



D4.2 Initial development of online training courses and workshops for different stakeholder groups

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QUANTUM summary	QUANTUM aims at developing and implementing a label mechanism that could be ideally adopted in the future HealthData@EU. QUANTUM builds on 5 technical work packages (WP). WP1 conceptualises and provides technical specifications for a data quality, utility, and maturity label. WP2 designs, develops a conformance-checking tool and tests, at small-scale, the label. WP3 implements the labelling mechanism in a number of data holders. WP4 engages the data quality users' community; and, WP5 outreaches other interested parties, including other initiatives building HealthData@EU.
Deliverable abstract	This deliverable presents the initial development of the QUANTUM Academy's online training curriculum, designed to enhance stakeholders' understanding and adoption of the Data Quality and Utility (DQ&U) label within the European Health Data Space (EHDS). Based on the learning needs identified in Deliverable 4.1, the curriculum currently includes two modules with four courses. This deliverable outlines the curriculum structure, validation process, and roadmap for refinement, further development, and long-term sustainability of the QUANTUM Academy.
Keywords	Health data quality, secondary use, data quality label, data quality education, training programme, training curriculum, online training platform



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QUANTUM CONSORTIUM			
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3	Health Data Hub	PLATEFORME DES DONNEES DE SANTE	FR
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18	BFARM	BUNDESINSTITUT FÜR ARZNEIMITTEL UND MEDIZINPRODUKTE	DE
19	HIQA	HEALTH INFORMATION AND QUALITY AUTHORITY	IE
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21	CESSDA ERIC	CESSDA ERIC	NO
21.1	KNAW	KONINKLIJKE NEDERLANDSE AKADEMIE VAN WETENSCHAPPEN - KNAW	NL
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QUANTUM
THE HEALTH DATA QUALITY LABEL

Developing a data quality and utility label for the European Health Data Space.

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List of Abbreviations and Acronyms

CSA	Coordination and Support Action
EHDS	European Health Data Space
HADEA	European Health and Digital Executive Agency
ISO	International Organization for Standardization
DQ&U	Data Quality & Utility
HDAB	Health Data Access Bodies
WP	Work Package
QUANTUM	Developing a data quality and utility label for HealthData@EU
EU	European Union

1 Introduction

1.1. Definition of task 4.2.

Task 4.2 focuses on the development and implementation of online training curriculum tailored to the diverse stakeholder groups' needs identified in deliverable 4.1. The training curriculum and its courses will address the capacity gaps revealed in the needs assessment, equipping stakeholders with the necessary skills and knowledge to enhance health data quality, and to effectively adopt QUANTUM labelling practices.

To ensure clear and impactful training, various consortium partners will contribute their expertise and domain-specific knowledge to the development of training content. All educational content will be hosted on an online e-learning platform, offering training participants the ability to:

- Track their learning journey through personal accounts.
- Access on-demand training materials at their own pace.
- Obtain necessary insights upon successful completion of each module.

To validate and refine the training curriculum, we revise the contents of training courses in a dedicated workshop for colleagues from other work packages (WPs). Additionally, project partners and Delphi survey participants (deliverable 1.1) will at a later stage be invited to assess the contents as early users and evaluators. The feedback we receive from these groups is essential and will contribute to establishing the roadmap for continuous improvement, ensuring the courses remain relevant, user-friendly, and effective.

1.2. Scope and objective of deliverable 4.2.

With this deliverable, we initiate the development of online training courses and workshops to different stakeholder groups within the health data ecosystem. Building on the stakeholder needs identified in Deliverable 4.1, this deliverable translates those insights into structured, accessible, and engaging educational content.

Deliverable 4.2. represents the first step in implementing the QUANTUM Academy, focusing on the development of modules and courses for which sufficient content already exists. Specifically, it covers Modules 1 and 2 of the QUANTUM Academy - comprising four courses - which draw from scientific literature, policy guidance, and project outputs from other QUANTUM work packages. Module 3 will be addressed in a subsequent phase (update of Deliverable 4.2), once its supporting materials are available.

The main objectives of this deliverable are:

- To develop engaging, and easily accessible online training materials that explain the QUANTUM Data Quality and Utility Label tool and specification.

- To begin closing some critical knowledge and skills gaps related to health data quality, as identified in Deliverable 4.1.
- To structure and validate the curriculum content of modules 1 and 2, laying the foundation for the technical production of the courses.
- To introduce a roadmap for full course development and future refinements that will be addressed in later phases of task 4.2, including the updated version of Deliverable 4.2.

As defined in Deliverable 4.1, the QUANTUM Academy is structured into three core modules, comprising eight courses in total. Table 1 provides an overview of the current structure.

Table 1. Overview of the curriculum in QUANTUM Academy

QUANTUM curriculum			
Module		Course	
1	Introduction	1.1	Introduction to Health Data Quality
2	Data Quality Components in QUANTUM	2.1	Specifications of the Quality and Utility Label
		2.2	Data Holder' Maturity Model
		2.3	Fit for Purpose (Users' Experience)
3	Understanding of the label	3.1	Tools and Methods used in QUANTUM
		3.2	Design and Development of the Label Tool
		3.3	Implement and Interpreting the Label
		3.4	Interaction with the Label from the HDAB Perspective

Deliverable 4.2 focuses solely on the first two modules. At this stage of the project, module 3 is not yet addressed, as the necessary content for its development is still under preparation in ongoing work packages. Moreover, the primary scope of this deliverable is the creation and validation of course content for modules 1 and 2. Technical production of the training materials will follow once the content has been finalized. Feedback on the user experience and pedagogical aspects of the courses will be collected and addressed in the subsequent phases of task 4.2, particularly in the updated version of Deliverable D4.2 and future WP4 milestones.

2 The QUANTUM Academy

2.1 Scope of the curriculum

The QUANTUM Academy is designed to equip key stakeholders in the health data environment with the knowledge and skills necessary to understand, apply, and benefit from the QUANTUM data quality and utility (DQ&U) label. This educational initiative provides a structured approach to understanding the DQ&U label components, how it is applied within various health data environments, and its significance for data holders, data access bodies, and data users. By fostering data quality literacy, EHDS alignment, and best practices, the training curriculum serves as a key resource for improving health data quality and data holder maturity.



2.2 QUANTUM Academy target audience

The curriculum of the QUANTUM Academy is tailored to multiple stakeholder groups involved in health data quality management, ensuring that each category gains the necessary expertise to integrate the DQ&U label effectively into their operations. The curriculum is built in a way that it should be relevant to all stakeholders as can be seen in Table 2. The stakeholder groups and their alignment with EHDS priorities have been identified and categorized based on the analysis provided in Deliverable 2.1.

The primary target audience aligned with EHDS include:

- **Data holders:** Organisations responsible for creating, managing and providing access to health data. They will learn how to implement and apply the DQ&U label while ensuring regulatory compliance with the EHDS requirements.
- **Health data access bodies:** Entities that oversee and regulate health data access. While the DQ&U tool is primarily used by data holders to generate the label, HDABs may be responsible for managing and disseminating the label.
- **Data users:** Researchers, policymakers, and academia who interpret and utilise health data. They will gain the ability to understand dataset quality, interpret the DQ&U label effectively, and make informed decisions based on standardised data quality metrics.

By targeting these key audiences, the curriculum ensures that all actors in the health data ecosystem are aligned with best practices in health data quality.

Table 2. The relevance of each course to the specific stakeholder group. The amount of x's indicate the applicability or degree of benefit to each stakeholder group - the most x's representing the highest relevance. These relevance levels were defined based on the stakeholder needs assessment and analysis conducted in Deliverable 4.1.

QUANTUM curriculum			
Course	HDAB	Data Holders	Data users
Introduction to Health Data Quality	xxx	xxx	xxx
Specifications of the Quality and Utility Label	xxx	xxx	xxx
Data Holder' Maturity Model	xx	xxx	x
Fit for Purpose (Users' Experience)	x	xx	xxx
Tools and Methods used in QUANTUM	xx	xxx	x
Design and Development of the Label tool	xx	xxx	x
Implement and Interpreting the Label tool	xx	xx	xxx
Interaction with the Label from the HDAB Perspective	xxx	xx	x

2.3 Technical Composition of the Developed Modules

At this stage, the QUANTUM Academy modules will be implemented as self-paced online courses hosted on the Moodle-based i~HD Academy eLearning platform. The instructional content is to be primarily delivered through PowerPoint slide decks enhanced with voice-over narration to guide learners through each topic. While the curriculum outlines a recommended learning path across the three core modules, it has been designed with flexibility in mind - allowing users to engage with modules and even individual chapters in either a sequential or standalone manner, depending on their specific interests and learning needs.

Each course concludes with a set of review questions that assess the learner's understanding of the presented material, with performance thresholds established to ensure adequate comprehension before progressing. These formative assessments are embedded directly within the Moodle platform. Upon completion of the entire training programme, learners will be awarded a certificate of attendance and participation.

As outlined in the scope of this deliverable, the current focus is on the development and validation of the content for modules 1 and 2. The educational materials created at this stage - including the initial PowerPoint slide decks with embedded voice-over narration - are based on the structure, goals, and learning outcomes defined in the Deliverable 4.1. While this

deliverable does not include the full technical production or finalized versions of all content, it does cover the initial instructional materials and draft content outlines used for validation purposes. These draft materials form the foundation for the user feedback and refinement processes described in the following section. A more detailed breakdown of the topics covered and intended learning outcomes per course can also be found in Deliverable 4.1.

The detailed evaluation of user experience and usability, within the Moodle environment, will be addressed in the next phase of the project.

2.4 Validation of the QUANTUM Academy course materials

To support the initial validation of the QUANTUM Academy course materials, an internal online workshop was held in March 2025 with the participation of QUANTUM WP and Task leaders, as well as WP4 partners. This session provided an opportunity to gather expert feedback from those directly involved in the development of the QUANTUM deliverables and the DQ&U label framework. The primary objective was to ensure that the training materials are understandable for audiences with varied levels of expertise, and that the course contents accurately reflect the technical and strategic components of the QUANTUM project.

Although Milestone 4.3 - which will formally report on course piloting by QUANTUM partners and Task 1.2 Delphi participants - was not yet available at the time of this deliverable, the feedback gathered during the workshop has been used to guide immediate content refinement.

The feedback was compiled from all participants in the workshop and has been systematically analysed to support structured improvements to the course material. A total of 14 participants contributed to the session, including QUANTUM work package and task leaders, work package 4 partners and other contributors. The participants were from seven different QUANTUM partner countries, and 9 of them were women and 5 men, ensuring that the validation process is sufficiently representative. Their feedback has been reviewed, synthesised, and summarised across four main categories, chosen to reflect and support structured improvements to the course material:

1. Content Accuracy and Completeness

Feedback under this category addressed the correctness of the technical content, alignment with project deliverables, and inclusion of essential context.

- Ensure content sections align correctly with module themes (e.g., shifting label-specific content from introductory modules to dedicated sections).
- Verify all references (e.g., correct EU regulation numbers, use of official terminology like Article 78).
- Include references to source materials, including QUANTUM deliverables and EU regulations.
- Add clear and complete definitions (e.g., of data quality, relevance,

representativeness).

- Expand on underdeveloped content areas, especially where references to models or frameworks are made (e.g., ISO standards, maturity assessment methods).
- Revisit duplicate or redundant slides.

2. Pedagogical Structure and Learning Design

This group of comments relates to how the materials are structured for learning, clarity of objectives and progression of concepts.

- Introduce clear learning objectives at the beginning of each course/module.
- Add summary or reflection slides at the end to reinforce key messages.
- Reframe introduction/conclusion slides as “What you will learn” and “What you have learned” to enforce the learning objectives.
- Clarify the flow of information, especially where technical terms or complex processes are introduced too early without explanation.
- Reorganise modules to follow a logical learning journey, building understanding progressively.

3. Examples, Use Cases, and Practical Application

Multiple suggestions pointed to the need for real-world context and examples to enhance understanding.

- Add practical examples, vignettes, or case studies to illustrate how the DQ&U label is applied.
- For complex models (e.g., the maturity model), introduce step-by-step walkthroughs with example organisations.
- Include example purpose in the “Fit-for-Purpose” section to show how quality metrics apply in different research or policy contexts.
- Integrate scenarios or story-driven elements where appropriate, to make abstract concepts more relatable and memorable.

4. Presentation and Visual Improvements

Participants offered feedback on visual clarity, format, and accessibility of the slides and supporting material.

- Replace text-heavy slides with infographics or more engaging visuals.
- Rebuild key graphics (e.g. pyramids, workflows) for interactivity or clarity.
- Ensure slide titles are clear and informative.
- Avoid reliance on speaker notes for critical information - important content should appear in the slides themselves.
- Use consistent formatting, terminology, and British English spelling (in line with EU project conventions).
- Where possible, make slides more accessible through clearer design, better structure, and self-contained visuals.

The feedback received during the workshop has been instrumental in guiding improvements to

the current training modules. These refinements will ensure that the QUANTUM Academy curriculum is not only accurate and complete but also engaging, accessible, and pedagogically sound. We are expecting to complement the received feedback with the results of Milestone 4.3, where we anticipate the perceived areas of improvement to be similar to those already observed. The current version of the course materials will be revised based on the feedback from the categories above, with changes prioritised according to their impact on learner understanding and content quality. After this revision cycle, the contents of the first four courses can subsequently be deemed final, and they can proceed to the technical production to eventually be available through the QUANTUM Academy.

2.5 Accessing the QUANTUM curriculum and courses

As described in the Deliverable 4.1, the courses within QUANTUM curriculum will be hosted on the i~HD Academy e-learning platform (<https://academy.i-hd.eu/>). This platform is already operational and supports both interactive and self-pacing learning. Participants will be able to register, enroll, and engage with QUANTUM training materials directly through the platform.

The i~HD Academy utilises Moodle as their e-learning platform and already provides courses related to the trustworthy use and reuse of health data, with a strong emphasis on health data quality. Access to the platform is open to all users upon registration. After a successful registration process, when the account has been confirmed, the user can access the available QUANTUM curriculum and self-enrol to the courses. All the courses can be taken up at any time, allowing for flexibility and adjusting the learning to users' own schedules. Evaluation of the user experience and usability of the modules within the Moodle environment will be addressed in the next phase of the project.

3 Roadmap for further refinement and course development

To ensure the continued relevance, effectiveness, and sustainability of the QUANTUM Academy, a roadmap has been defined to guide the refinement of existing materials, the development of future modules, and the enhancement of the overall learning experience.

3.1 Refinement of existing course content and learning experience

The initial set of courses - covering approximately half of the planned curriculum - has been developed and validated through internal expert feedback. After complementing it with the results of Milestone 4.3, we can take the next steps in refining the course contents by incorporating the feedback, aligning it more closely with learning design and best practices.

In parallel, efforts will be made to enhance the learning experience within the Moodle platform. While this deliverable currently focuses on content validation, the next phase of this task will explore options such as increasing the interactivity of the materials and applying learner engagement strategies. This refinement and user experience enhancement represent a top priority in our roadmap moving forward.

3.2 Development of module 3

The third module of the curriculum will be developed once the required input and content from Work Packages 2 and 3 are available, as these work packages provide essential foundations for its creation. This module will cover more advanced and applied aspects of the DQ&U label, with a focus on labelling tool implementation, methodology, and stakeholder interaction. The plan is to have more hands-on experience in the courses of this module to complement the more theoretical framework of the courses in modules 1 & 2.

As with the first set of courses, the learning experience for module 3 will be developed with attention to clarity, modularity, and user engagement. Upon completion of this module, a second internal workshop will be organised to gather structured feedback from project partners and stakeholders - mirroring the successful approach used for validating the course contents of modules 1 and 2.

3.3 Alignment with broader educational initiatives

While QUANTUM focuses on a specific stage of the health data quality lifecycle, it is essential to connect and align the curriculum with other education efforts in this domain. As highlighted in the Milestone 4.1, there is a clear need for a more holistic data quality education throughout the entire data lifecycle and across all involved stakeholders.

To that end, we aim to:

- Map the QUANTUM curriculum against other training programmes from related EU-funded projects.
- Identify opportunities for cross-promotion and content integration.
- Offer learners access to complementary materials beyond the scope of QUANTUM via curated links.

This alignment will strengthen the relevance of the QUANTUM Academy and support a more comprehensive educational landscape for health data quality. Furthermore, these efforts align with our Task 4.3 “Sustainable community of practice and repository of best practice resources”, where we are building a repository of additional training resources to enhance the stakeholder community understanding and skills on data quality, and thus promote the support of the QUANTUM labelling. This repository will be an indexed collection of links to additional already available training from other relevant European projects, from data quality initiatives, and from health data landscape. The aim is not to duplicate any training development efforts,

but rather to point the stakeholder community to the right direction when looking for additional information or training on specific topics of their interest. We foresee that this builds up also more improved data labelling user experience and supports the pan-European capacity building.

3.4 Ensuring long-term sustainability and enabling capacity-building

Another key area of focus is the sustainability of the curriculum beyond the lifetime of the project. This includes:

- Establishing maintenance and update mechanisms, as well as a life cycle for course materials to keep them relevant in time and to archive them properly when they have become obsolete.
- Exploring options for hosting the QUANTUM Academy contents under EU Academy for long-term sustainability after the project lifetime. Another option for long-term hosting on the i~HD Academy platform and/or other open learning environments.
- Identifying strategic partnerships for continued delivery, promotion, and potential expansion of the training offer in QUANTUM Academy.

Furthermore, we may need to explore the possibility to increase the learning platform capacity when users start registering and self-enrolling to the courses to ensure smooth user experience and to allow all interested users to take the courses.

These elements - content refinement, module development, strategic alignment, and sustainability planning - will be further elaborated and formalised in the updated version of Deliverable 4.2.

4 Conclusions

The initial development of the QUANTUM Academy curriculum marks a foundational step in building capacity for high-quality health data management across Europe through targeted, accessible online training. This first implementation phase focused on translating the learning objectives and stakeholder needs identified in Deliverable 4.1 into structured, pedagogically sound course materials.

Central to this curriculum is the introduction and explanation of the Data Quality and Utility (DQ&U) label, a core outcome of the QUANTUM project. The training materials developed to date - particularly within modules 1 and 2 - equip stakeholders with the conceptual and practical understanding needed to implement, interpret, and apply the DQ&U label in alignment with European Health Data Space (EHDS) objectives. Complementing this is content on the maturity model for data holders, providing a structured pathway for organisations to



assess and improve their data governance practices.

Validation of the training content through internal expert feedback has ensured alignment with the QUANTUM tool, reinforcing its technical foundations while enhancing usability for a diverse range of learners. This feedback has led to targeted refinements that improve both content accuracy and in the future learner engagement.

As the project advances, efforts will turn to the development of module 3, which will integrate forthcoming insights from Work Packages 2 and 3. This next phase will further enhance the QUANTUM Academy by deepening the content on label interaction, regulatory alignment, and real-world application. It will also provide an opportunity to incorporate the emerging maturity dimension into the curriculum, particularly as discussions continue around its integration into the label.

Looking ahead, sustainability will be important. Establishing processes for continuous content updates, aligning with broader educational initiatives, and forming strategic partnerships will ensure that the QUANTUM Academy - and the DQ&U label - remain relevant and accessible beyond the project's lifespan. Through these measures, the Academy will continue to support long-term capacity-building, maturity progression, and the adoption of the QUANTUM tool and labelling practices across Europe.

With this deliverable, we lay the groundwork for continued refinement, expansion, and integration - ensuring that the QUANTUM Academy becomes a lasting asset for the health data ecosystem.

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