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**European Core Curriculum**

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The main objective of this thesis was ‘to improve clinical pharmacology and therapeutics education in the undergraduate medical curricula of European medical schools and ultimately contribute to improvements in the quality and safety of patient care’. Although debate about the ideal CPT curriculum is evident in the literature, very few examples of such curricula have been published. Moreover, the examples that have been published are focused on the setting in a specific country, mainly the UK and USA.<sup>1,2,20,21</sup> As mentioned previously in this thesis, we believe that a collaborative approach should be adopted in order to harmonize and modernize CPT education across Europe, because CPT education requires substantial improvement in most medical schools. In order to help medical schools to improve their CPT education, we have developed a blueprint for a European core curriculum in CPT (Figure 1) based on the results of this thesis, previous studies of CPT curricula,<sup>1,2,20-24</sup> and teaching and assessment methods that have been successful in various medical schools. The blueprint shows what a European curriculum in CPT *could* look like. It is not intended to reflect the *only* way CPT can be taught and assessed. Since the structure of medical curricula in Europe differs considerably, the blueprint can be adapted to suit local preferences, depending on available resources. In this final chapter, we discuss the blueprint in detail according to five practical questions:

- **What** CPT topics should be taught and assessed?
- **When** should CPT be taught and assessed?
- **How** should CPT be taught and learned?
- **How** should CPT be assessed?
- **Who** should teach and assess CPT?

We conclude this chapter with future perspectives and recommendations for Europe, based on our findings.

## WHICH CPT TOPICS SHOULD BE TAUGHT AND ASSESSED?

In the Delphi study described in Chapter 4.2, we identified 252 key learning outcomes (192 knowledge, 47 skills and 13 attitudes) that should be included in undergraduate CPT curricula to ensure that European medical graduates are able to prescribe rationally. These learning outcomes form the basis of what should be taught and assessed during medical education and training. The factual burden of the large number of learning outcomes can be eased by prioritizing learning around a limited list of core drugs (a ‘student formulary’) and associated diseases. For this purpose, medical schools could use national or international formularies, such as the WHO Model List of Essential Medicines and/or the list of European core drugs and diseases described by Orme *et al.*<sup>23,25</sup> In Chapter 4.1, we defined to what extent medical students are expected to know about these core drugs.

## WHEN SHOULD CPT BE TAUGHT AND ASSESSED?

As illustrated in the blueprint, CPT should be a clear and visible programme integrated longitudinally throughout the entire medical curriculum, starting as early as possible. We believe that medical students will acquire a more thorough understanding of CPT if the subject is frequently

repeated across different modules over several study years rather than presented in one or two distinct courses. Furthermore, the early introduction of CPT in the medical curriculum might help to emphasize the importance of this subject to students from an early stage. At the start of the curriculum, emphasis lies on gaining knowledge of the principles of basic pharmacology (e.g., pharmacokinetics, pharmacodynamics) and clinical pharmacology (e.g., adverse drug reactions), while simultaneously learning to apply this knowledge by training prescribing skills (e.g., writing prescriptions). In the following years, as knowledge increases, more emphasis should be given to training prescribing skills (e.g., rational prescribing) in simulated (e.g., role-playing session) and clinical (e.g., real-world prescribing) environments, while the acquisition of knowledge diminishes. To evaluate whether outcomes have been acquired, there should be a robust and separate CPT assessment structure throughout the medical curriculum. CPT should ideally be assessed in a combined formative and summative format in each study year. At or near the end of the curriculum, there should be a summative prescribing assessment to evaluate whether graduates are able to prescribe rationally. In general, it is important that the learning outcomes are consistent with the teaching and assessment activities. For example, the outcome 'students should be able to prescribe rationally' should be taught and assessed in ways that enable students to achieve this outcome, such as active prescribing in simulated or clinical settings instead of listening to lectures or reading textbooks.

## HOW SHOULD CPT BE TAUGHT AND LEARNED?

As shown in Chapter 3.1, the majority of European medical schools still mainly use traditional learning methods, such as lectures and self-study, in their CPT curriculum. However, since prescribing is a complex process that is often performed in a challenging, rapidly changing social environment, it should be practised as a complete task in an integrated and contextualized approach.<sup>3,26</sup> To this end, we argue that context-based learning, which is a more extreme form of problem-based learning, is a more effective and sustainable way of training and teaching CPT than traditional learning. Context-based learning refers to the use of real-life examples in teaching environments, in order to learn through clinical experience with a patient rather than just learning about theoretical aspects of clinical practices. The concept is based on four principles: setting, repetition, feedback and responsibility for learning.<sup>26,28</sup> The *setting* in which prescribing is taught or learned should be the same as or as similar as possible to the setting of the future profession, that is clinical practice.<sup>12</sup> This setting gives students the opportunity to gain prescribing experience in the same way doctors do, allowing them to generate a network of organized knowledge in their memory and to develop so-called treatment scripts.<sup>12,28</sup> These scripts contain clinically relevant information about a certain drug, its consequences, the context in which the script develops, and the personal circumstances and experiences of the doctor with previous patients. By frequent *repetition* of the whole task of prescribing, students add new knowledge and experiences to existing knowledge networks, from which easily accessible scripts gradually evolve. Moreover, students should receive *feedback* immediately after each prescribing experience, to ensure condensation of correct therapeutic scripts. Lastly, students should be *responsible* for their own learning progression and for covering

any deficits in knowledge or skills discovered during the clinical work and feedback sessions. Also, students should have real responsibility for patient care under the supervision of a senior clinician, in order to make their treatment script richer and more easily accessible.<sup>28</sup> Apart from the most realistic form of context learning, which is prescribing to real patients in clinical practice, there are many variations with lower levels of concreteness possible. Throughout the curriculum, we suggest that different teaching methods with varying levels of concreteness should be used (Figure 2). We recommend that around 5-10% of the total study load of a medical curriculum should be reserved for CPT education, of which most time should be devoted to methods with a high level of concreteness, since these are useful for training prescribing skills. Here, we discuss each teaching method mentioned in the blueprint, from low to high level of concreteness:

- *Self-study.* Self-study is currently the second most commonly used teaching method for CPT education in Europe (Chapter 3.1). Self-study is important in order that students acquire factual knowledge of CPT and an understanding of basic principles (e.g., pharmacokinetics, pharmacodynamics). Besides knowledge acquisition, it simulates the development of life-long learning skills, such as critical thinking, self-assessment of activities, and need for updating personal information.<sup>29</sup> During the CPT curriculum, various materials for self-study can be used, such as textbooks, E-books, clinical cases, lecture notes/slides, scientific articles, (student) formularies, guidelines, videos, podcasts, quizzes, E-learning and mobile applications. Each method has its own advantages and disadvantages. We believe that there should be a good mix of different materials so that students *can choose* the ones that suit their preferred learning style.
- *Lecture/seminar.* Although lectures are one of the oldest forms of teaching, they are currently still the most commonly used method for CPT education in Europe (Chapter 3.1). Lectures are an efficient way of transferring knowledge and concepts to large groups.<sup>30</sup> For example, they can be used to stimulate interest in CPT, emphasize the importance of rational prescribing, provide knowledge, and direct student learning. However, lectures tend to encourage passive learning. Therefore, they should not be regarded as an effective way of teaching highly cognitive processes such as prescribing skills and attitudes. We believe that currently too much time is devoted to lectures and that it would be more useful to reserve this time for teaching methods with a higher level of concreteness.
- *Journal club.* This involves students discussing the scientific literature in small groups, so that they learn critical appraisal skills.<sup>31</sup> Journal clubs can be very effective platforms where students can acquire knowledge first-hand about analysing, evaluating, scrutinizing and using information from clinical drug trials. Students learn to assess the quality, validity and relevance of these trials, guided by a tutor. Also, answers to clinical questions raised in everyday practice can be investigated and discussed. The feasibility of holding journal clubs for large numbers of undergraduates can be a major problem but can be solved if these clubs are incorporated into small working groups.
- *Case-based discussion.* This involves students discussing several written patient cases in small groups together with a (student) tutor. Students are asked to draw-up a therapeutic plan (e.g., according to the WHO 6-step method) for these written cases and subsequently motivate their

treatment choices. Students are encouraged to give each other feedback. The advantage of this approach is that students actively train therapeutic reasoning in a controlled environment; however, certain prescribing skills, such as communication with a patient, cannot be trained in this format.

- *E-learning.* E-learning has become very *popular* in the past decade. Nowadays, there is a great diversity of E-learning modules available, ranging from static content to complete virtual reality.<sup>32</sup> E-learning is usually an excellent route for delivering knowledge of the basic principles of clinical pharmacology and for training prescribing skills, such as calculating drug doses. Even practical prescribing can be trained in a virtual reality environment with simulated consequences for the patient and immediate feedback on drug choice, dosage and route.<sup>1,33</sup> Other advantages of E-learning are improved distribution of content, easy accessibility, ease of update, standardization and tracking of learning activities.<sup>33</sup> However, the investment and effort required to produce these modules are considerable in terms of time and resources. Therefore, there are strong arguments to develop E-learning at a national or even international level.
- *Prescribing tutorial.* This involves ward-based practical tutorials about common therapeutic problems and high-risk medicines during clinical attachments. Teaching is mainly provided by junior doctors and clinical pharmacists. Studies have shown that these sessions are highly valued by students and tutors and that they increase students' confidence and skills,<sup>33,34</sup> although it might be a challenge to organize them for all students during clinical attachments.
- *Bedside teaching.* Traditionally, bedside teaching has always been seen as a primary teaching modality for training diagnostic skills, such as general history taking and physical examination. However, it might also be useful for training prescribing skills, such as taking an accurate drug history. The advantage is that students can train their skills in a real-world setting while being supervised by a teacher. The teacher can provide feedback after or during the bedside teaching session. A disadvantage of this format is the potential burden on patients, although they usually regard it as enjoyable.<sup>35</sup>
- *Role playing session.* This involves carrying out therapeutic consultations with simulation patients. Students have to draw-up a treatment plan (e.g., based on the WHO 6-step method) based on a written patient case, write a prescription and subsequently communicate their plan to the simulated patient. A trained actor, tutor or student can play the role of the patient. A tutor or peer-assessor should observe the consultation and provide feedback on the performance of the student. This format provides a safe environment for students to train communication skills with patients, although it may not fully reflect the prescribing experience in real clinical practice.
- *Pre-prescribing seminar.* This involves final-year medical students writing prescriptions on real in-patient drug charts or in electronic prescribing systems during clinical attachments, which have to be validated by a doctor before drugs are administered.<sup>1</sup> One study showed that pre-prescribing was safe and could be successfully implemented in a teaching hospital.<sup>36</sup> The advantage is that the task closely resembles the work that final-year students will perform from the first day after graduation. As a downside, it should be noted that medical students

in most European countries are not officially authorized to write in official documents or to prescribe drugs via electronic prescribing systems.

- *Student-run clinic.* This novel approach is designed to teach and train complex prescribing competencies, such as patient communication, therapeutic reasoning and prescribing, in a real context. In a student-run clinic, teams comprising medical students from different study years deliver (free) patient care. They perform patient consultations and propose treatment plans and follow-up under the close supervision of a senior clinician. Studies have shown that these clinics are beneficial to patient care, are feasible and can be considered a valuable educational activity for learning prescribing.<sup>37,38</sup> A disadvantage is that these clinics can be time-consuming to organize and a struggle to implement in the rigid structure of hospitals.
- *Real-world prescribing.* This is the highest level of concreteness and involves performing the whole prescribing process with real patients in clinical practice. The student's performance is observed and evaluated by a supervising clinician. The prescribing process can be performed in different settings, such as hospitals wards, outpatient clinics, general practitioner clinics, or nursing homes. This method enables students to learn to cope with the hazards of clinical practice, such as a high workload and time pressure. Medical schools should introduce real-world prescribing as early as possible in the curriculum and should not wait until the clinical attachments. Apart from prescribing new drugs to patients, this format can also be used to train students to critically review the medicines of patients in clinical practice (i.e., medication reconciliation). A difficulty of this format is that it is a challenge to incorporate the supervision in the daily work of busy clinicians. Moreover, the supervising clinicians have to be educated in teaching rational prescribing to medical students, which is again time-consuming.

## HOW SHOULD CPT BE ASSESSED?

Medical schools should implement a longitudinal and separate CPT assessment procedure to identify students who are not competent to prescribe, measure the effectiveness of the training programme and direct student learning ('assessment drives learning').<sup>39</sup> Most European medical schools currently integrate CPT into larger course assessments (Chapter 3.1), which usually cover only a small proportion of the entire assessment. A problem of this approach is that students can compensate for a poor performance in CPT by having a good performance in other areas. A Swedish study showed that 90% of third-year medical students in one medical school passed the internal medicine examination when clinical pharmacology questions were integrated; however, only 73% passed when these questions were assessed separately.<sup>40</sup> We believe strongly that CPT should be assessed separately because medical students tend to focus their learning on those subjects that will enable them to pass an examination and may ignore those areas that have limited significance for the overall assessment, regardless of their importance.<sup>41</sup> To demonstrate that medical graduates have achieved the necessary competence to prescribe rationally, medical schools should incorporate a separate prescribing assessment at or near the end of the curriculum. In Chapter 3.1, we showed that medical schools that have a final prescribing assessment perceived their students to be better prepared for their prescribing responsibilities as doctors. Recent studies

have shown that it is feasible and beneficial to develop these assessments online at a national level, such as the Prescribing Safety Assessment (PSA) in the UK<sup>42</sup> and the National Pharmacotherapy Assessment in the Netherlands.<sup>43</sup> Since 2016, the PSA has become mandatory for all new doctors prior to commencing foundation-year training in the UK. Each year around 7,000 final-year medical students from all UK medical schools complete the PSA, with the majority of students meeting the required level of competence.<sup>42</sup> Apart from being assessed separately, CPT assessments should be reliable (reproducibility), valid (whether the method assesses what it purports to) and relevant to clinical practice. To date, few CPT assessment methods have been widely applied or validated. To increase validity, the content of the assessments should be developed by experts in the field (e.g., clinical pharmacologists, pharmacists, other medical specialists and trainees) and reflect minimal requirements for rational prescribing, such as described in Chapter 4.2. To maximize reliability, medical schools should regularly evaluate the accuracy of their assessments according to indices of reliability (e.g., Cronbach's alpha). To increase relevance, assessments should be carried out, as far as possible, in clinical practice. However, in recognition of the fact that no single method is adequate to assess all components of clinical practice, we advise that multiple assessments should be performed in varying contexts and environments throughout the curriculum.<sup>44</sup> To identify the most suitable assessment at each stage of the curriculum, Miller's pyramid of clinical competence might be useful. As described in the Introduction, this framework identifies four levels of competence attainment from early learning ('knows') through understanding ('knows how'), to the ability to demonstrate ('shows how') and the ability to perform ('does') (see page 16).<sup>46</sup> Here, we discuss each assessment method mentioned in the blueprint, from the 'knows' to 'does' level.

- *Written assessment (knows/knows how).* This is currently the most commonly used method for CPT assessment in European medical schools (Chapter 3.1). Written assessments may contain a wide variety of different questions such as true/false questions (TFQ), multiple-choice questions (MCQ), extended-matching questions (EMQ), short answer questions (SAQ) and modified essay questions (MEQ). TFQs and MCQs can be used for testing factual knowledge and are relatively easy and quick to mark,<sup>39</sup> whereas EMQs, SAQs and MEQs can be used for testing applied knowledge (and if well-designed also skills) but are labour-intensive and time-consuming to mark. The advantage of written assessments is that they can be used to assess large cohorts of students simultaneously. The disadvantage is that they do not reflect the real-world setting and are usually not suitable for providing individual feedback to students.
- *Computer-based assessment (knows/knows how).* Similar to written assessments, computer-based assessments may contain a wide variety of different questions. However, the difference is that they offer the facility for rapid collection, marking and feedback to students. In addition, they can also incorporate multimedia elements such as images, videos, and audio to make the testing experience more real. It is also increasingly possible to simulate more complex tasks in a virtual environment, including patient consultations and communication with other healthcare providers. We believe that virtual environments may add to, but should not replace, real-world clinical assessment.

- *Oral assessment (shows how)*. Oral assessments are currently the second most commonly used method for CPT assessment in European medical schools (Chapter 3.1). The structure of these assessments can vary considerably but usually involves the presentation of specific case details (e.g., according to the WHO 6-step method), followed by questions from the assessor. The assessment is usually based on a patient case that the student encountered in clinical practice but can also take place without patient interaction. The advantage of oral assessment is that applied knowledge and skills, such as therapeutic reasoning, can be examined. However, the poor reliability of this method should be recognized because of the different content and complexity of each case.<sup>46,47</sup>
- *Objective structured clinical examination (OSCE; shows how)*. This involves a series of stations with simulated patients to assess prescribing knowledge and skills. A trained assessor scores the student's performance, using a standardized scoring form. The advantage is that students receive individual feedback on their performance and that several prescribing skills can be assessed in a safe environment, such as drug history taking and patient communication. The disadvantage is that the assessment can be logistically challenging, relying heavily on the availability of examiners and resources.
- *Portfolio (does)*. Portfolios contain reports of patient encounters and are designed to reflect the professional development of the student. They may be successfully used in a combined formative and summative format. Portfolios are designed to promote self-reflection as a component of life-long learning.<sup>48,51</sup> They may provide a holistic view of the development of prescribing skills and attitudes over time. A successful portfolio programme requires clear goals, specific instructions, a flexible format and adequate mentoring.<sup>48-51</sup> A disadvantage is that a portfolio requires considerable time to complete and that students may not engage unless required to do so.
- *Workplace-based assessment (does)*. This involves prescribing for real patients in clinical practice and is directly monitored by a clinician, for example during hospital ward rounds or patient contacts in outpatient clinics. Feedback on the student's performance is provided by the clinician directly afterwards, using a standardized assessment form (e.g., based on the WHO 6-step method). Ideally, multiple patient encounters should be assessed by multiple clinicians to gain a complete picture of the student's ability. An advantage is that the whole prescribing process can be assessed in a real environment. A disadvantage is that this format is restricted by the competencies and availability of assessors, the availability of suitable patients and the time required for the process.

## WHO SHOULD TEACH AND ASSESS CPT?

Each medical school should identify one individual who is responsible for the development and organization of CPT in the medical curriculum. This individual should convince policy-makers, such as faculty boards, about the importance of CPT and negotiate sufficient time for the subject in the curriculum.<sup>2</sup> Additionally, he or she should make sure that all teaching and assessment activities are delivered throughout the medical curriculum. This is particularly important because CPT is

integrated into different modules throughout the curriculum. This person should also be involved in the development of study materials, such as student formularies, clinical cases, E-books and E-learning. The role of coordinator should ideally be undertaken by a doctor with a background (and training) in clinical pharmacology. However, since several European medical schools do not have a clinical pharmacologist, it can also be fulfilled by other enthusiastic and dedicated teachers, such as basic pharmacologists, (clinical) pharmacists or medical specialists (e.g., internist, geriatrician). It is important to note that this coordinator does not have to do all the teaching and assessment on his or her own. Since medical schools usually have a small department of clinical pharmacology, other teachers should be involved:

- *Medical students.* Medical students should play an active role in the development and delivery of CPT education. A master class consisting of a group of medical students with a special interest in CPT could be useful for this purpose.<sup>26</sup> This group of students can be trained to give CPT teaching to other students of the same or lower level of medical education under the supervision of experienced teachers ('near-peer' teaching). In particular, they can be useful for case-based discussions and role-playing sessions in the earlier years of the curriculum. To prepare student teachers for their task, they should be trained by experts such as clinical pharmacologists, clinical pharmacists and doctors from other specialties. Student teachers should be given didactic training by educationalists in order to prepare them for teaching. Besides organizational benefits (e.g., more teachers, low costs), there are also educational advantages for this student-led approach. Student teachers may better understand the challenges that other students face. Also, they can explain difficult pharmacological concepts at an appropriate level and create a 'safe atmosphere' to raise questions and concerns. Lastly, the student teachers themselves become more knowledgeable, which hopefully leads to better prescribers. A disadvantage is that they have limited clinical experience, which can make it difficult for them to motivate students or to illustrate practical clinical applications for discussion. Taken together, we think that the advantages of near-peer teaching outweigh the disadvantages and that it is a win-win venture for both students and faculty.
- *Pharmacy students.* Similar to medical students, pharmacy students should also be involved in near-peer teaching. This because they usually have a better knowledge of basic pharmacology than medical students.<sup>52</sup> Additionally, early exposure to pharmacy students might improve medical students' understanding of the pharmacist's role in health care. As a result, future doctors might be more likely to engage with pharmacists throughout their careers.
- *Junior doctors.* Studies have shown that prescribing tutorials led by junior doctors are highly valued by students and tutors.<sup>33</sup> Most students even preferred prescribing training delivered by junior doctors than by more senior doctors. Possible explanations for the success of this approach include junior doctors' recent experience of being a medical student, their approachability and ease with which students can ask questions, and their recent insights into prescribing in daily clinical practice.
- *Senior doctors.* Apart from clinical pharmacologists (in training), other clinical specialists, such as cardiologists and pulmonologists, should be involved because of their expertise in specific drugs for individual organ systems. Also, general practitioners, internists and geriatricians are

useful because of their broad expertise of different drug classes. They should be encouraged to help students with the rational prescribing process, such as weighing risks and benefits, communicating with patients and drug monitoring. Simply providing a link between drugs and a clinical condition is insufficient to understand the complex process of prescribing.<sup>2</sup>

- *Clinical pharmacists.* Pharmacists possess skills and attitudes that could be beneficial for CPT education.<sup>53</sup> For example, their theoretical and practical knowledge of drugs and their familiarity with prescribing documentation, processes, information sources and patient safety. Moreover, they are usually available in greater numbers than clinical pharmacologists. Pharmacists can be involved in a variety of teaching and assessment methods throughout the entire CPT curriculum, ranging from lectures and case-based discussion in the early years to prescribing tutorials in the later years. The involvement of pharmacists might encourage a cultural change towards a more multiprofessional approach to patient care.
- *Pharmacologists.* Because of their scientific background, pharmacologists are particularly useful in the earlier years of the CPT curriculum for teaching the basic principles of pharmacology (e.g., pharmacokinetics, pharmacodynamics). However, they are usually not many pharmacologists available.

## FUTURE PERSPECTIVES

This thesis adds to a growing body of evidence showing that future doctors are currently not well prepared for rational prescribing, which is probably one of the causes for the high number of prescribing errors and adverse drug events in clinical practice. Although we particularly focused on the situation in Europe, there are indications that our findings are also applicable to other parts of the world.<sup>54-56</sup> The lack of prescribing competence among European medical students is most likely caused by shortcomings in CPT education in the undergraduate medical curriculum. Since the demands placed on new prescribers will probably increase in the coming years, because of the increasing complexity of patients and systems, changes in undergraduate CPT education are urgently required. We believe that the best way to improve CPT education is by working together across borders and sharing knowledge and resources. Apart from the European core curriculum in CPT described in this chapter, we have three additional recommendations:

1. *European online platform.* Although poor prescribing is a problem in many countries, most CPT teachers focus too much on their own curriculum. For example, CPT teachers often develop new CPT teaching and assessment materials that could be very useful elsewhere but do not share these materials with other teachers. We believe that there are strong arguments to develop and share CPT teaching and assessment materials at a European level, such as E-books, E-learning, clinical cases and standardized scoring forms. First, materials will be accessible to a larger number of medical students and CPT teachers. Second, this might improve the quality of the materials because the expertise of a larger number of CPT teachers can be used and more medical students can review the content of the materials. Third, this will probably save time and money that could be used to develop new innovative teaching methods. Fourth, this would provide opportunities to perform large multicentre studies to evaluate the effect of CPT teaching methods and materials. A European online platform should be created where all materials can be stored, peer-reviewed and easily accessed by CPT teachers throughout Europe. Although the initial investment is significant, if done collaboratively it should be cost effective, stimulating and highly appreciated by teachers and students. There are always practical problems with sharing teaching materials across different countries, such as language barriers and differences in guidelines. However, we believe that the overall benefits of a collaborative approach definitely outweigh these practical issues.
2. *European Prescribing License.* As addressed in this thesis, it is important to evaluate whether medical students have attained the necessary competence to prescribe rationally by the time they graduate. To this end, medical schools should implement a separate high-quality prescribing assessment at or near the end of the medical curriculum. Recent studies have shown that it is feasible and beneficial to develop these assessments online at a national level, such as the Prescribing Safety Assessment (PSA) in the UK<sup>42</sup> and the National Pharmacotherapy Assessment in the Netherlands.<sup>43</sup> However, not all European countries have the resources to develop and implement a national prescribing assessment. Therefore, we believe strongly that a 'European Prescribing License' should be developed, consisting of a computer-based assessment that covers various aspects of prescribing and which can effectively identify

students who are not competent to prescribe. Medical students should have to pass this assessment before they are allowed to prescribe medications in European countries. We believe that a European assessment is increasingly important given the increased cross-border mobility of medical students and junior doctors.<sup>57</sup> Although the CPT guidelines vary in different European countries, we think that there is enough overlap to create a valid and reliable assessment.

3. *European student formulary.* We should agree on and publish a European student formulary that outlines core drugs and diseases that all medical graduates should know about. To date, only Orme *et al.* has published a European list of core drugs and diseases.<sup>23</sup> However, this list is out of date and we think that more European CPT teachers should be involved in the next version. Creating an international student formulary might be helpful for prioritizing learning objectives and for standardizing the content of CPT education across Europe.

Since these recommendations are expensive, international funding resources should be approached, such as Horizon 2020 provided by the European Commission. Furthermore, the Network of Teachers in Pharmacotherapy (NOTIP) should play a main role in their realization. By following these recommendations, we believe that meaningful improvements in CPT education can be achieved that will eventually contribute to improvements in the quality and safety of patient care.

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