

Listed here are the different genomic education competencies from various sources, and how PHIX Academics adheres to them.

Framework for development of physician competencies in genomic medicine¹

Category	Relevant Course
Family History elicit, document, and act on relevant family history pertinent to the patient's clinical status;	103: Genes, Inherited Diseases, and Pregnancy; 102: The Basics of Genomics and Oncology
Genomic Testing use genomic testing to guide patient management;	202: The Potential of Precision Oncology; 205: Scientific Advancements in Diagnostics
Treatment Based on Genomic Results use genomic information to make treatment decisions;	
Somatic Genetics use genomic information to guide the diagnosis and management of cancer and other disorders involving somatic genetic changes; and	102: The Basics of Genomics and Oncology
Microbial Genetic Information use genomic tests that identify microbial contributors to human health and disease, as well as genomic tests that guide therapeutics in infectious diseases.	104: Infectious Diseases Fundamentals

Core Competencies (2019)³

101: Genomics in Modern-Day Healthcare

Knowledge

1. Knowledge of the structure and function of nuclear DNA, genes and chromosomes, their organization into the genome, their replication and transmission through mitosis and meiosis
 2. Knowledge of the structure and regulation of protein-coding genes, their transcription and translation, RNA construction, protein synthesis
 3. Knowledge of the structure, function and transmission of mitochondrial DNA
 4. Knowledge of genotype-phenotype correlations; understanding of how gene variations can influence disease presentation, its severity, and clinical manifestation (anticipation, incomplete penetrance, variable expressivity)
 5. Understanding of the role of behavioural, social, and environmental factors that modify or influence genetics in the manifestation of complex diseases
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102: Basics of Genomics and Oncology

Knowledge

1. Knowledge of the process of DNA mutations (de novo, hereditary); knowledge of the role of these mutations as physiological or pathological events (cancer, multifactorial diseases, monogenic diseases)
 2. Knowledge of the role of genetic factors in disease prevention
 3. Knowledge of the potential physical and/or psychosocial benefits and risks of genetic information for individuals in the context of the family and community, here included also the possibility of preventive measures such as reproductive options for mutation carriers
 4. Knowledge of the genetic approaches to treatment (including pharmacogenomics and gene therapy)
 5. Knowledge of the indications for genetic testing and referral to genetic specialists
 6. Knowledge of ethical, legal, and social issues related to genetic testing and information recording
 7. Knowledge of Direct-To-Consumer genetic and genomic tests, possible results and potential risks
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Attitudes

Awareness of the ethical, social, cultural, religious, and ethnic issues that may interfere with care; awareness of the importance of an accurate communication, without coercion or personal bias, and appropriate to the culture, knowledge, and language level of the patient

Abilities

1. Ability to educate patients about the range of emotions they and/or their family members may experience as a result of receiving genetic information; being able to refer patients to appropriate support groups
 2. Ability to safeguard the privacy and confidentiality of the genetic information of patients
 3. Ability to inform patients of potential limitations of maintaining privacy and confidentiality of genetic information, with an appropriate informed consent process
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103: Genes, Inherited Diseases, and Pregnancy

Knowledge

1. Knowledge of transmission of hereditary diseases (autosomal dominant/recessive, X-linked, mitochondrial, chromosomal, multifactorial)
 2. Understanding of the importance of the three-generation family history in assessing predisposition to disease
 3. Knowledge of the role of genetic factors in disease prevention
 4. Knowledge of the organization of genetic services
 5. Knowledge of the potential physical and/or psychosocial benefits and risks of genetic information for individuals in the context of the family and community, here included also the possibility of preventive measures such as reproductive options for mutation carriers
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Attitudes

Awareness of the sensitivity of genetic information, and the need for privacy and confidentiality while delivering genetic education and counselling

Abilities

1. Ability to gather genetic family history information (including an appropriate multi-generational family history)
 2. Ability to explain basic concepts about probability, disease susceptibility, and the influence of genetic factors on maintenance of health and development of disease
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104: Infectious Diseases Fundamentals

Knowledge

Knowledge of the organization of genetic services

Abilities

Ability to apply the most recent national and international guidelines to manage patients with genetic conditions

105: Introduction to Molecular Biology

Knowledge

1. Understanding the difference between clinical diagnosis of disease and genetic predisposition to disease. Knowledge of the different types of genetic tests (diagnostic, predictive, test for carriers)
 2. Knowledge of the most frequent genetic variants in your professional specialty; knowledge of the clinical features and therapeutic response associated with the different variants
 3. Basic knowledge of the research approaches used to study genomic variants and their correlation with clinical data
 4. Knowledge of the principal methodologies for genetic sampling, laboratory techniques with their pros and cons, and knowledge of the terminology used in lab reports
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Abilities

Ability to utilize effectively informatic technologies to perform counselling

Advanced Courses

202: The Potential of Precision Oncology

Knowledge

1. Knowledge of genotype-phenotype correlations; understanding of how gene variations can influence disease presentation, its severity, and clinical manifestation (anticipation, incomplete penetrance, variable expressivity)
 2. Knowledge of the most frequent genetic variants in your professional specialty; knowledge of the clinical features and therapeutic response associated with the different variants
 3. Knowledge of the indications for genetic testing and referral to genetic specialists
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Attitudes

1. Awareness of the importance of working in a multi-professional team (including the family physician) in evaluation, diagnosis, and treatment of patients tested and referred to genetic consultation
 2. Awareness of the ethical, social, cultural, religious, and ethnic issues that may interfere with care; awareness of the importance of an accurate communication, without coercion or personal bias, and appropriate to the culture, knowledge, and language level of the patient
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Abilities

1. Ability to understand genetic test results and their clinical implications
 2. Ability to refer the patient to the appropriate experts in genetics and to work in team
 3. Ability to communicate with patients regarding their genetic condition and its implications
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205: Scientific Advancements in Diagnostics

Knowledge

Knowledge of the principal methodologies for genetic sampling, laboratory techniques with their pros and cons, and knowledge of the terminology used in lab reports

RISE2 Genomics Standards (2021)²

I. Development and Design		
Item	Description	Comments / Suggestions
Aim	State the overarching goal(s) of the intervention.	specified in each course
Rationale	Provide a justification of the need for the intervention	
Target Group(s)	Describe the main background/specialty of the intended learners and why they were targeted, noting any subpopulation(s) or if interdisciplinary.	on the Home Page
Target Group recruitment	Describe how the target group was made aware of the intervention and how to access it	required registration for access, certificate for incentives
Context	Present any relevant information about the environment where the intervention was delivered and whether it was accredited.	found on the course introductory page
Learning Objectives	Describe the intended learning objectives of the intervention.	specific for each course
Developer(s) / Instructor(s)	Specify the organization(s) or people who developed and/or delivered the intervention	On the Home Page
Prerequisite Knowledge / Skills	Identify any assumed level of prior knowledge or skills in genetics/genomics in the target group.	mentioned in each course
Approach to Development	Present clear descriptions of the principles and processes undertaken to plan and develop the intervention	consulting experts for more advanced courses
Future Directions	Describe any plans to evaluate or amend and/or repeat the intervention.	plans for more advanced courses and their content
II. Delivery		
Item	Description	Comments
Mode	Provide details of mode of delivery	fully online
Duration	Specify the time required to complete the intervention.	specified for each course
Structure	Describe the components of the intervention, such as modules, workshops, etc.	given an outline at each course home page; explanation that there will be a quiz at the end of each lesson
Content	Summarize the key broad topics and/or skills covered by the intervention.	lesson and course summaries are available for all courses
Assessment	State if the target group was tested against the learning objectives and, if so, when, how, by whom and where relevant, to what standard.	quiz and final quiz

References

1. Korf, B. R. *et al.* Framework for development of physician competencies in genomic medicine: report of the Competencies Working Group of the Inter-Society Coordinating Committee for Physician Education in Genomics. *Genetics in Medicine* **16**, 804–809 (2014).
2. Nisselle, A. *et al.* Ensuring best practice in genomics education and evaluation: reporting item standards for education and its evaluation in genomics (RISE2 Genomics). *Genetics in Medicine* **23**, 1356–1365 (2021).
3. Tognetto, A., Michelazzo, M. B., Ricciardi, W., Federici, A. & Boccia, S. Core competencies in genetics for healthcare professionals: results from a literature review and a Delphi method. *BMC Med Educ* **19**, 19 (2019).

