organized by Sino-EU PerMed in February 2022[6] has also been integrated into this document. This stakeholder workshop explored the potential for cooperation between Europe and China in advancing PM. The current state of PM in science and technology in both regions were discussed, highlighting strengths and areas for improvement. The benefits of increased collaboration between Europe and China in PM and related key challenges and barriers were also discussed.

6 https://www.sino-eu-permed.eu/files/SinPerMed_PolicyBrief_22-3.pdf

# Why is ELSA important for development and implementation of PM?

The significant development within research, innovation, and implementation of PM in recent years has made it clear that PM cannot be considered a traditional linear process along the value chain. It is much more a circular process covering research, innovation and implementation, involving a large number of key stakeholders (see "PM System of Health" as defined in the Strategic Research Agenda (SRIA) for the European Partnership for Personalised Medicine[7]).

It is implicit that the patient/individual stands at the absolute centre of PM as such approaches are targeting the well-being of the patient/individual. As a consequence, the related health data must be handled in an ethical and regulatory way, which protects the privacy and autonomy of the patient/individual, who also at the same time must be approached in a respectful and ethically appropriate way. In addition, cultural, familial, community, and societal norms, values, and rights and interests must also be considered in PM research and implementation.

The development of PM by researchers and clinicians in China and Europe raises a number of ethical, legal, and societal challenges. These challenges can be further complicated when multiple regulatory frameworks, socio-economic inequalities as well as socio-cultural norms and values intersect in the context of research collaborations between Chinese and European academics, clinicians, decision makers, industry, and societal partners like e.g., patient organisations. PM research requires collaboration between researchers and voluntary human subjects who, on the basis of sound understanding, consent to 1) having biological samples collected, stored and analysed (sequenced genomes and biochemical analyses) together with the biological data derived from these samples while also 2) having their health data (lifestyle information, environmental data, family stories, health records) collected, stored and analysed and finally 3) participating in clinical trials with (experimental) PM-based interventions.

In addition, equity in access to healthcare should be ensured as much as possible and in that context, it is necessary to obtain buy-in and commitment from decision makers and politicians to ensure equity in the implementation of PM. This assigns ethical requirements to the decision makers.

7 https://www.eppermed.eu/publications-resources/ep-permed-publications strategic-research-innovation-agenda-for-personalised-medicine/

A final aspect which must be considered in relation to implementation of PM-based healthcare is the health economics aspect. Although it is outside the scope of this policy brief to go into details of this topic, it is important to emphasise that the direct cost of developing and implementing PM-based approaches currently is as major challenge in developing PM and the consequences are of high ethical and societal relevance.[8]

Thus, a number of key ELSA must be considered in the development and implementation of PM (see Fig 1 for an overview[9]).

**Interaction between healthcare professionals and patients**

- Recruitment and informed consent
- Inequalities in access to healthcare (participation in research can be a way to access healthcare)
- Undue influence, therapeutic misconceptions
- Medical ethics, data ethics, and public health ethics as three intertwined yet different areas of ethics – what are patients/individuals consenting to?
- Important to listen to patient experiences as well as doctors and nurses involved in recruiting
- Privacy, confidentiality, and anonymity

**Ethical oversight**

- Ethical review committees or institutional review boards – varying skills and competences, capacity building
- Commercial vs. public review boards
- Different standards and norms in different countries
- Sino-European exchange between members of ethical review boards and supervisory agencies

**Ethical and legal regulation**

- Different regulations across borders governing biomedical research (consent), data protection, use of genomic and healthcare data, exchange of biological samples, genetic testing, clinical trials, etc.
- Which laws are relevant in Sino-European collaborations – is it the country in which research takes place, funders of research, patient's location etc?
- Areas of harmonisation and potentially conflicting regulations
- Distinction between 'hard' laws and 'soft' guidelines/standards, e.g., national security and industry policies

**Public deliberation – stewardship**

- National Bioethics councils and commissions – reports on PM
- Setting health research priorities
- Involving key stakeholders from the very beginning of the development of new medical technologies
- Public awareness and empowerment, e.g., town hall meetings, involving pro-actively patients/individuals, patient associations or representatives
- Political lobbying, addressing commercial interests
- Fairness, equity, benefit sharing – social justice

*Fig 1: Key ELSA to be considered in relation to PM*

8 Koleva-Kolarova, Rositsa & Buchanan, James & Vellekoop, Heleen & Huygens, Simone & Versteegh, Matthijs & Mölken, Maureen & Szilberhorn, László & Zelei, Tamás & Nagy, Balázs & Wordsworth, Sarah & Tsiachristas, Apostolos. (2022). Financing and Reimbursement Models for Personalised Medicine: A Systematic Review to Identify Current Models and Future Options. Applied Health Economics and Health Policy. 20. DOI: 10.1007/s40258-021-00714-9

9 based on "Four ELSI Governance Spheres", developed in the BIONET project on ethical governance: see https://bionet-china.com/

# Legal and regulatory aspects: the health data perspective

Setting up appropriate legal frameworks which will ensure the privacy and protection of the individual as well as allowing the use of health-related data for research in Europe has been a longstanding challenge, both from a national as well as from an EU perspective. Since PM research is relying on data, in particular genomic and epigenomic data, the difficulties in accessing such data have actually been a major challenge for many PM-related research projects so far[10]. It is adding to the complexity that very often the projects have a need to pool data from several countries and there is today no overarching legal framework which allow a one-point-of-entry application to access such data. The time it takes to make individual access applications to several countries and get the approvals is often detrimental for the project. There are more limited solutions available as for example Health Data Cooperatives (HCDs)[11], mainly of use for e.g., specific consortia, but HCDs do not represent a general solution to the problem.

Fortunately, the field is starting to move. A number of European countries are in the process of streamlining their approval procedures (see e.g., the Danish example[12]). At a European level, the European Parliament has recently approved a new regulation, the European Health Data Space[13] (EHDS) which will provide all Member States with a common legal framework that will allow access and use of health data for research, with one national access point. This regulation is a follow up on the General Data Protection Regulation[14] (GDPR) which was adopted in 2017 and will help to develop life-saving treatments and personalised medicine interventions. It will still take time before the EHDS regulation is implemented by the individual member states, but it is definitely an important step in the right direction.

The situation is similar in China. Through two five-year plans China has had a specific focus on PM. This has made China a key player within PM, in particular when it comes to collection of genomic data and early-stage PM research. This has also set an increased focus on regulation of data and data use[15], where the Personal Information Protection Law (PIPL) was adopted in 2021 and which is the Chinese analogue of GDPR. The PIPL has been supplemented by the Data Security Law (DSL) and the Cybersecurity Law (CSL).

10 For an overview of benefits and risks of using health data for research, see: https://hal.science/hal-04371062

11 https://digitalhealtheurope.eu/glossary/health-data-cooperative/ and van Roessel I, Reumann M, Brand A. Potentials and Challenges of the Health Data Cooperative Model. Public Health Genomics. 2017;20(6):321-331. DOI: 10.1159/000489994

12 https://www.em.dk/aktuelt/nyheder/2021/mar/faelles-indgang-til-sundhedsdata-skal-styrke-forskning-og-udvikling

13 https://www.european-health-data-space.com/

14 For GDPR see: https://gdpr-info.eu/

15 For an overview of China data protection laws, see e.g., https://www.dataguidance.com/notes/china-data-protection-overview

Although the overarching concept of the GDPR and PIPL regulations are similar there are some important differences, which have practical implications for e.g., collaborations and exchange of data (see Fig 2).

| | |
|---|---|
| **Dedicated Data Protection Agency v multiple agencies** | **GDPR:** dedicated data protection authority with sufficient expertise and independence<br><br>**PIPL:** multiple agencies with overlapped, blurred and sometimes broken boundaries of jurisdictions. Enforcement may not be consistent across agencies and regions. |
| **One GDPR v layered rules** | **GDPR:** one pillar law supported by EDPB and EDPS guidelines and local laws that are consistent with GDPR<br><br>**PIPL:** layered rules in varying legal hierarchies with multiple rules at each level |
| **Personally Identifiable Information (PII) v all data** | **GDPR:** PII only<br><br>**China data regime:** PII + important data + state core data + state secret |
| **Complicated legal consequences** | **GDPR:** mainly pecuniary fine<br><br>**PIPL:** fine, suspension/revocation of licenses, criminal liabilities at both corporate and individual levels, debarment from professional jobs and senior management, tainted social credits, civil damages, etc. |

*Fig 2: Key differences between GDPR and PIPL*

The introduction of Chinese data protection regulations in particular was initially a major obstacle to cooperation between China and the EU in the life sciences and other areas, as it prevented the free flow of data in and out of China. Academic collaborations were often made impossible and companies to a large extent had to change development strategies to only do clinical studies in China for Chinese. In March 2024 a new set of guidelines how to interpret the data laws were published by the Cyberspace Administration of China[16] (Order No 16 of the CAC). The practical implementation will now show whether these new regulations will make cross-border data transfer more feasible. The data regulations from both EU and China are still requiring a lot of attention when setting up e.g., collaborations and cross-border clinical studies. Some overall key points shall be mentioned here:

16 https://www2.deloitte.com/cn/en/pages/risk/articles/cross-border-data-flow-regulations.html

***Important observations relating to data regulations in EU and China when setting up cross-border collaborations:***

From EU perspective:

- The European GDPR regulation on data protection and privacy is in effect in all European Union countries and must be addressed in e.g., consortia agreements. Some key aspects of this regulation relate to privacy of data, consent from patients/citizens, storage, and access to data by third parties.
- For EC funded projects the EC requires that a data management plan is put into place.
- Besides the overall EU regulation, each of the countries in Europe are having their national rules and regulations relating to data protection. Project consortia must be aware of this, and it is recommended that the individual partner of a consortium is addressing this issue in their particular country.
- Within Europe also the Directive 2011/24/EU of the European Parliament and of the Council of 9 March 2011 on the application of patients' rights in cross-border healthcare offers the opportunity to share health data aiming for example to improve the quality and standardisation of health interventions such as in the area of rare diseases.
- Overall, it is generally possible to get access to health data in all countries in Europe for research purposes, but consortia must be aware that the rules and regulations are often complex, and it can require considerable attention and efforts to get the necessary approvals. These processes can also take a long time.

From China perspective:

- Overall, it is the Chinese members of a cross-border collaboration who must take care of obtaining the necessary approvals from the Chinese data authorities (the "data processor") on behalf of the collaboration.
- A key requisite for obtaining approval is to perform a data classification. This includes: 1) prepare a data inventory, 2) categorize data based on data impact assessment, 3) prepare data protection measures, 4) put an appropriate agreement in place to ensure data security post outbound flow, 5) review the previous points regularly.
- Obtaining consent from involved patient/citizen is generally very important.

- Health data are subject to special rules and regulations which must be addressed.
- The Chinese data regulations are complex, particularly in the field of health data, and it is strongly recommended to involve expert legal support to ensure that all rules and regulations are met. The retributions can be severe if the requirements are not met (see Fig 2).

These observations are generally directed towards researchers who want to access data for research projects. However, there are some further perspectives which should be considered by in particular decision makers and healthcare providers (e.g., ministries):

- To further develop and implement PM to the benefit of patients and citizens more research is heavily needed, both nationally and internationally. Thus, decision makers should continue to strive for further developments of data governing frameworks of making data FAIR[17] (Findable, Accessible, Interoperable, Reusable).
- Data regulations also apply to data access in healthcare, where improved data access for health care professionals (HCP) are needed to provide a better care for patients/citizens. The individual HCP should always be able to access all health data relating to their individual patient to be able to take the best decisions for this patient. This is not the case today. Thus, decision makers and healthcare providers should continue to further develop both data regulations and healthcare data infrastructures to make this possible and thereby better accommodate the opportunities provided by PM.

17 Annika Jacobsen et al; FAIR Principles: Interpretations and Implementation Considerations. Data Intelligence 2020; 2 (1-2): 10–29. doi: https://doi.org/10.1162/dint_r_00024

# Ethical and societal perspectives

Ethical and societal perspectives play an increasingly important role in the development and implementation of PM. There are many aspects that need to be addressed. The Sino-EU PerMed expert group discussed a number of these aspects as follows.

***Building a foundation for a Sino-European ELSA dialogue***

Cultural differences do not preclude the existence of shared values and principles between European and Chinese perspectives. While cultures may express values and principles differently, the underlying ethical foundations can be alike. The behaviour resulting from adherence to these shared values may vary, with different justifications being offered. To further promote PM there is both a basis and a need for an open-minded dialogue on ethical, and societal issues to promote mutual understanding and collaboration.

Recommendation:

- Facilitate stakeholder meetings in China and Europe on a regular basis led by inter-cultural ethics experts including public health experts working in the field of good governance and health diplomacy to exchange ideas and discuss ELSA issues, particularly matters arising regarding innovative research approaches and methodologies such as those found in PM. The aim would be to build an open climate for PM research based on mutual respect and a shared vision of improving health outcomes.

***Distribution of benefit - real needs and priorities of local populations, stewardship of science directions***

There is a real risk that benefits from PM will be restricted to those who are well off, thereby further exacerbating health inequity in China and Europe. For example, while millions of people suffer from cancer in both regions, commercially driven healthcare systems may keep new PM-based treatments out of reach for a majority of these patients, primarily because they are very costly treatments and not covered by social health insurances. The aim of ensuring health equity, must be built into the very shaping of the PM research agenda in China and Europe. It is imperative to have trust and community support as well as supportive political will, hence active efforts are needed to involve key stakeholders through continued relationships and communication with local communities and patient groups. It is essential to listen to patient groups, to include their voices in the setting of research priorities, also in upstream basic biological research into disease mechanisms and targets for novel drugs, increasingly supported by enabling and analytical technologies.

Recommendation:

- Organise multi-stakeholder meetings regionally in China and Europe on a regular basis to ensure the input of patient organizations, ethicists, researchers, including human and social disciplines, industry, government agencies and more.
- Each region must facilitate processes ensuring that relevant stakeholders contribute to the defining of science directions, what to prioritise, where should limited research resources be directed and what supervision/monitoring mechanism should be in place, based on the very diverse and specific needs of the regions.
- Appropriately formulate and support both European and Chinese stakeholders' motivation to participate in cross-border PM collaborations through a fair, reasonable and non-discriminatory benefit sharing mechanism, for instance, to ensure equal access to research data and findings as well as products and services, proper sharing of intellectual property rights, and equal opportunity for publications, while promoting Open Access Policies wherever possible[18].

***Participant recruitment: conflicts of interests, undue inducement, and therapeutic misconceptions***

Many hospitals in China and Europe have gained considerable experience in carrying out clinical trials over the past two decades. Recruitment and consent procedures have been standardised and dedicated research departments within hospitals work with Contract Research Organisations (CROs) to recruit patients into trials, often carried out in collaboration with multinational pharmaceutical companies. Given this high volume of clinical trials, and the obvious commercial as well as (hospital/researcher) prestige interests that are at stake, there is a risk that standardised and streamlined informed consent processes aimed at ensuring voluntariness and understanding will be compromised by conflicts of interest related to dual physician-investigator roles and commercial interests leading to undue inducement.

18 See e.g., Zhang, L, Downs, RR, Li, J, Wen, L and Li, C. 2021. A Review of Open Research Data Policies and Practices in China. Data Science Journal, 20: 3, pp. 1–17. DOI: https://doi. org/10.5334/dsj-2021-003 and The Beijing Declaration on Research Data: https://doi.org/10.5281/zenodo.3552330

Recommendation:

- Ethical review committees in hospitals where research takes place should have the responsibility to ensure that all potential conflicts of interests are identified and mitigated, and they should carry out periodic in-person audits of patient recruitment.
- To avoid inequality in access to healthcare, there should be periodic review of participants compositions to improve fair access to healthcare.
- Particular attention should be paid to the risks of therapeutic misconception whereby patients mistake research participation for treatment.
- Ethical (refresher) training of healthcare professionals (e.g. project nurses, clinicians) responsible for patient recruitment should be mandatory, focusing on each of these areas.

***Return of genetic findings to patients***

Given that PM generally involves genomic sequencing, it is imperative that researchers and healthcare professionals define, prior to commencing patient recruitment, how return of genetic findings will be organised, both regarding return of genetic findings in relation to targeted disease as well as in relation to incidental findings. Internationally, there are a variety of ways in which the return of (incidental) findings following research-led genomic sequencing occurs. In some countries ACMG's list of "clinically actionable" gene variants[19] are seen as essential to feedback because they are clinically relevant for the person in ways that can be acted upon. In other countries researchers/HCPs can only look for those variants that are related to the condition, they have informed research participants they are interested in learning about. In China and also in Europe, there are reservations about reporting back, for example on all clinically actionable findings, due to the anxiety such risk information could cause already vulnerable patients (and their families), the possibilities for stigmatisation that such genetic information might engender for families (and local communities) and the fact that patients/families might not have resources to follow up on recommended actions. European and International initiatives such as 1-M Genomes' initiative[20] and GA4GH, the Global alliance for Genomics and Health[21], should be followed closely as they address this issue with concrete cases and in an international dialogue.

19 https://pubmed.ncbi.nlm.nih.gov/25741868/

20 https://digital-strategy.ec.europa.eu/en/policies/1-million-genomes

21 https://www.ga4gh.org/

Recommendation:

- Public and private organisations involved in PM research must formulate a clear position on how genetic findings targeting a specific disease will be returned back to the patient.
- It should be clarified with the patient whether incidental findings will be returned to the patient and whether the patient wish to receive such information.
- In both cases it should be ensured that appropriate counselling is available to ensure that a patient consents to sequencing based on a sound understanding of potential consequences. It is not evident that hospital research departments and CROs have the required competences to ensure this, in which case capacity building will be necessary.
- The concerned patient should be reminded that the feedback may reveal health risk exposures of the family.
- Research on this topic involving human and social sciences should be conducted in order to enlighten the different positions of stakeholders on this matter and to evaluate the consequences of the various policies adopted in a comparative way

***Anonymity in relation to sharing of health data***

The complex landscape of regulations to cover health data sharing and access has already been discussed above. A particular point in this context with strong ties to ethics relates to anonymity of data. In general, it is considered that health data used in research should be anonymous or anonymised, thus it should not be possible to track the data back to the originating individual patient/citizen. In Europe, the regulations are offering two possible options for reuse of health data: Anonymisation makes it easier to share data with third parties, whereas pseudonymisation needs to be overlooked by an ethics committee. Both approaches are possible. However, when it comes to PM research this principle is challenging for several reasons. There is no universal way of anonymising data, and the available methods depends very much on the type of data in question. Furthermore, due to the principle of PM it is often necessary to connect data to the individual. As a consequence, ethics review committee members and researchers often have challenges in distinguishing between anonymised, pseudo-anonymised and de-identified data sets with all the different technicalities that went into ensuring them.

Recommendation:

- Relevant European organisations represented in China should cooperate with e.g., the Human Genetic Resources office to provide information/trainings in compliance with relevant regulations and ethical frameworks for using health data in research for European researchers, organisations and companies interested in collaborating with partners in China. These trainings would promote mutual understanding and appreciation of diverse practices to ensure ethics compliance. They should focus on how to define and classify the types of sensitive personal health data that PM research would generate, how to account for plans to collect, store, analyse, share such data, and how to dispose of them.

***Monitoring and supervision of PM research***

Some form of ethics review committee or institutional review boards are now mandatory in clinical settings where research takes place in both China and Europe as stipulated by regulations. These review committees have gained sound experience over the past 15 years as advanced biomedical research develops in both regions. However new issues related to new technologies such as large-scale sequencing and artificial intelligence tools need specific considerations that are also a challenge for such committees. Training is necessary for members of such committees to be able to review this kind of projects in a relevant way.

Recommendation:

- When partners from Europe and China collaborate in PM, it is recommended that meetings between relevant ethical review committee members in China and Europe are facilitated in order to exchange experiences and to promote as much harmonization as possible.
- Ideally this should be done at an overall policy level and organised by relevant ministries, but a more practical approach would be to organise more local meetings between the review boards from the institutions involved in the particular collaboration project.
- Comparative research on values and best practices in such committees could help making such meetings more operational.

### *Complexity of understanding PM research*

The general public understanding of the concept of PM and what it implies in terms of improved healthcare and health research is an area which needs attention, both in Europe and China. Overall, the PM concept has been communicated and discussed in more detail in Europe in the public than in China. In China the general population is not very much aware of PM and the opportunities it provides in terms of better healthcare outcomes. However, it is very important to promote public awareness and discussion of PM since it will be public interest (together with development of PM-based approaches in healthcare and prevention) that eventually motivates decision makers, healthcare providers and payers to make the right and evidence-informed decisions to implement PM in healthcare.

Recommendation:

- Public materials and campaigns should be launched in both Europe and China to increase awareness and health literacy of PM and the opportunities it provides in terms of better healthcare and prevention.
- The general public's concerns and questions regarding PM should be collected to conduct more targeted advocacy, education, and social science research.
- Regarding recruitments of patients and citizens for studies, a checklist of ethical and social questions relating to obtaining informed consent that are relevant to patients and the local communities should be used to formulate clear answers in a language that is understandable to all potential participants. Involving patient and citizen organisations in building up such instruments and revisiting their language should be organised.

**Suggested checklist for patients:**

- Biological samples: What will happen with my biological samples, how will they be stored/used/disposed? Who will have access? What will institutions/companies do with my biological samples? Will I have the possibility to withdraw my biological samples from a biobank? Who are the regulatory bodies and where can I file a complaint if needed?
- Health data: What will happen with my health data (sequenced genomes, lifestyle information, health records), how and where will they be stored/disposed, can they be misused, who will have access, what will institutions/companies do with my data? Will I have the possibility to withdraw my health data from repositories? Who are the regulatory bodies and where can I file a complaint if needed?
- Genomic sequencing: What will potential genetic/genomic findings following sequencing mean for me and my family? Which findings will be fed back to me? Can I refuse to have findings fed back to me? Do I have to inform my family members? And if yes how?
- Experimental treatment/clinical trials: What am I saying yes to (treatment/research), what other options do I have, what are the benefits and what are the risks?
- Benefit sharing and equity: Who will benefit from the research, how will the benefits be shared, what are the risks to my community?

# Conclusions

The concept of PM has come a long way since its start as a scientific speciality within genetics research almost two decades ago. Importantly, it is now generally accepted, also by decision makers, that PM must be a key part of our future healthcare system to be able to provide improved diagnosis, treatment, and prevention for patients and citizens. Development and implementation of PM has now reached a point of very high complexity and ELSA are an increasingly important part of this complexity. Whereas the path forward for e.g., science and technology of PM is mature enough to proceed although uncertainty still exist, the solutions to ELSA are less clear and often difficult to find. A key issue for all stakeholders is to fully understand the needs and implications of ELSA in relation to PM to be able to identify the best set of solutions in a very timely and proactive manner to avoid that ELSA research will be lacking behind and by this loosing trust of patients/citizens and decision makers.

The target audiences for the discussions, observations and recommendations provided in this policy brief are diverse, including researchers, clinicians, decision makers, healthcare professionals, healthcare providers and payers, patients and citizens. However, all these groups are key stakeholders in implementing a future PM-based healthcare and it is important that all stakeholder groups understand each other's perspectives in the organisation of our future healthcare systems.

There are many ELSA issues in relation to development and implementation of PM, but the points discussed above were considered urgently relevant. Hopefully, this policy brief can help stakeholders both to better understand the importance of ELSA in relation to PM and the need for further research on these aspects in order to better inform how they potentially not only can be resolved but also pro-actively becoming a vehicle to frame and promote PM research and development.


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