



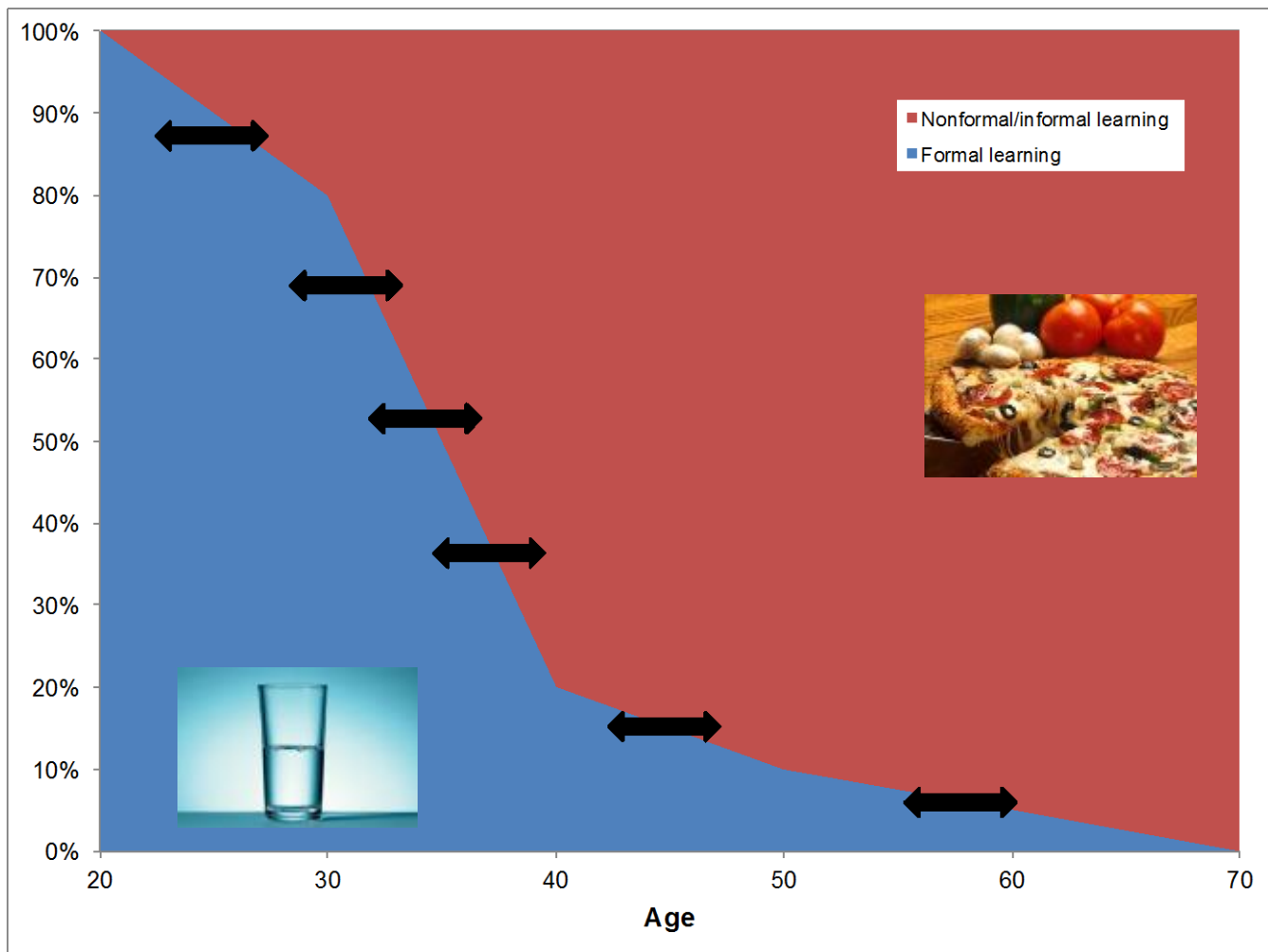
Competency profiling in practice

Summary of the landscape and methodologies available

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A journey through lifelong learning



Competency defined

Competency is ‘an observable ability of any professional, integrating multiple components such as knowledge, skills, values and attitudes’.

- Acquisition can be validated objectively
- Shared ‘currency’ applicable to learning of all types and at all career stages

Competency profiles defined

- A competency profile is a description of the knowledge, skills, values and attitudes necessary for a profession or a particular job role.
 - Enables individuals to evaluate and collect evidence of their current competencies and plan career development.
 - For employers, they facilitate recruitment and employee development.
 - For course providers, they can be used to match training to trainees' requirements and assess training outcomes.
 - For professional bodies, they define competency requirements for a specific profession.

At a glance...

- May be specific for a role or a discipline
- May be divided into areas/clusters/domains of competencies
- Each competency has a description encompassing the knowledge, intellectual abilities, skills, techniques, experience, behaviours or professional standards required
- For each competency there may also be
 - A description of the depth required
 - Guidance on or examples of how competency can be achieved
- Competency frameworks may also include:
 - Guidance on gathering and documenting evidence
 - A process for assessment
 - Guidance on career progression

There is no 'one size fits all' but...

	Competence	Role 1	Role 2	Role 3
Domain 1	Comp. 1	Awareness	Working knowledge	...
	Comp. 2		Specialist knowledge	
Domain 2	Comp. 3	Working knowledge	Awareness	
	Comp. 4	Specialist knowledge	Working knowledge	
Domain 3	Comp. 5		Working knowledge	
	Comp. 6	Awareness		
Domain 4	Comp. 7			
	Comp. n	Awareness	Specialist knowledge	

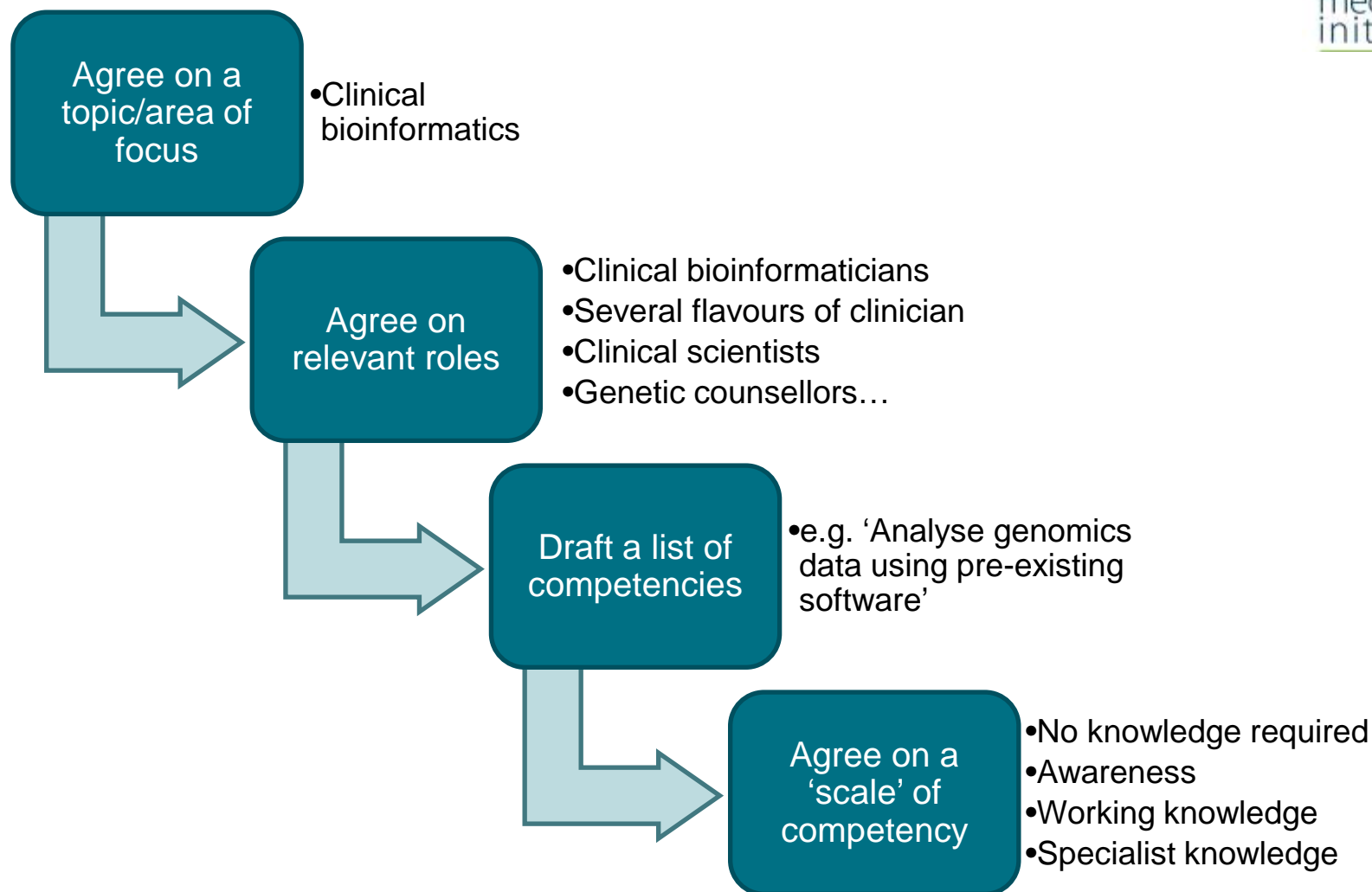
Case study: clinical bioinformatics

- To address immediate needs arising from the UK's 100,000 Genomes Project...
 - **Specialist healthcare scientists** require training to handle and interpret genomic data
 - **Clinical staff** involved in recruiting patients to the 100,000 Genomes Project require training to understand the results of genome sequencing and to counsel patients (and their relatives)
 - The **general workforce** requires training to provide awareness of genomic medicine and how it can improve patient care

Our task

- Define the competencies needed by healthcare professionals to enable them to use data emerging from the 100,000 Genomes Project to inform clinical decision-making
- Work out which competencies are met by existing training programmes
- This will inform the design of future training programmes for healthcare professionals

Defining the scope



After the definition stage...

Empty matrix

Competency	Role1	Role 2	...
Competency 1			
Competency 2			
Competency 3			
...			

Scale of competency



Group of experts



Consensus view of competency requirements

Consultation phase

Ask experts/
practitioners to
complete the matrix

- Enough experts to reach reasonable consensus for each role (for us this was 5–10)

Ask them to list any
missing competencies
and/or provide
amendments to
existing competencies

Set some rules and
some boundaries

- What competencies are required to meet a specific goal?
- Do you need to consider different competencies for early-stage and senior people in similar roles?

After consultation...

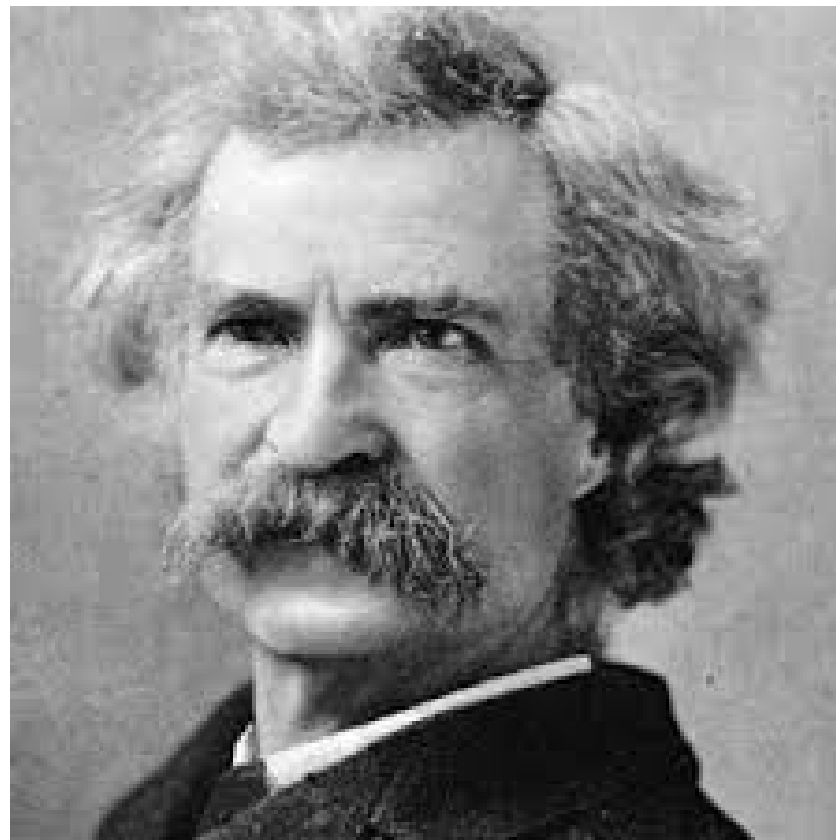
Competency	Role1	Role 2	...		
Competency 1	Level 1				
Comp	Competency	Role1	Role 2	...	
Comp	Competency 1		Level3		
...	Com	Competency	Role1	Role 2	...
	Com	Competency 1		Level3	
	...	Competency 2		Level 2	
	Compe	Competency	Role1	Role 2	...
		Competency 1			Level 1
	...	Competency 2			Level 2
		Competency 3			Level 2
		Competency 4			Level 3

Putting it all together

Role	Clinical bioinformatician	Other bioinformatician	Specialist clinician with genomics/genomics expertise	Other specialist clinician	Other clinician	Clinical genetic Scientist	Other healthcare scientist	Specialist nurse/counsellor	Nurses and other allied health professionals	IT specialist	Data specialist
No. responses	11	6	5	5	6	8	6	6	5	7	7
Example	NHS diagnostic bioinformatician [1]	Academic bioinformatician, industry bioinformatician	Clinical geneticist or pathologist, haematologist, microbiologist with leadership responsibility in clinical lab	Cardiologist, neurologist, oncologist, paediatrician	General Practitioner	NHS diagnostic clinical scientist, microbiologist, statistical/analytical epidemiologist	Genetic technologist, immunologist, epidemiologist	Genetic counsellor; Preimplantation genetic diagnosis nurse; clinical nurse specialist in surgery or oncology; Genetic Diabetes Nurse	Non-specialist nurse; physiotherapist	Systems administrator	Curator, data scientist
Competency	Specialist knowledge	Specialist knowledge	No knowledge required	No knowledge required	No knowledge required	Awareness	No knowledge required	No knowledge required	No knowledge required	No knowledge required	Specialist knowledge
Write computer programmes and algorithms that can analyse data	Specialist knowledge	Specialist knowledge	Specialist knowledge[2]	Awareness	No knowledge required	Specialist knowledge	Awareness	No knowledge required[3]	No knowledge required	Awareness	Working knowledge
Analyse genomics data using pre-existing software, including linking genotype to phenotype/microbial strain comparisons	Specialist knowledge	Specialist knowledge	No knowledge required	No knowledge required	No knowledge required	No knowledge required	No knowledge required	No knowledge required	No knowledge required	Working knowledge	Specialist knowledge
Employ good software development practice	Working knowledge	Working knowledge	No knowledge required	No knowledge required	No knowledge required	No knowledge required	No knowledge required	No knowledge required	No knowledge required	Specialist knowledge	Working knowledge
Apply computer science theory to computer system design	Working knowledge	Working knowledge	No knowledge required	No knowledge required	No knowledge required	Working knowledge	Awareness	Awareness[3]	No knowledge required	Awareness	Specialist knowledge
Manage and organise genomics data and results	Working knowledge	Specialist knowledge	Working knowledge	No knowledge required	No knowledge required	Awareness[4]	Awareness	No knowledge required	No knowledge required	Awareness	Awareness
Apply statistical research methods to genomics, medical, and population genetics	Working knowledge	Awareness	Specialist knowledge	Awareness	Awareness	Specialist knowledge	Working knowledge	Specialist knowledge	Awareness	No knowledge required	Specialist knowledge
Use health informatics systems and understand their relevance to clinical genomics	Specialist knowledge	Specialist knowledge	Specialist knowledge	Working knowledge	Working knowledge	Specialist knowledge	Working knowledge	Specialist knowledge	Awareness	No knowledge required	Awareness
Principles of genetics, genomics and genome-sequencing technology	Working knowledge	Working knowledge	Specialist knowledge	Working knowledge	Working knowledge	Specialist knowledge	Working knowledge	Specialist knowledge	Awareness	No knowledge required	No knowledge required
Principles of genetic disease	Working knowledge	Working knowledge	Awareness	No knowledge required	Awareness	Awareness	Awareness	No knowledge required	Awareness	No knowledge required	No knowledge required
Principles of systems biology	Specialist knowledge	Specialist knowledge	Awareness	Awareness	Awareness	Specialist knowledge	Awareness[6]	Awareness	No knowledge required	No knowledge required	Awareness
Principles of next-generation sequencing	Working knowledge	Working knowledge	Specialist knowledge	Working knowledge	Working knowledge	Specialist knowledge	Awareness	Specialist knowledge	Awareness	Awareness	Awareness
Ethical, legal and social implications of clinical use of genomic data (including issues surrounding identification of patients, clinical benefits and risks, patient consent, incidental findings and ethical implications of unexpected clinically actionable findings)	Specialist knowledge	Working knowledge	Specialist knowledge	Working knowledge	Awareness	Specialist knowledge	Awareness[5]	Specialist knowledge	No knowledge required	No knowledge required	No knowledge required
Interpret genetic variation in a clinical context, including understanding limitations of analysis, assessing quality and evidence for clinical interpretation	Working knowledge	Awareness	Specialist knowledge	Working knowledge	Working knowledge	Working knowledge	Awareness	Specialist knowledge	Awareness	Working knowledge	Awareness
The role of various types of healthcare professional in genomic medicine	Specialist knowledge	Specialist knowledge	Working knowledge	Awareness	No knowledge required	Working knowledge	Awareness	Awareness	No knowledge required	No knowledge required	Awareness
The scientific discovery process and of the role of bioinformatics in it	Specialist knowledge	Specialist knowledge	Working knowledge	Awareness	Working knowledge	Specialist knowledge	Awareness	Specialist knowledge	Awareness	No knowledge required	Awareness
The risks (and benefits) to patients and their families arising from the prediction of causal variants	Specialist knowledge	Awareness	Specialist knowledge	Working knowledge	Working knowledge	Specialist knowledge	Awareness	Specialist knowledge	Awareness	No knowledge required	Awareness
Integrate and jointly analyse genomic and other data						[7]					

“Continuous improvement is better than delayed perfection.”

Mark Twain



Mapping to existing training

Key:

No training available but no requirement identified	No training provided by the courses that we mapped, but training available outside the NHS	No training course identified	Training available through other HEE routes
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Notes

1. STP genetics curriculum review is in progress
2. Could be included in Clinical Bioinformatics HSST

Competency	Level		
	Awareness	Working knowledge	Specialist knowledge
Write computer programmes and algorithms that can analyse data	Required by clinical genetic scientists ¹	MSc Clinical Bioinformatics	Required by clinical bioinformaticians ² , other bioinformaticians; data specialists
Analyse genomics data using pre-existing software, including linking genotype to phenotype/microbial strain comparisons	MSc Genomic Medicine	MSc Genomic Medicine, MSc Clinical Bioinformatics	MSc Clinical Bioinformatics
Employ good software development practice (software carpentry)	HEE Intro to Bioinformatics	Required by clinical bioinformaticians, IT specialists but available as part of specialist training or as standalone software carpentry workshops	MSc Clinical Bioinformatics
Apply computer science theory to computer system design	No training available but no requirement identified	MSc Clinical Bioinformatics	Required by IT specialists but may be provided through higher education in computer science
Manage and organise genomics data and results	HEE Intro to Bioinformatics, HEE intro to consent and ethics	MSc Clinical Bioinformatics	MSc Clinical Bioinformatics
Apply statistical research methods to genomics, medical, and population genetics	MSc Genomic Medicine	MSc Clinical Bioinformatics	Required by statistical/analytical epidemiologists
Use health informatics systems and understand their relevance to clinical genomics	HEE Intro to Bioinformatics, MSc Genomic Medicine	MSc Genomic Medicine	Required by specialist clinicians with genetics/genomics expertise; data specialists
Principles of genetics, genomics	HEE Intro to Bioinformatics, HEE intro to genomics. HEE intro to	MSc Clinical Bioinformatics, MSc	MSc Clinical Bioinformatics

Challenges

- Evidence, evidence, evidence!
 - Articulating the evidence required to show that someone has gained a specific competency
 - Assessing that a competency has been assimilated into an individual's day-to-day work
 - Mapping courses and other learning opportunities to competencies – especially when learning outcomes are not specified

Related projects

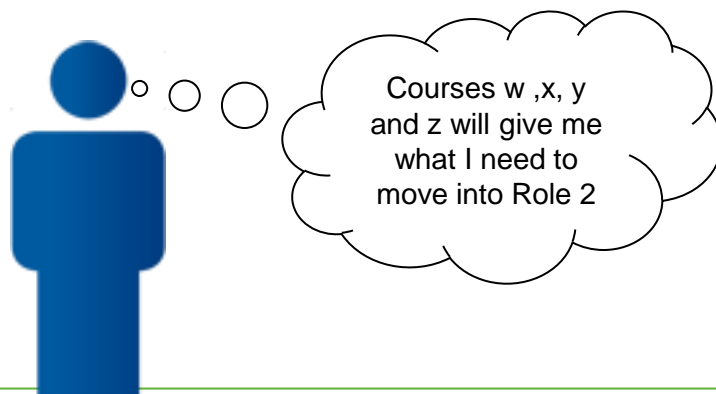
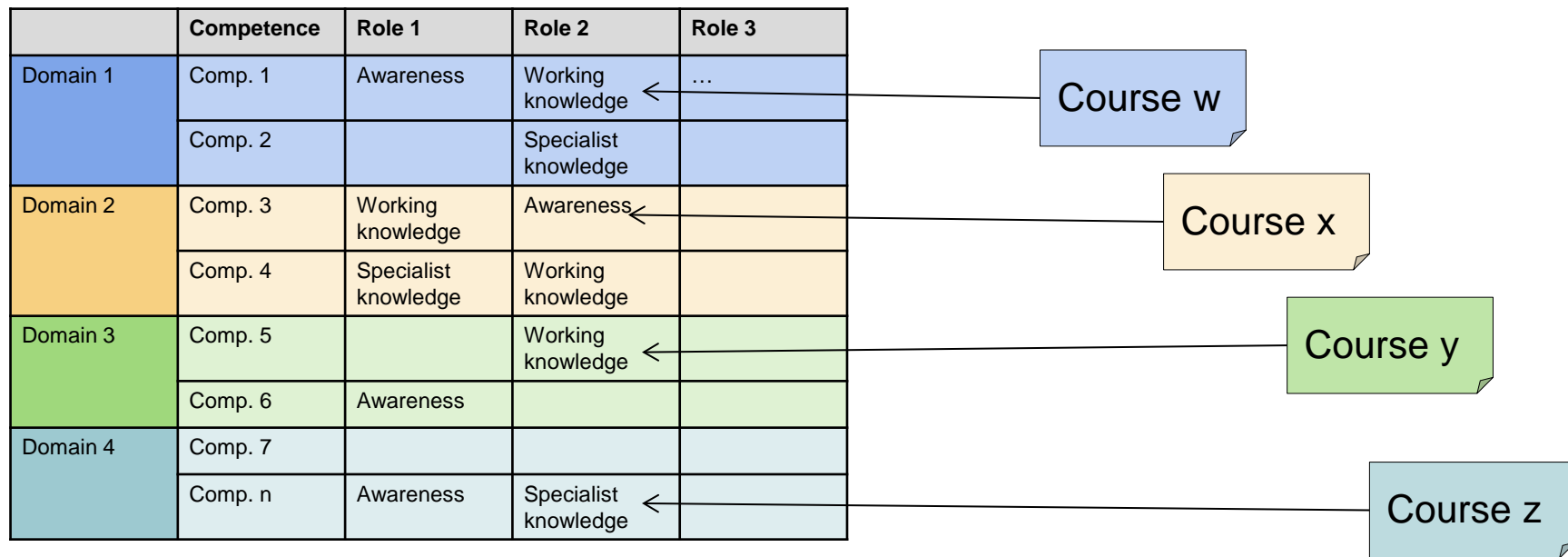
- The International Society of Computational Biology is developing competency profiles for a broader constituency of bioinformatics users, scientists and engineers
Welch, L. et al. (2014) *PLoS Comp. Biol.* **10**: e1003496 (DOI: 10.1371/journal.pcbi.1003496)
- Health Education England is about to embark on a project to develop a curriculum for specialist clinical bioinformaticians (HSST Clinical Bioinformatics)
- Applying a similar process to capacity building for research infrastructures
 - Managerial and leadership roles
 - Technical roles
 - Pending applications to H2020

Towards a database of competency profiles

Specialist in medicines development

What is it?	A set of core competencies for pharmaceutical physicians and drug development scientists. It can be summarized in a Statement of Competence; it has been benchmarked against the learning outcomes of the PharmaTrain Base Course
Who is it relevant to?	Pharmaceutical physicians and other biomedical professionals involved in drug development
How was the profile developed?	A working group with experience of teaching pharmaceutical medicine at undergraduate, postgraduate and CPD level was convened and performed a thorough review of published competencies related to pharmaceutical medicine (more...)
Who developed it?	International Federation of Pharmaceutical Physicians and Pharmaceutical Medicine in collaboration with PharmaTrain
How is it being used?	The competencies are intended to serve as a resource and guide for those interested in improving the quality and accountability of pharmaceutical medicine education and training (more...)
What is the process for keeping the profile up to date?	An iterative 3-5-year cycle of refinement and development in light of feedback from IFAPP's national member associations.
Reference(s)	Core competencies for pharmaceutical physicians and drug development scientists Silva, H. et al. Front Pharmacol. (2013) 4: 105. doi: 10.3389/fphar.2013.00105

And a searchable list of competencies mapped to courses in on-course®



Acknowledgements



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Clinical bioinformatics

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Thank you!

