Adoption of precision health and precision medicine approaches in addressing population health needs in Europe

CRA Charles River Associates

EPH208

Antun Sablek[1], Tosin Adyemo[2]

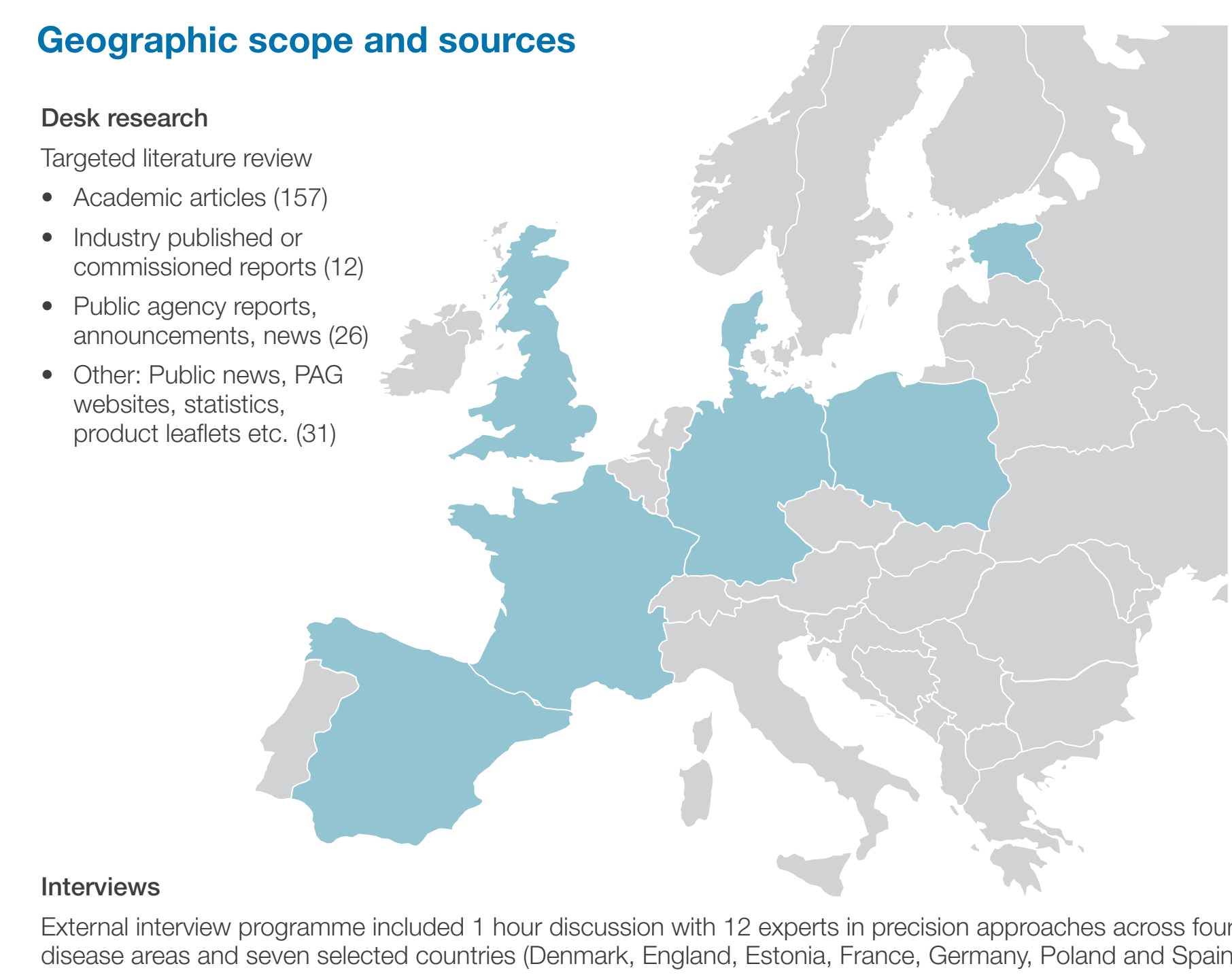[1]Charles River Associates, Belgium; [2]Charles River Associates; UK

Background

Precision medicine (PM) has evolved beyond its genomic roots to encompass holistic patient care, from disease prevention to patient care management. Growing evidence highlights its efficacy in addressing broader population health needs throughout the patient care pathway
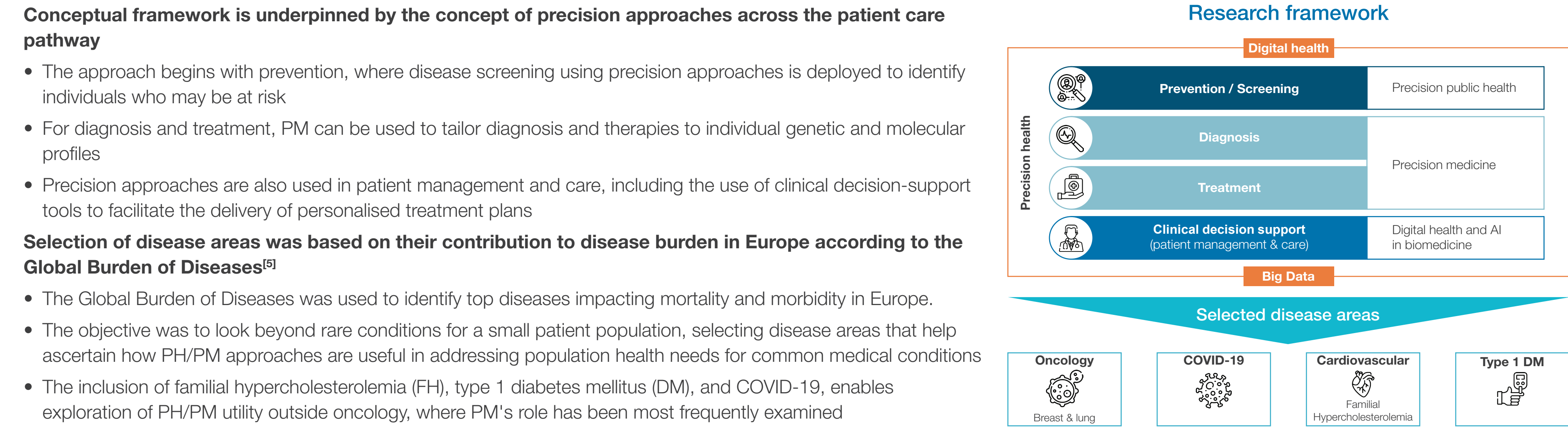
Definition of key concepts

- **Precision medicine** is defined as a healthcare approach that utilises molecular information (genomic, transcriptomic, proteomic, metabolomic, etc.), phenotypic and health data from patients to generate care insights to prevent or treat human disease resulting in improved health outcomes. (EFPIA definition)[1]

- **Precision health** is a complementary but wider concept that brings into focus determinants of health beyond the provision of medical care and uses extensive population-specific data to provide the right intervention to the right population at the right time.[2]

- **Population health** is defined as the health outcomes of a group of individuals, including the distribution of such outcomes within the group, and aims to improve the health of an entire human population.[3]
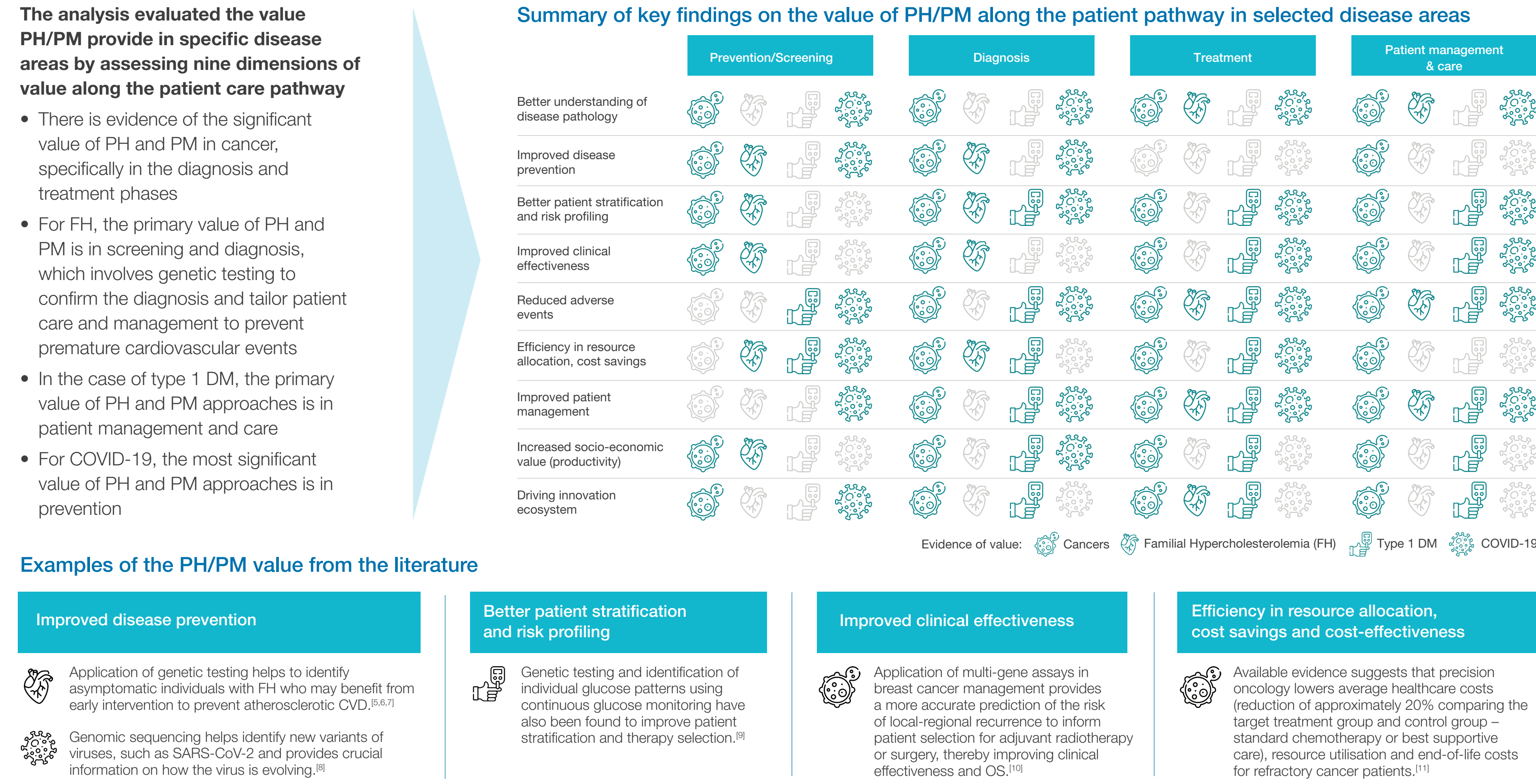
Methods

The project was carried out in four stages:

1. Development of a review and analysis framework
2. A targeted literature review to identify available evidence of the value of precision approaches
3. Development of country case studies to showcase the current state of adoption and access to PH/PM approaches in Europe across four diseases
4. External interview programme to gather additional insights and perspectives from a variety of stakeholder groups across different countries
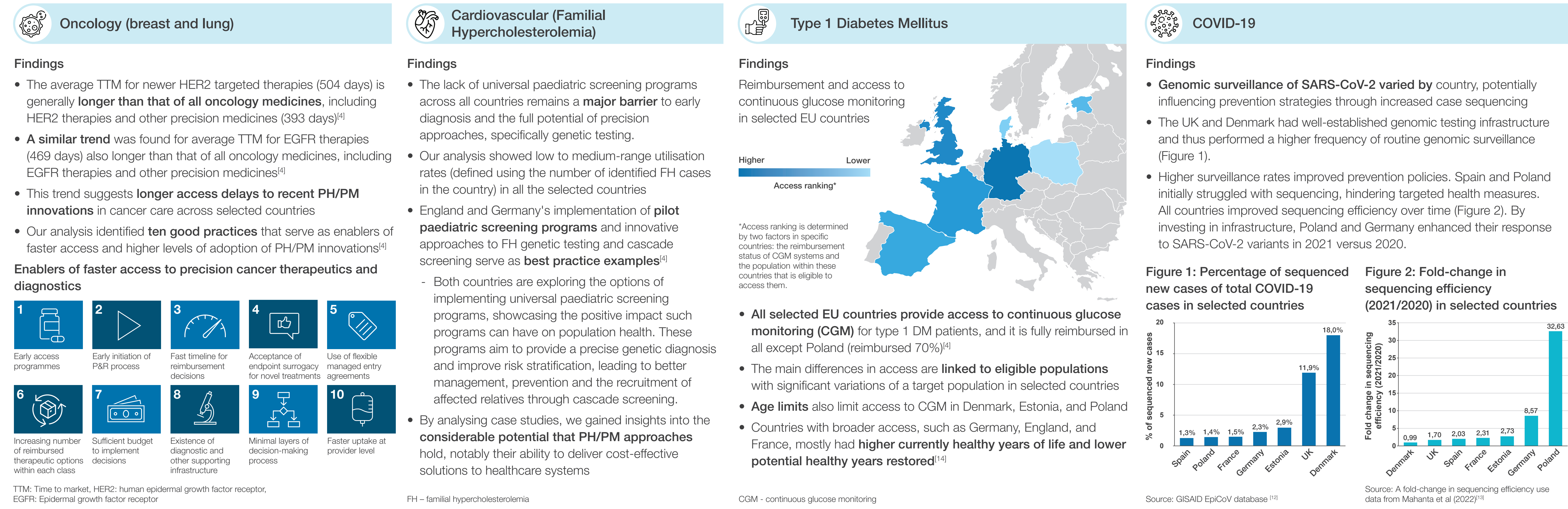
Geographic scope and sources

Desk research

Targeted literature review
- Academic articles (157)
- Industry published or commissioned reports (12)
- Public agency reports, announcements, news (26)
- Other: Public news, PAG websites, statistics, product leaflets etc. (31)

Interviews

External interview programme included 1 hour discussion with 12 experts in precision approaches across four disease areas and seven selected countries (Denmark, England, Estonia, France, Germany, Poland and Spain)

Our approach

Conceptual framework is underpinned by the concept of precision approaches across the patient care pathway

- The approach begins with prevention, where disease screening using precision approaches is deployed to identify individuals who may be at risk

- For diagnosis and treatment, PM can be used to tailor diagnosis and therapies to individual genetic and molecular profiles

- Precision approaches are also used in patient management and care, including the use of clinical decision-support tools to facilitate the delivery of personalised treatment plans

Selection of disease areas was based on their contribution to disease burden in Europe according to the Global Burden of Diseases[5]

- The Global Burden of Diseases was used to identify top diseases impacting mortality and morbidity in Europe.

- The objective was to look beyond rare conditions for a small patient population, selecting disease areas that help ascertain how PH/PM approaches are useful in addressing population health needs for common medical conditions

- The inclusion of familial hypercholesterolemia (FH), type 1 diabetes mellitus (DM), and COVID-19, enables exploration of PH/PM utility outside oncology, where PM's role has been most frequently examined

Research framework

Selected disease areas: Oncology (Breast & lung), COVID-19, Cardiovascular (Familial Hypercholesterolemia), Type 1 DM

Results: Value of PH/PM along the patient pathway

The analysis evaluated the value PH/PM provide in specific disease areas by assessing nine dimensions of value along the patient care pathway

- There is evidence of the significant value of PH and PM in cancer, specifically in the diagnosis and treatment phases

- For FH, the primary value of PH and PM is in screening and diagnosis, which involves genetic testing to confirm the diagnosis and tailor patient care and management to prevent premature cardiovascular events

- In the case of type 1 DM, the primary value of PH and PM approaches is in patient management and care

- For COVID-19, the most significant value of PH and PM approaches is in prevention

Summary of key findings on the value of PH/PM along the patient pathway in selected disease areas

Dimensions assessed across Prevention/Screening, Diagnosis, Treatment, Patient management & care:
- Better understanding of disease pathology
- Improved disease prevention
- Better patient stratification and risk profiling
- Improved clinical effectiveness
- Reduced adverse events
- Efficiency in resource allocation, cost savings
- Improved patient management
- Increased socio-economic value (productivity)
- Driving innovation ecosystem

Evidence of value: Cancers, Familial Hypercholesterolemia (FH), Type 1 DM, COVID-19

Examples of the PH/PM value from the literature

Improved disease prevention

Application of genetic testing helps to identify asymptomatic individuals with FH who may benefit from early intervention to prevent atherosclerotic CVD.[5,6,7]

Genomic sequencing helps identify new variants of viruses, such as SARS-CoV-2 and provides crucial information on how the virus is evolving.[8]

Better patient stratification and risk profiling

Genetic testing and identification of individual glucose patterns using continuous glucose monitoring have also been found to improve patient stratification and therapy selection.[9]

Improved clinical effectiveness

Application of multi-gene assays in breast cancer management provides a more accurate prediction of the risk of local-regional recurrence to inform patient selection for adjuvant radiotherapy or surgery, thereby improving clinical effectiveness and OS.[10]

Efficiency in resource allocation, cost savings and cost-effectiveness

Available evidence suggests that precision oncology lowers average healthcare costs (reduction of approximately 20% comparing the target treatment group and control group – standard chemotherapy or best supportive care); resource utilisation and end-of-life costs for refractory cancer patients.[11]

Results: Disparities in the adoption of PH/PM approaches across selected countries

Oncology (breast and lung)

Findings

- The average TTM for newer HER2 targeted therapies (504 days) is generally **longer than that of all oncology medicines**, including HER2 therapies and other precision medicines (393 days)[4]

- A similar trend was found for average TTM for EGFR therapies (469 days) also longer than that of all oncology medicines, including EGFR therapies and other precision medicines[4]

- This trend suggests **longer access delays to recent PH/PM innovations** in cancer care across selected countries

- Our analysis identified **ten good practices** that serve as enablers of faster access and higher levels of adoption of PH/PM innovations[4]

Enablers of faster access to precision cancer therapeutics and diagnostics

1. Early access programmes
2. Early initiation of P&R process
3. Fast timeline for reimbursement decisions
4. Acceptance of endpoint surrogacy for novel treatments
5. Use of flexible managed entry agreements
6. Increasing number of reimbursed therapeutic options within each class
7. Sufficient budget to implement decisions
8. Existence of diagnostic and other supporting infrastructure
9. Minimal layers of decision-making process
10. Faster uptake at provider level

TTM: Time to market, HER2: human epidermal growth factor receptor, EGFR: Epidermal growth factor receptor

Cardiovascular (Familial Hypercholesterolemia)

Findings

- The lack of universal paediatric screening programs across all countries remains a **major barrier** to early diagnosis and the full potential of precision approaches, specifically genetic testing.

- Our analysis showed low to medium-range utilisation rates (defined using the number of identified FH cases in the country) in all the selected countries

- England and Germany's implementation of **pilot paediatric screening programs** and innovative approaches to FH genetic testing and cascade screening serve as **best practice examples**[4]

  - Both countries are exploring the options of implementing universal paediatric screening programs, showcasing the positive impact such programs can have on population health. These programs aim to provide a precise genetic diagnosis and improve risk stratification, leading to better management, prevention and the recruitment of affected relatives through cascade screening.

- By analysing case studies, we gained insights into the **considerable potential that PH/PM approaches** hold, notably their ability to deliver cost-effective solutions to healthcare systems

FH – familial hypercholesterolemia

Type 1 Diabetes Mellitus

Findings

Reimbursement and access to continuous glucose monitoring in selected EU countries

Access ranking*

*Access ranking is determined by two factors in specific countries: the reimbursement status of CGM systems and the population within these countries that is eligible to access them.

- All selected EU countries provide access to continuous glucose monitoring (CGM) for type 1 DM patients, and it is fully reimbursed in all except Poland (reimbursed 70%)[4]

- The main differences in access are **linked to eligible populations** with significant variations of a target population in selected countries

- **Age limits** also limit access to CGM in Denmark, Estonia, and Poland

- Countries with broader access, such as Germany, England, and France, mostly had **higher currently healthy years of life and lower potential healthy years restored**[14]

CGM - continuous glucose monitoring

COVID-19

Findings

- Genomic surveillance of SARS-CoV-2 varied by country, potentially influencing prevention strategies through increased case sequencing

- The UK and Denmark had well-established genomic testing infrastructure and thus performed a higher frequency of routine genomic surveillance (Figure 1).

- Higher surveillance rates improved prevention policies. Spain and Poland initially struggled with sequencing, hindering targeted health measures. All countries improved sequencing efficiency over time (Figure 2). By investing in infrastructure, Poland and Germany enhanced their response to SARS-CoV-2 variants in 2021 versus 2020.

Figure 1: Percentage of sequenced new cases of total COVID-19 cases in selected countries

Country	% of sequenced new cases
Spain	1.3%
Poland	1.4%
France	1.5%
Germany	2.3%
Estonia	2.9%
UK	11.9%
Denmark	18.0%

Source: GISAID EpiCoV database [12]

Figure 2: Fold-change in sequencing efficiency (2021/2020) in selected countries

Country	Fold change in sequencing efficiency (2021/2020)
Denmark	0.99
UK	1.70
Spain	2.03
France	2.31
Estonia	2.73
Germany	8.57
Poland	32.63

Source: A fold-change in sequencing efficiency use data from Mahanta et al (2022)[12]

Policy recommendations

Policy recommendations to enhance the adoption of PH/PM approaches in addressing population healthcare needs across Europe

Prioritizing availability and investment in PH/PM technologies

Investing in PH/PM technologies like genomic sequencing and targeted therapies can ensure that patients have access to the most advanced and beneficial health technologies, leading to better prevention, screening, diagnosis, treatment, and patient management

Building infrastructure and raising awareness

Building infrastructure for PH/PM approaches like genetic testing and genomic sequencing and raising awareness of the benefits of these approaches in disease prevention and surveillance can improve disease prevention and detection before symptoms appear, ultimately improving population health outcomes

Data sharing and collaboration

Prioritising data sharing and collaboration among healthcare providers, researchers, and patients can build a robust data ecosystem that supports the development and implementation of PH/PM approaches, providing a more comprehensive understanding of population health needs

Patient-centred care plans

Developing patient-centred care plans tailored to individual needs and circumstances through PH/PM approaches can promote individualized and more effective treatments, ultimately contributing to the overall improvement of population health outcomes

Education and training of healthcare

Education and training for HCP on PH/PM approaches, including interpretation of genomic data and the use of advanced technologies like machine learning and artificial intelligence, can ensure that HCP have the necessary skills and knowledge to address population healthcare needs

Ensure equal access to PH/PM approaches

It is crucial to ensure that all patients have access to the best possible care through PH/PM approaches, including targeted therapies and diagnostics, without any inequalities in patient access to medicines and diagnostics across Europe

References: [1] Precision medicine. (n.d.). Retrieved September 28, 2022, from https://www.efpia.eu/about-medicines/development-of-medicines/precision-medicine/ [2] Khoury, M. J., Engelgau, M., Chambers, D. A., & Mensah, G. A. (2018). Beyond Public Health Genomics: Can Big Data and Predictive Analytics Deliver Precision Public Health?. Public health genomics, 21(5-6), 244–250. https://doi.org/10.1159/000501465. [3] Kindig, D., & Stoddart, G. (2003). What is population health? American journal of public health, 93(3), 380–383. https://doi.org/10.2105/ajph.93.3.380 [4] CRA (2023): Adoption of precision health and precision medicine approaches in addressing population-health-needs-in-europe.pdf [5] Global Burden of Diseases, EU (GBD, 2018) [6] Vrablik, M., Tichy, L., Freiberger, T., Blaha, V., Satny, M., & Hubacek, J. A. (2020). Genetics of Familial Hypercholesterolemia: New Insights. Frontiers in Genetics, 11. https://www.frontiersin.org/articles/10.3389/fgene.2020.574474 [6] Knowles, J. W., Rader, D. J., & Khoury, M. J. (2017). Cascade Screening for Familial Hypercholesterolemia and the Use of Genetic Testing. JAMA, 318(4), 381–382. https://doi.org/10.1001/jama.2017.8543 [7] Sturm, A. et al. (2018). Clinical Genetic Testing for Familial Hypercholesterolemia. Journal of the American College of Cardiology, 72(6), 662–680. https://doi.org/10.1016/j.jacc.2018.05.044 [8] Saravanan, K. A., Panigrahi, M., Kumar, H., Rajawat, D., Nayak, S. S., Bhushan, B., & Dutt, T. (2022). Role of genomics in combating COVID-19 pandemic. Gene, 823, 146387 [9] Klonoff DC, Florez JC, German M, Fleming A. The Need for Precision Medicine to be Applied to Diabetes. J Diabetes Sci Technol. 2020;14(6):1122-1128. doi:10.1177/1932296819894206 [10] Harris, E. E. R. (2018). Precision Medicine for Breast Cancer: The Paths to Truly Individualized Diagnosis and Treatment. International Journal of Breast Cancer, 2018, 4809183. https://doi.org/10.1155/2018/4809183 [11] Haslem, D. S., Chakravarty, I., Fulde, G., Gilbert, H., Tudor, B. P., Lin, K., Ford, J. M., & Nadauld, L. D. (2018). Precision oncology in advanced cancer patients improves overall survival with lower weekly healthcare costs. Oncotarget, 9(15), 12316–12322. https://doi.org/10.18632/oncotarget.24384 [12] GISAID EpiCoV database (https://gisaid.org/) was accessed in November 2022. Data used from March 2020 - October 2022 [13] Mahanta U, Saberwal G, Sharma G. Are Countries Becoming Better at SARS-CoV-2 Genomic Surveillance? Front Public Health. 2022 Apr 25;10:887955. doi: 10.3389/fpubh.2022.887955. PMID: 35558539; PMCID: PMC9068876. [14] Type 1 Diabetes Index - t1dindex.org/

Full report available here: