Razvoj študija farmacije na Medicinski fakulteti Univerze v Mariboru: kronološki pregled do akreditacije leta 2025

Development of Pharmacy Education at the Faculty of Medicine, University of Maribor: A Chronologic Review Leading to the 2025 Accreditation

Avtor / Author

Uroš Maver [1],Ivan Krajnc [1], Iztok Takač [1], Tina Maver [1]

Ustanova / Institute

[1]Univerza v Mariboru, Medicinska fakulteta, Maribor, Slovenija;

[1]University of Maribor, Faculty of Medicine, Maribor, Slovenia

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Naslov za dopisovanje / Correspondence
prof. dr. Uroš Maver, mag. farm.
Univerza v Mariboru | Medicinska Fakulteta, Taborska ulica 8, 2000 Maribor, Slovenija
+386 2 234 5823
uros.maver@um.si

Izvleček

Namen: *Vzpostavitev enovitega magistrskega študijskega programa Farmacija na Medicinski fakulteti Univerze v Mariboru (MF UM) je bila posledica nacionalnega pomanjkanja farmacevtov, širitve farmacevtske industrije, večjih potreb po klinični farmaciji ter usklajevanja z evropskima direktivama 2013/55/EU in 2024/782/EU. Ti dejavniki so potrdili nujnost drugega akreditiranega študijskega programa farmacije v Sloveniji. Članek obravnava razvoj, ki je decembra 2024 pripeljal do akreditacije programa.*

Metode: *Izveden je bil kronološki, na dokumentih temelječ pregled institucionalnih arhivov, treh akreditacijskih vlog, poročil Nacionalne agencije Republike Slovenije za kakovost v visokem šolstvu (NAKVIS), internih strateških analiz, partnerskih sporazumov ter nacionalnih statističnih podatkov. Viri so bili dopolnjeni z znan-*

Abstract

Background: *Establishment of the Integrated Master's Programme in Pharmacy at the Faculty of Medicine, University of Maribor (MF UM) was driven by national pharmacist shortages, expansion of the pharmaceutical industry, increasing clinical pharmacy needs, and harmonisation under EU Directives 2013/55/EU and 2024/782/EU. These factors underscored the necessity of a second accredited pharmacy programme in Slovenia. This review summarises the development that led to accreditation in December 2024.*

Methods: *A chronologic document-based review was performed using institutional archives, three accreditation applications, reports from the Slovenian Quality Assurance Agency for Higher Education (NAKVIS), internal strategic analyses, collaboration agreements, and*

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stveno literaturo s področja farmacevtskega izobraževanja in evropskega regulativnega okvira z namenom identifikacije strukturnih, pedagoških in vsebinskih elementov, ki so oblikovali končni program.

Rezultati: *Razvoj je potekal v treh fazah: zgodnja zasnova (2006–2016); dve akreditacijski vlogi (2017–2020), ki sta razjasnili vsebinske, kadrovske in kompetenčne vrzeli; ter celovita prenova programa (2021–2024), ki je vključevala interdisciplinarno sodelovanje med MF UM, Fakulteto za kemijo in kemijsko tehnologijo Univerze v Mariboru (FKKT UM), kliničnimi ustanovami in partnerji iz farmacevtske industrije. Končni kurikulum je usklajen z evropskimi kompetenčnimi zahtevami in vključuje biomedicinske, tehnološke, analitske ter klinične vsebine. Tako klinične kot tudi industrijske komponente so bile utrjene preko obsežne mreže partnerstev.*

Zaključki: *Program predstavlja pomemben napredek na področju farmacevtskega izobraževanja v Sloveniji. Odgovarja na potrebe hitrega in obsežnega razvoja farmacije v Sloveniji, krepi regionalni razvoj ter dopolnjuje obstoječe izobraževalne zmogljivosti. Vzpostavitev tega programa poudarja pomen strateškega načrtovanja in medsektorskega sodelovanja v sodobnem farmacevtskem izobraževanju.*

national statistical data. These materials were integrated with the scientific literature on pharmacy education and EU regulatory frameworks to identify structural, pedagogic, and contextual elements shaping the final programme.

Results: *Development of the Integrated Master's Programme in Pharmacy progressed through three phases: early conceptualisation (2006–2016); two accreditation attempts (2017–2020), which clarified curricular, staffing, and competency gaps; and a comprehensive redesign (2021–2024) involving interdisciplinary collaboration among the MF UM, Faculty of Chemistry and Chemical Engineering, University of Maribor (FKKT UM), clinical institutions, and pharmaceutical industry partners. The final curriculum aligns with EU competence requirements and integrated biomedical, technological, analytical, and enhanced clinical sciences. Strong inter-faculty collaboration and robust clinical and industrial components were formalised through extensive partnerships.*

Conclusions: *The programme represents a significant advance for Slovenian pharmacy education, addressing national workforce needs, strengthening regional development, and complementing existing educational capacities. Establishment of the Integrated Master's Programme in Pharmacy at the MF UM highlights the value of strategic planning and cross-sector collaboration in contemporary pharmacy education.*

INTRODUCTION

Pharmacy, as a discipline in healthcare, has evolved rapidly at the intersection of biomedical innovation, clinical transformation, and expansion of the pharmaceutical industry. Over the past 2 decades the rapid development of biological and biotechnological medicinal products, the emergence of advanced therapy medicinal products, and the growing complexity of pharmacotherapy have expanded the scope and depth of competencies required of pharmacists (1). These shifts have paralleled the changes in European legislation, first with Directive 2013/55/EU and more recently with Directive 2024/782/EU, which together define an integrated profile of professional knowledge, skills, and attitudes, essential for the regulated profession of pharmacists across the European Union.

Until recently Slovenia maintained a single national pharmacy program at the University of Ljubljana. Despite the established reputation and academic strength, structural limitations (primarily related to space, staffing, and regional accessibility) prevented expansion of enrolment to meet the national need of pharmacists. At the same time, the Slovenian pharmaceutical sector underwent a significant transformation. Lek d.d. (part of Sandoz AG) initiated large-scale biopharmaceutical investments exceeding

€400 million, while Krka d.d. expanded its production and research footprint. In addition, several small and medium enterprises and technology-based companies intensified the demand for highly trained graduates. These developments highlighted the pressing need for a larger and more diverse cohort of pharmacists with strong competencies in industrial pharmacy, biotechnology, analytics, and regulatory science.

Concurrently, healthcare needs have also increased nationwide. Clinical pharmacy, once an emerging field in Slovenia, has expanded into hospital wards, specialised clinics, and interdisciplinary care teams. Numerous studies have demonstrated the increasing impact of clinical pharmacists on patient safety, therapy optimization, and the reduction of adverse drug events (2). Yet the capacity to train pharmacists with advanced clinical competencies in Slovenia is constrained.

The epistemic conjuncture (Figure 1) that framed the establishment of the pharmacy programme at the Faculty of Medicine, University of Maribor (MF UM) arose from the following convergence:

1. scientific and technological shifts in medicinal product development, particularly in biopharmaceuticals and advanced therapies;
2. clinical and healthcare system demands for pharmacists with stronger clinical integration;
3. industrial expansion, especially in northeastern Slovenia, requiring specialised competencies;
4. regulatory harmonisation under EU directives demanding comprehensive, unified pharmacist training;
5. the challenge of geographical equity and improving access to higher education for students from the eastern cohesion region, thereby addressing long-term regional development objectives; and
6. long-term strategic vision at MF UM, which has already successfully developed and implemented integrated programmes in medicine and dental medicine.

Recognising these pressures and opportunities, MF UM initiated a long-term project to establish a new Integrated Master's Programme in Pharmacy (Enoviti Magistrski Študijski Program Farmacija (EMŠP Farmacija)). While early conceptual discussions date back nearly 2 decades, systematic development intensified in 2016 with the formation of the first expert committee (3), followed by a sequence of structured accreditation attempts and comprehensive programme redesigns. The process culminated in December 2024 when the National Agency for Quality in Higher Education (NAKVIS) granted

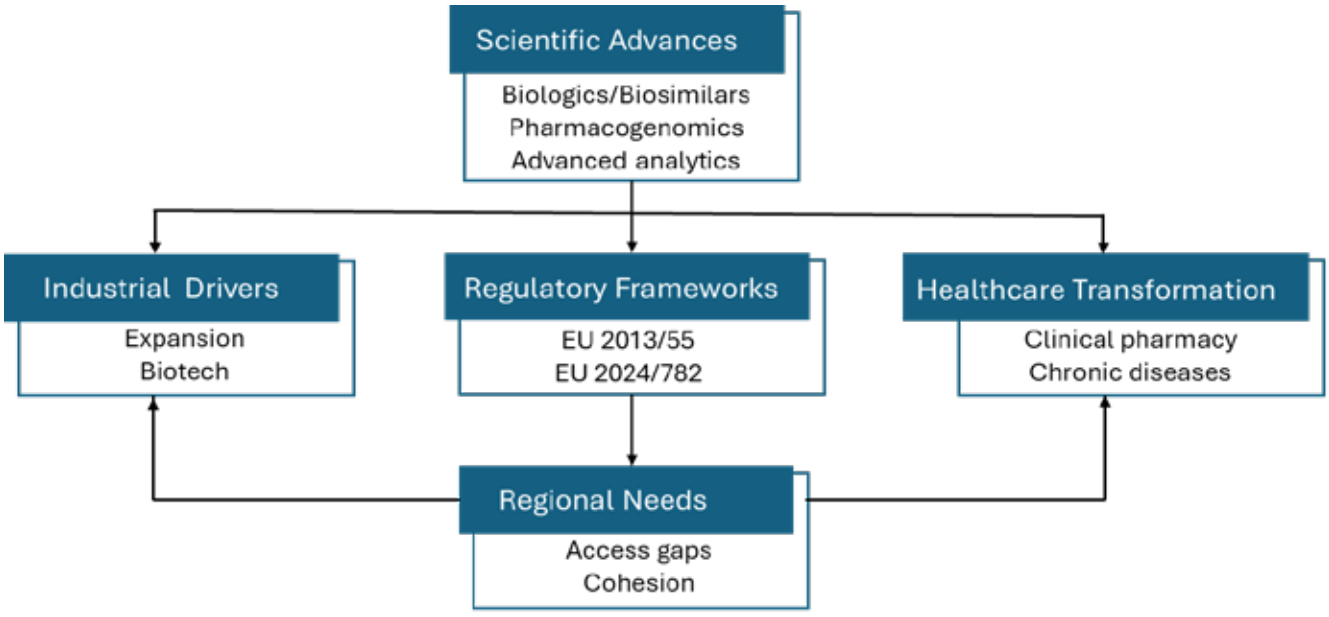

Figure 1. *Epistemic conjuncture influencing establishment of the programme.*

full accreditation (4), enabling enrolment of the first cohort of students in the 2025/2026 academic year. This article provides a comprehensive scholarly review of the process involved in developing the Integrated Master's Programme in Pharmacy at the MF UM. Building on institutional documentation, accreditation records, strategic analyses, and supporting literature, the chronologic evolution of the programme is reconstructed, the factors driving the programme design are critically evaluated, and the "Maribor model" is situated within national and European trends in pharmacy education. The review also highlights the unique interdisciplinary character of the programme, which integrats biomedical, chemical, technological, and clinical sciences across multiple UM faculties and external partners (5), (6).

The structure of this article follows a chronologic narrative, where the subsequent chapters outline all the developmental steps, from the earliest conceptual foundations (2006–2016) through several accreditation attempts and related curriculum redesigns (2017–2020), to the final successful accreditation (2021–2024). The article then discusses the regional, national, and European significance of the programme, concluding with reflections on future directions.

Together, these chapters provide insight into how institutional initiative, regulatory processes, and broader societal dynamics converged to establish the second accredited pharmacy programme in Slovenia.

HISTORICAL DEVELOPMENT AND EARLY FOUNDATIONS (2006—2016)

The idea of developing a pharmacy programme at the MF UM can be traced back to the establishment of the faculty nearly 2 decades ago. The MF UM benefited from strong natural, infrastructural, and academic conditions from inception that made the long-term development of pharmacy education feasible and strategically aligned with its mission. Very early discussions reflected in the first conceptual outlines of Lekarniška Farmacija and later Klinična Farmacija, indicate that the idea was present from the formative years of the institution (7).

Although the vision of establishing a pharmacy programme in Maribor had existed for many years, realization of the programme was demanding precisely because the development at the MF UM had to begin from scratch. Despite having well-established laboratory infrastructure in both the pre-clinical and clinical domains, the faculty initially lacked the critical mass of specialized experts in pharmaceutical sciences, which is an indispensable prerequisite for delivering a high-quality program in analytical, technological, clinical, and regulatory pharmacy. This initial absence of a broader, dedicated academic and research core necessitated a long-term, strategic, and highly coordinated process of building new teaching capacity, strengthening scientific disciplines, and establishing a stable interdisciplinary environment that spanned pharmaceutical technology, industrial pharmacy, clinical pharmacy, and related biomedical fields. These circumstances explain why the path to establishing the programme was significantly longer and more complex than the development of existing medical programmes. Today, after nearly 20 years of deliberate planning, recruitment, and close collaboration between the MF UM, FKKT UM, and numerous clinical and industrial partners, the original state of "beginning from scratch" has evolved into a mature academic ecosystem capable of delivering a comprehensive and modern pharmacy curriculum.

The concept of a pharmacy programme matured in parallel as the faculty grew across all core dimensions (professional, pedagogic, and especially scientific). Rapid expansion of interdisciplinary research, the recruitment and development of highly qualified staff, and pioneering contributions in emerging biomedical fields created an environment in which pharmaceutical education could naturally take root (8), (9). Comparable developments were occurring nationally and internationally because pharmacy, as a healthcare discipline, experienced substantial scientific and professional advances, including the rise of biopharmaceuticals, strengthened clinical pharmacy practice, and the increasing integration of pharmacists into healthcare systems (10).

These broader trends reinforced the relevance and timeliness of establishing a modern, interdisciplinary pharmacy programme at the MF UM, laying the conceptual foundation for the structured

development that would follow in subsequent years. Although informal discussions predate official documentation, the earliest structured records indicate that the first conceptual outline, under the working title "Lekarniška Farmacija," was actively explored until 2012–2013 (7). At that stage, the MF UM was still a relatively young medical institution, focused primarily on developing programmes in general medicine and later dental medicine. Nevertheless, several faculty members recognized the strategic opportunity to expand into pharmaceutical education, particularly due to the strong biomedical foundation of the faculty and emerging collaborations with clinical institutions.

During these early years, the principal motivations for exploring a pharmacy programme stemmed from the following:

1. increasing national need for pharmacists;
2. early recognition of regional imbalance in access to pharmacy education;
3. opportunities to leverage the clinical environment at the University Medical Centre Maribor (UKC Maribor); and
4. the long-term academic vision of the MF UM to integrate biomedical, clinical, and pharmaceutical sciences.

Although the initial concept was not fully developed, it already hinted at a model distinct from the only other study programme in pharmacy at the University of Ljubljana, one that would be more closely integrated with clinical practice and tailored to the specific needs of northeastern Slovenia.

By 2016 the MF UM formalised its intentions by shifting the conceptual framework to a new working title: "Klinična Farmacija" (8). This change reflected a strategic repositioning aligned with contemporary global and European trends that increasingly emphasised the clinical role of pharmacists (11). The MF UM possessed a unique advantage in this domain. Specifically, many of the faculty members also held clinical positions at UKC Maribor and the hospital already maintained a strong culture of interdisciplinary clinical collaboration. These circumstances allowed the concept of pharmacy education to mature, focusing on the integration of biomedical, patient-centered, and clinically oriented competencies.

A key milestone occurred in March 2016 when the MF UM appointed the first formal Expert Committee to prepare the programme (3). This committee established an institutional mandate to begin curriculum development, assess resource needs, and initiate consultations with external partners. The MF UM began signing cooperation agreements with clinical partners, public institutions, and early industry collaborators during 2016–2017 (6), demonstrating a growing recognition that pharmacy education must be integrated across healthcare and industrial environments.

Although these steps did not produce a complete curriculum, the foundation was laid for the distinctive identity that would ultimately define the MF UM study programme, one characterised by clinical proximity, interdisciplinary cooperation, and strong ties to practice-based environments.

FIRST AND SECOND ACCREDITATION ATTEMPTS (2017–2020)

The First Accreditation Application (2017–2019)

The formal development of the Integrated Master's Programme in Pharmacy accelerated in late 2017 when the MF UM submitted a request to the university leadership for permission to begin the accreditation process for the programme under its final name (EMŠP Farmacija) confirmed by the MF UM Senate in November 2017 (12). A unified application was finalised and approved by the UM Senate after internal alignment across involved faculties in June 2018 (13). The first full accreditation application was formally submitted to NAKVIS in June 2018 (14). Later that year (October 2018) NAKVIS appointed its Evaluation Committee, which subsequently conducted an on-site visit in February 2019 (15). The visit involved inspections of laboratories, discussions with faculty, and evaluation of the pedagogic and infrastructural readiness of the MF UM.

Following the visit, NAKVIS requested substantial revisions to the initial application (16), which the MF UM provided in April (17). Despite notable improvements, the final evaluation report delivered in

June 2019 (18) concluded that additional development, particularly in staffing depth and curriculum detail, would be necessary. The Ministry of Health issued a separate positive opinion on the programme at approximately the same time (19), confirming the national need for an additional pharmacy programme. However, the opinion was received after the NAKVIS report and could not influence the evaluation outcome. Considering the weight of the outlined shortcomings in the obtained reports, especially related to the staff, UM withdrew the first application from the accreditation process in August 2019 (20). Although disappointing, this withdrawal proved strategically constructive and provided an opportunity to rethink several key structural components of the programme, expand the academic base, and establish more robust clinical and industrial partnerships.

The Second Accreditation Application (2019–2020)

The MF UM submitted a second accreditation application (21) in October 2019 after several months of extensive work on the exposed issues. The MF UM prepared a much-needed upgrade to the documentation based on the feedback obtained from NAKVIS and a more refined vision. Early in 2020 NAKVIS appointed a new Evaluation Committee, which conducted a review and released an interim report in June 2020 (22).

The MF UM responded to all comments provided in July 2020 (23), improving several components of the programme, including curriculum alignment, staffing plans, and the integration of clinical pharmacy content. Nevertheless, indications from the evaluation process suggested that the second application was also likely to receive an unfavourable decision. Based on this information, and through our continuous commitment to ensuring long-term success rather than short-term approval, UM (again) strategically withdrew the application before the final assessment at NAKVIS (24).

This second withdrawal marked a critical turning point. Rather than continuing to iterate on the programme, which was incrementally improving but faced some structural limitations, the MF UM chose a strategic course of action (a comprehensive redesign of the programme). The faculty recognized that contemporary pharmacy education necessitated an even broader, future-oriented vision (deeper interdisciplinarity, stronger integration of industrial trends (biopharmaceuticals, analytics, and quality systems), substantially enhanced clinical training, and a sustainable long-term staffing model).

This strategic decision, favouring comprehensive restructuring over incremental concession, paved the way for the reimagined and ultimately successful final application.

THE FINAL ACCREDITATION APPLICATION AND PROGRAMME DESIGN (2021–2024)

Renewal of Strategy and Formation of the Extended Working Group (2021)

The MF UM undertook a comprehensive reassessment of its approach to pharmacy education following the strategic withdrawal of the second accreditation application. The faculty officially established a new extended working group with a broader academic, clinical, and industrial representation in July 2021 (25). This group included experts from the MF UM, FKKT UM, and UM, while internationally recognized scholars, clinicians, and industry representatives provided support as outside partners and supervisors. The establishment of this group marked a decisive shift from incremental corrections to systemic curricular redesign. The mandate included the following:

- full reconstruction of the curriculum aligned with the emerging new EU directive (2024/782/EU);
- reorganisation of subject areas to ensure improved vertical integration, considering the increasing competencies in all core pillars of pharmacy (apothecary work, clinical pharmacy, and industrial pharmacy);
- putting additional emphasis on strengthening the industrial, analytical, and pharmaceutical-technological components;
- deepening of clinical exposure and interdisciplinary training, considering the latter gaining importance in the European and Slovenian healthcare system; and
- development of a sustainable, long-term staffing plan.

Although the newly appointed working group had a

central role in shaping the successful final application, the majority of the substantive material, conceptual groundwork, and supporting documentation had already been generated during the previous two accreditation cycles. Over the following 3 years, the group systematically reviewed, consolidated, and reinterpreted this extensive body of earlier work, carefully integrating the work with the latest developments in pharmaceutical sciences, healthcare practice, and higher-education policy. In doing so, the group produced updated internal documentation, revised concept papers, refined competency matrices, and a restructured curricular framework, transforming previously accumulated content into a coherent, future-oriented programme.

This process involved not only aligning the existing materials with emerging European guidelines and best practices, but also "purifying" and reorganising the textual and structural components of the curriculum to better reflect contemporary professional expectations. Special attention was given to ensuring that the curricular architecture supported the progressive acquisition of key competencies across all major pillars of pharmacy, community/apothecary practice, clinical pharmacy, and industrial pharmacy, while also accommodating the expanding academic staff profile and interdisciplinary strengths. The result was a refined, pedagogically integrated, and strategically updated programme that retained the strongest elements of earlier versions, while incorporating essential modernisations required for a competitive, EU-aligned pharmacy curriculum.

Integration with FKKT UM and Expansion of Interdisciplinary Collaboration

An important step in the new programme design was the formal inclusion of the FKKT UM as a co-applicant for the programme in 2023 (5). This decision significantly strengthened the chemical and analytical foundations of the curriculum, aligning the curriculum with modern requirements for pharmaceutical chemistry, drug analytics, industrial processes, and quality assurance.

The collaboration was expanded substantially during this period within the UM and beyond. The deepened partnership with the FKKT UM, whose scientific productivity and long-standing excellence in analytical, physical, and organic chemistry, as well as chemical engineering and industrial process development based on strong collaboration with industrial partners, provided important disciplinary and strategic support for the programme. Involvement of the FKKT UM ensured an even more robust scientific foundation and helped align the curriculum with the expectations of modern pharmaceutical development, quality assurance, and analytical practices.

In parallel, the network of external collaborators, which had existed in earlier stages of programme development, was significantly expanded and formalised. Internationally recognised experts from universities in Graz and Sarajevo, contributed specialised knowledge in domains ranging from advanced analytics-to-pharmaceutical technology. At the same time, the MF UM deepened cooperation with clinical pharmacists, physicians, and researchers from UKC Maribor and regional hospitals, thereby strengthening the clinical relevance of the programme and ensuring that the curriculum reflected contemporary healthcare needs.

This period was marked not merely by the expansion of partnerships but by the concretisation of collaboration agreements, active involvement of specific academic and professional stakeholders, and establishment of clear commitments regarding teaching, mentorship, and research participation. These developments contributed to the refinement and optimisation of the final accreditation application, ensuring that the programme was supported by a cohesive and well-coordinated network of institutional, clinical, industrial, and international partners, whose expertise and engagement reinforced academic integrity and practical relevance.

The programme thus developed into a multi-faculty and -institutional educational ecosystem, positioning the MF UM and FKKT UM as highly competitive collaborators in pharmacy education.

Strengthening Industry Partnerships and Clinical Integration

The MF UM signed or renewed numerous cooperation agreements (collaboration contracts) with pharmaceutical and biomedical partners between 2021 and 2024. Formal endorsements were also secured from the two principal professional bodies in the field of pharmacy in Slovenia (the Slovenian Pharmaceutical Society and the Chamber of Pharmacy), further confirming the national relevance and professional support for the establishment of the programme (26), (27). Central among the professional bodies was the partnership with Lek d.d., which was formalised through two umbrella collaboration contracts covering educational and research activities. These agreements established a comprehensive framework for meaningful collaboration between the university and the industrial partners, providing students with opportunities to conduct thesis projects directly within pharmaceutical and biotechnological environments, where students could engage with real-world production, formulation, and analytical challenges. The MF UM gained the foundation for structured access to practical knowledge (e.g., production lines, quality-control laboratories, and advanced analytical platforms) through these partnerships, enabling students and academic staff to experience the technological and regulatory dimensions of pharmaceutical development firsthand. The cooperation also facilitated the systematic integration of good manufacturing practice (GMP) principles (which were already partially addressed by the FKKT UM), quality management, and regulatory science into the curriculum, ensuring that graduates would be well-prepared for contemporary industrial demands. Equally important was the active involvement of industry specialists in selected teaching activities, which brought current professional experience, case-based instruction, and technologically relevant perspectives into the academic setting.

Importantly, the formal agreements did not merely express an intention to collaborate but explicitly defined the modalities of cooperation in educational and research domains. On the educational side, public pharmacy institutions committed to providing structured training within the community-pharmacy setting, including clearly defined numbers of available mentors for practical training and sustained participation in the organisation of pharmacy practice. Industrial partners, in turn, agreed to contribute to specific curriculum components, particularly in courses covering analytical methods, pharmaceutical technology, regulatory affairs, and industrial manufacturing processes. On the research side, the agreements established a framework for joint scientific activities, outlining the basic conditions for collaborative projects, student research involvement, and the exchange of expertise and laboratory resources.

At the same time, clinical integration was significantly strengthened. Collaboration with UKC Maribor provided access to diverse clinical departments and interdisciplinary teams, allowing the development of practice-oriented courses in clinical pharmacology, pharmacotherapy, and clinical pharmacy. Partnerships with public pharmacy institutions in Maribor, Ptuj, and Ormož further expanded the practical foundations of the programme, offering authentic insights into community pharmacy operations, patient counselling, and primary healthcare workflows. Additional cooperation with specialised hospitals in Murska Sobota, Ormož, and Vojnik enriched the clinical landscape by adding settings with distinct therapeutic focuses and patient populations. Together, these clinical and community-based collaborations formed a cohesive network that ensured the

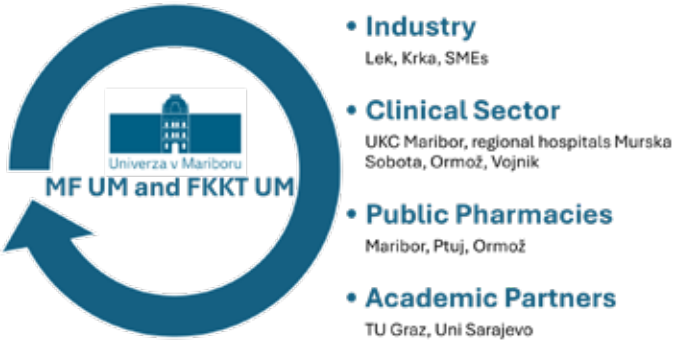

Figure 2. *Partner network map.*

programme was deeply embedded in the realities of Slovenian healthcare practice and that students would be exposed to a broad range of professional environments throughout their education.
All in all, this combined network enabled the creation of a uniquely practice-oriented curriculum within Slovenia (Figure 2).

Curriculum Architecture and Competence Framework

The final curriculum was designed in full alignment with the competence framework required by EU directives and international best practices in pharmacy education, integrating the structural, pedagogic, and professional expectations outlined in the accreditation documentation (28). The latter included the most relevant subject catalogue to date, as well as highlighting an updated list of crucial, future-oriented general and subject-specific competencies. The architecture follows a vertically integrated 5-year progression that systematically guides students from foundational biomedical and natural sciences toward increasingly specialised pharmaceutical disciplines, and ultimately, into advanced clinical and industrial practice. The early years of the programme emphasize the molecular, cellular, biochemical, anatomic, and physiologic foundations, ensuring that students acquire the scientific literacy necessary to understand drug action and therapeutic decision-making. Building on this foundation, subsequent years introduce the core pharmaceutical sciences, including pharmaceutical chemistry, technology, pharmacology, biopharmacy, and related analytical disciplines, allowing knowledge to develop in a structured and cumulative manner, as required by the principles of competency-based pharmacy education (29).
A defining characteristic of the curriculum is the pronounced approach towards gaining clinical competencies, reflecting both European trends and the longstanding clinical profile of the MF UM. Courses in clinical pharmacology, pharmacotherapy, social pharmacy, and clinical pharmacy are positioned within the heart of the curriculum and supported by direct integration with hospital-based teaching environments. This structure enables students to develop patient-centred competencies, such as communication skills, counselling, medication optimisation, and interprofessional collaboration, which are central to modern pharmaceutical care.
Equally important is the technological and industrial dimension of the programme, shaped by the growing practical orientation of the MF UM, the expertise of the FKKT UM, and the involvement of industrial partners. This is possible through a reimagined integration and alignment of modules, including pharmaceutical technology, pharmaceutical analysis and instrumentation, quality and stability of medicines, industrial pharmacy, and bioanalytics, all of which are continuously evolving fields, requiring direct connections with the practical environment. The industrial component ensures that students gain an understanding of GMP, regulatory processes, quality assurance, analytical evaluation of medicinal products, and the technological underpinnings of contemporary drug development. These elements reflect evolving global trends and the needs of the rapidly expanding pharmaceutical sector in Slovenia.
In addition to the clinical and industrial dimensions, the curriculum places strong emphasis on community pharmacy, which forms the third foundational pillar of the programme. Through subjects, such as social pharmacy, pharmaceutical care, communication in healthcare, and primary care pharmacotherapy, students acquire the competencies required for safe and effective practice in public pharmacies. This includes developing skills essential for medication counselling, managing minor ailments, supporting chronic disease management, and contributing to public health initiatives. The integration of community pharmacy training is further reinforced by collaborations with regional public pharmacy institutions, which provide structured practical experience and mentorship, ensuring that graduates are fully prepared for the professional realities of primary pharmaceutical care.
Interdisciplinarity, another central pillar of the programme, emerges naturally from the convergence of biomedical, chemical, technological, and clinical sciences. Subjects related to biopharmacy, pharmacogenomics, biotechnology, genetics, and biomedical informatics serve as integrative bridges connecting scientific foundations with therapeutic

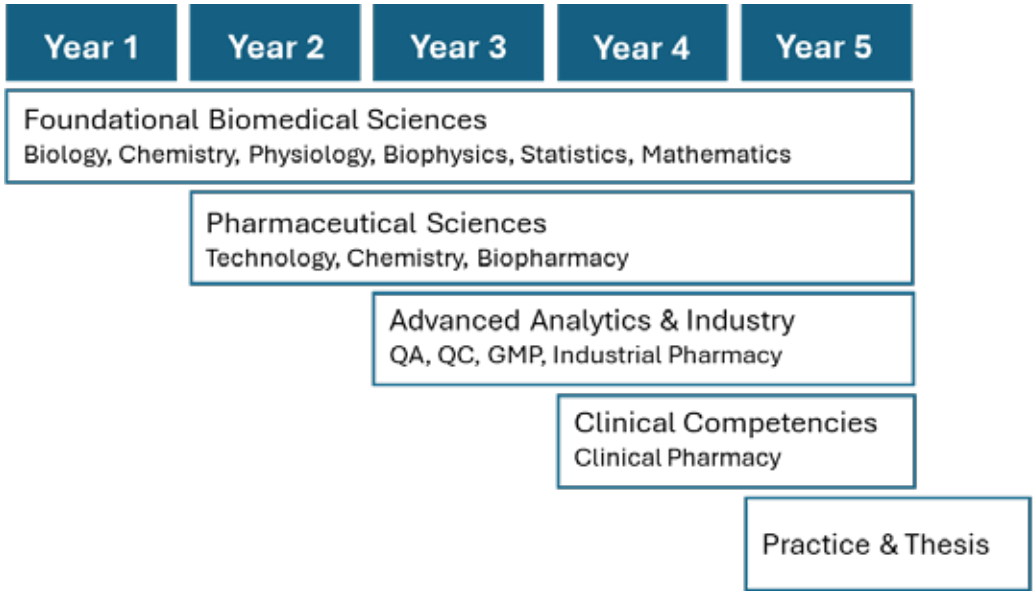

Figure 3. *Vertical integration of competences.*

and technological applications. Placement within the curriculum reflects the epistemic landscape identified in the accreditation application, where advances in molecular medicine, omics technologies, and digital health increasingly shape the role and expectations of pharmacists.

Taken together, the curriculum forms a coherent, competence-driven structure that supports the gradual acquisition of scientific, clinical, and technological knowledge, culminating in a comprehensive practical training experience and the preparation of a master's thesis in the final year. The design adheres not only to EU regulatory requirements but also to the broader strategic visions of the MF UM and FKKT UM, as articulated in the accreditation documentation, positioning graduates to contribute effectively across all major pillars of pharmacy (community, clinical, and industrial practice). Figure 3 illustrates the vertical integration of competencies acquired by students over the course of the 5-year programme.

Submission and Accreditation (2024)

After 3 years of intensive preparation and official withdrawal of yet another version of the documentation in December 2022 (30), the MF UM submitted the 4th and final accreditation application in February 2024. The NAKVIS Evaluation Committee provided a favourable interim report in June 2024 (31), followed by confirmatory updates and approvals within the MF UM, FKKT UM, and the University Senate in September 2024 (32). The Ministry of Health also approved this latest version of the study programme (33).

NAKVIS issued a highly positive final report in November 2024 (34). The NAKVIS Council formally granted accreditation on 19 December 2024 (35), marking the successful conclusion of a multi-year process. Subsequently, the Ministry for Higher Education confirmed funding for the first cohort through an official letter in January 2025 (36), enabling the UM to finalize all remaining organizational steps for the official launch of the programme in the autumn of 2025. This milestone enabled the enrolment of the first generation of pharmacy students in the 2025/2026 academic year, marking a historic moment for the MF UM, FKKT UM, and the broader University.

The newly admitted students successfully completed the introductory orientation day on 30 September 2025, during which an exceptionally positive atmosphere and strong sense of collegiality quickly

emerged among the pharmacy students and in the interactions with peers from other study programmes at the MF UM. This early display of mutual support and collaboration reflected the integrated academic culture that the MF UM had sought to cultivate throughout the development of the programme.

Equally encouraging was the excellent cooperation between tutors from the MF UM and the FKKT UM, who had a central role in guiding the new cohort through the initial academic and administrative transitions. The joint engagement demonstrated the strength of the interfaculty partnership underpinning the curriculum and provided a solid foundation for future interdisciplinary collaboration in teaching and mentoring. Figure 4 shows the timeline of the study programme development at MF UM from the start to accreditation in 2025.

The official start of the academic year on 1 October 2025 was accompanied by media coverage, including a feature on RTV Slovenia and segments on Radio Maribor, underscoring the regional and national importance of establishing the second pharmacy programme in Slovenia and highlighting the expanding role of the UM in pharmaceutical education.

REGIONAL, NATIONAL, AND EUROPEAN SIGNIFICANCE OF THE PROGRAMME

Slovenia has faced a persistent shortage of pharmacists for many years, a trend well documented by EUROSTAT, which consistently positions the country near the lower end of the European scale in terms of pharmacists per capita, the Statistical Office of the Republic of Slovenia that reports a steady 5%–10% annual growth in employment demand (37). This structural gap has been particularly evident in regions outside the central part of the country, where access to some fields in higher education is more limited and graduates are less likely to relocate. The UM directly addressed this imbalance and enhanced the availability of highly trained professionals in areas where professionals are most needed by establishing a pharmacy programme in Maribor. The presence of a second national centre of pharmacy education thus strengthened not only workforce capacity but also regional development and equity, supporting long-term cohesion objectives nationally and within the broader European framework.

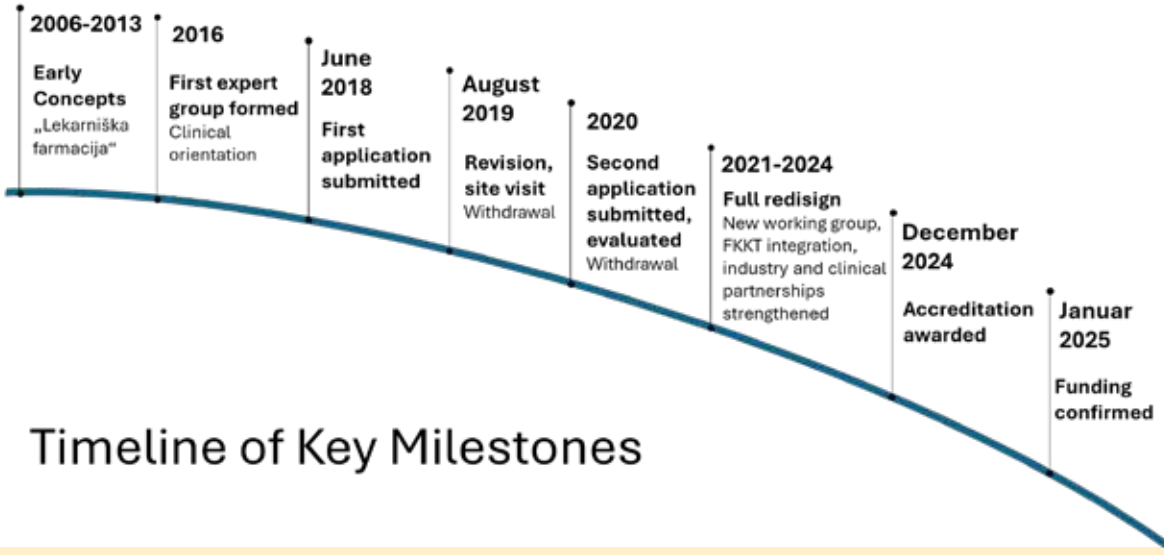

Figure 4. *Timeline of key milestones (2006–2024).*

The eastern cohesion region of Slovenia has historically been underrepresented among pharmacy graduates, largely due to financial, logistical, and social barriers associated with relocating to Ljubljana for study (38). The introduction of the programme at the MF UM fundamentally changed this landscape by providing a high-quality educational pathway within the region. This improved accessibility ensures that talented students who might otherwise have been deterred can now pursue pharmacy studies closer to home, contributing to greater regional retention of skilled professionals and reinforcing local healthcare and industrial capacity.

At the same time the programme responds to the rapid expansion and transformation of the Slovenian pharmaceutical industry, which has intensified investment in biotechnological development, advanced analytics, biosimilar production, and high-throughput manufacturing in recent years (39). Large-scale industrial projects, including major expansions by leading national pharmaceutical companies, as well as the growth of specialised SMEs in the wider Maribor region, have significantly increased the demand for graduates with strong technological, analytical, GMP, regulatory, and bioprocessing expertise. Through close collaboration with the FKKT UM and key industrial partners, many of whom have decades-long traditions of applied research and development, the curriculum integrates these industrial trends into the scientific and pedagogical framework. This approach not only ensures that graduates are prepared for the contemporary needs of the industry but also strengthens the innovation capacity across the pharmaceutical sector in Slovenia.

Equally important is the programme emphasis on clinical pharmacy and integration within the wider healthcare system. The proximity of the MF UM to UKC Maribor enables a depth of clinical exposure that aligns with European developments, emphasizing patient-centered pharmaceutical care, antimicrobial stewardship, personalized medicine, and multidisciplinary therapeutic collaboration. The curriculum dedicates substantial space to clinical pharmacology, pharmacotherapy, and clinical pharmacy, ensuring that students acquire the clinical reasoning, communication skills, and interprofessional competencies required for modern clinical roles. These elements are further reinforced through cooperation with public pharmacies and regional hospitals, offering students a comprehensive understanding of the continuum from community-to-clinical practice.

The »Maribor programme« complements, rather than competes with, the long-established pharmacy programme in Ljubljana. The demographic trends in Slovenia, combined with industrial expansion and increasing healthcare demands, require more than a single educational provider. The strengths of the MF UM in clinical sciences and biomedical technology, the FKKT UM in chemical engineering and various branches of chemistry, and the broader institutional culture of interdisciplinarity in the UM create a distinct yet synergistic educational profile. Both programmes collectively contribute to innovation, capacity building, and resilience within the national pharmaceutical and healthcare landscape by diversifying academic environments and pedagogic approaches within the country.

Long-term Vision Toward 2030 and Beyond

Looking ahead, the programme is positioned to evolve dynamically in response to emerging scientific, clinical, and societal challenges. The coming decade is likely to see the development of specialized postgraduate pathways, deeper integration with biomedical engineering, microphysiologic systems, advanced materials science, and digital health technologies, fields in which the MF UM and FKKT UM already demonstrate strong interdisciplinary potential. Strengthening international visibility through ERASMUS+, joint degree programmes, and expanded research collaborations will further contribute to academic excellence and global relevance.

The programme scientific ambitions align closely with modern research frontiers in biotechnology, pharmacogenomics, advanced analytics, and drug delivery. These areas not only shape the future of pharmaceutical practice but also offer opportunities for cutting-edge translational research that can directly benefit the healthcare system and pharmaceutical industry in Slovenia. Importantly, the COVID-19

pandemic has underscored the vulnerabilities and systemic gaps within healthcare systems worldwide, highlighting the need for interdisciplinary problem-solving, rapid innovation, and flexible workforce deployment. The MF UM curriculum, rooted in biomedical science, enriched by industrial and technological insight, and deeply integrated with clinical practice, provides an effective framework for training professionals capable of responding to such complex, cross-sector challenges.

To sustain this long-term vision, ongoing investment in staff development, research infrastructure, and curricular flexibility will be essential. The rapid evolution of pharmaceutical sciences demands an educational model that remains responsive to new discoveries and technologies. The MF UM is strongly committed to monitoring professional, pedagogic, and scientific trends and continually updating the curriculum to ensure that graduates remain well-prepared for the evolving roles of pharmacists in healthcare, industry, and society at large. This continuous improvement mindset positions the programme not only as a timely response to present needs but as a forward-looking driver of innovation and resilience in the Slovenian healthcare and pharmaceutical ecosystem. Figure 5 summarizes the main specialities of the developed education model of pharmacy education at the MF UM.

CONCLUSION

The development of the Integrated Master's Programme in Pharmacy at the MF UM represents a major milestone for Slovenian higher education, healthcare, and industry. The programme is built upon a solid foundation of scientific, clinical, and industrial relevance that emerged from nearly 2 decades of conceptual exploration, four accreditation cycles, and extensive interdisciplinary collaboration. The successful accreditation of the programme in December 2024 reflects not only administrative competence but a deep alignment between academic vision and societal need. The "Maribor programme" establishes a second national centre for pharmacy education, one characterised by strong clinical integration, modern industrial and technological orientation, interdisciplinarity across faculties, and a commitment to regional development.

Looking ahead to the next decade, the programme is well-positioned to contribute to the pharmaceutical innovation ecosystem in Slovenia, address evolving workforce demands, and support the transformation of healthcare delivery. The establishment of the programme underscores the importance of strategic planning, evidencebased curricular design, and cross-sector partnership in advancing pharmaceutical education.

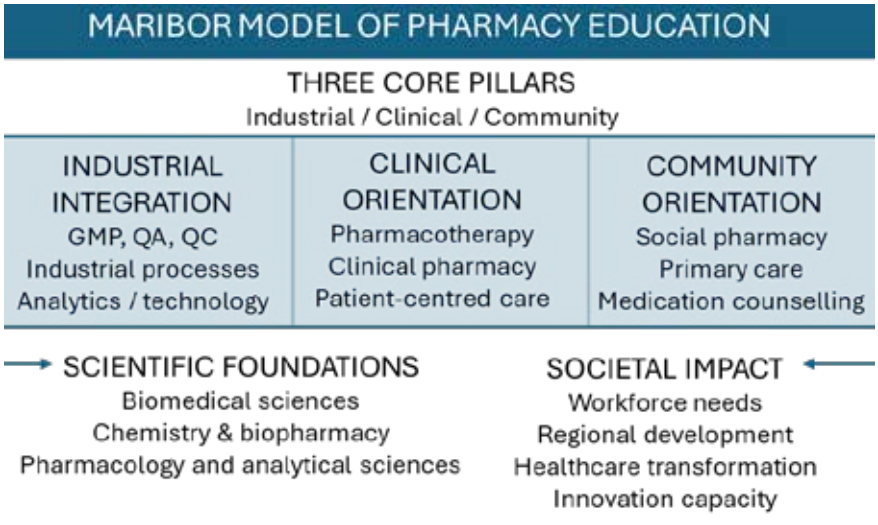

Figure 5. *The »Maribor Model« of the study programme.*

CONFLICT OF INTEREST

None.

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LITERATURE

1. Atkinson J, Rombaut B, Sánchez Pozo A, Rekkas D, Volmer D, Anderson C, et al. The role of the European Pharmacists Consortium in advancing pharmacy education across Europe. Pharmacy (Basel). 2021;9(2):99.
2. Leape LL, Cullen DJ, et al. Pharmacist participation on physician rounds and medication errors. JAMA. 1999;282:267–270.
3. Faculty of Medicine, University of Maribor. Senate decision No. 55: Appointment of the Expert Committee for the preparation of the Pharmacy study programme. Maribor: MF UM; 21 Mar 2016.
4. National Agency for Quality in Higher Education (NAKVIS). Accreditation decision No. 6033-7/2024/21: Integrated Master's Study Programme Pharmacy (EMŠP FARM), University of Maribor. Ljubljana: NAKVIS; 19 Dec 2024.
5. University of Maribor, Faculty of Medicine; Faculty of Chemistry and Chemical Engineering; University of Maribor. Agreement on cooperation in the development and implementation of the Integrated Master's Study Programme Pharmacy (EMŠP FARM). Maribor: UM; 15 Feb 2024.
6. University of Maribor, Faculty of Medicine. Collaboration agreements with clinical, industrial, and academic partners supporting the development of the Integrated Master's Study Programme Pharmacy (EMŠP FARM) (2016–2024). Internal documentation. Maribor: MF UM; 2024.
7. Faculty of Medicine, University of Maribor. Internal working draft of the accreditation application for the programme "Lekarniška farmacija". Maribor: MF UM; 2011.
8. University Medical Centre Maribor. Consent letter No. 115-04/NL: Approval for cooperation in the implementation of the study programmes Dental Medicine and Pharmacy. Maribor: UKC Maribor; 24 Nov 2017.
9. Faculty of Medicine, University of Maribor. Application to the Senate: Request for support in the preparation of the new study programme "Klinična farmacija" (Document No. 410-1/2015/1/200-UM). Maribor: MF UM; 10 Nov 2015.
10. Hepler CD, Strand LM. Opportunities and responsibilities in pharmaceutical care. Am J Hosp Pharm. 1990;47:533–543.
11. Mossialos E, Courtin E, Naci H, Benrimoj S, Bouvy M, Farris K, et al. From "retailers" to health care providers: transforming the role of community pharmacists in chronic disease management. Health Policy. 2015;119(5):562–568.
12. Faculty of Medicine, University of Maribor. Senate decision No. 29: Approval of the application for accreditation of the new Integrated Master's Study Programme Pharmacy (EMŠP FARM). Maribor: MF UM; 22 Nov 2017.
13. University of Maribor. Senate decision of the 34th regular session: Approval of the application for accreditation of the new study programme Integrated Master's Study Programme Pharmacy (EMŠP FARM). Maribor: University of Maribor; 19 Jun 2018.
14. University of Maribor, Faculty of Medicine. Accreditation application for the Integrated Master's Study Programme Pharmacy (EMŠP FARM). Maribor: University of Maribor; 8 Jun 2018.
15. National Agency for Quality in Higher Education (NAKVIS). Schedule of the expert panel site visit for the Integrated Master's Study Programme Pharmacy (EMŠP FARM), Faculty of Medicine, University of Maribor (26 Feb 2019). Maribor: NAKVIS; 2019.
16. National Agency for Quality in Higher Education (NAKVIS). Expert panel evaluation report for the accreditation of the Integrated Master's Study Programme Pharmacy (EMŠP FARM), Faculty of Medicine, University of Maribor. Ljubljana: NAKVIS; 1 Apr 2019.
17. Faculty of Medicine, University of Maribor. Response to the expert panel report regarding the accreditation of the Integrated Mas-

ter's Study Programme Pharmacy (EMŠP FARM). Maribor: MF UM; 17 Apr 2019.
18. National Agency for Quality in Higher Education (NAKVIS). Final expert panel accreditation report for the Integrated Master's Study Programme Pharmacy (EMŠP FARM), University of Maribor, Faculty of Medicine. Ljubljana: NAKVIS; 5 Jun 2019.
19. Ministry of Health of the Republic of Slovenia. Decision No. 603-162/2018-9: Consent to the accreditation of the Integrated Master's Study Programme Pharmacy (EMŠP FARM), Faculty of Medicine, University of Maribor. Ljubljana: Ministry of Health; 28 Jun 2019.
20. University of Maribor. Official letter to the National Agency for Quality in Higher Education (NAKVIS) regarding the withdrawal of the accreditation application for the Integrated Master's Study Programme Pharmacy (EMŠP FARM). Maribor: University of Maribor; August 2019.
21. Faculty of Medicine, University of Maribor. Cover letter with clarifications and resubmission of the accreditation application for the Integrated Master's Study Programme Pharmacy (EMŠP FARM) (Document No. 2-159/2019-401). Maribor: MF UM; 21 Oct 2019.
22. National Agency for Quality in Higher Education (NAKVIS). Expert panel interim report for the accreditation of the Integrated Master's Study Programme Pharmacy (EMŠP FARM) (Document No. 6033-487/2019/8). Ljubljana: NAKVIS; 24 Jun 2020.
23. Faculty of Medicine, University of Maribor. Response letter with clarifications to the NAKVIS expert opinion on the accreditation of the Integrated Master's Study Programme Pharmacy (EMŠP FARM) (Document No. 2-111/2020-401). Maribor: MF UM; 22 Jul 2020.
24. National Agency for Quality in Higher Education (NAKVIS). Council decision No. 6033-487/2019/10: Termination of the accreditation procedure for the Integrated Master's Study Programme Pharmacy (EMŠP FARM), University of Maribor, Faculty of Medicine. Ljubljana: NAKVIS; 17 Sep 2020.
25. Faculty of Medicine, University of Maribor. Dean's decision No. 0732-2/2021/1: Appointment of the working group for the preparation of the accreditation application for the Integrated Master's Study Programme Pharmacy (EMŠP FARM). Maribor: MF UM; 2 Jul 2021.
26. Slovenian Pharmaceutical Society (SFD). Professional opinion on the proposed Integrated Master's Study Programme Pharmacy (EMŠP FARM), Faculty of Medicine, University of Maribor (Document dated 15 Aug 2024). Ljubljana: SFD; 2024.
27. Slovenian Chamber of Pharmacy (LZS). Official opinion on the proposed Integrated Master's Study Programme Pharmacy (EMŠP FARM), Faculty of Medicine, University of Maribor (Document No. 702-11/2024-7). Ljubljana: LZS; 25 Mar 2024.
28. University of Maribor, Faculty of Medicine; Faculty of Chemistry and Chemical Engineering. Accreditation evidence document (Article 53 of the NAKVIS Criteria) for the Integrated Master's Study Programme Pharmacy (EMŠP FARM) – final version. Maribor: University of Maribor; 23 Sep 2024.
29. Dell KA, Frankart LM, Ogbonna KC, DiPiro JT. The need for competency-based education. Am J Pharm Educ. 2024;88(6):100706.
30. University of Maribor. Official letter No. 40/2022/8/417-PU: Withdrawal of the accreditation application for the Integrated Master's Study Programme Pharmacy (EMŠP FARM), Faculty of Medicine, University of Maribor. Maribor: University of Maribor; 14 Dec 2022.
31. National Agency for Quality in Higher Education (NAKVIS). Expert panel report in the accreditation procedure for the Integrated Master's Study Programme Pharmacy (EMŠP FARM), University of Maribor (Document No. 6033-7/2024/13). Ljubljana: NAKVIS; 27 Aug 2024.
32. University of Maribor. Supplementary sub-

mission to the accreditation application for the Integrated Master's Study Programme Pharmacy (EMŠP FARM) (Document No. 2-50/2024-400). Maribor: University of Maribor; 23 Sep 2024.
33. Ministry of Health of the Republic of Slovenia. Decision No. 603-84/2024-2711-4: Consent to the accreditation of the Integrated Master's Study Programme Pharmacy (EMŠP FARM), Faculty of Medicine, University of Maribor. Ljubljana: Ministry of Health; 25 Apr 2024.
34. National Agency for Quality in Higher Education (NAKVIS). Notification letter on the final expert panel report in the accreditation procedure for the Integrated Master's Study Programme Pharmacy (EMŠP FARM), Faculty of Medicine and Faculty of Chemistry and Chemical Engineering, University of Maribor (Document No. 6033-7/2024/19). Ljubljana: NAKVIS; 4 Nov 2024.
35. National Agency for Quality in Higher Education (NAKVIS). Accreditation decision No. 6033-7/2024/21 for the Integrated Master's Study Programme Pharmacy (EMŠP FARM), University of Maribor, Faculty of Medicine and Faculty of Chemistry and Chemical Engineering. Ljubljana: NAKVIS; 19 Dec 2024.
36. Ministry of Higher Education, Science and Innovation of the Republic of Slovenia (MVZI). Official response regarding the financing of the Integrated Master's Study Programme Pharmacy (EMŠP FARM) (Document No. 6037-17/2024-3360-58). Ljubljana: MVZI; 23 Jan 2025.
37. Statistical Office of the Republic of Slovenia (SURS). Registered pharmacists and pharmacy workforce demand in Slovenia – annual labour market statistics. Ljubljana: SURS; 2015–2024. Available at: https://www.stat.si/.
38. Government Office for Development and European Cohesion Policy. Slovenia's Development Strategy and Cohesion Policy 2021–2027: Regional Development Report. Ljubljana: SVRK; 2021. Available from: https://www.gov.si/.
39. Kosi N. Sandoz v Sloveniji z več kot 400 milijoni evrov največja farmacevtska investicija v zgodovini. Delo. 2023 Oct 10. Available from: https://www.delo.si/.