

Improving Cause-of-Death Certification in Portugal Through a nanoMOOC for Health Professionals

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Abstract — This short paper reports the design, implementation, and initial evaluation of a self-paced nanoMOOC that trains health professionals in Portugal to certify causes of death according to World Health Organization (WHO) standards. The course was designed in collaboration between the Portuguese Directorate-General of Health and the Laboratory of Distance Education and eLearning (LE@D) - Universidade Aberta and builds on the outputs from the Certification of Causes of Death in Europe (CODA-EU) Erasmus+ project, a multidisciplinary partnership involving France, Poland, Greece, and Portugal. The CODA-EU project addressed a persistent public health challenge: inaccurate completion of death certificates and the frequent use of non-specific “garbage codes,” which reduce the quality and comparability of mortality statistics needed for epidemiological surveillance and health policy.

The nanoMOOC is an enhanced version of the CODA-EU pilot course, localised to the Portuguese current health system. It was delivered on the national MOOC platform NAU. The nanoMOOC comprises three theoretical and practice-oriented modules: (1) Death certification in Portugal (legal framework), (2) Identifying and documenting the causal chain leading to death, and (3) Procedures for death certification. Design decisions aimed to support health professionals through concise learning units, case-based practice, and alignment between learning outcomes, activities, and assessment.

In this paper we evaluate the course first edition, combining participant feedback from the end-of-course questionnaire with a structured review using the MOOC Quality Checklist. The analysis focuses on clarity of guidance for completing death certificates, Course Syllabus and Pedagogy, Impact of the Training Professional Development and Global Course Overall Satisfaction. Results provide evidence of the course’s usefulness for continuing professional development and identify concrete improvement actions for subsequent editions. The paper concludes with transferable lessons for implementing short, practice-oriented MOOCs in regulated professional contexts.

Keywords—*Death Certification, Professional development, nanoMOOC.*

I. INTRODUCTION

Despite various recommendations regarding the recording and coding of causes of death, significant limitations in the quality of mortality data persist in Portugal and in some other European countries. There is a recurring problem with the

registration of ill-defined causes of death or conditions that offer low value for public health analysis. These inaccuracies, often referred to as “garbage codes,” undermine the ability of health authorities to monitor population health trends, plan effective screening and prevention programs, and implement strategic policies that address the most critical risk factors and population needs. Furthermore, frequent errors in filling out the causal sequence and identifying the deceased can lead to substantial delays in the certification process and the production of national statistics [1], [2]. To mitigate these issues, a nanoMOOC was developed to capacitate medical professionals and students in issuing death certificates that are clear, precise, and compliant with World Health Organization (WHO) guidelines. By improving the reliability and comparability of mortality data, especially in preparation for the digital-first International Classification of Diseases (ICD-11) transition, the initiative seeks to enhance epidemiological research and ultimately secure better health outcomes for the population. The course builds on outputs from the Certification of Causes of Death in Europe (CODA-EU) Erasmus+ project, a multidisciplinary collaboration involving partners in France, Poland, Greece, and Portugal. This enhanced Portuguese version of the CODA-EU course was co-designed by the Laboratory of Distance Education and eLearning (LE@D) - Universidade Aberta (the Portuguese Open University) and the Portuguese Directorate-General of Health and delivered on the national MOOC platform NAU. The nanoMOOC aims to support health professionals through concise learning units, case-based practice, and alignment between learning outcomes, activities, and assessment.

II. BACKGROUND

A. Quality of death certification in Portugal

Reducing major errors in death certification is vital, as incorrect data compromises national health policy and poses risks at both the individual and societal levels. In Portugal, notable improvements in the quality of cause-of-death data have been described since modern civil registration was established in 1911. Nonetheless, in the beginning of the 21st century, a relatively high rate of unknown causes of death was still reported on death certificates (around 10%) [3].

In this regard, the transition from the paper-based system to a 100% electronic mortality information system (e-death certification), based on the the digital Death Certificate

Information System (SICO), was met with high expectations [4]. Still, even after its implementation, in 2014, cause-of-death data quality has remained suboptimal, with 5-7% of death being classified as deaths caused by ill-defined diseases (often referred to as "garbage codes" in mortality statistics) [5-8], due to persistent underlying issues, such as insufficient medical training on proper death certification.

B. The CODA-EU Project

The CODA-EU Certification of Causes of Death in Europe (2020-23) project was an initiative supported by the Erasmus+ program that aimed to harmonize and improve the quality of mortality data across the European Union [9]. The project was prompted by research showing that several Member States, including Portugal, Greece, Poland, and Bulgaria, recorded a high percentage of deaths—ranging from 8% to 30%—linked to ill-defined conditions or codes with low value for public health analysis. Its primary objective was to provide medical educators with an innovative learning tool (CODA) to improve the training of students regarding the World Health Organization (WHO) standards and recommendations for certifying causes of death.

A central output of the project was the development of a MOOC (Massive Open Online Course) specifically designed for trainers and university professors to help them adapt the CODA tool to their own educational objectives. This initiative saw significant success, with 580 participants, the majority of whom were medical doctors, completing training courses held in France, Greece, Poland, and Portugal.

C. MOOCs, NanoMOOCs and professional development

Massive Open Online Courses (MOOCs) are characterized as online training initiatives designed for large-scale participation, providing open access to educational content through the web [10]. The implementation of these courses, including more specialized or condensed formats often referred to as nanoMOOCs, contributes significantly to professional development by providing flexible, evidence-based training [11] [12]. In the context of this training of healthcare providers these educational tools empower physicians and medical students to master complex systems like the Death Certificate Information System (SICO) in Portugal and the International Classification of Diseases (ICD). By participating in these courses, professionals gain practical competencies to avoid frequent certification errors and distinguish between direct and underlying causes of death.

D. MOOC Quality Project

Although there are several frameworks that addressed the quality assurance of online courses, these did not address MOOCs specific quality assurance requirements [13]. The Massive Open Online Education Quality – MOOQ project (2016-19), also known as European Alliance for Quality of Massive Open Online Courses, was a global initiative funded by the European Commission, with the fundamental goal of strengthening and improving the quality of MOOCs [14]. To support this goal, the project developed three primary instruments and practical tools: the Quality Reference Framework (QRF), the Quality Checklist for Beginners, and the Quality Criteria for Experts. These resources are designed to provide structured guidance for improving online courses and learning opportunities regardless of the user's expertise level. The Quality Reference Framework (QRF) is a generic framework based on the International ISO standard ISO/IEC 40180. It is designed to be adaptable to specific contexts for

the purpose of analysing, designing, developing, and evaluating online courses [15]. The framework is structured around three primary dimensions: Dimension 1: Phases – This dimension encompasses the full lifecycle of an online course, consisting of five phases: Analysis, Design, Implementation, Realization, and Evaluation. Dimension 2: Perspectives – This dimension addresses the different lenses through which quality is viewed, specifically the Pedagogical, Technological, and Strategic perspectives. Dimension 3: Roles – This dimension identifies the key stakeholders involved in the course, categorised as the Designer, Facilitator, and Provider.

III. COURSE DEVELOPMENT AND EVALUATION

A. Course development

The "Certification of Deaths in Portugal" course development team was trained for course creation on the NAU platform. This training was structured in six modules designed to guide participants through the entire process of developing a Massive Open Online Course (MOOC). The curriculum covers foundational pedagogical concepts, such as adult learning styles and the formulation of objectives using Bloom's taxonomy, as well as instructional design models and team coordination. Participants also received technical training on the NAU ecosystem, including hands-on experience with the NAU Studio for editing, parameterising resources, and creating multimedia content like videos, screencasts, and infographics. [16]

The typical development process for a course on the NAU platform is structured into four primary stages that guide a project from its inception to its delivery: forming the production team, planning the course, producing the content, and finally, implementing and evaluating the course. Within this framework, the specific instructional design of the course follows a top-down methodology divided into four distinct phases: First Phase: Establishing a general top-down approximation of the course; Second Phase: Defining the specific topics or sections that will make up each module; Third Phase: Developing the individual information units that the learner will see on the screen; Fourth Phase: Performing final revisions and adjustments to the material.

As the course moves toward completion, it undergoes a beta testing phase to identify necessary improvements before the official launch. As the course developed was an enhanced version of the original CODA course, the main phases that needed work were the Third and Fourth Phases. Apart from adapting the language and creating specific scenarios adapted to the Portuguese context, several new videos were created, with the assistance of a professional company support.

B. Course structure

The nanoMOOC "Certification of Deaths in Portugal" is a self-paced asynchronous course, with estimated 4 hours of work, that comprises three theoretical and practice-oriented modules: (1) Death certification in Portugal (legal framework), (2) Identifying and documenting the causal chain leading to death, and (3) Procedures for death certification. The main course objectives are: To recognize the importance of reliable information on the causes of death; Understand the functioning of the death certification system in Portugal; To distinguish the underlying cause of death from the direct cause of death; To know the International Statistical Classification of Diseases and Related Health Problems; To know the

recommendations of the World Health Organization for filling out death certificates; To recognize the most frequent errors in the certification of deaths; To systematize knowledge and gain practical skills in filling out death certificates.

In the initial module participants are informed about the course and asked to complete a questionnaire to characterize their profile and a diagnostic initial questionnaire. Each module contains essential information in short videos and audio (voice-over) support, complemented by a document where the essential aspects of the module are briefly described, as well as bibliographic references. It includes case-based quizzes with unlimited attempts that are not graded but with mandatory completion for the course conclusion.

The final assessment is a 20-question timed exam. The course completion with a grade equal or above 50% grants a certificate of completion

C. Course evaluation

Concerning course evaluation, the final course version was reviewed by two experts, that had already participated in the CODA project course development. Beta testing was conducted by three medical specialists of different areas of expertise.

At the end of the course, participants were asked to answer an Evaluation and Satisfaction Questionnaire of the course, that addressed the following items: Course Syllabus and Pedagogy; Impact of the Training for Personal and Professional Development; Global Course Evaluation; Further comments.

IV. RESULTS

The course started on 3/3/2026 and this first edition will remain open to participants until 4/3/2027. In the first month of running, 547 students have accessed the course, although only 269 have answered the initial questionnaire, a precondition to access the full course. From these, 65 (24%) have successfully completed the course and received the certificate of completion.

A. Results of the Evaluation and Satisfaction Survey

The Evaluation and Satisfaction Survey covered the following topics, with responses measured on a Likert scale: *Understanding, Up to date level and Relevance of Syllabus Contents, Adequacy of the Pedagogical Strategies, Appropriateness of Assessment Tools, Adequacy of the Course Duration, Impact of the Training in Professional Practice and Global Course Rating.*

The survey data indicates a high level of participant satisfaction regarding the course's **instructional design and syllabus structure**. A considerable majority of respondents (94%) expressed being "satisfied" or "very satisfied" with the clarity, up-to-date nature, and relevance of the syllabus contents. This positive reception is mirrored in the pedagogical execution, where over 90% of participants found the materials adequate for the topics and the assessment tools appropriate for validating their knowledge. Furthermore, the alignment between **course objectives and the syllabus** and the **appropriateness of the course duration** both received satisfaction ratings of 94% or higher, suggesting the four-hour self-paced format successfully met learners' needs.

Beyond the structural elements, the results highlight the **practical utility and professional impact of the training for**

health workers. The results show that 92% of participants found the course "helpful" or "very helpful" for their professional practice, directly supporting the initiative's goal of improving the quality of death certification in Portugal. This perceived value is consolidated in the **Global Course Rating** regarding expectations, where 96% of respondents reported high levels of satisfaction. These outcomes provide strong evidence that the Portuguese adaptation of the CODA-EU project effectively localized complex medical certification standards into a format that professionals find both engaging and directly applicable to their daily responsibilities.

B. Review using the MOOC Quality Checklist

The survey results demonstrate a strong alignment with the theoretical design criteria established in the Quality Reference Framework (QRF). By comparing the survey tables with the QRF's "Design" dimension, it is evident that the course successfully implemented key processes required for high-quality online education.

1) Instructional Alignment and Objectives

The QRF emphasizes **Instructional Alignment (D-4)**, requiring a clear link between learning objectives, module goals, activities, and assessments. It also dictates that learning objectives should be defined based on desired outcomes (D-1). The survey data confirms this was achieved, as **96% of participants** were satisfied or very satisfied with the **correspondence between course objectives and the syllabus**. Additionally, the QRF calls for defining objectives based on the entry level of target learners. The survey shows that **94% of respondents** felt they had a clear understanding of the syllabus contents, suggesting the design appropriately met their baseline knowledge.

2) Content Relevance and Duration

A central design process in the QRF is the **Concept for Content (D-4)**, which suggests adopting a needs-driven approach and aligning content with the course duration. The nanoMOOC's focus on Portuguese legal frameworks and WHO standards reflects this needs-driven design. Survey results validate this, with 94% of participants rating the **relevance of the syllabus** highly and 94% finding the **course duration adequate**. Furthermore, the QRF focus on "up-to-date" content is reflected on results that show that 94% of learners were satisfied with the **current nature of the material**.

3) Pedagogical Adequacy and Assessment

The QRF's **Didactical Concept (D-3)** and **Assessment Concept (D-11)** focus on using appropriate methodologies and instruments that validate knowledge transmission. The survey results directly mirror these standards:

- **Materials:** **92% of participants** found the pedagogical materials adequate for the topics, fulfilling the QRF's requirement for structured content based on unit size and expert knowledge.
- **Evaluation:** The QRF advocates for thematic tests and case study analysis. The course's use of case-based quizzes and a final timed exam resulted in a 94% satisfaction rate regarding the appropriateness of assessment tools.

This high level of satisfaction across all design-related metrics suggests that the course's structural foundation, built on the **CODA-EU project** and the **NAU platform training**,

successfully translated the QRF's expert criteria into a functional and professional learning experience.

V. CONCLUSIONS

This high level of satisfaction across all design-related metrics suggests that the course's structural foundation, built on the **CODA-EU project** and the **NAU platform training**, successfully translated the QRF's expert criteria into a functional and professional learning experience.

Some limitations of this study merit consideration. As data was collected during the first month of the course's initial edition, the findings should be regarded as preliminary, and data from the course complete edition will allow for a more comprehensive assessment. Additionally, as is common in voluntary end-of-course evaluations, the response rate was modest, and respondents were predominantly learners who completed the course; future iterations may benefit from strategies to capture broader participant feedback. Finally, the evaluation focused on satisfaction and perceived utility, which are recognised indicators of training effectiveness in professional development contexts but longitudinal measures of impact on certification practices would nonetheless strengthen the evidence base in subsequent studies.

Based on the lessons learned in implementing this nanoMOOC in the professional field of medical certification, we have identified several transferable lessons for developing short, practice-oriented online courses in the area, as follows:

1) **Align Content with Legal and International/National Standards:** For courses in regulated sectors, it is essential to ground all training in current national legislation and international guidelines (such as WHO recommendations). This ensures that the professional development is not only theoretically sound but also legally compliant and directly applicable to mandatory systems like the Death Certificate Information System (SICO).

2) **Prioritize Practical Error Mitigation:** Effective professional MOOCs should focus on recognizing and avoiding common practical errors that have real-world consequences, such as incorrect data entry in public health records. Providing specific, detailed examples—such as how to correctly document sequences of death or distinguish between direct and underlying causes—allows learners to gain immediate, high-value competencies.

3) **Design for Targeted Flexibility and Accessibility:** In demanding professional contexts, courses should be structured into manageable modules with clear estimated completion times. Additionally, providing resources in multiple formats (e.g., downloadable low-resolution videos, audio MP3s, and text transcripts) ensures that busy professionals can access critical training regardless of their technological constraints or location.

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