EP PerMed
European Partnership
for **Personalised Medicine**

EP PerMed Conference on Personalised Medicine Research

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Table of contents

1 Executive Summary

The European Partnership for Personalised Medicine (EP PerMed) organised a "Conference on Personalised Medicine Research" on 11 and 12 February 2025 in Berlin, Germany. The conference brought together around 250 international experts in the areas of personalised medicine (PM) to present and discuss cutting-edge research and their translation into clinical practice.

The two (2)-day conference combined insights into state-of-the art transnational research in PM from different perspectives such as diagnostics, therapy and clinical trials, and addressed the ethical and legal aspects of PM. It also provided an excellent networking opportunity for top researchers from Europe and beyond to collaborate on future challenges in PM and prepare for upcoming funding opportunities.

The conference welcomed 29 speakers in nine (9) plenary talks and six (6) breakout sessions with the following topics:

- Integrating Multi-Omics for Personalised Approaches
- Personalised Prevention
- Machine Learning and Artificial Intelligence applied for Personalised Medicine
- Woman Health in Personalised Medicine
- Clinical Trial Design for Personalised Medicine
- Personalised Medicine for Children and Adolescents

> "With ever-improving biomedical and supporting technologies we now have the opportunity to exploit much more of the excellent results from research and innovation projects. More and more precise treatments are now in our hands for diagnosis, treatment and prevention of diseases."
>
> **Wolfgang Ballensiefen, Deutsches Zentrum für Luft- und Raumfahrt e.V., DLR Projektträger, Division Health, EP PerMed coordinator**

We had outstanding speakers, insightful presentations and engaging discussions with all conference participants. Patients and society will benefit from the implementation of the PM approaches discussed in the years to come.

2 Welcome & Introduction

Speakers:

- **Carmen Laplaza Santos,** Head of Unit Health Innovations and Ecosystems, European Commission
- **Wolfgang Ballensiefen**, Deutsches Zentrum für Luft- und Raumfahrt e.V., DLR Projektträger, Division Health, EP PerMed Coordinator

Carmen Laplaza Santos

Attendees of the EP PerMed Conference come from diverse backgrounds and disciplines, united by a shared passion: advancing and integrating PM into healthcare. This passion goes beyond professional interest—it's a commitment to a future where treatments are tailored to individuals, maximising efficacy and minimising side effects.

PM tailors healthcare by considering genetic, environmental, and lifestyle factors, promising to revolutionise prevention, diagnosis, and treatment for better outcomes and more efficient healthcare systems. The European Commission (EC) strongly supports advancement and integration of PM approaches into clinical practice. Strengthening Europe's health sector competitiveness is crucial, and to achieve this, the EC will prioritise competitiveness, resilience, and security. Europe must stay ahead to ensure better health outcomes, and these priorities will shape the next phase of ambition.

The EC President recently announced the launch of the Competitiveness Compass to drive three critical transformations for European's future:

- Closing innovation gaps, accelerating innovation and competitiveness, finding new worth in genes,
- Joining the carbonisation and competitiveness plans, decarbonising while keeping competitiveness, notably by decreasing energy cost,
- Increasing security and resilience.

> "Competitiveness is the roadmap to translate research into actions."
>
> **Carmen Laplaza Santos, Head of Unit Health Innovations and Ecosystems, European Commission**

As part of the life science strategy, these actions support the green and digital transitions and high-value technology development. The strategy leverages Europe's strengths alongside Member States, with the upcoming European Biotech Act fostering innovation in health technology assessment, clinical trials, and biotech-driven economic growth. In the coming years, research and innovation will be central to Europe's economy.

Europe will boost innovation by increasing research and development (R&D) investment and promoting free knowledge and talent circulation. The upcoming European Research Area Act aims to align funding priorities, reduce research fragmentation, and finally reach the long-standing 3% R&D target. Clinical trials will be a key focus, enhancing Europe's appeal as a hub for cutting-edge research.

Regarding health priorities, the Commission aims to complete the European Health Union with resilient systems, diversified supply chains, and a stronger focus on prevention and non-communicable diseases. PM presents a key opportunity, requiring collaboration between research, policy, and clinical practice to accelerate the translation of scientific discoveries into tangible benefits.

Translation is more than applying new technologies, it requires a multidisciplinary approach that considers ethical, regulatory, and societal impacts. Bridging research and clinical practice is where PM's true value emerges, transforming discoveries into life-changing therapies in a way that is accessible, responsible and equitable. This complex process demands investment, innovation, and adaptability, but its potential rewards make the commitment worthwhile.

In the context of translation, a clear opportunity from genomic research is pharmacogenomics, i.e. personalising drug prescriptions to reduce side effects. Yet, the uptake across Europe remains slow and uneven between European countries despite strong evidence supporting its benefits. With OECD (Organisation for Economic Co-operation and Development) estimates showing 20% of healthcare spending is wasted, reducing inappropriate resource use is essential, especially amid workforce and medicine shortages. PM plays a crucial role in optimising care and addressing major challenges like healthcare's environmental impact—it ranks as the world's fifth-largest polluter, emitting more carbon than logistics and aviation combined. Smarter resource use, driven by PM, is key to sustainability and better healthcare.

Fortunately, policy is increasingly recognising this shift. Over a year ago, Spain introduced a genomic passport for all patients, while Romania granted all citizens access to PM. The European Medications Agency (EMA) is actively working to integrate pharmacogenomics into clinical practice, though systemic change in healthcare remains challenging. We hope for widespread implementation soon, beyond privileged regions. We eagerly await the results of EP PerMed's recent call on pharmacogenomics. This field is a key part of

personalised prevention, a Commission priority. Last year, we launched a PM prevention call, selecting four projects, including one focused on cardiovascular risk in menopausal women.

This conference will explore the latest PM research, address challenges, discuss strategies, and feature expert insights, lively debates, and collaborative workshops. It is not just a knowledge-sharing opportunity, but a call to action—an invitation to reaffirm our commitment to advancing PM.

> "PM is an investment […] that can help tackle some of the important challenges Europe is facing today."
>
> **Carmen Laplaza Santos, Head of Unit Health Innovations and Ecosystems, European Commission**

Wolfgang Ballensiefen

Welcome to this first EP PerMed conference on behalf of EP PerMed consortium, the German Federal Ministry of Education and Research and the German Federal Ministry of Health.

The foundation of EP PerMed is based in the research-supporting activities of the European Research Area Network on Personalised Medicine (so-called ERA PerMed) as well as the International Consortium for Personalised Medicine (ICPerMed) and related and cooperating projects. However, EP PerMed goes beyond research, also focusing on PM innovation and the integration into healthcare systems. It's a significant challenge, but one we are committed to tackling—together in the coming years.

Over the past 8 years, ERA PerMed, and now EP PerMed, have been dedicated to advancing PM research not only across Europe but also on regional and national levels. Their efforts have supported research and implementation, ensuring benefits for patients and citizens while actively involving them in the process. While Germany has seen significant regional and national activities, EP PerMed partners across various countries also play a crucial role in driving PM initiatives dedicated to research and within their healthcare systems. This broad and collaborative approach is essential for driving progress forward. Furthermore, the partnership is fortunate to continue and build on the efforts of ERA PerMed and numerous other European and national initiatives, institutions and consortia in all areas essential to develop PM approaches. Although, PM is already a reality; our task now is to accelerate its progress across all three key areas: research, innovation, and implementation.

Over the past decade, PM has evolved into a widely recognised and scientifically valid concept in biomedical research, alongside advancements in emerging technologies such as imaging, multi-omics, artificial intelligence (AI), and machine learning (ML). These innovations have accelerated the development and implementation of personalised approaches in healthcare.

Additionally, this new partnership aims to facilitate the transition from research results to innovative and sustainable implementations within diverse healthcare systems. While the structural differences among healthcare systems across countries present challenges, they also offer valuable opportunities for PM integration. Some regional healthcare systems have already taken the lead, serving as pilots for PM implementation and paving the way for broader adoption. Furthermore, citizen support is essential for successfully implementing PM in healthcare systems and overcoming its challenges.

To ensure that patients and citizens truly benefit from PM and personalised preventive strategies, it is crucial to implement, provide, and fund safe PM approaches. The partnership has already launched several calls to support PM-related research and innovation, with more in preparation and planned for the future. We are actively supporting researchers and SMEs in integrating their PM solutions into healthcare systems. More information can be found on the EP PerMed webpage, through our newsletter, and on EP PerMed social media.

The vision for EP PerMed is to enhance health outcomes within sustainable healthcare systems by advancing research, innovation, and the implementation of PM approaches for the benefit of patients, citizens, and society as a whole. This is the ambitious goal we are striving towards, and we are committed to achieving it.

> "To take personalised medicine to the next level, cross-border, multidisciplinary and cross-sectoral collaboration is key. We all have a common goal here: to advance the field of personalised medicine."
>
> **Wolfgang Ballensiefen, Deutsches Zentrum für Luft- und Raumfahrt e.V., DLR Projektträger, Division Health, EP PerMed coordinator**

3 Keynote Lectures

Speakers

- **Monika Frenzel**, The French National Research Agency (ANR), France
- **Étienne Richer**, Canadian Institutes of Health Re-search (CIHR), Canada
- **Benedikt Westphalen**, Comprehensive Cancer Center Munich (LMU), Germany
- **Sahar Barjesteh van Waalwijk van Doorn-Khosrovani**, CZ Health Insurance & Leiden University, The Netherlands

Monika Frenzel: "8 years of multinational research funding – ERA PerMed and EP PerMed"

Collaboration starts with common definitions and a common goal, like the definition of PM through the European Council Conclusions and the first Strategic Research and Innovation Agenda (SRIA) in 2015. Ever since, the International Consortium for Personalised Medicine, ICPerMed, as a policy platform, the ERA Net ERA PerMed as joint funding programme and nine (9) projects as Coordination and Support Action were funded and worked together under the ICPerMed Family umbrella structure. Through ERA PerMed and five (5) calls for proposal, 111 transnational, intersectoral and multidisciplinary research projects in diverse disease areas and application fields were funded with a total budget of 132,9 M€. The work of the ICPerMed Family is now continued and extended through EP PerMed, launched in November 2023. Besides supporting research in the PM field, the EP PerMed is supporting PM innovation, implementation and cross sector well as cross-border collaboration on all levels and globally. The structure of EP PerMed and the different planned activities were presented.

Key messages:

While substantial financial support for PM development comes through the European Union, even more is invested by the different countries and European National Regions. One example is the ERA-Net ERA PerMed: The support of 9,5 M€ EU co-funding leveraged to a total investment of 133 M€ in research grants for 111 projects, hence +1300% national contribution vs. EU co-funding. While the research knowledge is constantly increasing, there is a need to support the translation of research outcomes into health innovations towards implementation. This need was outlined in the SRIA for PM (2023) and will be put into action through the EP PerMed, e.g. though annual Joint Transnational Calls, biannual Research Innovation & Technology or Demonstrator Calls (including support for PM Pilots), biannual Network Supporting Calls, Survey Calls, site visits and sharing of good practices, Reverse Technology Transfer activities, trainings and summer schools, and other activities. EP PerMed's major communication tool is its website, including a database of projects

funded by ERA PerMed and EP PerMed, and LinkedIn. Who would like to be updated regularly, is invited to inscribe to the newsletter.

Étienne Richer: "Holistic View of Personalised Medicine Research and Current Status"

The underrepresentation of data from individuals of non-European descent leads to misdiagnoses, pharmacogenomic gaps, and biased genotyping arrays, reducing the accuracy of polygenic risk scores in underrepresented populations. Including diverse communities in research and clinical studies is crucial for achieving equitable health outcomes.

The CIHR Rare Disease Research Initiative exemplifies a holistic approach to patient inclusion in programme development. Its four (4) main objectives are to enhance clinical trials and treatments, reduce time to diagnosis, increase treatment availability, and improve data quality and monitoring. These goals were developed in close collaboration with patient partners, who were involved in consultations, research applications, and peer-review processes, significantly influencing project evaluations.

Healthcare systems and research communities should actively partner in innovation, creating learning systems where data drives research and swiftly integrates solutions into care. Future perspectives should consider personalised prevention, AI/ML use, national and international data sharing, clinical translation, harmonised regulations, economic development, competitiveness, social acceptance, and equity and diversity inclusion.

Value evaluation of PM should occur throughout the research and development process, i.e. research investment, market access, and pricing and reimbursement decisions. Traditional evaluations focus on direct healthcare costs, but PM requires considering additional factors such as diagnostic tools, patient screening, and long-term prevention benefits.

In conclusion, collective effort toward health system transformation is needed with involvement of all stakeholders (researchers, clinicians, patient organisations, regulatory actors, etc.).

Key messages:

One issue that limits significant breakthrough in PM is the underutilisation of data from underrepresented populations in studies. For instance, the UK Biobank includes 5% diversity, mirroring the UK population, yet many studies exclude this data due to variations. Historically, this practice led to the exclusion of women from clinical trials, resulting in higher adverse events in this population. While sequencing the entire population raises ethical concerns, advocating for diverse data inclusion in research and clinical studies is crucial, especially as PM develops.

Regulations differ between countries, hindering data sharing across jurisdictions. To address this, we must harmonise regulations and integrate new concepts like AI. The Global

Alliance for Genomics and Health (GA4GH) leads in this area by developing standards for responsible genomic data management. Implementing GA4GH standards enhances harmonisation and strengthens international partnerships to overcome these challenges.

The misuse of genetic data by medical insurance companies to discriminate, raise premiums, or deny coverage is a significant concern. To address these issues in the implementation of PM, countries should consider enacting genetic non-discrimination laws. Such legislation would help protect individuals from unfair treatment based on their genetic information.

Benedikt Westphalen: "Incorporating recent advances in cutting edge personalised medicine research into the real clinical practice"

There is a need of wide and equal patient access to diagnostic technologies and therapeutics, i.e. access to quality ensured testing, expertise and treatment.

The European Society for Medical Oncology recommends running of tumour next generation sequencing (NGS) in advanced non-squamous non-small cell lung cancer, prostate cancer, colorectal cancer, cholangiocarcinoma, and ovarian cancer as well as performing tumour NGS to detect tumour-agnostic alterations in patients with metastatic cancers where access to matched therapies is available.

There is an expansion of recommendations to encompass patients with advanced breast cancer and rare tumours such as gastrointestinal stromal tumours, sarcoma, thyroid cancer, and carcinoma of unknown primary. The landscape of molecular insights and molecularly guided therapeutics is rapidly evolving, but current guidelines can only insufficiently capture this evolution in time.

Comprehensive tumour profiling can inform standard of care, support screening for clinical trials and provide caregivers with additional clinical information. AI in diagnostics supports the prediction of microsatellite instability directly from histology in gastrointestinal cancer.

Precision Oncology as a concept has the potential to fundamentally change our approach and perception to public health by personalised prevention, personalised early detection and personalised treatment. This realisation has socio-economic and ethical implications and hence underscores the need for integrated healthcare solutions with truly multi-stakeholder collaboration and trans-sectoral approaches.

Key messages:

Scaling precision oncology requires equitable access to molecular diagnostics, expertise to interpret results, and availability of targeted therapies.

To maximise impact, we must prioritise clinically relevant, practical solutions and work towards a truly patient-centred, globally accessible approach to cancer care.

Sahar Barjesteh van Waalwijk van Doorn-Khosrovani: "Sustainable Transition of Innovation into Patient Care"

Independent academic trials make up half of all ongoing clinical studies. Many of these trials aim to address the real unmet medical needs faced in clinical practice. However, many of the insights gained from these trials and their innovative ideas never reach patients. Several factors contribute to this issue, including a lack of sustained funding throughout the entire development pathway and limited interest from pharmaceutical companies in further development and repurposing—especially as drugs progress further in their life cycle. Additionally, there are often no clear pathways for regulatory assessment, Health Technology Assessment (HTA) evaluation, and reimbursement of academic-driven innovations. It is therefore important for the healthcare system to address these challenges to prevent a waste of resources and to establish a sustainable approach to developing new therapies.

Key messages:

To foster greater engagement with payers and HTA bodies, it is crucial to include HTAs, payers, and policymakers in discussions about reimbursement strategies and cost-effectiveness thresholds. Researchers should actively involve these stakeholders to offer insights into ongoing research and clinical trials, which may not be widely known to them.

We need to establish a regulatory pathway for independent clinical trials to streamline clinical approval. Many of these trials focus on additional indications rather than new substances, addressing unmet medical needs for patients who require alternative therapies. Unfortunately, the pharmaceutical industry often lacks interest in these trials, leaving investigators without support to implement results and make therapies available. Current practices and pathways must be revised to assist investigators in bringing safe therapies to patients. Implementing repurposing pathways could clarify and accelerate this process for researchers.

4 Breakout session 1 – Integrating Multi-Omics for Personalised Approaches

Moderator: **Alexandra Becker**, Deutsches Zentrum für Luft- und Raumfahrt e.V., DLR Projektträger, Division Health (ERA PerMed, Joint Call Secretariat 2020)

Panellists

- **Jesús María Hernández Rivas**, University of Salamanca (IBSAL), Spain
- **Holger Prokisch**, Technischen Universitat München, Germany
- **Isabella Ceccherini**, IRCCS Istituto Giannina Gaslini, Italy

Aim of the session:

This session aims to showcase research that integrates multi-omics data, technologies, and tools for PM approaches. It highlights the benefits and challenges of incorporating omics in various research fields. The discussion covers the use of multi-omics for biomarker identification, clinical diagnostics, and drug discovery, as well as the implementation of these tools in clinical practice. By exploring these aspects, the session provides insights into the potential and practical considerations of multi-omics in advancing personalised healthcare.

Jesús María Hernández Rivas: "Synthetic Lethality for Personalised Therapy-based Stratification In Acute Leukemia (SYNtherapy)"

The aim of the SYNtherapy project was to develop a ML-based model to predict personalised treatment for relapsed or refractory acute leukaemia. Differential expression analysis of RNA-Seq data provided primary molecular markers, while protein-protein interaction networks were used to identify secondary not altered candidate genes of synthetic lethality. Combination of omics and ex-vivo drug screening data of selected DNA damage response inhibitors was used as training dataset for the predictive model. A multi-centric investigator-initiated clinical trial tested the performance of the predictive model as well as the practical feasibility of the whole procedure. The creation of the HARMONY Big Data Platform with its Outcome Predictor Calculator aims to precisely match leukaemia patients with the most effective targeted therapy, thereby increasing chances of successful treatment and definitely adding value to all stakeholders in the field of blood cancers.

Key messages:

Each collaboration, with academic institutions, clinicians, patient organisations, industry, regulatory agencies, HTAs, etc., should start with a common project. Europeans are sometimes isolated, hence the importance of networking and collaborations.

When building a translational project, it is crucial to determine the best and most sustainable therapy for patients. Patient involvement is central for this aspect, and a patient group coordinated one of the project's Work Packages to this end.

Data sharing is important for the impact and implementation of projects. The HARMONY Big Data Platform collected and shares data from more than 20 European countries.

Holger Prokisch: "Personalised Mitochondrial Medicine (PerMiM): Optimising Diagnostics and Treatment for Patients with Mitochondrial Diseases"

There are more than 1,000 metabolic disorders among which a large fraction affects energy metabolism in mitochondria, the powerhouses of cells. Several mitochondrial disorders are amenable to treatment, often with a simple diet change such as vitamin supplementation. However, pinpointing the genetic cause of mitochondrial disorders and determining the appropriate treatment remains open for most affected individuals. To address this challenge, the Eurasian personalised mitochondrial medicine project (PerMiM) aimed for early diagnosis by integrating information on the patient's genes, metabolites, and proteins using skin biopsies. The project was part of the larger GENOMIT project and was divided in three (3) Work Packages: integration of clinical data from -omics, biomarkers for treatments and clinical management strategies. RNA-sequencing as molecular diagnostic tool and a pipeline for personalised antisense oligonucleotide therapies were developed. The same cell lines were used to quantify over 50% of the proteins involved in mitochondrial disorders using proteomic analysis. Multi-omics evidence increased diagnostic yield by 20%. These tools were also used for identification and validation of novel mitochondrial disease genes.

Key messages:

Challenges faced when implementing these strategies in clinical settings included the implementation of AI to sort the data and identify outliers and teaching the value of using skin biopsies in certain fields, e.g. neurological diseases. Furthermore, an experienced IT group is needed to analyse all the data, which is foreseen as a challenge for the implementation of these kinds of big data analyses in clinical settings. Finally, the consortium was an international collaboration, which made this project possible. Multinational collaborations will be necessary to further develop these strategies for clinical diagnostics, especially in the case of rare diseases.

The presented method cannot detect any direct evidence with mutations that do not change protein levels. However, indirect evidences of the functional consequences of a gain- or loss- of-function without change in the protein level can be detected.

Some digenic disorders were discovered by this method already. The detection was driven by the hypothesis, i.e. it was based on specific knowledge of the diseases and specific questions of proteins affecting same protein complexes.

Isabella Ceccherini: "PERsonalised medicine for Systemic Autoinflammatory Diseases (PerSAIDs)"

Systemic Auto-Inflammatory Diseases (SAIDs) are a growing number of rare conditions with monogenic or multifactorial genetic aetiology, causing deregulation of the mechanisms that control innate immune responses. For specific monogenic SAID, PM is already an established reality. However, evidence suggests that personalised approaches could also benefit other SAIDs, 70-80% of which are considered "undefined" because molecular testing cannot provide diagnostic confirmation. This project linked some of the largest registries and bio-sample repositories on SAIDs in Europe and used retrospective and prospective datasets from eight (8) omics layers to find new diagnostic signatures: genomics, epigenomic, transcriptomics, proteomics, metabolomics, lipidomics, immunomics and inflammation panel (olink). Data processing and analysis was performed on a MOLGENIS-based platform. Supervised and unsupervised analytical methods were used to superpose the multi-omics data. This led to the discovery of 16 candidate SNPs to identify 459 QTL from six (6) omics datasets. Despite the limited robustness of the candidates due to the small cohort size, the concordance between different -omic datasets is promising.

Key messages:

The methodologies and protocols were standardised and shared for cross-border collaboration purposes and could also be applied to other rare diseases, such as orphan diseases.

Project limitations include the small size of the cohort and the unequal patient distribution across hospitals of origin.

Single-cell sequencing was not performed but cell deconvolution was used on the whole blood RNA-sequencing to identify and quantify the contribution of different cell types to the overall gene expression profiles.

Panel Discussion:

A major barrier to implementing multi-omics for PM in healthcare is integrating gene expression from different tissues. DNA is the only stable molecule for this purpose, while RNA is unstable and influenced by therapies, drugs, time of day, and activity. Transcriptomes require careful analysis and large patient cohorts for reliable results. Tissue-specific sensitivity is limited, and technologies are being developed to predict variant effects across tissues.

Data harmonisation is a significant bottleneck when integrating multi-omics analyses. A lot of data is lost due to lack of quality, availability or harmonisation. Therefore, for both diagnostics and drug discovery, high-quality multi-omics data and its integration are crucial. This data must be validated across diverse populations, including different countries, genders, and age groups. AI tools can accelerate these essential validation steps.

Clinicians need user-friendly tools to implement omics analyses effectively. While the wealth of information from omics is valuable, the feasibility of implementation is essential. Omics technologies must become faster, more accurate, and cost-efficient before they can be fully integrated into healthcare systems.

When dealing with patients who have rare, heterogeneous, or complex diseases, each case is unique. Multi-omics approaches can help stratify patients by dissecting the underlying complexities, revealing differences among seemingly similar patients and aiding in more precise diagnoses.

Main Key Message of the Session 1

While the wealth of information from multi-omics analyses is valuable, the feasibility of PM implementation is essential for its success in clinical practice.

5 Breakout session 2 – Personalised Prevention

Moderator: **Monika Frenzel**, The French National Research Agency, ANR (ERA PerMed, Joint Call Secretariat 2022)

Panellists

- **Mark Little,** Trinity College Dublin, Ireland
- **Julia Goedecke,** South African Medical Research Council, South Africa
- **Edward Vigmond,** University of Bordeaux/ Liryc, France

Aim of the session:

Preventive strategies have always used the "one size fits all" public health recommendations. This session aims to show that PM, namely recent advances in genetics and multi-omics, enable the use of new technologies to stratify disease risks at an individual level fostering personalised prevention and predict outcome of treatment as well as relapse. Heterogenous diseases address the need for more effective prevention challenges. Health policy makers and public health professionals need to develop new strategies for the implementation of Personalised Prevention.

Mark Little: "PersonAlisation of RelApse risk in autoimmune DISEase (PARADISE)"

Autoimmune diseases affect 10% of adults, most are women. ANCA-associated vasculitis is a fatal multisystem autoimmune disease that causes kidney failure and bleeding from the lungs, caused by an abnormal immune reaction against either myeloperoxidase or proteinase-3. It represents a relapsing and remitting disease in 50% of patients within five (5) years with consequent progressive organ injury. Treatment with high dose immunosuppressive therapy is toxic and very expensive.

International guidelines recommend rituximab maintenance therapy, ranging from 24 to 48 months, while the protocol depends on the patients. There is a need of personalised treatment duration which integrates multiple static and dynamic factors to estimate future relapse risk.

The PARADISE project aims to provide a dynamic, time sensitive algorithm-guided decision support. The goal of the project is to generate personalised decision support tools that consider the current status of the patient from multiple angles: past events such as prior relapses, past treatment exposure, novel biomarkers and app-generated patient derived outcomes, using exciting deep generative AI modelling techniques. The modelling framework established, focusing on the switch from remission to relapse over time, will be translatable to other autoimmune diseases with appropriate fine tuning of the algorithms using relevant disease specific datasets.

The key output from the PARADISE is the creation of a nidus for collaboration. Next steps are 1) emulated trial testing the efficacy of a personalised stopping algorithm, 2) connection to electronic health records, 3) FDA/EMEA approval and 4) validation in diverse jurisdictions and ethnicities as well as AI act compliance.

Key messages:

Leverage cross-border collaboration to maximise data availability, but do not underestimate the time required for agreements. Build in a task at the start to build synthetic datasets, so optimisation and simulations can begin without delay while the data sharing agreements are being developed.

Julia Goedecke: "Omics Approach for Personalised Prevention of Type 2 Diabetes Mellitus for African and European Populations (OPTIMA)"

There are 73 proteins associated with dysglycaemia, 34 validated in European population (EpiHealth) and 39 are African-specific proteins. The aim of OPTIMA is to develop ethnic- and sex-specific risk prediction models for the early detection of dysglycaemia (impaired glucose metabolism and Type 2 Diabetes) in African and European populations through the identification of early biomarkers (proteins and metabolites) specific to populations of African and European ancestry, including migrant populations. The OPTIMA cohorts are located in South Africa, Ghana and Sweden.

Early biomarkers are modifiable through lifestyle interventions, and are crucial for developing targeted Type 2 Diabetes prevention strategies, when linked to dietary data.

The next steps of the project are 1) Multi-centre nutrition intervention of tailored dietary prevention intervention trials relevant to African and European populations; 2) Development of commercialised targeted assays for early prediction of Type 2 Diabetes; and 3) Improved risk stratification guidelines that are more relevant to African and European populations.

Key messages:

The pathophysiology of Type 2 Diabetes in African populations differs to that of European populations. Accordingly, risk stratification and generalised recommendations that are based on studies performed in predominately European populations may not be appropriate in populations of African origin. Notably, fasting glucose and HbA1c do not fit as markers for Type 2 Diabetes risk in African populations. It is therefore essential to identify African-specific risk markers for the early prediction of Type 2 Diabetes in populations of African origin. These risk markers will not only give insight into the pathophysiology of Type 2 Diabetes in African populations, but also by linking these markers to dietary intake, it will be possible to develop targeted dietary strategies for the prevention of Type 2 Diabetes in African populations.

Edward Vigmond: "Digital Twins to Treat Atrial Fibrillation (DAWN-AF)"

Atrial Fibrillation is the most common clinical arrhythmia which affects 10% of people over the age of 75. The best current treatment option is the ablation but the redo rate at two (2) years after the first intervention is around 50%.

The aim of the DAWN-AF project is to advance tertiary prevention, define costs and effectiveness of current catheter ablation treatment methods compared to a simulated personalised catheter ablation, and the development of a web service.

The project is working on pre-therapy data processing, i.e. processing of atrial scans to create computational mesh and processing of electrocardiograms to infer activation patterns and material properties, and on intraprocedural processing via a special hardware to interface with electroanatomic mapping system in real-time and ML to determine optimal ablation map during mapping.

Key messages:

Digital twins of the atria can be improved by integrating functional data to deduce missing anatomical data that varies on the individual level. Furthermore, this information can be used to design personalised ablation strategies to reduce ablation redo procedures.

Panel Discussion:

Personalised prevention can support different levels from primary to tertiary prevention. In the field of diabetes, diverse -omics technologies can be used to identify markers for simple tests in early prediction. This may reveal origin specific differences (African vs. European background) or sex specificities, to identify biomarkers to prevent occurrence of disease for example through adaption of lifestyle. Considering tailored dietary strategies, economic analysis on "affordability" and "availability" should be included.

An aspect of tertiary prevention is the identification of personalised relapse risk, i.e. risk assessment and the timing for intervention. Overall, preventive measures allow the "treatment" of more people, not only those that need an urgent intervention.

Barriers for the development and implementation of preventive measures in healthcare may be the lack of access to data (i.e. missing data governance) and lack of standardisation of data, affecting interoperability and scalability. Research *per se* cannot be counted as barrier but a difficult hurdle for implementation of lifestyle connected diseases may be the change of perception of participants and changing of their habits, including nutritional regiments.

The relation with the industry and the private sector is very important to explore new avenues. Private companies provide and include great services and they perform research themselves. If funding from the government is limited, like it is the case for example in

many African countries, there is a need to rely on industry investment and collaboration to push research.

There is a need to solve issues of clinical data harmonisation considering that every company has its ML techniques (and connected intellectual property) adapted to individual PM solution. To solve problems related to the use of data from different countries, a solution could be that the different teams process data separately and only merge results. Merging of whole a detailed raw data sets within one database is challenging, time consuming and requires data sharing agreements.

In the future, EP PerMed could financially support teams to scale up data acquisition and building global cohorts. In general, there is a need for more financial support for research, including follow-up funding to scale up projects and further develop technologies.

Main Key Message of the Session 2

Personalised Prevention could offer a promising tool to reduce the impact of communicable and non-communicable diseases.

6 Breakout session 3 – Machine Learning and Artificial Intelligence applied for Personalised Medicine

Moderator: **Katja Kuhlmann**, Deutsches Zentrum für Luft- und Raumfahrt e.V., DLR Projektträger, Division Health (ERA PerMed, Joint Call Secretariat 2020)

Panellists

- **Mark Van Gils,** Tampere University, Finland
- **Sigrid Skånland,** Oslo University Hospital, Norway
- **Stefan Kalabakov,** Hasso Plattner Institute for Digital Engineering, Germany

Aim of the session:

This session aims to present examples of research leveraging AI/ML methodologies to develop personalised approaches in healthcare. It explores how AI/ML can enhance decision-making for patient treatments and prevention strategies. Additionally, the session addresses the feasibility and challenges associated with implementing AI/ML in healthcare systems, highlighting both opportunities and obstacles.

Mark Van Gils: "Personalised Prognostics and Diagnostics for Improved Decision Support in Cardiovascular Diseases (PerCard)"

Cardiovascular diseases account for 45% of all deaths in Europe. The majority (80%) of premature heart diseases are preventable, if personal risks can be identified early. However, currently used risk models 1) do not reflect true populations, especially with regard to gender, 2) do not sufficiently consider the genetic backgrounds of individuals, and 3) do not use all the information available in different data sources. PerCard combined different data (echocardiography, electrocardiogram, clinical data, etc.) with novel analysis methods (AI/ML, signal processing) to deliver an improved risk modelling tool. The developed methods are explainable, practical, accessible, and affordable. Development combines existing Finnish and Italian data and new-to-be-collected data in Italy. Ethical and societal aspects, including gender and accessibility to all, received special attention. Six (6) potential use cases were identified for implementation of this modelling tool including two (2) fully implemented thus far.

Key messages:

Challenges encountered in this project included data harmonisation, the short funding period (3 years), and the rapidly evolving innovations and implementation landscapes. A programme has initiated the use of AI for data harmonisation, which could address harmonisation challenges. However, the process remains highly complex.

Clinical use cases are essential to set up meaningful research projects as well as the practical feasibility.

International collaborations demand a lot of work, brainstorming and rejections. It is unrealistic to expect perfect alignment in all collaborations. But international networks offer multiple benefits to one's career, although these may not be apparent until years after a project is completed. While some collaborations are more successful than others, each experience provides valuable insights. It is essential to maintain an open mind and embrace new collaborations, rather than relying solely on established contacts.

Sigrid Skånland: "Tailoring the targeted Treatment of Chronic Lymphocytic Leukemia (CLL-CLUE)"

Chronic lymphocytic leukaemia (CLL) is the most common form of leukaemia in Europe and it remains incurable despite current treatments. Targeted therapies have revolutionised the treatment of CLL. However, many patients develop resistance, have severe side effects or relapse during treatment. Response to the traditionally chemotherapy is well predicted by different biomarkers. However, there is a large shift toward targeted therapies, which responses fail the be predicted accurately by the current biomarkers. In the CLL-CLUE project, immunophenotyping, protein profiling, drug testing and development of a PM ML model (functional prognostic model) were used to find new biomarkers and stratify patients' response to the new therapies. Functional profiling predicted treatment outcome better than other models all cohorts (test, validation and combined cohorts).

Key messages:

The aim of the ERA PerMed consortium CLL-CLUE is to identify a predictive biomarker for response to targeted therapy in CLL and facilitate PM. By performing functional profiling of tumour cells from 177 patients with CLL, the project could identify predictors of treatment outcome. Functional assays were found to be better to stratify the patients compared to classical genetic methods.

Patient involvement is very important to discuss priorities of patients, e.g. survival vs. quality of life in decision making.

The predictive biomarker will be prospectively validated in the EP PerMed consortium CLL-OUTCOME.

Stefan Kalabakov: "Predicting Cardiovascular Events Using Machine Learning (PRECARE ML)"

Atherosclerosis, a condition that is often clinically undetected until it is too late, underlies major cardiovascular events such as heart attacks and strokes. Early identification of people at high risk for such clinical events enables preventive actions. However, conventional risk

prediction scores are often not widely adopted in otherwise healthy and symptom-free people. At the same time, medical information is increasingly digitalised. This leads to huge amounts of electronic health data amenable to risk prediction. Yet, conventional approaches fail to handle this data in its entirety and harness it for medical decision-making. Here, AI methods were used to develop modern risk prediction tools for early identification of people at high risk for major cardiovascular events. This project first aimed to validate and improve AI models by federated leaning across different hospital networks and populations. Second, these models will be integrated in hospital information systems and their impact will be assessed on daily hospital routine. Lastly, as part of the communication strategies to effect behavioural changes in patients, the ClearRisk platform is under development for health professionals and patients. Professionals and patients will be able to enter clinical data and get a risk assessment. They will also be able to play with features to see how the risk evolves if a feature were to change.

Key messages:

Diverse data from different countries were used in this project, which brought challenges regarding 1) regulations surrounding personal data sharing, and 2) performance degradation when moving models to other health systems. These challenges were tackled by using federated learning, i.e. each entity trained local data and only models were shared with an aggregation centre which then trained global data.

Current cardiovascular disease risk assessment tools are limited by considering only small numbers of factors that matter and that often are only tailored to specific regions or populations. The aim of the ClearRisk tool was to develop two (2) versions of generalised models to predict patients' risks and to effectively communicate to medical professionals and patients/citizens at risk. The first model will consider a lot of factors from the electronic health records (designed for healthcare professionals) and a second version of the model distilled that will consider more general factors that patients/citizens will be able to enter on their own.

Panel Discussion:

Researchers should be aware of regulatory and legal issues, security reports, practical considerations, and paperwork requirements in advance of starting the research or developing a project.

Different interpretation of the General Data Protection Regulation (GDPR) is an issue when involving different countries. Data sharing platforms and cooperation agreements have to be in place from the beginning of a project to avoid losing time in collaborative projects.

Using synthetic data and virtual twins offers advantages and can be a viable alternative at the early stages of a project when clinical data are difficult to access. However, real-world

data should remain the gold standard as projects advance. Federated learning can help facilitate access to these data while maintaining privacy and security.

AI can enhance decision-making by presenting potential scenarios, but its effectiveness relies on the quality of available data, which can be a limitation. Ultimately, decisions should be made by humans, with AI serving solely as a support tool.

Implementing an invention typically requires 7–8 years for regulatory approval and validation. Additionally, securing company support is crucial, as public funding alone is insufficient to sustain this process.

Main Key Message of the Session 3

AI has the potential to be a powerful tool, supporting clinicians in their decision-making. Challenges still remain in data harmonisation and data sharing.

7 Breakout session 4 – Woman Health in Personalised Medicine

Moderator: **Monika Frenzel**, The French National Research Agency, ANR (ERA PerMed, Joint Call Secretariat 2019)

Panellists

- **Ron Maymon and Hamutal Meiri,** Assaf Harofeh University Medical Center, Israel
- **Irene De la Calle Fuentes,** Vall Hebron Institute of Research VHIR, Spain
- **Mattias Rantalainen,** Karolinska Institutet, Sweden

Aim of the session

This session underlines the advancements in genomics, biomarkers, and targeted therapies which are tailoring treatments for complex and common diseases in women, including breast cancer, endometriosis, and autoimmune disorders. This might result in faster diagnosis, more effective treatments, and fewer adverse effects. The session also discusses the issues related to costs, confidentiality of data, and accessibility of diagnostics and treatments to insure efficient and equitable healthcare for every woman.

Ron Maymon and Hamutal Meiri: "Develop a Multi-disciplinary Approach for a Personalised Prenatal Diagnostics and Care for Twin Pregnancies (PRETWINSCREEN)"

Feto-maternal complications in twin pregnancies can be structural, genetic complications, preeclampsia, intrauterine growth restriction, preterm delivery, gestational diabetes, vasa previa, placenta accreta. The objective of the PRETWINSCREEN project is the evaluation of twin pregnancies to determine the risk, and develop prevention strategies, i.e. a GOLD Standard for twin pregnancy management.

There is a need for early prediction of preeclampsia in twins. The procedure proposed was to evaluate in the first trimester the cell-free foetal DNA fraction to predict preeclampsia alone and combined with the placental growth factor, mean arterial pressure, the uterine artery pulsatility index for predicting preterm preeclampsia in twin pregnancies. Thereby, reduced cell-free foetal DNA fraction predicts preterm preeclampsia in twins. The combination of low cell-free foetal DNA fraction, low placental growth factor and elevated mean arterial pressure are good first trimester predictors of preterm preeclampsia in twin pregnancies.

Non-invasive prenatal screening might allow a dual role in screening for both major trisomies and preterm preeclampsia. Prospective multi-centre studies on the national level could support to develop multi-national curves for foetal growth in twins. A new paradigm

of identifying malformations in twin pregnancies by introducing three (3) anatomical scans, one in each trimester:

1. First trimester enables early detection, counselling, and informed decisions,
2. Second trimester standard scan, together with 1st trimester, identifies 80% of malformations, followed by counselling, genetic analysis, and follow-up,
3. Third trimester scan detects late-onset cases, improves new-born delivery plan and post-partum care: post-partum standard new-born analysis of malformation and developmental issues.

Key messages:

Early estimation of patient-specific risks for pregnancy complications would improve pregnancy outcome by shifting prenatal care from a series of routine visits to a more individualised patient and disease-specific approach both in terms of the schedule and content of such visits.

Irene De la Calle Fuentes: "Development of a personalised non-invasive diagnosis of endometrial cancer using proteomic markers in cervical fluids and clinical data (CytoMARK)"

The most common symptom of endometrial cancer is the abnormal uterine bleeding. The aim of the CytoMARK project is to establish ground-breaking progress towards a standard of care for endometrial cancer diagnosis by developing a non-invasive tool for diagnosis of endometrial cancer which relies in protein biomarkers in cervical fluid.

Uterine aspirate and cytology, as well as cervical fluids are a source of protein biomarkers for early, non-invasive endometrial cancer diagnosis. They are also a source of biomarkers of other gynaecological diseases as ovarian cancer and endometriosis.

Within this project, seven (7) biomarkers were validated in four (4) independent cohorts. The identified biomarkers are endometrial cancer related proteins. The transferability to RUO-ELISA of five (5) protein biomarkers have been proved with >0,7 correlation. AGRN antibody have been developed and its immunoassay optimised.

Key messages:

CytoMARK is a project developing a non-invasive *in vitro* Diagnostic test for endometrial cancer using cervical fluid biomarkers. This approach will reassure most women with abnormal uterine bleeding of a benign condition while reducing unnecessary invasive biopsies. In detail, the project has resulted in:

- Non-invasive breakthrough: Cervical fluid biomarkers offer a promising alternative for endometrial cancer detection, avoiding unnecessary invasive biopsies.

- Strong biomarker validation: Four (4) independent studies involving 499 patients identified robust diagnostic panels with high sensitivity and specificity.
- Clinical translation: A transition to antibody-based technology since mass spectrometry is not widely implemented in clinical labs. Results were successfully transferred to immunoassay, leading to the development of *in vitro* Diagnostic and Proof of Concept tests.
- Impact on patient care: This tool could streamline diagnosis, reduce invasive procedures, and prevent the pain, risks, and psychological distress associated with entering an unnecessary multi-step biopsy pathway.

Mattias Rantalainen: "Advancing Breast Cancer histopathology towards AI-based Personalised Medicine (ABCAP)"

The aim of the ABCAP project is to use AI models to risk-stratify patients based on routine Haematoxylin and Eosin whole-slide images.

There is a large retrospective population representative study with real-world data and diverse clinical information from national health registries, from multi-sites and multiple cancer diagnoses (breast, prostate, colorectal, skin, lung and more). AI precision pathology, e.g. via AI models for unstained tissue analysis, is relevant, as the complexity for its implementation of the approach in clinical practice is minimal, with low costs but with results delivered within minutes, which overall ensures equality in care.

Around 52.75% of genes were successfully predicted by CNNs (individual deep Convolutional Neural Network models) from routine histopathology slides, 1,011 genes were brought forward for validation, 876 (87%, internal test set) and 908 (90%, external test set) were successfully validated. Overall, intra-tumour heterogeneity patterns, characterised by spatially predicted molecular markers, provide independent prognostic information.

Within the project, an improved prognostic stratification of early-stage breast cancer was developed from academic research and transformed into a regulatory-approved product in clinical use. Deep Grade provides independent prognostic stratification of Nottingham histological grade 2 breast cancer cases. The prognostic stratification has similar performance as currently available molecular assays like gene expression profiling. Stratipath Breast was validated in 2,719 patients and prognostic performance was confirmed.

Key messages:

Improving diagnostics support a better stratification of risk groups and may avoid overtreatment. The technology development in the ABCAP research project has led to the establishment of a spinout company. While the service provided finds acceptance in the clinical setting, such an endeavour requires substantial initial investments (financially but also personnel) and may not create a return of investment earlier than 5-10 years later.

The developed tool is based on datasets of patients from Nordic countries. The next steps are validation studies to integrate more datasets globally.

Panel Discussion:

Equity and consideration of gender balance is an important aspect to be considered in research. There is a necessity to consider gender, genetic background, and accessibility to hospitals. As example, women and notably pregnant women are often underrepresented in clinical studies. Particularly twin pregnancies are not sufficiently considered. For the project PRETWINSCREEN, all women were eligible to join the study. Children and twins need tailored and personalised approaches as they cannot be considered as small adults and twins, even in foetal stage, have to be handled as two (2) individuals. In fields like breast cancer, major progress has been made over the last few years, but today geographical distribution needs to be better considered for the development of PM approaches, specifically in terms of prevention.

To improve preventive measures for women, research on gender-oriented medicine should be promoted, considering factors such as pharmacogenomics and focusing on gender related specificities. Integrative medicine avoids stigmatising and underestimation of patient reported outcomes (e.g. "it is normal that females have more belly pain than males"). This may be realised in clinical practice through healthcare services including diverse specialities, e.g. a multidisciplinary team to address public involvement, to communicate with different stakeholders, to consider smaller populations and overall improve healthcare systems. Women may act or suffer differently compared to men, hence alarm signals may be different for the same disease. There are for example different early alarm symptoms in the field of cardiovascular diseases for women compared to men. Testing and diagnostics should be expanded, and the opportunity and access to testing should be publicly disseminated and offered to all women. Screening strategies should thereby consider social and economic status of citizens.

To drive research towards innovation and implementation, appropriate incentives are needed, such as highlighting the current burden for healthcare systems. There is a need to reduce the proportion of twin pregnancies hospitalised in intensive care: while twin pregnancies are 5% of birth cases, they represent 30% of cases in intensive care. Furthermore, researchers should be supported in the translation of research results, like diagnostic methods, to the market, e.g. to understand the regulatory landscape, cost/marketing strategies or connect researchers with for-profit private partners that take over this part. The latter could also be supported by bringing different expertise together in one project, including collaborate with companies.

For technology development, it may be recommended to start with smaller populations (e.g. validation studies on local and harmonised data on national level) and to scale-up

afterwards globally. Implementation science may support the analysis on if a developed tool, e.g. for diagnostics, is manageable in a clinical setting.

To further push the field, EP PerMed may consider to support gender-oriented medicine. Furthermore, there is the need for more research funding, including the further validation and scaling-up of results through follow-up funding. Support is needed to increase the exploitation of research results by companies and governments, including development of new reimbursement strategies and risk sharing strategies for bringing innovations to the market via public-private partnerships.

Main Key Message of the Session 4

Narrowing the gender gap and promoting woman's participation in clinical research is crucial to advance scientific understanding of woman's health.

8 Breakout session 5 – Clinical Trial Design for Personalised Medicine

Moderator: **Maria Jose Ruiz Alvarez**, IT-MoH (ERA PerMed, Joint Call Secretariat 2021)

Panellists

- **Christophe Le Tourneau and Célia Dupain,** Institut Curie, France
- **Susana Ochoa,** Fundacio Sant Joan de Deu (FSJD), Spain
- **Anca-Ligia Grosu,** University of Freiburg, Germany

Aim of the session

This session aims to present examples of clinical trial designs for PM across various disciplines. It explores the unique requirements for PM clinical research and discusses the translatability of clinical trial methodologies from one disease area to another. Additionally, the session addresses the challenges associated with designing clinical trials for PM, highlighting potential solutions and best practices to overcome these obstacles.

Christophe Le Tourneau and Célia Dupain: "Data solutions based on a basket prospective trial with pembrolizumab and Vorinostat in patients with late stage squamous cell carcinoma (PEVOdata)"

Late stage cancers acquire multiple drug resistance mechanisms making them difficult to cure with medical treatments. Because combination of drugs may be needed for treatment, the discovery of a cure for late stage disease extremely challenging. While traditional drug development is based on cancer types, stratified medicine is now based on molecular landscape, independently of tumour location (tissue-agnostic). Integration of multiple molecular data with patients' clinical history is today crucial to apprehend new mechanisms related to drug efficacy or resistance. In the PEVOdata project, with at its core the PEVOSQ basket trial in patients with late stage squamous cell carcinomas treated with pembrolizumab in combination with vorinostat, immune-related and molecular-epigenetic biomarkers were explored and found to be associated with treatment response and outcome. The Digital drug-assignment system was built to be used as a database integrating molecular and clinical profiles for treatment decision. Finally, long-term standards alongside other strategies for data collection and management were developed.

Key messages:

Convincing European regulatory agencies to approve tissue-agnostic treatments, where a single therapy is used across different cancer types, has been challenging. While some countries, like the USA, have already approved tumour-agnostic drugs or drug

combinations, Europe has yet to follow suit. European regulators require historical controls or synthetic arms with patients who did not receive the drug in question. Databases containing drug and genetic data could provide the necessary control data to facilitate regulatory approval. However, the shift from cancer type-specific to molecular alteration-based treatments is hindered by the lack of historical data, as current drugs have been developed based on cancer type for decades. The scientific community needs to advocate for this transition to advance tissue-agnostic treatment approaches

When integrating large volumes of multi-omics data with clinical data from a limited number of patients, achieving sufficient statistical power to obtain significant p-values can be challenging. Additionally, tumours from different locations may respond differently, and these clinical features must be considered in the datasets. The data from this project will be used to populate databases and increase the number of patients, thereby enhancing the robustness of future analyses. Regarding statistical methods, Kaplan-Meier curves are still commonly used to compare groups. However, new AI tools that do not rely on p-values present novel challenges and necessitate the development of innovative statistical methods. One potential approach is to consider each patient as their own control, comparing individual progression rather than comparing patient groups.

Susana Ochoa: "Towards a personalised medicine approach to psychological treatment for psychosis (PERMEPSY)"

Despite the efficacy of psychological interventions in people with psychosis few patients receive them, and none of them were personalised. PERMEPSY aims to integrate new technologies such as harmonisation of data and ML for providing a prototype platform that will allow to personalise a psychological treatment named Metacognitive Training (MCT). The project is divided into two (2) phases. The first one consisted of a systematic review of the literature and the harmonisation of previous data (approx. 500 patients with sociodemographic, clinical, cognitive and meta-cognitive, and biomarkers information) to develop a prototype platform that will predict personalised treatment (P-MCT). The second phase is currently ongoing and will validate the P-MCT compared with classical MCT in a prospective pilot clinical trial study in five (5) countries: Poland, Germany, France, Chile and Spain (including 252 patients). PERMEPSY project will develop an open platform for clinicians to predict the response to MCT and recommend a personalised MCT treatment.

Key messages:

Patients with psychological issues need to get more adequate treatments. In the pilot study the therapy includes pharmacological treatment together with MCT. A patient approach is necessary to understand how they feel in therapy and caregivers can explain what they see in the patient during/after the therapy. To reduce biases, patients do not know which therapy they receive and evaluators are blinded. The overall aim is to find the right treatment for patients who benefit most and the perfect timing for treating each individual.

The P-MTC platform is currently being improved and the next step is to consider this platform as medical device. For this, discussions with regulatory agencies to meet regulations of medical devices are needed.

Anca-Ligia Grosu: "Implementation of mobile health tools and artificial intelligence for personalised radiation treatment planning and monitoring in prostate cancer (PersoRad)"

Prostate cancer (PCa) is the most frequent diagnosed malignancy in male patients and radiation therapy (RT) is a main treatment option. However, RT concepts for PCa have an imminent need to be rectified in order to personalise the RT strategy by considering the individual PCa biology and the individual disease process of each patient. One main goal of this project was to define sensibility and sensitivity of CT-PET (Computed Tomography-Positron emission tomography) and Magnetic Resonance Imaging for radiation therapy and to use AI to extract information from the images in comparison to histology method of tumour delimitation by experts. Tumour segmentation using AI was proven to work in different institutions. Segmentation algorithms were used to detect the normal tissue (spare normal tissue from radiotherapy). Radiomic features were also able to detect tumour cell infiltration outside the main tumour and the imaging features aligned with proteomic profiles. The consortium concatenated a prospective, nonrandomised phase II trial for personalised RT of PCa patients (HypoFocal) with novel tools for patient involvement, advanced "omics" and bioinformatical analyses. Image-guided focal dose escalation radiotherapy was performed in patients with primary prostate cancer. Focussed radiotherapy decreased the days of treatment from 20-40 day to 5 days. The implementation of novel computational components enabled unbiased characterisation of tumour and normal tissue biology for personalised treatment planning processes and direct integration of patients' preferences for a personalised treatment planning and follow-up process after RT.

Key messages:

Multicentre clinical trials are extremely time-consuming and challenging, particularly when finalising contracts with various institutions. The competition is intense, and finding ways to save time is crucial. There is a pressing need to reduce bureaucracy in Europe, as the current complexity hinders effective collaboration and workflow. Excessive bureaucracy significantly undermines European research competitiveness, especially when compared to countries like the USA.

Panel Discussion:

AI/ML in PM (or computer-assisted decisions) is required to move from stratified medicine to PM. The AI's main objective is to leverage computational tools to support physicians in making more precise and effective treatment decisions. By using data-driven insights, these

tools can help identify optimal treatment strategies that slow disease progression; and, ultimately, extend patients' lives by optimising therapeutic approaches based on advanced analytics and predictive modelling.

In clinical trials, the collaborative effort is a key aspect. Involving expertise from multiple European countries allows for fostering high-performance research. To be successful, a project requires a new collaborative paradigm defined by the close collaboration of multiple industry, academic, regulatory, and community oncology stakeholders. But partnerships between academia and industry are challenging. Sometimes the goals of the pharmaceutical industry and academic researchers do not align, highlighting the need for mutual understanding and collaboration to develop projects that benefit all parties. Challenges also include lengthy legal processes aimed at mitigating intellectual property issues and potential conflicts of interest.

Cross-border clinical studies are facing additional challenges linked to logistical and technical hurdles such as complex coordination efforts; regulatory barriers to opening clinical trials in other countries; country-dependant regulatory approvals, ethical guidelines, and data privacy laws (e.g., GDPR in Europe), complicating trial coordination. They often require multiple funding sources, legal agreements, and administrative approvals, increasing costs and delays. There is a real need to reducing bureaucracy in Europe to facilitate clinical studies and cross-border collaborations. This need is further emphasised by the rise of AI technologies, which generate vast amounts of data. Consequently, AI research will face even greater challenges due to the current regulatory requirements.

Main Key Message of the Session 5

Facilitating cross-border collaborations and clinical studies by reducing regulatory requirements can support the implementation of PM in clinical practice.

9 Breakout session 6 – Personalised Medicine for Children and Adolescents

Moderator: **Monika Frenzel**, The French National Research Agency, ANR (ERA PerMed, Joint Call Secretariat 2019)

Panellists

- **Paola Romagnani,** Meyer children's hospital, Italy
- **Klaus Tenbrock,** RWTH Aachen University, Germany
- **Seema Mital,** University of Toronto, Canada

Aim of the session

PM recognises that research with adults cannot simply be generalised or extrapolated to new-borns, children, and adolescents and, thus, research is needed on this subset of population. Currently, children and adolescents can be considered as "underrepresented populations" in research studies, resulting in not adapted dosing or therapy protocols as well as not suitable preventive measures. Including minors in research needs additional consideration of ethical requirements in research with children and adolescents from their perspective as study participants but on a long term may increase the success rate of therapy by reducing adverse reactions.

Paola Romagnani: "Implementation of personalised management in nephrotic syndrome (PER-NEPH)"

Personalised genetic diagnosis improves clinical outcome in Nephrotic syndrome in children and adolescents. The overall aim of the PER-NEPH project is to predict outcome in a personalised manner. Anti-slit antibodies were observed in a subset of patients with nephrotic syndrome. This observation translated into a test may support the identification of patients that respond to second-line immunosuppressants and to better predict outcome compared to pathology pattern. The assessment of anti-podocin in the serum can be used to monitor disease outcome and response to treatment.

The achievement of the project is a diagnostic tool to identify patients with genetic or autoimmune forms of nephrotic syndrome, and even combined ethiologies, in a personalised and non-invasive manner to develop personalised treatments and provide counselling to families.

Key messages:

To diagnose nephrotic syndrome and to distinguish between an autoimmune or genetic variant, 3-4 weeks of practice and an invasive step of biopsy sampling are required. In the

PER-NEPH project, a novel imaging (microscopy) technology was developed to identify a biomarker that was not visible with ancient technologies. This high-level technology may not be available in all clinical settings. Hence, to enable the use of the knowledge in clinical practice an often-used essay, i.e. ELISA, was adapted to help to have an accessible and non-invasive diagnostic tool. Instead of requiring biopsy sampling, the diagnosis can be performed on blood samples. The biomarker enables to identify those patients for that a gene therapy may be needed.

Klaus Tenbrock: "Personalized medicine to tackle immune dysfunction in refractory juvenile idiopathic arthritis (PerMIDRIAR)"

For oligoarticular juvenile idiopathic arthritis (JIA), a standardisation of diagnosis, therapy and monitoring improves the prognosis of disease. Treat to target enables early remission or minimal disease activity.

The results of the project are:

- Polyarticular JIA (>4 joints) is clinically inactive or minimal active disease (70%)
- Oligoarticular JIA (<=4 joints) is clinically inactive or minimal active disease (49%)
- Peripheral blood mononuclear cell RNA Nanostring analysis of identified putative targets (preliminary analysis from Best-for Kids study) in different cohorts as well as serum and miRNA samples investigated using multiplex analysis
- Collagen-induced arthritis is not suited as a JIA Model
- Blockade of Fatty acid uptake prevents pAKT and mTOR activation

PM in childhood JIA is possible but hampered by 1) lack of and non-harmonised drug approval, 2) missing or insufficient disease classification (oligo vs. poly vs. JIA vs. psoriatic, vs. enthesitis associated vs. unclassified etc.), 3) lack of pathophysiological understanding (no antigen identified yet), 4) differences in drug availability in different countries while specifically easier drug availability for children is needed and 5) insufficient number of international collaborations.

Key messages:

In many disease areas, clinical processes have not changed over the last 50 years and are in many cases a form of trial and error for selecting the care pathway than decision based on real stratification. This may be change through new technologies.

Regulation for the access to medication, including the duration of the eligibility for reimbursement for a drug are different from one country to another. Hence, there is a risk of families or individuals moving from one country to another only to get access to therapy or to a drug.

Seema Mital: "PeRsOnalized Genomics for CongEniTal HEart Disease (PROCEED)"

Congenital Heart Disease affects 1 in 100 live births. The goal of the PROCEED project is to use whole genome sequencing to find missing genetic etiology of congenital heart disease, and predict disease phenotype and outcomes with the aim to guide counselling and treatment, as well as the development of a polygenic risk score that predicts heart failure, death or transplant after transposition of the great arteries repair.

Translatability of project results is supported via data sharing, which occurred for 1500 genomes and genome data deposited in federated data repository, health assessment, licencing and software development. The clinical impact of the project is a non-invasive prenatal genetic testing, early planning for foetal interventions and early post-natal surveillance, prenatal counselling of recurrence risk in future pregnancies. The project has demonstrated that patient engagement is needed, including steering, advisory and planning committees. The challenges observed are delayed sequencing and the process of cloud-based data sharing.

Key messages:

Whole genome sequencing enabled a 4-fold increase in genetic diagnosis in congenital heart disease. Multi-omics approaches facilitated the development of heart-specific models for identifying splice-disrupting variants in children with heart disease. The return of clinically actionable genomic findings to families enabled personalised care of patient and family members including prenatal counselling and phenotype predictions.

Panel Discussion:

Researchers encounter different challenges around regulatory aspects or ethical approvals concerning data sharing (particularly on genetic data) or bio-sampling. Due to the high complexity, research may simply not be conducted or is delayed (up to a year). For example, a central ethics committee decision may be a solution if several clinical centres are participating in one single study instead of requesting individual ethics approvals.

When it comes to regulatory processes, transnational research projects struggle with ethical and privacy laws which are different from one country to another but even within country and different national regions. The delay in research but also implementation will risk to further increase the cost of the treatments and drugs. A consequence is that due to high costs of diagnostics, the technologies will not reach the patients or that only companies, no academic, can afford the costs to develop drugs.

Different regulations for medications also result in different accessibility to drugs from one region or country to another. A solution could be to discuss and exchange with regulatory agencies like the EMA.

It is important to ensure the dissemination of research results, for example via sharing data through public database and returning results to families. Funding organisations may request mandatory that institutions place their research data into dedicated libraries, i.e. funds are only provided if research organisations confirm this requirement.

Harmonised procedures are helpful for scaling-up of PM approaches and to allow their wider application in different regions and countries. The implementation of new technologies or PM approaches in hospitals may be challenging. To facilitate the implementation in healthcare, specialised centres (hospital or academic) could be created to provide a specific service in a centralised manner to a region. While samples are collected locally, they are transferred to and analysed in the specialised centre. Patients do not need to travel to the specialised centres but are treated close to their place of living. Therewith, quality of diagnosis increases and costs decrease, and in consequence diagnostics and treatment options do become accessible for many and decrease overall costs for healthcare. This process can be translated from one region to another or from one healthcare system to another but requires political support (e.g. organisational support provided from the Ministry of Health). Implementation may be supported via training of healthcare workforces, i.e. training provided to centres and training provided to different countries.

Children and adolescents are still not sufficiently considered in research and clinical studies for several reasons: 1) Complex processes for safety and regulations, e.g. FDA and regulatory agencies do not allow clinical trials on children; 2) Lack of market and lack of financial support. There is a high risk for companies to invest in clinical trials on children and adolescents, i.e. the costs for trials vs. the return of investment through selling of a drug may not be balanced. Hence, there is low interest of the private sector in developing medication or other PM applications for children. The public sector needs to step in here to support PM developments based on the value for and needs of the society, not solely driven by the creation of profit.

To further advance in PM, there is a need to support the establishment, extension but also sustainability of cohorts for observatory studies and upscale but also financially support for the long-term follow-up (especially for research with children and adolescents).

Project funding durations should be longer than the typical three (3) years, for example up to five (5) years in that the first year is dedicated to ethical approvals and other agreement developments, sample sharing, analysis and integration of data will take around three (3) years, and conclusion and revision of results would take place in the last year. Alternatively, a six (6) months start-up phase for administrative procedures would be helpful. For projects running for three (3) years, results presented at the end are usually the output of more than one grant/project running time. Furthermore, the funding provided is in many cases, specifically for translational and applied research insufficient and research teams have to rely on additional sources of funding, e.g. support and partnerships with industry.

EP PerMed specifically may have a central role in Europe in supporting implementation and the harmonisation of processes, procedures and regulations.

Main Key Message of the Session 6

Children and adolescents are not 'small adults', they have their own pharmacogenomics and their specific drug metabolism, efficacy and toxicity.

10 Panel discussion – Personalised medicine innovation and their implementation

Moderator: **Monika Frenzel**, The French National Research Agency, ANR (EP PerMed WP2)

Panellists

- **Benedikt Westphalen,** Comprehensive Cancer Center Munich (LMU), Germany
- **Holger Prokisch,** Technischen Universität München, Germany
- **Jolien Roovers,** Flemish Government, Belgium
- **Norma Jäppinen,** Business Finland, Finland

Aim of the Panel

Over the past years, the number of research projects dedicated to PM is increasing but still only few research results are reaching the market or are translated in healthcare practices. The panel on "Personalised medicine innovation and their implementation" welcomed four (4) panellists on the stage to discuss the steps to be taken from research results to innovation and successful implementation healthcare with the overarching goal to transform todays research results in improved healthcare which is accessible and a reality for citizens and patients. Different perspectives were considered: The researchers and clinicians' perspective, the perspective of an innovation agency and of the EP PerMed, with a specific focus on the work package 3 (WP3) focussing on accelerating PM development, innovation, and absorption to maximise impact.

The session started with two (2) introductory talks by Norma Jäppinen and Jolien Roovers.

Norma Jäppinen is chief funding advisor at Business Finland. Business Finland is participating in the EP PerMed as funder in transnational calls for proposal.

Norma Jäpping explained the role of Business Finland as innovation funder specifically in support of companies but also research organisations (advanced research, no fundamental research) under the mandate of the Ministry of Economic Affairs and Employment. In this role, Business Finland is supporting Finish teams nationally but also globally (public internationalisation services). In the health sector, the organisation supports innovation, i.e. the transition of research to business, via 2-years grants of around 300-700k€ provided to research organisations to prepare commercialisation steps, proof of concept activities, including IPR issues. For Norma, the key to success are: Dedicated teams, early connection to venture capital, understanding of the customer needs and regulatory landscape as well as of intellectual property rights and competitor status, and last but not least: a vision and results to support it.

Key messages:

- Personalised medicine and prevention are promising (and necessary), but the uptake to clinical use has been slower than expected.
- Recognising the bottle necks on the road to implementation and working on them together with different fields, countries, sectors and stakeholders are crucial.
- Let's aim high, but also keep in mind that sometimes "good enough" results could make a huge difference for the patients.
- Resources are limited, so let's do everything we can to work synergistically and share data, knowledge, practices as openly as possible.
- All parties should stay active with the setting and changing of laws, policies, regulations and standards. Don't wait to see how the playground changes, but help build it.

Jolien Roovers is working as policy advisor at the Department of Work, Economy, Science, Innovation, and Social Economy of the Flemish Government, and leads the EP PerMed WP3.

Jolien Roovers presented the aims and activities of the EP PerMed WP3 "Accelerating PM Development, Innovation, and Absorption – Maximising Impact". With the EP PerMed Radar, WP3 analyses the innovation potential of PM research projects to develop insights of needs and options for development and innovation. Thereby, input of stakeholders from European National Regions, different countries of Europe and globally are considered. Based in the Radar results, the EP PerMed Accelerator covers three (3) parts – offers, connect and act. (I) "Offers" include information on e.g. available tools, calls, resources, programmes, infrastructures and events to further develop projects outcomes and PM approaches. (II) "Connect" facilitates connections of needs and offers between various partners for new collaborations to support PM innovations. (III) "Act" proposes actions, activities and tools according to the identified needs.

Input from the audience collected via a questionnaire:

The conference audience was invited to share their opinion via a Mentimeter with the following results:

1. Based on your results obtained, do you consider applying for innovation-focussed calls?

   69 participants answered the question as followed: 23 votes (33,3%) for "Yes", 14 votes (20,3%) for "No" and 32 votes (46,4%) for "Maybe" (see also figure 1).

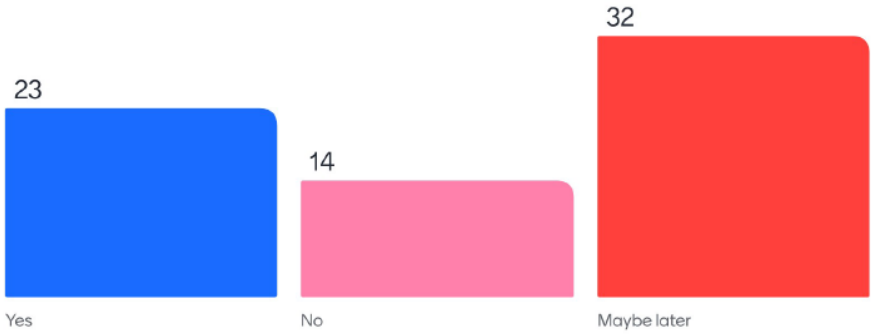

Figure 1: Results on the question: "Based on your results obtained, do you consider applying for innovation-focussed calls?"

2. Do you need support to take your research outcomes one step further? (multiple answers were possible)

   Participants answered the question as followed (from the first ranked to the lowest ranked option): 50 votes for "To find financing", 35 votes for "To find partners", 27 votes for "Regulatory advice", 9 votes for "Patient participation" and "others" and 4 votes for "No support needed" (see also figure 2).

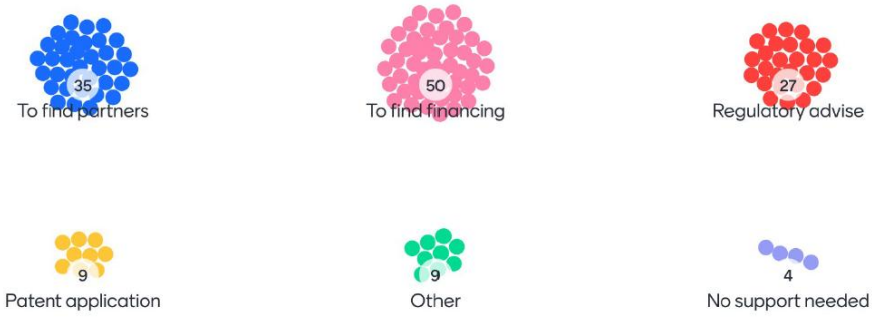

Figure 2: Results on the question: "Do you need support to take your research outcomes one step further?" (multiple answers were possible)

3. Would you be interested in participating in any of the EP PerMed innovation actions? (multiple answers were possible)

   Participants answered the question as followed (from the first ranked to the lowest ranked option): 36 votes for "Summer School", 34 votes for "Innovation call", 26 votes for "Fast track validation call", 23 votes for "Venture creation programme" and 18 votes for "Hackathon" (see also figure 3).

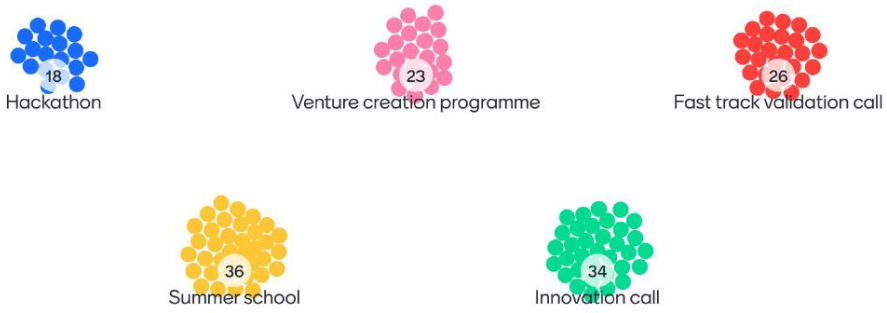

Figure 3: Results on the question: "Would you be interested in participating in any of the EP PerMed innovation actions?" (multiple answers were possible)

Panel Discussion

What are hurdles or bottlenecks and potential needs to allow PM research to go one step further towards innovation (and ultimately implementation)?

One big hurdle is the lack of knowledge about the different regulations, especially as more than one regulation may apply, depending on the research (e.g. related to medical devices or AI).

A second major hurdle is the lack of data quality. A solution to overcome these hurdles could be dedicated education programmes for individual researchers, innovators and healthcare professionals. On the one hand, this will provide a basic understanding for example of IPR but also existing regulations. On the other hand, it will allow the individuals to talk to policy makers for example to drive actively the development or adaption of regulations, instead of passively and solely applying them.

What are incentives to accelerate the translation of PM approaches from research to market?

Incentives for enabling the transition of research results to market are:

- Teamwork: bring the right people together which as a team will join the required expertise, i.e. not every individual needs to be a "superhero" being an expert in all fields (acquisition of funding resources, researcher, regulatory expert, entrepreneur, etc.).
- Motivation: Encourage people to take risks and to leave their comfort zone and typical environment, e.g. to create start-ups. An additional incentive in this regard could be ownership of property rights to value personal investment.
- Trust in research: Encourage funders to invest in research and innovation by delivering research results that are in line with application promises submitted to defined call scopes.
- Creation of a trustful environment for innovation: Innovators need to openly share information about their activities, instead of working siloed and in isolation on a small scale. This includes sharing of hurdles to help guiding others and to advance together and therewith quicker and further than alone.
- Network creation: Many activities are running in parallel. To avoid redundancies, stakeholders or different projects need to be brought together more regularly. Instead of funding many smaller projects, larger initiatives could be of advantage. This may overall support the development and commonly applied standards and data harmonisation.
- Sustainable or follow-up funding and longer funding durations: The development of innovation may require time (e.g. can span over the time of three (3) PhD contract periods), hence continuous funding is needed. Longer funding duration may allow

consortia to organise internal agreements (like consortium or data agreements) and ethical approvals before the scientific project start.

- Institutional support for R&D: Institutions like universities can substantially support the identification of in-house research results with high innovation potential via dedicated R&D offices. They could also act as bridge to connect research teams with relevant for-profit private partners and industry. Long standing public-private collaboration also improve innovation processes (where is a real need and market demand) as well as revise tools on the market through a constant feedback loop.

Which role could EP PerMed have in the process of accelerating the translation of PM approaches from research to market?

- Provide support for Health Technology Assessment (HTA).
- Support the conduction of health economic analysis or reflections that are going beyond a simple research project and knowledge of research teams and include the entire perimeter of healthcare.
- Provide education and training opportunities, as stakeholders are in general eager to change, improve or adapt processes and methods and are willing to learn.
- To explore on needs and opportunities for follow-up funding, notably TRL 5-6.
- Provide partnering tools or organise activities that support the creation of networks and talent teams.
- Support the elaboration of health economics considering PM.
- Support the exchange with regulators, like the EMA and others, hence to actively participate in guiding regulations to be supportive for PM applications. Share information on how to best consider existing regulations.

Main Key Message of the Panel Discussion

There is no need to create "superheroes", instead, the focus should be on fostering a supportive environment, the work in multidisciplinary teams and a culture of innovation, where research seamlessly aligns with implementation and health economic research, public-private collaboration, entrepreneurship, ethics, regulation, etc.

11 Young Investigator Session – Winners Ceremony: EP PerMed Video Competition

Moderator: **Liron Even-Faitelson**, CSO-MOH (EP PerMed WP2)

Speaker: **Eirini Tsirvouli,** Norwegian University of Science and Technology, Norway

Title of the Talk: **"Computational modelling and functional validation platform for personalised colorectal cancer clinical therapy decision support (ONCOLOGICS)"**

The ONCOLOGICS project combined computational and experimental models to predict drug responses and identify potential synergies for treating colorectal cancer. Drug synergy in combination therapies offers increased effectiveness, sensitivity, and reduced doses and side effects. However, identifying and validating effective drug combinations is challenging due to their rarity and the combinatorial explosion of possibilities. The project utilised two (2) computer models (cell fate and DNA damage responses) to predict drug synergies efficiently. Logical modelling allowed for cost- and time-effective exploration of the combinatorial space, prioritising likely synergistic combinations. The models predicted 26 pairwise drug combinations, significantly reducing the 820 combinations that would otherwise need testing. Experimental results showed that synergies are cell line-specific, and mutation status does not predict them. Cell lines resistant to single drugs exhibited more synergies, and several mTOR inhibitors showed synergies across most cell lines. The model's predictions were experimentally validated, with about 50% of predicted combinations showing synergy, compared to ~5% in similar datasets without prediction. Future steps include fine-tuning the models and simulation parameters, identifying biomarkers for synergy predictions, and testing synergies on organoids.

Key messages:

Logical models can effectively predict synergistic drug combinations, the ONCOLOGICS project is a proof-of-concept of the potential of computer-based models for supporting treatment decisions.

Participating in the ONCOLOGICS project as a young researcher has enhanced Eirini's exposure to diverse perspectives and expertise, fostering multidisciplinary collaborations. It helped bridging communication barriers and align research priorities and methodologies. Through this project, Eirini had built a strong professional network across disciplines and countries, leading to an enriching and enjoyable research experience. This has opened doors to potential future collaborations and career opportunities.

Main Key Message

The ONCOLOGICS project demonstrates the potential of computer-based models in predicting synergistic drug combinations to support treatment decisions. For young researchers, participating in a collaborative project broadens exposure to diverse perspectives, fosters multidisciplinary collaborations, and helps build a strong professional network, opening doors for future opportunities.

12 Closing Remarks

Wolfgang Ballensiefen, Deutsches Zentrum für Luft- und Raumfahrt e.V., DLR Projektträger, Division Health, EP PerMed coordinator

Thanks to all participants of this first EP PerMed conference and to their immense dedication to PM; to the EC for fruitful exchanges and its financial as well as cooperating and networking support; and to all partners of the partnership who are crucial for EP PerMed calls and the diverse activities.

One key takeaway is that PM is already an established concept in biomedical and technology-related research. PM research, driven for example by the 111 ERA PerMed and 27 EP PerMed funded transnational consortia, is both active and successful. Additionally, various supporting technologies are either already available or advancing rapidly, which will further drive PM research and, we hope, the implementation of PM approaches both today and in the future. Moving forward, it is crucial to translate these existing and upcoming achievements into practice, fostering effective and efficient healthcare through the establishment of personalised diagnostics, treatments, and, where possible, prevention strategies.

> "[…] I remember, 10-15 years ago, personalised medicine […] was a buzzword you used to get grants, and now I think it is established […]."
>
> **Wolfgang Ballensiefen, Deutsches Zentrum für Luft- und Raumfahrt e.V., DLR Projektträger, Division Health, EP PerMed coordinator**

Another significant development is that the majority of new drugs, diagnostics, and treatments are now PM. We cannot ignore these advancements in our healthcare systems or research. There are ethical concerns in having these treatments available and not considering them, even if they may come at a higher cost. It is essential that they remain accessible to everyone. These are goals we must strive to achieve as closely as possible.

EP PerMed closely collaborates with ICPerMed and there is a bi-annual exchange with other partnerships in the cluster "Health" established. Furthermore, EP PerMed exchanges with other European, regional and national initiatives, institutes, and projects related and dedicated to PM. We hope these collaborations will help to further develop and implement PM

as a concept in all fields of healthcare. It is also planned to have strategic and policy briefings and documents, and to update the Strategic Research and Innovation Agenda on PM.

The core elements of EP PerMed include research, innovation, implementation, and patient/citizen organisation. A key addition in JTC2025 was our effort to establish funding for patient organisations as partners within consortia via EP PerMed. While this approach is complex, it is essential to include patients already early in research activities. However, many funding agencies either cannot or will not support them. This was a challenge already identified in ERA PerMed. With funding of patient or citizen representing organisations, EP PerMed aims to bridge that gap and will assess its success moving forward.

Many EP PerMed activities are now open or upcoming, including the Joint Transnational Calls; Network Supporting Calls; Research, Innovation and Technology Calls; Fast Track Calls; Venture Creation Programme; matchmaking events; training events; video awards; summer schools; Hackathons, and more. All activities are dedicated to research, technology, or innovation topics, implementation or patient/citizen engagement.

The next conference will be the joint event of EP PerMed and ICPerMed in Prague in November. The focus will be on international activities, policy and strategy in PM.

Thanks to all speakers, panel participants, moderators, and the event organising team for setting up this interesting and important agenda and the organisation of a smooth and successful conference.

> "As this conference shows, dedicated researchers and innovators are at the forefront of the personalised medicine concept and are changing the way we treat diseases in the present and future."
>
> **Wolfgang Ballensiefen, Deutsches Zentrum für Luft- und Raumfahrt e.V., DLR Projektträger, Division Health, EP PerMed coordinator**

13 Annex: Agenda

Agenda Day 1: Tuesday 11 February 2025

08:30 – 09:00	Registration	
09:00 – 09:30	Welcome and opening Carmen Laplaza, Head of Unit Health Innovations and Ecosystems, European Commission Wolfgang Ballensiefen, DLR Projektträger, Division Health, EP PerMed Coordinator	
09:30 – 09:50	8 years of multinational research funding – ERA PerMed and EP PerMed Monika Frenzel, The French National Funding Agency (ANR), EP PerMed WP2 lead	
09:50 – 10:20	Keynote Lecture: "Holistic View of Personalised Medicine Research and Current Status" Étienne Richer, Canadian Institutes of Health Research (CIHR), Canada	
10:20 – 11:00	Coffee Break	
11:00 – 12:30	**Breakout session 1** Integrating Multi-Omics for Personalised Approaches	**Breakout session 2** Personalised Prevention
12:30 – 14:00	Lunch Break	
14:00 – 14:30	Keynote Lecture: "Incorporating recent advances in cutting edge personalised medicine research into the real clinical practice" Benedikt Westphalen, Comprehensive Cancer Center Munich (LMU), Germany	
14:30 – 16:15	Panel discussion: "Personalised Medicine innovation and their implementation" Moderator: Monika Frenzel, ANR (EP PerMed WP2)	

Benedikt Westphalen, Comprehensive Cancer Center Munich (LMU), Germany
Holger Prokisch, Technischen Universität München, Germany
Jolien Roovers, Flemish Government, Belgium
Norma Jäppinen, Business Finland, Finland

16:15 – 17:00	Coffee Break	
17:00 – 18:30	**Breakout session 3** Machine Learning and Artificial Intelligence applied for Personalised Medicine	**Breakout session 4** Woman Health in Personalised Medicine
18:30	End of day 1	
19:00	Dinner reception Conference Venue, Foyer, 2nd floor	

Day 1: Breakout Session - Morning

11:00 – 12:30	Breakout session 1 - Integrating Multi-Omics for Personalised Approaches Meeting Room: "Europa 5/6" Moderator: Alexandra Becker, DLR Projektträger, Division Health (ERA PerMed, Joint Call Secretariat 2020)

Synthetic Lethality for Personalised Therapy-based Stratification In Acute Leukemia (SYNtherapy)
Jesús María Hernández Rivas, University of Salamanca (IBSAL), Spain

Personalised Mitochondrial Medicine (PerMiM): Optimising Diagnostics and Treatment for Patients with Mitochondrial Diseases
Holger Prokisch, Technischen Universitat München, Germany

PERsonalised medicine for Systemic Autoinflammatory Diseases (PerSAIDs)
Isabella Ceccherini, IRCCS Istituto Giannina Gaslini, Italy

Panel discussion

11:00 – 12:30	Breakout session 2 – Personalised Prevention Meeting Room: "Europa 4" Moderator: Monika Frenzel, ANR (ERA PerMed, Joint Call Secretariat 2022)

PersonAlisation of RelApse risk in autoimmune DISEase (PARADISE)
Mark Little, Trinity College Dublin, Ireland

Omics Approach for Personalised Prevention of Type 2 Diabetes Mellitus for African and European Populations (OPTIMA)
Julia Goedecke, South African Medical Research Council, South Africa

Digital Twins to Treat Atrial Fibrillation (DAWN-AF)
Edward Vigmond, University of Bordeaux/ Liryc, France

Panel discussion

Day 1: Breakout Session - Afternoon

17:00 – 18:30	Breakout session 3 - Machine Learning and Artificial Intelligence applied for Personalised Medicine Meeting Room: "Europa 5/6" Moderator: Katja Kuhlmann, DLR Projektträger, Division Health (ERA PerMed, Joint Call Secretariat 2020)

Personalised Prognostics and Diagnostics for Improved Decision Support in Cardiovascular Diseases (PerCard)
Mark Van Gils, Tempere University, Finland

Tailoring the targeted Treatment of Chronic Lymphocytic Leukemia (CLL-CLUE)
Sigrid Skånland, Oslo University Hospital, Norway

Predicting Cardiovascular Events Using Machine Learning (PRE-CARE ML)
Stefan Kalabakov, Hasso Plattner Institute for Digital Engineering, Germany

Panel discussion

17:00 – 18:30	Breakout session 4 - Woman Health in Personalised Medicine Meeting Room: "Europa 4" Moderator: Monika Frenzel, ANR (ERA PerMed, Joint Call Secretariat 2019)

Develop a Multi-disciplinary Approach for a Personalised Prenatal Diagnostics and Care for Twin Pregnancies (PRETWINSCREEN)
Ron Maymon and Hamutal Meiri, Assaf Harofeh University Medical Center, Israel

Development of a personalised non-invasive diagnosis of endometrial cancer using proteomic markers in cervical fluids and clinical data (CytoMARK)
Irene De la Calle Fuentes, Vall Hebron Institute of Research VHIR, Spain

Advancing Breast Cancer histopathology towards AI-based Personalised Medicine (ABCAP)
Mattias Rantalainen, Karolinska Institutet, Sweden

Panel discussion

Agenda Day 2: Wednesday 12 February 2025

08:30 – 09:00	Registration	
09:00 – 10:30	**Breakout session 5** Clinical Trial design for Personalised Medicine	**Breakout session 6** Personalised Medicine for Children and Adolescents
10:30 – 11:15	Coffee Break	
11:15 – 11:45	**Young Investigator Plenary Session** Winners Ceremony: EP PerMed Video Competition Moderator: Liron Even-Faitelson, CSO-MOH (EP PerMed WP2) **Computational modelling and functional validation platform for personalised colorectal cancer clinical therapy decision support (ONCOLOGICS)** Eirini Tsirvouli, Norwegian University of Science and Technology, Norway	
11:45 – 12:15	Keynote Lecture: "Sustainable Transition of Innovation into Patient Care" Sahar Barjesteh van Waalwijk van Doorn-Khosrovani, CZ Health Insurance & Leiden University, The Netherlands	
12:15 – 12:30	Closing Wolfgang Ballensiefen, DLR Projektträger, Division Health, EP PerMed Coordinator	
12:30 – 13:45	Lunch Break	

Day 2: Breakout Session - Morning

09:00 – 10:30	Breakout session 5 - Clinical Trial design for Personalised Medicine Meeting Room: "Europa 5/6" Moderator: Maria Jose Ruiz Alvarez, IT-MoH (ERA PerMed, Joint Call Secretariat 2021)

Data solutions based on a basket prospective trial with pembrolizumab and Vorinostat in patients with late stage squamous cell carcinoma (PEVOdata)
Christophe Le Tourneau and Célia Dupain, Institut Curie, France

Towards a personalised medicine approach to psychological treatment for psychosis (PERMEPSY)
Susana Ochoa, Fundacio Sant Joan de Deu (FSJD), Spain

Implementation of mobile health tools and artificial intelligence for personalised radiation treatment planning and monitoring in prostate cancer (PersoRad)
Anca-Ligia Grosu, University of Freiburg, Germany

Panel discussion

09:00 – 10:30	Breakout session 6 – Personalised Medicine for Children and Adolescents Meeting Room: "Europa 4" Monika Frenzel, ANR (ERA PerMed, Joint Call Secretariat 2019)

Implementation of personalised management in nephrotic syndrome (PERNEPH)
Paola Romagnani, Meyer children's hospital, Italy

Personalized medicine to tackle immune dysfunction in refractory juvenile idiopathic arthritis (PerMIDRIAR)
Klaus Tenbrock, RWTH Aachen University, Germany

PeRsOnalized Genomics For CongEniTal HEart Disease (PROCEED)
Seema Mital, University of Toronto, Canada

Panel discussion