Guidance on Ethical, Legal and Social Challenges Related to the Further Use of Human Genomic Data for Research

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Content

Summary

Public trust in genomic research can only be achieved by anticipating and proactively addressing the related ethical, legal and social challenges. The following recommendations made by the Ethical, Legal and Social Implications advisory group (ELSIag) at the Swiss Personalized Health Network (SPHN) are intended to create a sustainable basis for cultivating public trust and to thus advance genomic research and genomic medicine in Switzerland.

Pursuing the goal of creating good framework conditions for genomic research must be balanced with protecting the rights of individuals whose data is processed (referred to as *data subjects*) and responding to the public's expectations and concerns related to the topic. To help achieve this balance, the ELSIag has developed this guidance paper, which includes practical recommendations. These recommendations are summarized below:

– **Consent**
When signing general consent or project-specific consent forms, data subjects should be actively informed of the general significance and implications of genomic research and the potential further use of their genomic data. Information regarding potential benefits and risks should be as specific and granular as possible and should include details about the potential further use of data subjects' genomic data. If a form requesting general consent is used that does not include specific information on genomic research, data subjects should be offered the opportunity to opt out of genomic research.

– **Genetic findings**
Profound ethical challenges exist in the context of genomic research, especially regarding genetic findings with consequences for patients' health. Data subjects should be informed about the possibility of genetic findings. Findings should be communicated to individuals if they are clinically relevant and actionable, properly validated and both legally and ethically permissible. Communicating any findings to a data subject should follow an approved policy and should be in line with that individual's consent.

– **Data protection and governance**
Researchers should assess the risk of reidentification and consider which comprehensive measures are to be taken to minimize and balance this risk. Any party accessing, using and/or sharing genomic data must have the best interests of patients and citizens as well as the advancement of genomic medicine at heart. National genomic data collections should be supported by national coordination efforts. Governance decisions should be guided by transparent processes and fair decision criteria.

– **Public awareness and involvement**
Those involved in research, infrastructures and institutions should engage in open and regular communication with the public in order to increase public awareness, inform the public about policies and allow citizens' voices to be heard. It is in the interest of individuals and society to purposefully involve data subjects – and citizens – in the research process. This involvement helps promote the benefits that the further use of human genomic data provides to individuals and society as a whole.

Purpose

This guidance document addresses ethical, legal and social challenges related to the further use of human genomic data for research purposes in Switzerland. It focuses on the topics of data subjects' consent, data protection and data governance as well as the involvement of and dialogue with patients and citizens. The guidance in this document applies to all technologies that produce genomic data on a large scale, such as whole genome sequencing (WGS), whole exome sequencing (WES) and large-scale genotyping. Research with genomic data (genomics) is a subdiscipline of what is called *omics* research, which is characterized by studying the *entirety* of a biological substance. Other omics research includes, for example, transcriptomics, which analyses the entirety of an individual's RNA sequences, and proteomics, which analyses the entirety of an individual's proteins. Omics research outside the field of genomics has the potential to provide a similar wealth of information and may face similar ethical challenges. Therefore, this document may also be consulted for guidance on other types of omics research.

The recommendations in this document are intended to support various stakeholders involved in the further use of human genomic data. In particular, it should be useful for providers, recipients and processors of samples or genomic data as well as those involved in the regulation of such data, such as ethics or governance boards. The aims of the proposed recommendations are to promote a harmonized national practice that facilitates national and international collaboration and to foster data subjects' and the general public's trust when it comes to sharing genomic data.

A variety of international initiatives have discussed different ethical and legal aspects of genomic data and its further use. Most importantly, some well-advanced genomic initiatives have provided a variety of policies and guidance, such as a framework developed by the Global Alliance for Genomics and Health (GA4GH)[1] and policies formulated by Beyond One Million Genomes (B1MG).[2] The World Health Organization (WHO) is currently developing guidance on high-level principles for genome data access, use and sharing.[3] Other relevant policies include the Declaration of Taipei on Ethical Principles for Health Data Bases issued by the World Medical Association[4] and CARE Principles for Indigenous Data Governance.[5]

[1] Global Alliance for Genomics and Health. GA4GH Framework for Responsible Sharing of Genomic and Health-Related Data. Version 3 (2019). Available online: https://www.ga4gh.org/framework/

[2] Rebers, S., Mežinska, S., Thorogood, A., and Becker, R. Beyond 1 Million Genomes (B1MG) D2.2 Policy Document for a Genome Data Sharing Initiative (2023). Available online: https://doi.org/10.5281/zenodo.8199373

[3] World Health Organization. WHO Principles for Human Genome Data Access, Use and Sharing. Draft (April 8, 2024). Available online: https://cdn.who.int/media/docs/default-source/research-for-health/who-principles-human-genome-data-access--use--and-sharing_public-consultation_8-april.pdf?sfvrsn=f2c7afc7_3

[4] World Medical Association. WMA Declaration of Taipei on Ethical Considerations Regarding Health Databases and Biobanks. Revised version (2016). Available online: https://www.wma.net/policies-post/wma-declaration-of-taipei-on-ethical-considerations-regarding-health-databases-and-biobanks/

[5] Global Indigenous Data Alliance. Care Principles for Indigenous Data Governance (2019). Available online: https://static1.squarespace.com/static/5d3799de845604000199cd24/t/6397b363b502ff481fce6baf/1670886246948/CARE%2BPrinciples_One%2BPagers%2BFINAL_Oct_17_2019.pdf

In Switzerland, the Ethical, Legal and Social Implications advisory group (ELSIag) at the Swiss Personalized Health Network (SPHN) has previously published an ethical framework for the processing and sharing of health data[6] as well as guidance on the reporting of actionable genetic findings.[7] While building on existing resources, this document is specifically designed to provide practical guidance on genomics in the Swiss legal and social contexts.

The recommendations in this document are based on a review of existing international guidelines and pertinent scientific literature, collective deliberation within the ELSIag on ethical norms and legal principles, and a consultation process involving different stakeholder groups in Switzerland that included legal experts, members of ethics committees and data governance boards, scientific and policy experts, and patient representatives. The recommendations made in this document are intended to be ethically and legally sound and draw wide support. Because genomic technologies are continuing to emerge and change, these recommendations may need to be adapted in the future. Stakeholders are encouraged to participate in the ongoing dialogue on and the future development of genomic research in Switzerland and beyond.

Ethical, legal and social contexts of genomic research

The ethical context of genomic research

Swiss legislation grants a higher level of protection to genetic data than to nongenetic data because such data has particular ethical characteristics. These characteristics include the predictive power for disease predisposition and the carrier status of genetic variants associated with monogenetic diseases as well as the direct implications of such information for biological relatives.

Analyzing human genomic data[8] goes far beyond analyzing individual genes and deserves careful ethical consideration. Genomic data analysis includes technologies such as whole genome sequencing (WGS), which analyses the entire genome, whole exome sequencing (WES), which analyses all protein-coding regions of genes (approximately 1% of the entire genomic sequence) and genome-wide genotyping, which can detect hundreds of thousands of single nucleotide polymorphisms (SNPs) and other genetic variants. While the overregulation of scientific activities is undesirable, several ethical considerations justify genomic

[6] Swiss Personalized Health Network. Ethical Framework for Responsible Data Processing in Personalized Health Research. Version 2 (May 7, 2018). Available online: https://sphn.ch/wp-content/uploads/2019/11/Ethical_Framework_20180507_SPHN.pdf

[7] Swiss Personalized Health Network. Reporting Actionable Genetic Findings to Research Participants. Version dated April 29, 2020. Available online: https://sphn.ch/document/reporting-actionable-genetic-findings-to-research-participants/

[8] In this document, genomic data is defined as a subtype of genetic data. It is used to refer to large-scale genetic data produced by whole exome sequencing, whole genome sequencing or other technologies that produce large-scale genetic information such as genotyping. Legal regulations (Human Research Act) refer exclusively to genetic data, which encompasses both genetic and genomic data.

data being governed by ethical requirements that go beyond the minimum legal requirements for genetic data.

First, the output of human genomic data analysis is a unique biological fingerprint, which is interpreted as a person's *biological identity* in the literature.[9] This biological identity remains largely persistent throughout a person's life and is often associated with an individual's deepest level of personality, thus transcending other identity-forming clinical characteristics such as diagnoses. Sharing one's genomic data, therefore, can be perceived as analogous to sharing intimate details about one's personality. The intimate nature of genomic data should be honored by showing the proper respect for data subjects.

Second, because the genome is a unique sequence, it can (theoretically) always be attributed to a specific person. As a consequence, the complete anonymization of genomic data is unachievable, and the risk of reidentifying data subjects is generally not low.[10] Therefore, protecting the privacy of individuals emerges as a major concern for genomic data.

Third, with human genomic data analysis, the probability of unintentionally generating information relevant to a person's current or future health, which is referred to as *incidental findings*, is high. For example, it has been estimated that the chances of finding a pathogenic genetic variant in 24 genetic conditions amenable to preventive measures and/or treatments is about 3%.[11] Therefore, handling such information responsibly is particularly pertinent to genomic data.

Fourth, the large-scale and long-term sharing of genomic data across institutional and geopolitical boundaries is essential to ensuring the success of genomic medicine. This process will inevitably create large temporal and spatial gaps between the initial data collection and its subsequent uses. Over time, technology will evolve and the attitudes and/or life circumstances of data subjects may change. As a result, the extended reuse of genomic data demands careful consideration of consent models, the development of robust and trustworthy governance structures, and sustained engagement with individuals who have entrusted researchers with their genomic data.

Fifth, genomic research intersects with several socially controversial issues, including insurance discrimination, the potential to exacerbate social inequality, the patenting of genetic information, gene editing and concerns about genetic discrimination. While these societal concerns may not always be scientifically justified, they highlight the need for a

[9] Deutsche Akademie der Naturforscher Leopoldina. Nova Acta Leopoldina. Neue Folge, Band 117, Nummer 396, 9–24 (2013). Available online: https://www.leopoldina.org/fileadmin/redaktion/Publikationen/Nova_Acta_Leopoldina/2013_Leopoldina_NAL_396.pdf [in German]
[10] Vokinger, K. N. Gesundheitsdaten im digitalen Zeitalter. Jusletter (January 27, 2020). [in German]
[11] Ding, L.-E., Burnett, L. and Chesher, D. The Impact of Reporting Incidental Findings from Exome and Whole-Genome Sequencing: Predicted Frequencies Based on Modeling. Genetics in Medicine. Volume 17, pp. 197–204 (March 2015). https://doi.org/10.1038/gim.2014.94

proactive approach for engaging both data subjects and the broader public in the development of genomic medicine. This engagement is crucial for building trust and ensuring that genomic data is used responsibly.

The legal context of genomic research

The basic right to self-determination, and in particular what is referred to as *informational self-determination*, is an essential legal principle that refers to an individual's right to control their own personal data and be protected against its misuse (Federal Constitution of the Swiss Confederation and the United Nations Universal Declaration of Human Rights Declaration).

In the context of genomic research and clinical applications, relevant legal frameworks in Switzerland include the Human Research Act (HRA), which regulates the use of genetic data and samples to generate such data for research purposes. Swiss legislation covers different types of consent, depending on the characteristics of data. Article 29 of the Human Research Ordinance (HRO) regulates the further use of *coded* genetic data for research *purposes* (referred to as *general consent*). Article 28 of the HRO regulates the further use of *uncoded* genetic data for research *projects* (referred to as *project-specific consent*). Article 30 of the HRO governs the further use of *anonymized* genetic data for research *purposes*. However, true anonymization is hardly feasible with genomic data,[12,13] rendering this legal provision inapplicable. In practice, consent forms for clinical trials and prospective projects outside the scope of clinical trials often include additional consent forms for further use *purposes* of data and samples that are generated within a specific trial or research project.

Outside the context of research (as defined in HRA, Art. 2), different national or cantonal data protection laws may also apply, e.g., the Federal Act on Data Protection (FADP) on the national level. Using genomic data for clinical (nonresearch) purposes is regulated in the Federal Act on Human Genetic Testing (HGTA). With the revision of the HRA's ordinances, some requirements in the HGTA also became relevant for clinical trials and nonclinical trials. For example, in the cases of presymptomatic genetic testing, prenatal genetic testing and family planning, if testing could produce health-related results, the concerned person must be informed during the consent process about additional aspects, such as the purpose and significance of the test, the medical, psychological and social implications, associated diseases and the possible significance of the result for that person and their family members. They must also be informed about their right not to know (Art. 7a of the Clinical Trials Ordinance (ClinO) and Art. 8a of the HRO). Special legal requirements for further use of genetic data were not addressed in the 2024 revision of the HRO but will probably be covered during the planned revision of the HRA. Further information on genetic aspects and

[12] Vokinger, K. N. Gesundheitsdaten im digitalen Zeitalter. Jusletter (January 27, 2020). [in German]
[13] Gymrek, M. et al. Identifying Personal Genomes by Surname Inference. Science. Volume 339, Issue 6117, pp. 321–324 (2013). DOI:10.1126/science.1229566

their legal basis for research can be found in a guidance document on genetics in human research published by swissethics.[14]

The socioethical context of genomic research

The socioethical context of genomic research spans a wide range of topics. While citizens and research participants generally recognize the potential benefits of sharing health data and of personalized medicine, genomic research also raises concerns and has sparked controversial social debates. Key among these concerns are the potential misuse of genomic data for genetic discrimination by insurers or employers and its use in criminal investigations and for law enforcement. Additionally, there are ongoing discussions about the risk of exacerbating social inequalities since advancements in genomic medicine may disproportionately benefit wealthier populations. At the same time, little is known about the attitudes and scientific literacy of Swiss residents regarding genomic medicine. Efforts to engage the public in a dialogue on genomic medicine and to raise awareness of it have been limited to a few local initiatives; therefore, public understanding is probably minimal and few engagement opportunities exist within the field. Nonetheless, public engagement and transparent governance are crucial in addressing these concerns, achieving truly informed consent for sharing genomic data and fostering trust in genomic research.

In the response to these challenges, participation has become an important socioethical cornerstone of efforts to increase the practical value and social acceptance of contemporary biomedical research. A proactive dialogue with patients and the public is replacing the paternalistic approach of the past, giving rise to a new collaborative culture. Incorporating patients' experiences of illness into research on health and disease adds value to research projects and increases their scientific and practical relevance. The field of biomedicine commonly refers to this collaboration as patient and public involvement (PPI). PPI representatives can be found at regulatory authorities, research ethics committees, the Swiss National Science Foundation (SNSF), the Swiss Clinical Trial Organisation (SCTO) and many other institutions.

Ethical principles and trust in genomic research

Biomedical decision-making is based on four foundational principles: beneficence, nonmaleficence, autonomy and justice.[15] These principles remain valid to this day and must be respected at all times. In the complex and interdependent network of actors involved in genomics (clinicians, researchers, laboratory technicians bioinformaticians, relatives, future patients, etc.), it is necessary not only to appeal to the ethical judgement of an individual but also to have overarching standards within the network of institutions involved, standards

[14] This guidance document on genetics in human research is available on the swissethics website: https://swissethics.ch/en/themen/positionspapiere [in French, German and Italian]
[15] Beauchamp, T. and Childress, J. Principles of Biomedical Ethics. 7th edition. New York, Oxford University Press (2013).

which consider ethical dimensions beyond the four foundational principles.[16] These ethical dimensions should aim to establish and maintain the trust of data subjects and the public at large. When an individual has trust in research, it means he or she is generally confident that all those involved are acting with the best intentions and knowledge. In the context of consenting to the use of personal data or samples, such a relationship of trust also implies that data subjects are confident the underpinning systems are reliable and their data will be used for the common good – and not in a way that could harm them.[17] Indeed, genomic research should serve the public good and, when applied clinically, the well-being of individual patients. A desire to contribute to this public good is typically what motivates individuals to consent to the further use of their health data and samples.

These considerations suggest that all institutions and actors involved in genomic research should aim to uphold the following ethical requirements:

– Respect the autonomy of individuals.
– Protect the privacy of data subjects.
– Promote the health and well-being of data subjects and society.
– Increase benefits and reduce risks.
– Ensure accountability and procedural fairness in underlying systems.
– Enable participation and engagement with patients and citizens.
– Promote social justice and the fair distribution of resources.

Recommendations

1 Consent and genetic findings

1.1 Consent of data subjects and communication of information

The ethical requirement to ensure autonomy
Obtaining data subjects' consent to provide their data and samples is a prerequisite for any primary or further use of data and samples for research purposes. Consent is an expression

[16] Deutsche Akademie der Naturforscher Leopoldina. Nova Acta Leopoldina. Neue Folge, Band 117, Nummer 396, 9–24 (2013). Available online: https://www.leopoldina.org/fileadmin/redaktion/Publikationen/Nova_Acta_Leopoldina/2013_Leopoldina_NAL_396.pdf [in German]
[17] Florin, M.-V. and Bejtullahu-Michalopoulos, K. Governance of Trust in Precision Medicine (2018). Available online: https://infoscience.epfl.ch/record/255071?ln=en&v=pdf

of an individual's autonomous decision and thus conforms to the bioethical principle of autonomy. Due to increasingly longer lapses in time between data collection and reuse, it is possible that a data subject's attitude towards data and sample donation for genomic research may change and/or that technology and science will evolve. The difficulty is that detailed information about future projects is limited and comprehensive communication is challenging.

The legal requirement to obtain consent
Consent is regulated in the HRA and its ordinances. Further use of uncoded or coded genetic data is allowed either with specific consent for a further use project (HRO, Art. 28) or with general consent for coded genetic data (HRO, Art. 29). Further use of genetic data is also allowed when clinical trials or nonclinical trials have additional, separate consent documents covering the further use of genetic data and samples. Current Swiss legislation does not specifically address genomic data.

Communication of specific information
Genomic research and the further use of genomic data has particular ethical characteristics that should be adequately communicated to data subjects. Generally, the consent procedure should inform data subjects as specifically as is feasible about the benefits and general risks as well as the potential consequences of genomic research. Where possible, interactive and dynamic consent models that facilitate ongoing communication and enable individuals to quickly update their consent preferences are encouraged.[18] E-consent, which has been legally permissible since November 1, 2024, offers new opportunities for such models.

Comprehensible information
In order for data subjects to be able to make autonomous decisions, they must be informed about the use of their data and samples for genomic research in a manner that they can understand. Information must be communicated in plain language and, if possible, in an individual's native language. Involving communication experts, patient representatives and the use of multi-media communication when developing and providing information is strongly encouraged.

Accessible communication
Overcoming communication barriers can strengthen trust. In addition to providing comprehensible information, it is essential to make interactions with potential data subjects easily accessible. This means that data subjects should be given the possibility to communicate their autonomous decisions with minimum effort, and they should not be overburdened with unnecessary information.

[18] Huggler, M. A., Frei, A. L., Schneider, D. and Mausbach, J. Dynamic Consent: Eine Kommunikationsplattform für Forschungsprojekte mit Gesundheitsdaten. Jusletter 28 (August 2023). [in German]

Measures for consent and communicating information

The following measures for enabling data subjects to make autonomous decisions are recommended:

– All institutions involved must make efforts to strengthen general consent as an expression of an autonomous decision based on specific and comprehensible information about genomic research. This can be done either by including information about genomic research on the general consent form itself or by using a separate consent form for the further use of genomic data.

– As an *interim solution* – and only if data subjects have previously expressed consent to the further use of their health data, including coded genetic data but without specific information about genomic research – researchers should make serious efforts to (re)contact data subjects (e.g., send a letter) to inform them about the risks and benefits of genomic sequencing before their samples are used to generate genomic data. In this letter, data subjects should be offered the opportunity to withdraw their consent, specifically for all future genomic research purposes (a general *opt-out for genomics*). This complex and costly process should be carefully planned and documented to avoid any duplication of efforts for future research projects and to avoid burdening and confusing data subjects.

– If genomic data is deposited into a repository or registry for the long-term further use of such data, data subjects should be informed about the further use of their genomic data and potential consequences (e.g., sharing within a genome archive and being linked with other omics data).

– It is possible that serious efforts have been made to recontact (e.g., by phone and/or letter) data subjects who already signed a general consent form in order to inform them about the possibility to *opt out* of genomic research, but these efforts are unsuccessful. In this situation, it seems legitimate to use data subjects' samples and/or data for genomic research within the scope of consent because the minimum legal requirement has already been fulfilled and all involved actors have behaved in a trustworthy manner.

– To summarize, the interim solution recommended above sufficiently ensures the trustworthiness of genomic research by respecting the principles outlined in this document. It provides specific information to all affected data subjects about the benefits and risks of genomic research and offers them the opportunity to *opt out* of these endeavors. In addition, it is an accessible means for most participants who want to support genomic research with their data and samples since it does not burden them with the need to take any action at all.

1.2. Considerations for reporting genetic findings in research

The ELSIag previously published a guidance paper entitled Reporting Actionable Genetic Findings to Research Participants.[19] It contains general and practical recommendations on reporting such findings and should be consulted alongside this guidance paper.

Ethical challenges related to reporting genetic findings in research
Even though there is in many cases a strong ethical rational to report genetic findings – including incidental findings[20] – to research participants, the right not to know has to be respected. How to deal with genetic findings is ethically and legally complex, because the guiding ethical principles of beneficence and the right not to know may be in tension with one another. Nondisclosure of clinically relevant genetic findings can create an ethical conflict for physician-researchers as it may contradict the medical profession's ethical obligations. A common approach to this dilemma is to advise individuals who do not wish to receive such information against consenting to the further use of their data. This practice, however, may hamper trust in genomic research if data subjects perceive it as a general exclusion from research. It must also be noted that communicating incidental findings is already challenging in clinical diagnostics. Not only are genetic experts needed but having consultations and explaining consequences to patients require time and resources. Moreover, the related testing and validation done by accredited laboratories are costly. In research settings, reporting such findings is even more challenging and requires coordinated preparatory work as well as a sustainable support system for researchers on a national level. In the case of genomic research, incidental findings are to be expected; therefore, the responsible handling of such information is particularly pertinent.

Legal requirements to inform data subjects of genetic findings
In a clinical setting, data subjects have the right to be informed of genetic findings that are relevant to their own health. This may also apply to clinical research and research involving people (according to HRO, Chapter 2), even though it is not legally binding for further use (HRO, Chapter 3).

Communication of variants with a strong clinical and ethical rationale
In clinical routine, specific genetic findings with different clinical relevance have practical and clinical utility and are communicated during a genetic consultation. In genomic research, however, only those variants with the strongest clinical and ethical rationale should be communicated to data subjects. This includes, in particular, pathogenic variants for which

[19] Swiss Personalized Health Network. Reporting Actionable Genetic Findings to Research Participants: Recommendations Developed by the Swiss Personalized Health Network (February 2020). Available online: https://sphn.ch/document/reporting-actionable-genetic-findings-to-research-participants/

[20] The concept of incidental findings is used synonymously with the legal concept referred to as *surplus information* (*Überschussinformation* in German; *informations excédentaires* in French) in the Federal Act on Human Genetic Testing (HGTA). The concept refers to genetic information that is relevant to an individual's health but not required to fulfill the primary purpose of a research project. In other words, such findings emerge incidentally as excess information during the research process. Surplus information is distinct from the concept of secondary findings, which also refers to information that is not required for the primary purpose of a research project; however, it is purposefully generated precisely because such information is relevant to patients' health. Secondary findings are commonly discussed in Anglo-Saxon countries (see the list of "actionable" genes from the American College of Medical Genetics and Genomics: https://www.ncbi.nlm.nih.gov/clinvar/docs/acmg/).

preventive and/or therapeutic measures are available (often called clinically actionable findings). An essential part of project planning is to define who will communicate these findings and how they will be communicated. Boards and consortia can support researchers if they are in doubt as to whether they themselves as research physicians or the treating physicians of the patient should communicate relevant findings to participants. In any case, researchers are strongly discouraged from actively screening available genomic data for a predefined list of actionable findings.

Validation of findings
Findings should be reported only after being properly validated by an officially certified, clinical-grade laboratory. An additional genetic consultation in a diagnostic setting may be necessary before reporting genetic findings to ensure that individual's preferences are respected when being given life-altering information.

Findings and further use
If genomic data is deposited in a repository or registry for further use, processes for reporting genetic findings should ensure that the same result is not communicated multiple times to the same data subject. Thus, it is advisable to document the communication of findings beyond an individual project.

2 Data protection and data governance

2.1 Data protection

The ethical requirement to protect the right to privacy
According to the SPHN Ethical Framework for Responsible Data Processing in Personalized Health Research, an individual's right to privacy and their personal protection are fundamenttal principles and must be upheld in every respect.[21]

Legal requirements to minimize the reidentification risk of genomic data
Assessing whether genomic data can be legally considered *uncoded*, *coded* or *anonymized* is complex. Complete anonymization of genomic data is unachievable, as the genome sequence (i.e., the order of the base pairs) is unique and permanent and can therefore always be attributed to a specific person.[12,13] However, the sequence of base pairs by itself does not allow an individual to be directly identified. Therefore, like other datasets, genomic data can be considered *coded* if all directly identifiable characteristics have been de-identified (e.g., age ranges instead of dates of birth and diagnoses), a disproportionate effort is necessary for reidentification (see the revised Art. 25 of the HRO) and the mapping key is securely stored. However, because the sequence is unique, it is essential to take

[21] Swiss Personalized Health Network. Ethical Framework for Responsible Data Processing in Personalized Health Research. Version 2 (2018). https://sphn.ch/wp-content/uploads/2019/11/Ethical_Framework_20180507_SPHN.pdf

comprehensive measures that go far beyond replacing personal data with a pseudonym to minimize the risk of reidentification. It is recommended to conduct a project-specific reidentification risk assessment.[22] The risk profile established from the risk assessment should be documented throughout the project and updated regularly.

The legal requirement to perform a data protection impact assessment
If there is a high risk that the planned processing of personal data will affect personal rights, a data protection impact assessment (DPIA) must be carried out (required in the FADP, Art. 22). A DPIA is a comprehensive assessment that extends beyond the scope of the reidentification risk assessment described above. If a DPIA shows that significant risks are present, a project must be submitted to the responsible data protection authority for prior review or consultation. Large national projects, such as the Genome of Switzerland (GoS) project, are subject to this requirement; for other projects, the results of the reidentification risk assessment may be sufficient. Cantonal data protection commissioners are responsible for specific cantonal issues. Cantonal data protection commissioners are coordinated on a national level under the umbrella of privatim.[23]

The legal requirement to report data breaches
If a data leak or a data breach occurs, it must be communicated to the affected data subjects. Federal and cantonal data protection laws also require data breaches to be reported to the data protection authorities (data breach notification).

Data protection measures
To minimize the risk of reidentification for genomic data, special considerations should be given to the following data protection measures:

– De-identification of data: Replace nongenomic identifying information with codes, pseudonyms or other de-identification options.
– Trusted research environments: Store and analyze genomic data only in secure, controlled environments with strict access controls (e.g., BioMedIT or the future Swiss node of the Federated European Genome-phenome Archive (FEGA)).
– Aggregation of data: When possible, handle information based on groups of individuals that provide generalizable results (e.g., disease associations between or the frequency of certain genetic variants in a population) rather than characterizing sequences of specific individuals.
– Separation of data: Keep genomic data physically separated from phenotype data (i.e., genomic and clinical data are not stored together but in separate repositories).
– Legal agreements: Regulate data access, data transfer and data use with legal agreements.

[22] Swiss Personalized Health Network. Guidance for De-Identification of Health-Related Data in Compliance with Swiss Legal and Data Protection Regulations. Available online: https://sphn.ch/network/data-coordination-center/de-identification/
[23] privatim is the Conference of Swiss Data Protection Commissioners. For more information, visit: https://www.privatim.ch/de/ [in French and German]

– Secure storage: Use well-defined data access principles, authorization and protocols for all nonaggregated genomic reference datasets.
– Documentation of data protection measures: Describe all data protection measures in a project's protocol or data management plan.
– Secure international data sharing: When data is shared in international contexts, it must be ensured that data security requirements are at least as stringent as those in the Swiss legal context.

2.2 Data governance

The ethical requirement to share data for the common good
Data governance should ensure fair and trustworthy access to data and samples only for the purposes of advancing scientific knowledge and promoting the health and well-being of all populations. The possibility to broadly reuse data generally increases the value of data and its results. Therefore, data access should be granted to local, national and international research projects alike as well as to quality assessment projects, technology development projects and projects from the private sector that aim to improve health or health care.

The ethical requirement to ensure accountability
Mechanisms should be established to ensure that those involved in the further use of genomic data can be held responsible for the consequences of their actions and for noncompliance with legal and ethical requirements.

Harmonized governance and national coordination
In Switzerland, local institutions such as hospitals or universities are responsible for the governance of health data and samples. Before access is granted, data governance bodies evaluate whether data access requests fulfill legal requirements and are in line with the approval of the research ethics committee. In cross-institutional, multicenter projects, data governance can be addressed in multiparty contracts with dedicated governance structures. Currently, there is no national body responsible for the governance of health data in Switzerland. In order to evaluate project applications for the further use of genomic data in an efficient and harmonized manner, the governance of data submitted to a national genomic data infrastructure such as the Swiss Federated Genomics Network (SFGN) should be coordinated nationally or done by a central, national committee. Before such an independent body is established, its composition, mandate and expertise – including expertise from local data governance boards – should be defined. Members of the mandated body should be required to submit a declaration of interests.

Procedural fairness
Regardless of which specific body is responsible for making decisions on access to genomic data and samples for further use, all decisions should be based on transparent policies and fair processes.

Decision-making criteria for data access

The following criteria for making decisions about controlled data access are recommended:[24]

- It is mandatory for genomic projects to receive ethical clearance from the responsible research ethics committee. The ethics committee reviews the project for its scientific integrity as well as its fulfillment of ethical and legal requirements or issues a declaration of nonresponsibility or a positive advisory opinion (according to HRA, Art. 51, para. 2).
- The purpose of the requested data and/or samples should be in accordance with the guiding principle of contributing to the common good, which means it aims to advance scientific knowledge and promote the health and welfare of society.
- The amount and types of requested data should be appropriate for the purpose of the project (purpose limitation), requested data should be limited to only what is needed to fulfil the project's purpose (data minimization) and the project should be feasible with the requested data. The minimization principle should be strictly adhered to with regards to disclosing linked phenotype data.
- The identity of applicants should be verifiable, and applicants should have documented expertise relevant to the intended project.
- A legal agreement on the transfer and use of data and samples should be in place and duly signed.
- Funding for the project should be secured before access to the data is granted.
- If applicable, it is important to ensure that data subjects have been informed about the potential use of their data by private organizations before such organizations are granted access to their data. It is reasonable to require private organizations to reimburse public institutions for all costs incurred for storing, curating and hosting data. In addition, the guidelines set forth in SPHN's Ethical Health Data Sharing in Public-Private Partnerships should be followed.[25] The commercialization of human body parts is prohibited (HRA, Art. 9); the same prohibition should apply to health data out of respect for data subjects.
- Measures must be in place that ensure the rights of data subjects are respected at all times, including their right to withdraw their consent at any time and their right to get access to their data upon request.

[24] The recommendations set out in this document are largely based on the Genomic Alliance for Genomics and Health's Data Access Committee Guiding Principles and Procedural Standards Policy. Version 1.0 (October 27, 2021). Available online: https://www.ga4gh.org/document/data-access-committee-guiding-principles-and-procedural-standards-policy-v2/

[25] Swiss Personalized Health Network. Ethical Health Data Sharing in Public-Private Partnerships: Guidelines (2021). Available online: https://sphn.ch/document/guidance-on-ethical-health-data-sharing-in-public-private-partnerships/

– Data governance bodies may impose additional ethical requirements based on the guiding principles of fairness, scientific integrity and transparency (e.g., the obligation to publish scientific findings, citation rules for data sources, inclusion of patients, and communication with the public).

3 Public awareness and involvement

3.1 Public awareness and communication of research findings

Communication of research findings
Open and regular communication with the public about genomic research and ongoing projects is crucial to foster trust. Research findings should be shared with the general public in an accessible manner. Layperson-friendly summaries of project findings should be made available on publicly accessible platforms, enabling nonexperts to understand a research project's goals, outcomes and potential implications.

Information about policies and governance
Communication should include information about the ethical frameworks and safeguards that are in place to protect participants' rights. This includes explaining how consent is obtained and respected, how data is de-identified and securely stored, and how genetic findings are handled and potentially communicated to data subjects.

Engagement of citizens
Citizens should have opportunities to participate in shaping the direction of genomic research, particularly by participating in discussions around consent, data privacy and the implications of genomic medicine. This can be done in the future by using dynamic consent models, public forums, surveys and consultation panels that provide a platform for individuals to express concerns and ask questions.

Genomic literacy and awareness campaigns
Awareness campaigns can enhance the public's understanding of genomic research, its potential benefits and its ethical challenges. A comprehensive strategy for genomic literacy programs should be implemented in the context of national genomic research initiatives. Such programs should realistically inform the public about the benefits and risks of genomic research. In addition, such efforts should consider campaigns for underrepresented groups in order to ensure equitable access to information across different social, cultural and linguistic communities. Creating a national register of all approved projects that includes lay summaries, contains findings communicated in lay language, and explains the purpose and outcome of projects would further enhance awareness and public engagement. These kinds of registries are already in place for clinical trials and well accepted worldwide. As of March 2025, it will be mandatory in Switzerland to communicate research results in plain language in clinical trial registries.

3.2 Involvement of patients and citizens

Ethical principles for cooperation and participation
Including public and patient involvement (PPI) representatives in the development and oversight of genomic projects ensures that research is better aligned with public values and needs. Basic principles for participation are set out in a framework developed by swissethics and research ethics committees.[26] The values emphasized in this framework, such as fairness, transparency and both cultural and ethnical inclusiveness, are particularly relevant in the context of genomic research with its unique ethical characteristics.

A focus on impact
Participation activities should be goal- and impact-oriented, and they should be planned according to the desired added value for research, participants, and/or the public.

Fair remuneration and acknowledgement
PPI representatives should be compensated fairly for their contributions. Contributions made by PPI representatives should be acknowledged in all publicly distributed communication.

Diversity
A balance of participant and patient representatives should be sought in terms of age, gender and ethnic background. Diversity in the representation of vulnerable groups, among others, should also be sought as much as possible, which means including ethnic minorities and socioeconomically disadvantaged populations.

Measures for promoting patient and public involvement
The following measures for ensuring meaningful participation and long-term engagement should be considered:

– PPI representatives should have the appropriate education, training and experience for their role, and they should undergo preparation for their responsibilities (e.g., research training and communication skills development). It is critical to provide ongoing support throughout a project's lifecycle.

– PPI's added value for a research project should be considered, particularly for activities such as codesigning research protocols and ensuring that information sheets can easily be understood.

– Clear rules on the objectives and roles of those involved need to be formulated in advance, possibly in the form of an agreement and/or a process for how patient feedback is integrated throughout a project's lifecycle. Carrying out a pilot project involving patients may provide useful insights on how to implement a larger project.

[26] swissethics. Framework for Patient / Participant Representation in Ethical Review Processes in Clinical Research. Available online: https://swissethics.ch/assets/pos_papiere_leitfaden/swissethics_framework-for-efficient-and-consistent-involvement-of-patient-representatives-in-ec-work_final_240530_en_adopted.pd

– Long-term engagement plans, including regular communication and updates with PPI representatives, can help to sustain their involvement.

Outlook

Public trust in genomic research can be achieved if the related ethical, legal and social challenges are anticipated and proactively addressed. These recommendations from the ELSIag are intended to create a solid and sustainable basis for achieving this goal. In the future, these recommendations should guide the process of establishing how to properly access, use and share genomic data for research, including the adaptations needed to support such research. General consent must be adapted, and, above all, the upcoming revision of the HRA should focus on genomic research.

Pursuing the goal of creating good framework conditions for research should be balanced with ethical requirements, protecting the rights of those involved in research and responding to the expectations and concerns of our society at large. This pursuit extends beyond Switzerland, making it crucial to promote cross-border collaborations on genomic research. In addition, educating the patient community and society on genomics are key elements to starting an active dialogue and keeping it going. All of these efforts help build the trust that is needed in this new dimension of genomic research in Switzerland.