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Are Dutch dental students and dental-care providers competent prescribers of drugs?

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Dental students and dental-care providers should be able to prescribe drugs safely and effectively. As it is unknown whether this is the case, we assessed and compared the prescribing competence of dental students and dental-care providers in the Netherlands. In 2017, all Dutch final-year dental students and a random sample of all qualified general dental practitioners and dental specialists (oral and maxillofacial surgeons and orthodontists) were invited to complete validated prescribing knowledge-assessment and skills-assessment instruments. The knowledge assessment comprised 40 multiple-choice questions covering important drug topics. The skills assessment comprised three common clinical case scenarios. For the knowledge assessment, the response rates were 26 (20%) dental students, 28 (8%) general dental practitioners, and 19 (19%) dental specialists, and for the skills assessment the response rates were 14 (11%) dental students, eight (2%) general dental practitioners, and eight (8%) dental specialists. Dental specialists had higher knowledge scores (78% correct answers) than either dental practitioners (69% correct answers) or dental students (69% correct answers). A substantial proportion of all three groups made inappropriate treatment choices (35%–49%) and prescribing errors (47%–70%). Although there were some differences, dental students and dental-care providers in the Netherlands lack prescribing competence, which is probably because of poor prescribing education during under- and postgraduate dental training. Educational interventions are urgently needed.

Dentists are legally entitled to prescribe drugs within their field of expertise. In 2015, approximately one million prescriptions were written out by Dutch dentists and dental specialists (oral and maxillofacial surgeons and orthodontists are the only official dental specialties in the Netherlands) (1). The drugs most commonly prescribed were broad-spectrum antibiotics (e.g., amoxicillin, clindamycin), analgesics (e.g., ibuprofen, naproxen), and local antiseptics (e.g., chlorhexidine) (1).

As Dutch dentists prescribe drugs regularly, dental students should be competent in prescribing at the point of graduation. Inappropriate prescribing may result in medication errors and adverse drug reactions, with potential consequences for patient safety and health-care costs (2–4). However, several studies suggest that dental students have not acquired appropriate prescribing competence before graduation. For example, dental students lack prescription-writing skills (5, 6) as well as pharmacological knowledge concerning antibiotics, analgesics, and local anaesthetics (7–13). Similar deficits in drug knowledge and prescription-writing skills have been found among dentists and dental specialists (14–16), and especially for antimicrobial prescribing (e.g., choosing the wrong antibiotic, or under- or overdosing) (17–21).

The lack of prescribing competence among dental students and dental-care providers might be caused by

poor clinical pharmacology and therapeutics (CPT) education during their under- and postgraduate training. Indeed, studies outside Europe have shown that most dental curricula devote little time to CPT education, and these findings indicate that further education is urgently required (11, 22). Moreover, few postgraduate courses currently focus on prescribing. Little is known about the prescribing competence of dental students and dental-care providers in the Netherlands, and whether they differ. It is important to clarify the latter in order to identify possible areas for improvement which might also be useful for dentists in other countries. Accordingly, the aim of this cross-sectional study was to determine and compare the prescribing competence of final-year dental students and a subset of dental-care providers in the Netherlands.

Material and methods

Study design

This descriptive, cross-sectional study was carried out between 1 January 2017 and 31 May 2017. Three groups of individuals (final-year dental students, general dental practitioners, and dental specialists) in the Netherlands were invited to participate. The first group comprised all 132 final-year dental students actively studying during the academic year 2017–2018 at all three Dutch dental schools: the Academic Centre for Dentistry Amsterdam (ACTA, $n = 80$), the Radboud University Medical Centre Nijmegen (RUMCN, $n = 28$), and the University Medical Center Groningen (UMCG, $n = 24$). The CPT education differs in each dental school but is usually integrated in courses throughout the second and third study years of the curriculum and is mainly based on traditional learning methods (i.e., passive learning), such as lectures, self-study, and written examinations. The second and third groups comprised a sample of 700 general dental practitioners and 200 dental specialists (i.e., oral and maxillofacial surgeons and orthodontists) who were randomly selected from the database of the Royal Dutch Dental Association using the random sampling procedure in IBM SPSS Statistics for Windows, Version 22.0. (Released 2013; IBM, Armonk, NY, USA). All qualified general dental practitioners ($n = 8{,}712$) and dental specialists ($n = 678$) in the Netherlands were registered in this database in 2017. The samples in groups 2 and 3 were representative regarding gender, age, and nationwide spread of location of practice. After giving informed consent, all participants were asked to complete a standardized online assessment and questionnaire. Ethical approval for this study was provided by the Dutch Ethics Review Board of Medical Education (project number NVMO-ERB 818).

Study materials

We developed an online knowledge and skills assessment using SurveyMonkey (SurveyMonkey, Dublin, Ireland). The knowledge assessment consisted of 40 multiple-choice questions covering five drug topics: anticoagulants (nine questions); analgesics (nine questions), antibiotics (nine questions); local anaesthetics (nine questions); and the oral manifestations of frequently prescribed drugs (four questions). The drug groups were chosen because they are frequently prescribed in dental practice (1) and are mentioned in the 'Medicines in Dentistry' section of the Dutch National Formulary (23). Each topic consisted of questions about side-effects (three questions), drug interactions (three questions), and contraindications (three questions). The questions focussed on prescribing knowledge that every dental graduate should have obtained in order to prescribe safely and effectively in daily practice (Appendix S1).

The skills assessment consisted of three common case scenarios that every dental graduate should know how to manage according to the Dutch National Blueprint for Dental Education, namely, periodontitis in patients with valvular heart disease, oropharyngeal candidiasis, and post-extraction pain (Appendix S2) (24). The scenarios were presented in a similar format and had comparable complexity (i.e., an elderly patient with polypharmacy and one clinically relevant drug interaction or contraindication). For each scenario, the participant had to make a treatment plan; that is, he/she could choose to prescribe a new drug, not to prescribe any drug, and/or adapt current medication. If the participant chose to adapt current medication, he/she had to briefly explain why. If the participant chose to prescribe a new drug, he/she had to complete an electronic prescription form, including drug name, dose, dosage, route of administration, and treatment duration (Appendix S2). Additionally, the participant could provide non-drug advice in an open text box (e.g., quit smoking, stop drinking alcohol). Lastly, the participant was asked to determine measures to monitor the effectiveness and potential side effects of the proposed treatment, such as follow-up consultations and laboratory tests.

We also developed a standardized questionnaire based on the available literature (Appendix S1 and S2) (11, 25, 26). The questions asked about demographic characteristics, work experience (years), number of hours worked per week, estimated number of drugs prescribed per 3 months, and self-rated confidence in prescribing (1 = unconfident, 2 = somewhat unconfident, 3 = neutral, 4 = somewhat confident, 5 = confident).

Validity and reliability

Face and content validity of the materials was established through two online questionnaire rounds with a Dutch expert panel. The panel consisted of three general dental practitioners/dental teachers, two oral and maxillofacial surgeons, two clinical pharmacologists, one medical doctor/dental teacher, one dental researcher, and one hospital pharmacist. Modifications in terms of length and clarity were made after a pilot test with two final-year dental students and two general dental practitioners from ACTA. The Guttman Lambda 2 of the multiple-choice questions was 0.67, meaning that they had acceptable internal consistency. This test was used because it is considered a more appropriate measure of internal consistency than the Cronbach's alpha (27). The percentage of respondents correctly answering a question ranged between 23% and 100% for the individual questions, indicating that the difficulty of the questions was variable. No questions were excluded because none had a negative item-rest correlation (r_{ir}).

Data collection

All participants were informed about the study objectives and received instructions. Selected at random (using simple

Table 1

Scoring categories for the treatment plans

Category	Description	Examples (Case 2)
Appropriate	A treatment plan was considered appropriate if it was complete, effective, safe, and low cost according to national guidelines	Prescribing clindamycin, as endocarditis prophylaxis, to a patient with an artificial heart valve and penicillin allergy before a pocket-reduction procedure
Suboptimal	A treatment plan was considered suboptimal if it was just below the standard of appropriate (e.g., the dose of the drug was slightly too high, or the drug prescribed was a less recommended drug choice)	Prescribing erythromycin, as endocarditis prophylaxis, to a patient with an artificial heart valve and penicillin allergy before a pocket-reduction procedure (less recommended drug choice)
Inappropriate	A treatment plan was assessed as inappropriate if it was significantly below the standard of appropriate (e.g., potentially harmful drug interaction, or relevant contraindication)	Prescribing amoxicillin, as endocarditis prophylaxis, to a patient with an artificial heart valve and penicillin allergy before a pocket-reduction procedure (relevant contraindication)

random sampling without replacement), half of the students and dentists (specialists) were asked to complete the knowledge assessment and the other half the skills assessment. The assessments and questionnaire took approximately 30–45 min to complete, and participants were allowed up to 4 wk to complete them. In contrast to the knowledge assessment, participants were allowed to use references when completing the skills assessment (e.g., drug formulary and national treatment guidelines), in order to reflect the real situation in clinical practice. To increase the response rate, students were invited by their own teacher (personalization), and all participants received an e-mail reminder 2 wk after the initial message. Participation was voluntary, anonymous, and confidential. To avoid test-driven learning, no incentives were offered prior to the assessment.

Scoring

The multiple-choice questions were scored as correct or incorrect. The case scenarios were scored according to a scheme based on relevant Dutch guidelines for dental practice (28–31). The main researcher (D.B.) scored each treatment plan as being inappropriate, suboptimal, or appropriate (Table 1). A second assessor (D.v.D.) reassessed all treatment plans to determine inter-rater reliability. The absolute agreement and kappa coefficient between D.B. and D.v.D. were 62% and 0.41, respectively, indicating moderate agreement (32). Subsequently, the main researcher screened the drug prescriptions for prescribing errors, as classified by Dean *et al*. (33). Errors found were categorized according to type.

Data analysis

The characteristics of the three groups were compared using ANOVA for continuous data (e.g., knowledge and confidence scores) and chi-square tests for categorical data (e.g., skill scores). Covariance analyses were performed to correct for possible confounders, such as age and sex. The Spearman correlation coefficient (r_s) was used to analyse whether work experience, number of drugs prescribed per month, and self-rated confidence in prescribing were associated with knowledge and skills scores. Knowledge and skills scores were calculated as percentages of the maximum score. Data were collected in Excel format and analysed using IBM SPSS Statistics for Windows, Version 22.0. (released 2013; IBM, Armonk, NY, USA). A value of $P < 0.05$ was considered significant.

Results

In total, 26 (20%) dental students, 28 (8%) general dental practitioners, and 19 (19%) dental specialists completed the knowledge assessment, and 14 (11%) dental students, eight (2%) general dental practitioners, and eight (8%) dental specialists completed the skills assessment. The groups differed in terms of age, sex, hours worked per week, and number of prescriptions (Table 2). Subgroup analysis between oral and maxillofacial surgeons and orthodontists in the dental specialist group was not considered meaningful because of the low number of orthodontists ($n = 2$) in each group.

Knowledge

Overall, dental specialists had significantly higher knowledge scores than general dental practitioners and dental students ($P = 0.01$; Table 3). Also, dental specialists had a better knowledge of different drug groups, and they had significantly better knowledge of 'Side-effects' ($P = 0.03$) and 'Drug interactions' ($P < 0.001$) than dental practitioners and dental students. 'Contraindications' was the only drug topic for which scores were not significantly different across the three groups.

Skills

Overall, dental specialists made fewer inappropriate therapy choices and fewer erroneous prescriptions than general dental practitioners and dental students, although the differences were not statistically significant (Table 4). The most common prescribing errors among the three groups were 'Protecting medication omitted' and 'No drug stopped/adapted', whereas the least common prescribing errors were 'Too short/long duration' and 'Incorrect drug form'. Apart from 'Lack of monitoring measurements', there were only minor differences in types of errors among the groups.

Attitudes

Overall, 30.0% of the dental students, 80.6% of the general dental practitioners, and 85.2% of the dental specialists felt (very) confident that they could prescribe drugs safely and effectively. On average, dental

Table 2

Characteristics of the dental students, general dental practitioners, and dental specialists taking part in the knowledge or skills assessment

	Knowledge assessment				Skills assessment			
Variable	Dental students (n = 26)	Dental practitioners (n = 28)	Dental specialists (n = 19)	P-value	Dental students (n = 14)	Dental practitioners (n = 8)	Dental specialists (n = 8)	P-value
Age, years [mean (SD)]	24.8 (2.2)	38.5 (12.3)	37.5 (11.4)	<0.001*	24.9 (1.7)	44.4 (13.0)	43.0 (10.0)	<0.001†
Sex (female, %)	77	71	47	0.09‡	71.4	37.5	0.0	<0.01§
Dental school (*n*)								
ACTA	12	–	–		4	–	–	
RUMCN	11				8			
UMCG	3	–	–		2	–	–	
Dental specialty (*n*)								
Orthodontist	–	–	2		–	–	2	
OMS	–	–	17		–	–	6	
Years of work experience [mean (SD)]		13.8 (12.1)	8.7 (9.2)	0.13¶		17.5 (13.5)	14.8 (10.5)	0.66¶
Working hours per wk [mean (SD)]		30.8 (8.5)	46.5 (8.7)	<0.001¶		25.8 (14.0)	45.5 (10.2)	<0.01¶
Number of prescriptions** [median (range)]	5 (0–100)	10 (0–250)	150 (0–600)	<0.001††	2.5 (0–11)	6 (0–20)	27 (0–600)	0.01‡‡

ACTA, Academic Centre for Dentistry Amsterdam; OMS, oral and maxillofacial surgeon (in training); RUMCN, Radboud University Medical Centre Nijmegen; UMCG, University Medical Center Groningen.

*ANOVA, all categories were significantly different from each other (all $P < 0.001$), expect for dentists and dental specialists ($P = 0.79$).

†ANOVA, all categories were significantly different from each other (all $P < 0.001$), expect for dental practitioners and dental specialists ($P = 0.82$).

‡Chi-square test.

§Chi-square test, all categories were significantly different from each other (all $P < 0.01$), expect for dental practitioners and dental specialists ($P = 0.06$).

¶T-test for independent samples.

**Estimated amount of drug prescriptions written during study (dental students) or during the last 3 months in clinical practice (dental practitioners and dental specialists).

††ANOVA, all categories were significantly different from each other (all $P < 0.001$), expect for dental students and dental practitioners ($P = 0.76$).

‡‡ANOVA, all categories were significantly different from each other (all $P = 0.01$), expect for dental practitioners and dental specialists ($P = 0.08$) and dental practitioners and dental students ($P = 0.19$).

practitioners (mean ± SD: 2.9 ± 0.4) and dental specialists (mean ± SD: 3.0 ± 0.5) felt significantly more confident than dental students [mean ± SD: 2.1 ± 0.9, $P = 0.03$; analysis of covariance (ANCOVA) adjusted for age and sex]; no significant differences were found between dental practitioners and dental specialists. During undergraduate training, dental students completed a median of five (range: 0–100) drug prescriptions. Over a 3-month period, dental practitioners prescribed a median of 10 (range: 0–250), and dental specialists a median of 135 (range 0–600), drugs.

Associations

There was no strong correlation between work experience (in years) and knowledge scores for general dental practitioners ($r = 0.05$) and dental specialists ($r = 0.05$) or between work experience (in years) and skill scores (dental practitioners, $r = 0.49$; and dentist specialists, $r = -0.32$). The number of drug prescriptions was not strongly correlated with skill scores in dental students ($r = -0.02$), dental practitioners ($r = 0.30$), or dental specialists ($r = 0.31$).

Discussion

In this study, we investigated the prescribing competence of dental students and a subset of dental-care providers in the Netherlands. Overall, our findings show that the dental students, general dental practitioners, and dental specialists in this study lack prescribing competence, although dental specialists outperformed the other groups on several aspects. In particular, all three groups had poor knowledge of local anaesthetics, analgesics, and drug interactions. Moreover, inappropriate treatment choices and prescribing errors for common clinical vignettes were frequently made in all groups. Despite the lack of competence, a large proportion of dental practitioners and dental specialists felt confident about their prescribing skills. Taken together, these findings suggest that CPT education during under- and postgraduate training does not prepare future and current dental-care providers sufficiently for safe and effective prescribing, which may lead to unnecessary patient harm.

Our findings suggest that dental students and dental-care providers in the Netherlands do not have sufficient

Table 3

Knowledge scores of dental students (n = 26), general dental practitioners (n = 28), and dental specialists (n = 19)

Variable	Dental students	Dental practitioners	Dental specialists	*P*-value ANOVA	Adjusted *P*-value ANCOVA*
Drug class					
Analgesics	63.3 (15.0)	63.1 (16.6)	76.0 (18.2)	0.02	0.06
Anticoagulants	77.4 (15.5)	74.2 (14.5)	86.0 (15.2)	0.03	0.05
Antibiotics	65.4 (13.1)	70.6 (14.9)	76.6 (15.7)	0.04	0.11
Local anaesthetics	57.7 (15.7)	58.3 (17.5)	64.3 (16.0)	0.36	0.28
Oral manifestations	94.2 (10.7)	93.8 (11.0)	98.7 (5.7)	0.20	0.17
Drug topic					
Side-effects	82.0 (13.3)	84.6 (11.3)	92.4 (10.5)	0.02	0.03
Contraindications	76.0 (13.8)	72.0 (12.5)	72.4 (13.0)	0.50	0.46
Drug interactions	43.9 (12.6)	46.1 (17.0)	64.5 (16.6)	<0.001	<0.001
Overall	68.8 (9.0)	69.3 (9.5)	78.0 (10.5)	<0.01†	0.01†

All knowledge scores are given as % (SD).

*Adjusted for age and sex by covariate analyses [analysis of covariance (ANCOVA)].

†Dental specialists outperformed dental practitioners and dental students (all $P < 0.01$); no other differences were found between dental practitioners and dental students.

prescribing competence, as defined by the Dutch National Blueprint for Dental Education (24). As in a previous study among medical students (25), we believe that participants should have high assessment scores (≥80%), which would demonstrate their competence in prescribing drugs safely and effectively. The lack of prescribing competence among dental students and dental-care providers has also been reported in other countries (5–19) and is a concern because it may have undesirable consequences for patients, such as adverse drug events and suboptimal treatment (34). Not surprisingly, dental specialists outperformed the other groups on several aspects of prescribing, possibly because oral and maxillofacial surgeons receive additional CPT education during their training. However, their prescribing level was still not satisfactory, which is a matter of concern as they prescribe more drugs than general dental practitioners. Unexpectedly, the knowledge and skills of dental practitioners and dental students were comparable, even though dental practitioners have considerably greater clinical experience. This is consistent with our finding that work experience was not strongly correlated with knowledge and skills scores. This could be because dental practitioners do not prescribe drugs on a regular basis (in general, only two or three prescriptions per month). It is recognized that knowledge and skills are not easily retained over time (35) and that they have to be regularly used or reviewed in order to be retained. Another explanation for the insufficient progression in knowledge and skills could be a lack of postgraduate training, although such training was recently (January 2018) made mandatory for all Dutch dental-care providers. Nevertheless, dental schools should ensure that their students are adequately prepared for prescribing by the time that they graduate.

Compared with dental students, most dental practitioners and dental specialists felt confident about prescribing, even though their actual performance was poor. This overconfidence might be because dental-care providers might not want to appear unsure about what to prescribe, which is generally considered a weakness and a sign of vulnerability (36). The overconfidence could also be related to 'illusory superiority', which refers to a psychological condition of a person overestimating their own qualities and abilities, in relation to the same qualities and abilities of other persons (37). However, this overconfidence may put patient safety at risk and should be addressed during under- and postgraduate dental education.

Similarly to medical students and doctors (25, 38), the three groups of participants had a poor knowledge of drug interactions. This is a concern because most dentists in the Netherlands – unlike most doctors – do not use electronic prescribing systems that provide drug safety alerts for harmful drug combinations. Moreover, dentists do not always have a clear and up-to-date overview of the medications used by their patients. Hence, dentists should have ready knowledge about common drug interactions to enable them to prescribe safely in standard clinical or acute situations.

Poor CPT education during undergraduate education may underlie the lack of prescribing competence, as indicated in previous studies from other countries (11, 22). Indeed, most dental schools in the Netherlands provide CPT education in the early years of the curriculum and use mainly traditional learning methods, such as lectures and written examinations. However, these methods simulate passive learning and should not be considered an effective way of teaching and assessing highly cognitive processes, such as prescribing skills (39). We argue that CPT education should be intensified during the clinical attachments, and more interactive education methods should be introduced, such as patient case discussions and practice prescribing for simulated and real patients. Previous studies have shown that these methods are effective for medical students (40–42). Also, the World Health Organization (WHO) six-step model (i.e., a normative model for therapeutic reasoning) should be used more often because it is the only effective method to teach rational prescribing in a wide variety of settings (43). To ensure that dental graduates are competent to prescribe, dental

Table 4

Skill scores of dental students (n = 14), general dental practitioners (n = 8), and dental specialists (n = 8)

Variable	Dental students	Dental practitioners	Dental specialists	*P*-value
Therapy appropriateness				
Total number of treatment plans	37	17	23	
Appropriate†	7 (18.9)	2 (11.8)	6 (26.1)	
Suboptimal†	12 (32.4)	7 (41.2)	9 (39.1)	
Inappropriate†	18 (48.6)	8 (47.1)	8 (34.8)	0.73*
Not immediately harmful	15 (83.3)	8 (100)	7 (87.5)	
Potentially harmful	3 (16.7)	0	1 (12.5)	
Potentially lethal	0	0	0	
Prescriptions				
Total number of prescriptions	23	15	19	
Total number of prescribing errors	60	31	34	
Number of prescriptions including errors	16 (69.6)	9 (60.0)	9 (47.4)	0.45‡
Types of errors§				
Drug not indicated	4 (6.7)	1 (3.2)	1 (2.9)	
Less effective drug choice	0	1 (3.2)	1 (2.9)	
Underdosing	0	1 (3.2)	0	
Overdosing	4 (6.7)	0	3 (8.8)	
Too short duration	0	0	1 (2.9)	
Too long duration	0	0	1 (2.9)	
Incorrect drug form	0	0	1 (2.9)	
Incomplete/incorrect drug prescription	3 (5.0)	2 (6.5)	1 (2.9)	
Protecting medication omitted	16 (26.7)	7 (22.6)	10 (29.4)	
Drug group name	0	0	3 (8.8)	
Lack of non-medicine advice	7 (11.7)	3 (9.7)	3 (8.8)	
Incomplete/incorrect non-drug advice	9 (15.0)	4 (12.9)	2 (5.9)	
Lack of monitoring measurements	4 (6.7)	6 (19.4)	0	
Incomplete/incorrect monitoring	5 (8.3)	1 (3.2)	2 (5.9)	
No drug stopped/adapted	8 (13.3)	4 (12.9)	3 (8.8)	
Drug stopped/adapted without reason	0	0	2 (5.9)	

Data are given as *n or n* (%).
*Chi-square test.
†Percent of total number of treatment plans.
‡Analysis of covariance (ANCOVA) adjusted for age and sex by covariate analyses.
§Percent of the total number of prescribing errors.

schools should implement a prescribing skills assessment, such as objective structured clinical examinations, near the end of the curriculum. Although a transition towards more practical teaching is necessary, the resource-intensive format is challenging for schools. In order to reduce the workload for teachers, online learning recourses, such as E-learning and E-books, might be useful as an addition to face-to-face lessons because they are readily accessible and suitable for teaching large cohorts of students.

Our study had several methodological limitations. First, despite efforts to maximize it, the response rate in the three study groups was remarkably low, possibly because of the complexity and length of the assessments. Thus, our findings might not be generalizable to the overall population of dental-care providers and dental students in the Netherlands. However, as participants in this study were probably more conscientious and motivated than dental students and dentists/dental specialists in general, the competence of the overall population is likely to be lower and this would further strengthen our findings. Second, because of the small sample size, the correct response rates for each category are more likely to be correlated (e.g., if one provider performs poorly in one section, they will probably also perform poorly in other sections), which may have affected our findings. Third, the statistical power of our study is limited because of the small sample size. Fourth, as participants were asked to complete the knowledge assessment in their own time, we cannot rule out that they might have used references or consulted colleagues. Again, in that case, competence would probably have been overestimated. Fifth, there was lack of full agreement between the two assessors (probably stemming from their different professional backgrounds), which may have influenced the results. Sixth, because the assessment was performed in a virtual environment, it is questionable whether similar findings would be observed in daily practice with real patients. However, it is unlikely that competence would be more appropriate in this setting, given the lack of time and the stress experienced in daily practice.

In conclusion, this study has highlighted a worrying lack of prescribing competence among participating dental students and a subset of dental-care providers in the Netherlands, which is probably a result of poor CPT education during under- and postgraduate dental training. To improve the prescribing competence of

future dental-care providers, we suggest that undergraduate training should devote more time to CPT, use teaching methods that are more interactive, and assess prescribing skills in a simulated or real environment. Moreover, postgraduate prescribing courses should be created to maintain and further develop these skills. Future studies should investigate which methods are most effective for teaching prescribing during dental training, in order to improve the prescribing competence of future dental-care providers.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Prescribing competencies of dental students and dental care providers in the Netherlands – Knowledge questions.

Appendix S2. Prescribing competencies of dental students and dental care providers in the Netherlands – Patient case scenarios.