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## Research training in dental undergraduate curriculum in Chile.

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**Abstract:** Research plays a central role in professional training in dentistry. There is a clear recommendation to include a minimum training in biomedical research at undergraduate level. In Chile, there is no standardized curriculum structure including research training for undergraduate students. **Objective:** To describe the presence of research courses in the undergraduate dental curriculum in Chile during 2014. **Methodology:** A descriptive cross-sectional study. The curriculum for all Chilean universities teaching dental careers and updated during 2014 were analyzed. **Results:** The dental curriculum for twenty Chilean universities was analyzed. On average, each university has  $4.05 \pm 2.06$  research courses (semesterly) from which  $1 \pm 0.92$  are thesis courses. In the private universities, these numbers were  $4.64 \pm 1.91$  and  $1.18 \pm 0.87$  respectively. Meanwhile, these numbers were  $3.33 \pm 2.12$  and  $0.78 \pm 0.97$  respectively in the traditional universities. Sixty percent of universities have thesis or research project courses. **Conclusion:** There is a disparate presence of research courses in the undergraduate dental curriculum in Chile, with a higher presence in private institutions. However, this does not actualize a greater scientific production by them.

**Keywords:** university, research, dental curriculum, Chile.

## Formación en investigación en las mallas curriculares de odontología en Chile.

**Resumen:** La investigación juega un rol central en la formación del profesional en Odontología. Existe una clara recomendación de incluir en el pregrado una cantidad mínima de formación en investigación biomédica. En Chile no existe una estructura curricular estandarizada que incluya investigación a alumnos de pregrado. **Objetivo:** Identificar la presencia de asignaturas de investigación en las mallas curriculares de las carreras de odontología dictadas en Chile para el año 2014. **Metodología:** Estudio descriptivo de corte transversal, la unidad de análisis correspondió a las mallas curriculares de la carrera odontología, de todas las universidades dictantes en Chile y actualizadas al año 2014. **Resultados:** Se analizaron las mallas curriculares de las carreras de odontología de 20 universidades chilenas. En promedio cada universidad tiene  $4,05 \pm 2,06$  ramos (semestrales) de investigación y de los cuales  $1 \pm 0,92$  son ramos de tesis. En las universidades privadas estas cifras son  $4,64 \pm 1,91$  y  $1,18 \pm 0,87$  respectivamente, mientras que en las tradicionales fueron de  $3,33 \pm 2,12$  y  $0,78 \pm 0,97$  respectivamente. El 60% de las universidades tiene algún ramo de tesis o proyecto de investigación. **Conclusión:** Existe una dispar presencia de ramos de investigación en los programas curriculares de odontología en Chile, con una mayor presencia en instituciones privadas. Sin embargo, esto no se materializa en una mayor producción científica por parte de ellas.

**Palabras clave:** Universidad, investigación, malla curricular, odontología, Chile.

### Introduction.

Research plays a central role in professional training in dentistry<sup>1</sup>, and there is consensus in promoting incorporation of subjects to enable dentistry students to understand and use information from scientific dental journals<sup>2-4</sup>. One of the recommendations on curriculum content is to include a research project as an integral part of the formative process. However, the minimum amount of hours needed to carry it out is not clearly defined<sup>5</sup>.

After expansion and diversification of Chilean higher education in the 80's, the issue of quality assurance started to gain importance in the early 90's. In 2006, the National System for Quality Assurance of Higher Education (Sistema Nacional de Aseguramiento de la Calidad de la Educación Superior, SINAC-ES)

was created. It brings three major players together: Higher Education Division of the Education Ministry (División de Educación Superior del Ministerio de Educación, DIVESUP), the National Council for Education (Consejo Nacional de Educación, CNED) and the National Accreditation Commission (Comisión Nacional de Acreditación, CNA). While licensing and accreditation are unique features of the CNED and the CNA respectively, these three actors share the task of providing information on higher education<sup>6</sup>. In Chile, universities do not have to comply with a standardized or compulsory structure regarding research topics. The National Accreditation Commission mandates that the study plan and the respective programs must be coherent, consistent with the principles and objectives of the unit and integrate the disciplinary

and professional training received through research, projects and/or the realization of a supervised and evaluated practice (CNAP)<sup>7</sup>. That is to say, it does not propose a mandatory work or research project in the curricular structure of dentistry careers at each university in order to be accredited. This situation is different in the United States, where accreditation standards for dental education programs require research as one of its six dentistry education components<sup>8-9</sup>.

Currently, there are more than thirty dentistry programs in charge of twenty institutions both traditional and private in Chile (The first ones are regulated by the Council of Rectors of Chilean Universities (CRUCH))<sup>10</sup>. Therefore, an average of 1,200 dentists graduates per year today.

The proportion of dentists for the rest of OECD countries is 1,200 inhabitants per each professional. In these countries, there are quality and quantity control systems for the graduates. Chile has a ratio of 1 dentist for every 950 inhabitants and it is expected that, by 2018, this ratio will be one dentist for every 550 inhabitants<sup>11</sup>. These values are very far from what the WHO recommended for developing countries, one dentist for every 2,000 inhabitants<sup>12</sup>.

Considering the number of dentistry careers taught in Chile has significantly increased and many of them incorporate the requirement of research work, it is curious to observe this increase is not reflected in a greater scientific productivity<sup>10</sup>.

For more than 90 years, there have been organizations that are concerned about dental research issues such as the International Association of Dental Research (IADR) and the American Association of Dental Research (AADR), both based in the United States. Afterwards, many similar movements appeared in Europe<sup>13</sup>. In general, research training in different dentistry areas is not encouraged at the same level in Latin America. Therefore, an important aspect to consider is adding new study programs to achieve quality training of human resources who are capable of carrying out quality research projects. This may help us to understand why dental research undergoes such underdevelopment in Latin America in comparison with The United States and Europe<sup>14</sup>.

In general terms, there is a clear recommendation to include a minimum amount of biomedical research training in undergraduate programs<sup>5</sup>, which is reflected in different forms in the formal curriculum depending on each country and institution<sup>15-18</sup>. Special programs to support additional or dual integrated training as a researcher-clinician must be added like in the United States and other developed countries<sup>19-22</sup>.

Among the various types of training, one of the

most recurrent is the realization of a project or research thesis at the end of the program, which would be supported by subjects of the area studied during the previous years. Generally, this is a requirement for degree completion<sup>23</sup>. In Chile, there is a similar system to complete the program with a project, thesis, dissertation or research work.

Another possible factor involved in research development is training quantity and quality at undergraduate level. Unfortunately, there are no published studies in this regard. The objective of this research is to identify the presence of research subjects in dentistry curriculum for programs taught in Chile during the year 2014.

#### Materials and methods.

Is a descriptive study. The analysis corresponded to the updated curriculum of the universities offering dentistry programs in Chile during 2014.

Curricula were searched on the university institutional websites and downloaded in PDF format. The following variables were included for the university: name and type (traditional or private); and for the research subjects: number, semester in which it is dictated and type (see below). In the event that a university had several campuses, each of them was searched for the curriculum.

Given the absence of classification in this regard, all subjects including any of the following words: *research, epidemiology, (bio)statistics, thesis, scientific, evidence, memory, methodology* and variations of these terms and their possible combinations in their names were considered as research subjects.

To simplify designations, five types of subjects were considered: scientific research methodology (metodología de la investigación científica, MIC), epidemiology (EPI), biostatistics (BIO), evidence-based dentistry (odontología basada en la evidencia, OBE) and thesis (tesis, TES). For EPI, BIO and OBE types, subjects with exclusive names were considered, i.e., they did not include another one or it was the first name (e.g., "Epidemiology and Biostatistics" corresponds to EPI). In the TES type, subjects with denominations of *thesis, project, and memory*, taught in the fifth and/or sixth year of the program, were included. The rest of the subjects were included in the MIC type. In all the cases, semi-annual subjects were considered; annual ones were considered separately in both semesters.

Data were tabulated on a MS Excel 2003 spreadsheet (Microsoft Corp., Redmond, USA). Descriptive statistical analysis was carried out and frequency distribution was presented in tables

**Results.**

The curricula of twenty dentistry programs in Chilean universities were analyzed. There were no differences between curricula in the cases in which the universities had more than one headquarter. On average, each university had  $4.05 \pm 2.06$  research subjects (yearly), of which  $1 \pm 0.92$  were thesis subjects. In the private universities, the numbers were  $4.64 \pm 1.91$  and  $1.18 \pm 0.87$ , respectively. While in the traditional ones, they were  $3.33 \pm 2.12$  and  $0.78 \pm 0.97$ , respectively.

A 40% of curricula do not explicitly reference research subjects (thesis, memory, project or similar), whereas only one university had subjects referred as OBE. A 40% had

a research subject during the first year. This amount rises to 70% by the end of the second year and 95% by the end of the third one, 60% had at least one thesis subject or research project.

According to the search performed through the web pages of each institution, only the University of Valparaíso and Universidad de Chile offered information regarding hours of each subject. The latter also gave information regarding credits of each subject. The other universities did not have information in this regard.

Subject distribution per type, university and semester, and coded by color and sequence, is shown in Table 1.

University	Sem 1	Sem 2	Sem 3	Sem 4	Sem 5	Sem 6	Sem 7	Sem 8	Sem 9	Sem 10	Sem 11	Sem 12
Universidad de Chile			1	2			1	2	3	1		2
Universidad de Concepción					1				1			
Universidad de Valparaíso		1				1			2	1	2	
Universidad de Antofagasta		1	1									
Universidad de Talca	1			1							1	2
Universidad de La Frontera												2
Universidad Mayor					1	2			1		1	2
Pontificia Universidad Católica de Chile	1							1				
Universidad Austral de Chile			1						2		1	2
Universidad de Los Andes			1	1	2	3					1	2
Universidad Autónoma			1	1								1
Universidad Bolivariana		1	1	1								1
Universidad del Desarrollo						1	1	2	3	4		
Universidad Diego Portales			1			1						
Universidad Finis Terrae	1	2	3	4		5					1	2
Universidad de La Serena					1	1			1			
Universidad Andrés Bello						1	2				1	2
Universidad Pedro de Valdivia		1		1	2				1	2	1	
Universidad San Sebastián			1									
Universidad de Viña del Mar		1	1						3	1	2	

Codes ■ Biostatistics ■ Epidemiology ■ Evidence-based dentistry ■ Methodology ■ Thesis

Table 1. Distribution of dentistry research subjects according to semester and university, Chile, 2014.

## Discussion.

On average, there are four research training subjects yearly. Some curriculum offered information about credits and hours. However, since it was not so for the majority of them, it was not possible to conduct a more in-depth analysis of this aspect. In spite of this, estimating a minimum of two teaching hours per week for each subject, it is appreciated dental students have a minimum of 120 teaching hours throughout the program. Considering the information about transferable credits for subjects which some universities reported, this number can rise to 750 teaching hours.

Taking into account thesis subjects or research projects, usually taught during the sixth year of the program, it can be seen they are explicitly present in three out of five universities and mainly in private ones. However, this is not translated into more scientific production. Partly, this can be explained by considering such presentations may be published in conferences and/or journals not indexed in the ISI database or are not being published at all<sup>24</sup>.

This first approximation to research training for undergraduate dentistry students has been chosen based only on the name of the subjects. However, this does not necessarily account for the real training development in these subjects or other extra-curricular instances offered by the universities. We must reiterate this research subjects classification clearly has an arbitrary character, which is solely intended to simplify the analysis of this first approach to the topic, so it should be understood with caution. In some universities, other subjects, such as public health or integration, may have some research aspect, but they were not considered in this instance due to the likely clinical approach they could have.

Despite the limitations of the present study, it is still interesting and paradoxical to note the private universities have almost 40% more research subjects than the traditional ones, but it does not mean a tangible impact on the scientific productivity<sup>10</sup>. By the way, the amount of articles a dentistry school publishes does not depend on the number of teaching hours per week their students have in research training, but we could foretell they are related. This is contradicted in this case; the traditional universities are the one that have more publications in ISI type journals.

Another point of interest is that there were no qualitative methodology subjects. Historically, this is not surprising given that this type of research has been strange to the dental profession<sup>25</sup>. There is data showing some universities included it in the methodology subject. Over the years, quantitative research, which delivers data and numerical and solid repeatable results enhancing the possibility of statistical information in large population groups, has been preferred<sup>26</sup>. But when looking at what happens in health careers such as

nursing<sup>27</sup>, it is important to recognize some areas of the dental practice, such as patients and professionals' satisfaction or quality of life issues, can be addressed using this methodology to enrich its view.

Research training present in the curriculum or other programs designed for dentists' instruction is mainly up to institutional decisions. Nevertheless, the presence of the lead actor, the student, must not be forgotten. In other countries, the students' perception of the research training or preparation they get has been investigated and, in general, it shows various limitations to investigate at undergraduate level<sup>28-29</sup>. However, it is recognized among the most important areas to develop<sup>30</sup>. In other countries, this model implementation has been beneficial and has allowed the students to develop critical skills<sup>31</sup>.

Dental Schools in the US have started to increase their emphasis on evidence based education (EBE), defined as the use of current scientific research in dentistry as a basis for planning clinical treatment in patients<sup>32-33</sup>. A four-year program with compulsory and elective components was executed in several cities in the same country. At the end of the program, it was noted the new curriculum had a favorable impact on students and teachers. In addition, research production increased in the school and institutional credibility amongst other universities and the research community was gained<sup>34</sup>.

It is essential to have professionals who are capable of formulating hypotheses which are clinically relevant, who guide health actions and not just implement medical services<sup>10</sup>. Development in biotechnology and biomedical sciences in general, along with the new advances in knowledge and dentistry technology has generated such amount of new knowledge that is virtually impossible to maintain the structure of the traditional curriculum (i.e., where education is based on teaching independent subjects). It has become evident that the programs and traditional teaching methodologies are not effective in promoting habits that instill self-directed learning, which is so necessary in today's knowledge society and, especially, for health care providers<sup>35-36</sup>.

Generation of scientific activity at undergraduate level should be key for the students' integral formation. Having knowledge about the scientific method and how to use it as a basic tool for conducting research will allow them to take a critical view of the scientific information, increasing their analysis capacity for therapeutic decision-making, the patient being the main beneficiary of this process<sup>37</sup>.

The solution lies in adding flexibility to the curriculum models and integrating the basic sciences, medical and dental, both vertically and horizontally. This should inspire students to become apprentices for life and to continue the knowledge acquisition process for practice based on evidence throughout their professional life<sup>5</sup>.

A point to investigate in the future is the amount of undergraduate research that ends up being presented at congresses of the area or published in indexed journals. Then, on that basis, identify the factors which facilitate or hinder the last stage of the research process, publication, paying special attention to organizations such as the National Scientific Association of Dental Students (Asociación Nacional Científica de Estudiantes de Odontología, ANACEO) and the National Congress of Dental Students (Congreso Nacional de Estudiantes de Odon-

tología, CONADEO) conducted annually throughout the country.

It is possible to conclude that there is a disparate presence of research subjects in the dentistry curriculum in Chile, with a greater presence in private institutions. This is a first approximation and future research is needed to recognize the factors that will stimulate researchers' formation at undergraduate stage and determine whether the curriculum must be adapted to these new paradigms in research.

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