

# A model for a geriatric teaching programme and its impact on self-rated and tested competencies of undergraduate dental students

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## Abstract

**Introduction:** In the light of the growing ageing population, it is important that future dentists be taught geriatric competencies to assure good dental care and treatment addressing the special needs of older patients.

**Materials and Methods:** We developed and evaluated a geriatric teaching programme amongst final year undergraduate dental students ( $n = 30$ ) at the University of Bern, Switzerland. The geriatric teaching programme was based on the European undergraduate curriculum in geriatric medicine for medical students covering the following eight geriatric domains that were considered relevant to dental care: Analgesics, cognitive impairment, decision-making capacity, gait and balance disorder, hearing impairment, malnutrition, polypharmacy and vision impairment. Using a pre/post-design, we administered a structured questionnaire including standardised questions on self-rated and tested competencies. Both assessments scores were standardised to a maximum score of 100 points. Data were evaluated by comparison of pre-test and post-test mean scores.

**Results:** The geriatric teaching programme proved to be feasible covering eight geriatric domains based on a case-based didactic approach in totally eight 45-minute lessons. Both self-rated and tested competencies of dental students increased in all eight domains in the course of the geriatric teaching programme. After the geriatric teaching programme, both mean self-rated competency scores (67.9 vs. 49.6,  $p < .001$ ) and mean tested competency scores (78.7 vs. 56.7 points,  $p < .001$ ) significantly improved compared to baseline.

**Conclusions:** Integrating a consolidated refined geriatric teaching programme is a potentially feasible and effective method for dental undergraduate students and is expected to have an impact on better dental care of older patients.

## KEYWORDS

dental education, geriatric curriculum, gerodontology, older patients, self-assessment, dental education, geriatric curriculum, gerodontology, older patients, self-assessment

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## 1 | INTRODUCTION

Healthcare providers are faced with an increasingly greater proportion of their patients being older and having multiple comorbid conditions. Good clinical practice necessitates that existing and future healthcare providers, including dentists, become competent in basic geriatric principles addressing the special needs of older patients.<sup>1</sup> Evidence emphasised that it is of key importance to consider geriatric syndromes in the management of underlying medical conditions.<sup>2</sup> Consequently, geriatric syndromes should be taught at an undergraduate level to assure good dental care and treatment of older patients by future dentists.

Prior evidence suggests that teaching programmes covering principles of geriatric care are either lacking or inconsistently implemented at dental universities.<sup>3-6</sup> Moreover, approaches to incorporating geriatric methods and concepts into teaching programmes for dental students vary substantially.<sup>7,8</sup> There are ongoing efforts to promote education on dental care of older patients based on the systematic curriculum of gerodontology for undergraduate dental students.<sup>9</sup>

In this curriculum of gerodontology “geriatric medicine” is listed, an essential part of the gerodontology curriculum for undergraduate dental students.<sup>9</sup> Although the curriculum proposes teaching of “frequent health problems” in geriatric medicine, the specific geriatric domains that should be addressed within the curriculum are not defined. The European undergraduate curriculum in geriatric medicine defined essential geriatric syndromes that should be covered in the curriculum for medical students.<sup>10</sup> However, a geriatric teaching programme specifying the geriatric syndromes of clinical relevance to dental students is lacking.

It is crucial that a teaching programme is verifiably effective in achieving the desired competencies that are a priori specified in the curriculum. To our knowledge, however, the impact of a dedicated geriatric teaching programme on resulting self-rated and tested competencies has not been investigated.

Therefore, the purpose of this study was to describe a feasible geriatric teaching programme serving as a teaching model and to measure the effect of a geriatric teaching programme on self-rated and tested competencies of undergraduate dental students.

## 2 | MATERIALS AND METHODS

### 2.1 | Educational setting

Undergraduate students at the School of Dental Medicine, University of Bern, Switzerland, undergo the curriculum as described in the Swiss educational objectives for dental medicine,<sup>11</sup> which has been accredited by the Swiss Federal authorities. The Gerodontology curriculum is embedded as a dedicated course in the series of prosthodontics during the Master of Dent Medicines course. It comprises patient treatment in the scope of the synoptic clinical course taught

in conjunction with the Department of Restorative, Preventive, and Paediatric Dentistry and the Department of Periodontology, and encompasses facultative one-on-one instruction in a geriatric hospital and the lecture series for “Gerodontology and Geriatric Aspects” in the second term of the 5<sup>th</sup> year. This lecture series was designed according to the recommendations of the European College of Gerodontology<sup>9</sup> and to be similar to courses at the University of Geneva. In Bern, it comprises 28 lecture units and reflects the multidisciplinary of Gerodontology. Of these 28 lecture units, 8 are specifically dedicated to the geriatric teaching programme Series that is taught by a geriatrician of the Department of Geriatrics at the University of Bern.

### 2.2 | Development of the geriatric teaching programme

The geriatric teaching programme was developed in a three-step process. First, the European undergraduate curriculum in geriatric medicine for medical students was consulted to identify overall geriatric domains for undergraduate dental students.<sup>10,12</sup> A consensus group of four experts in Geriatrics and Gerodontology decided on the geriatric domains to be included in the geriatric teaching programme based on predefined criteria. Geriatric domains were included if the expert group consented that the geriatric domain was clinically relevant to dental care of older patients. Geriatric domains exclusively covering issues of general education were not considered.

The consensus group agreed on the following eight geriatric domains to be included in the geriatric teaching programme: Analgesics, cognitive impairment, decision-making capacity, gait and balance disorder, hearing impairment, malnutrition, polypharmacy and vision impairment.

In a second step, specific learning objectives were identified for each geriatric domain along with measurements of competency for each objective.<sup>13</sup> Accordingly, we phrased the learning objectives for each domain based on the taxonomy of Bloom.<sup>13,14</sup> For each learning objective, the corresponding level of competencies of Bloom that could be achieved was attributed. Six levels of competencies were distinguished: level 1: knowledge, level 2: comprehension, level 3: application, level 4: analysis, level 5: synthesis and level 6: evaluation.

In a third step, clinical practice scenarios for dentistry were developed and aligned to each domain covering all learning objectives.<sup>15,16</sup> This case-based pedagogy is in line with Aquifer Geriatrics, a case-based curriculum for medical students emphasising learning outcomes and competency-based learning.<sup>17,18</sup>

Overall, this pilot study in 2019 resulted in a feasible geriatric teaching programme covering specific learning objectives with high rates of student satisfaction that could be applied for the current study. Based on the experiences during the pilot phase, we only

made a didactic change and replaced two lecture units with a seminar in small groups to enhance student learning activity.

## 2.3 | Study design

For this study, we included all dental undergraduate students in February 2020 attending their last year before graduation at the University of Bern, Switzerland ( $n = 30$ ). Female students accounted for 56.7% of the sample. All students participated in the assessments both before and after the geriatric teaching programme, so there was no attrition bias. Students were informed that completing the questionnaire amounted to providing consent for an anonymised analysis of their answers for this project. Whilst researchers do work with health-related data of human beings, the data can no longer be assigned to any specific individual. These criteria apply to our study, and therefore, our study was exempt from formal ethical approval.

## 2.4 | Outcome measures

To assess the impact of the geriatric teaching programme, we defined, a priori, a standardised questionnaire covering self-rated competencies and tested competencies of students. To compare the impact of the geriatric curriculum, we distributed this same questionnaire before the programme started in February 2020 (baseline) and after completion of the geriatric teaching programme in April 2020.

The outcome measures in the questionnaire are described in detail in the following paragraphs.

### 2.4.1 | Self-rated competencies

We used a previously validated self-evaluation scale with five response options (1) efficient, (2) need improvement, (3) meets expectation, (4) advanced for year level and (5) exceptional/at a professional level.<sup>19</sup> Using this scale, students self-rated their current competencies for each geriatric domain. The maximum score of self-rated competency was standardised to 100 points. For comparison of proportions for each domain, sufficient self-rated competency was defined as the answer with the option number (3), (4) or (5).

### 2.4.2 | Tested competencies

Student competencies were evaluated by a set of standardised questions covering the eight geriatric domains. The maximum overall score was standardised to 100 points. The questions were developed in line with the learning objectives and were derived from case-based scenarios. Four questions were Multiple Choice questions, and three questions were free-text field questions. Successful

attainment of the competency test was defined for each geriatric domain by a predetermined minimum score.

## 2.5 | Statistical analyses

Descriptive statistics were used to calculate proportions of categorical data and means with standard deviations for numerical data. Assessment scores means were compared using the Student's *t* test. Statistical analyses were performed using GraphPad Software (online version, San Diego, USA; 2020) statistical program. A two-sided *p*-value of  $<.05$  was considered statistically significant.

## 3 | RESULTS

### 3.1 | Geriatric teaching programme

Table 1 displays the content of the geriatric teaching programme indicating the specific learning objectives for each geriatric domain. Also, the highest possible level of competency according to Bloom's criteria are indicated for each learning objective. The resulting geriatric teaching programme consisted of totally eight 45-minute lessons directed by a trained geriatrician covering all eight domains. The detailed structure of the geriatric teaching programme is provided in the Supplementary information.

### 3.2 | Self-rated competencies

The proportion of students self-rating their competencies as sufficient is shown in Table 2. At baseline, the highest self-rated competencies were for the domains gait and balance disorder (80%) and hearing impairment (73%). In contrast, the majority of students reported insufficient competencies on the domains decision-making capacity and malnutrition. The largest increases in self-rated competencies after the geriatric teaching programme were seen for the domains decision-making capacity and polypharmacy.

### 3.3 | Tested competencies

Table 3 displays the proportions of students succeeding on the geriatric competency test. In line with their self-rated competencies, the majority of students succeeded in the domains of gait and balance disorder and hearing impairment, whilst only a minority of students passed the test in the domains of decision-making capacity and cognitive impairment. The domains where students showed the largest increase in competency over baseline was for polypharmacy and malnutrition.

TABLE 1 Description of the geriatric teaching programme for undergraduate dental students

Geriatric domain	Learning objectives	Level of competency	Case-based scenarios
Cognitive impairment	<p>1A. The student demonstrates basic knowledge of dementia, including prevalence, definition, therapy and prevention</p> <p>1B. The student identifies a patient with cognitive impairment or (potential) dementia in the dental practice</p> <p>1C. The student can describe potential difficulties treating a patient with cognitive impairment in dental care</p> <p>1D. The student takes and appraises appropriate interventions treating a patient with cognitive impairment in dental care</p>	2416	87-year-old woman with severe dementia
Vision impairment	<p>2A. The student demonstrates basic knowledge of visual impairment including prevalence, main aetiologies and their impact on functional impairment</p> <p>2B. The student can identify a visually impaired patient in dental care</p> <p>2C. The student takes and appraises appropriate interventions treating a visually impaired patient in dental care</p>	246	75-year-old woman with visual impairment
Hearing impairment	<p>3A. The student demonstrates basic knowledge of hearing impairment, including prevalence, main aetiologies and their impact on functional impairment</p> <p>3B. The student can identify a patient with a hearing impairment in dental care</p> <p>3C. The student takes and appraises appropriate interventions treating a patient with hearing impairment in dental care</p>	246	78-year-old man with hearing impairment
Malnutrition	<p>4A. The student demonstrates basic knowledge of malnutrition, including definition, prevalence, main aetiologies, effects and therapy</p> <p>4B. The student can identify patients with malnutrition in dental care</p> <p>4C. The student can identify enoral causes of malnutrition and stages the appropriate dental interventions for treatment/improvement</p>	246	82-year-old woman with malnutrition
Gait and balance disorder	<p>5A. The student demonstrates basic knowledge of gait and balance disorders including definition, prevalence, main aetiologies and effects</p> <p>5B. The student can identify patients with a gait and balance disorder in the dental practice</p> <p>5C. The student takes appropriate interventions treating a patient with a gait and balance disorder in dental care</p> <p>5D. The student describes important activities of daily living, thereby establishing the connection to gait disorders and malnutrition</p>	2465	87-year-old women with gait and balance disorder falling on the floor
Analgesics	<p>6A. The student demonstrates basic knowledge of pain in the elderly, including definition, prevalence, main aetiologies and entities</p> <p>6B. The student can identify enoral causes of pain and stage appropriate interventions in dental care</p> <p>6C. The student considers non-pharmacological analgesic therapy when prescribing in dental care</p> <p>6D. The student prescribes an appropriate analgesic drug and applies the principles of safe prescribing, that is considers other medication that the patient is currently taking, underlying diseases of the patient, functional impairment, allergies, step-by-step plan according to the World Health Organization (WHO) and effects/side effects</p>	2666	85-year-old woman with painful caries

(Continues)

TABLE 1 (Continued)

Geriatric domain	Learning objectives	Level of competency	Case-based scenarios
Polypharmacy	7A. The student demonstrates basic knowledge of polypharmacy in the elderly, including definition, prevalence, main aetiologies, multimorbidity, overtreatment, undertreatment and inappropriate treatment 7B. The student prescribes an appropriate drug to a patient with polypharmacy 7C. The student checks indications, contraindications, side effects and interactions of drugs 7D. The student identifies important interactions and side effects of drugs in the case examples that were reviewed	2664	83-year-old man taking metamizol
Decision-making capacity	8A. The student identifies patients requiring an evaluation of their decision-making capacity 8B. The student can evaluate decision-making capacity using the defined criteria 8C. The student shows basic knowledge of a living will or advance healthcare directive 8D. The student determines the authorised substitute for patient lacking decision capacity 8E. The student takes appropriate interventions in these two frequent situations: → Patient refuses dentist-recommended dental intervention; → Patient consents to dental intervention, but the dentist is unsure if the patient → possesses sufficient decision-making capacity	46245	L: 83-year-old woman rejects dental treatment

TABLE 2 Self-rated sufficient geriatric competencies before and after the geriatric teaching programme (n = 30)

Domain of teaching programme	Students self-rating sufficient geriatric competencies, n (%)	
	Before geriatric teaching programme	After geriatric teaching programme
Analgesics	16 (53%)	22 (73%)
Cognitive impairment	17 (57%)	27 (90%)
Decision-making capacity	6 (20%)	27 (90%)
Gait and balance disorder	24 (80%)	28 (93%)
Hearing impairment	22 (73%)	28 (93%)
Malnutrition	6 (20%)	25 (83%)
Polypharmacy	8 (27%)	20 (67%)
Vision impairment	21 (67%)	27 (90%)

### 3.4 | Changes of self-rated and tested competencies

Self-rated competency scores significantly increased from a baseline score of 49.6 (SD 8.4) to a score of 67.9 (12.3) points after the geriatric teaching programme ( $p < .001$ ) (Table 4). Similarly, tested competency scores increased by a mean of 22.0 points over time (95% CI 16.6 to 27.4,  $p < .001$ ).

## 4 | DISCUSSION

A feasible and effective geriatric teaching programme for undergraduate dental students is hereby presented. We found that this dedicated geriatric teaching programme is effective both in improving self-rated and tested geriatric competencies of undergraduate dental students.

Overall, the geriatric teaching programme and assessments applied in the present study were newly developed because evidence of similar programmes in this context is lacking. Therefore, direct comparison of feasibility and efficacy on competencies of our study with other programmes and assessments is not possible.

The aim of a teaching programme is to insure that students achieve the a priori defined competencies. Thus, the fact that the tested competency scores significantly improved after the geriatric curriculum indicate that this aim was met. In addition, student self-rated competencies were reflected in their tested competency scores. In this context, the fact that the geriatric teaching programme is embedded in the last semester of their five-year curriculum has to be considered. Before starting the geriatric teaching programme, dental students already had considerable clinical training including treatment of older patients throughout their studies. Thus, these experiences may also affect the results of competencies that we evaluated in this study at baseline. Consequently, the impact of the overall curriculum of Gerodontology/Geriatrics on competencies might even be larger, if the same geriatric competency assessment was compared between first semester and last semester dental students. In contrast, the hypothesis, that tested

competency scores after the geriatric teaching programme were affected by other variables than the geriatric teaching programme cannot be excluded but is potentially negligible, because the programme was scheduled and completed within a five-week period.

The geriatric teaching programme features several strengths that can facilitate its implementation at other university settings. The teaching programme is transparent and straightforward, presenting both competencies that have to be achieved and case-based scenarios at the outset of the programme. The teaching programme is consolidated into eight lecture units and well-structured as presented here, can feasibly be incorporated into an existing curriculum at another university site. In particular, we found the use of case-based scenarios helpful in enhancing the self-reliant learning process of students. The group size of eight students was optimal, as it provided opportunities for students to bring forward their own ideas and examples to discuss in these tutorial sessions. Because the geriatric teaching programme was compulsory, we were able to ensure that all dental students attended the complete geriatric curriculum and contributed consistently to this project, limiting attrition and selection bias.

There are several limitations to our study. First, whilst we included all undergraduate dental students, the sample size of 30 is small. However, this teaching programme proved to be effective in

**TABLE 3** Succeeded geriatric competency test before and after the geriatric teaching programme

Domain of teaching programme	Students succeeding competency test, n (%)	
	Before geriatric teaching programme	After geriatric teaching programme
Analgesics	20 (67%)	28 (93%)
Cognitive impairment	6 (20%)	14 (47%)
Decision-making capacity	6 (20%)	17 (56%)
Gait and balance disorder	26 (87%)	30 (100%)
Hearing impairment	22 (73%)	27 (90%)
Malnutrition	13 (43%)	24 (80%)
Polypharmacy	6 (53%)	17 (56%)
Vision impairment	9 (30%)	17 (57%)

**TABLE 4** Change of self-rated competencies and tested competencies over time

	Before geriatric teaching programme, mean (SD) (points)	After geriatric teaching programme, mean (SD) (points)	Mean difference (points)	95% Confidence interval (points)	p-value
Self-rated competency <sup>†</sup>					
Overall score	49.6 (8.4)	67.9 (13.2)	18.3	12.6 to 24.0	<.001
Tested competency <sup>†</sup>					
Overall score	56.7 (10.8)	78.7 (10.2)	22.0	16.6 to 27.4	<.001

<sup>†</sup>All scales and subscales were standardised to a score ranging from 0 to 100, with 100 indicating the best possible score.

improving competencies of students and offers a solid and feasible format to teach undergraduate dental students. Second, due to the limited sample size, it was an a priori decision not to perform sub-analyses of domains or subgroups of our study population. Rather, we focused on overall comparisons of the assessment scales of self-rated and tested competencies, which limited bias resulting from multiple comparisons. Third, we focused only on the short-term effect of the training course on competencies. Additional follow-up would be necessary to determine long-term result in either direction. Fourth, the attitude of dental students towards older patients could not be evaluated, because so far there is no validated geriatric attitude scale in German for dental students in the cultural context of Switzerland.<sup>20,21</sup> The evaluation of ageism using a valid attitude scale is a field that needs further investigation amongst dental students. Finally, these findings are based on a one-site experience. Feasibility and efficacy have to be proven for other settings and cultural contexts.

Our study has several implications for research, clinics and teaching. Future research should address the question of whether implementing a geriatric teaching programme at another dental university will produce results similar to ours. Further work also needs to be conducted to investigate and eventually positively modify students' attitudes towards geriatric patients.

Our geriatric teaching programme is presented in detail providing a model that can be easily implemented by other dental schools. From a teaching and clinical perspective, it is important that dental schools and universities not only teach gerodontology principles, but also offer a dedicated geriatric programme to all of their students. Thus, we encourage dental universities to educate their dental students systematically on geriatric competencies.

## 5 | CONCLUSIONS

In conclusion, integrating a consolidated refined geriatric teaching programme is a potentially feasible and effective method for dental undergraduate students and is expected to have an impact on better dental care of older patients.

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## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

## AUTHOR CONTRIBUTIONS

AKS and MS designed the study, analysed and interpreted data. AKS drafted the first version of the work, and MS substantially revised the work. Both authors AKS and MS approved the submitted version and agreed both to be personally accountable for the author's own contributions.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available in the supplementary material of this article.

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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