DIPLOMA IN APPLIED BIOSTATISTICS:
AN EXPERIENCE IN CONTINUING EDUCATION

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This work describes the program "Diploma in Applied Biostatistics"(DAB) which is designed to train or to bring up to date in Biostatistics and its applications the teaching professionals and researchers in the fields of Public Health and Biomedicine. This program has been offered since the year 2001, and to this date 67 health sciences professionals have participated in it; 67% of them physicians. This is a continuing education program that combines in person teaching with online distance education and it is fully accredited by the University of Chile. DAB is currently organized into three modules of biostatistics applications that span a total of 269 hours. The program runs from June to December with 100 hours of "in attendance" instruction distributed into seven intensive periods of two days each (Friday and Saturday), and 169 hours of distance education, distributed into six periods.

INTRODUCTION

Chilean heath professionals have realized that in order to perform their research activities in an up to date and competitive manner they need instruction in Biostatistics. In particular, they are in need of a program that integrates foundations and applications of biostatistics. To respond to this need the Division of Biostatistics and Demography of the School of Public Health of the College of Medicine of the University of Chile started in 2001 a project of instruction in Biostatistics as a continuing education program. The objective of the present work is to describe this program denominated "Diploma in Applied Biostatistics" (DAB) that has been developed to meet the needs of these health care professionals. The DAB is fully accredited by the University of Chile and offers the students the option of being formally evaluated. Students who choose this option have the possibility of transferring the credits obtained in the DAB to any of the graduate programs offered by the School of Public Health (Decree Nº 0027613. Univ. of Chile.) Choosing this option also qualifies them to obtain financing for the cost of the program through the National Service of Preparation for Employment (Code SENCE: 12-34-6666-76). In recent years, the program has been filled to capacity with most of the students choosing the formal evaluation option.

The DAB has evolved since its first offering in 2001. In its initial version, the program was taught over a period of three months. Each month included a one-week intensive "in attendance" instruction period (30 hrs per week) for a total of 90 hours. At that time, the program consisted of a total of 200 hours of work distributed into the areas of Biostatistics, Data Analysis Laboratory, with support of statistical software, and individual student work. The later versions evolved from 4 to 6 "in attendance" instruction periods.

Presently, the program is organized into seven "in attendance" instruction periods of two days each (Friday and Saturday) from June to December (100 hrs), and six online distance education periods (169 hrs). The topics covered by the program are divided into three modules: Exploratory Data Analysis, Probabilistic Modeling, and Statistical Modeling plus the elaboration of an individual project of investigation which is reported and evaluated during the last "in attendance" instruction period.

METHODOLOGY

Diploma in Applied Biostatistics combines theoretical and practical lectures taught at the School of Public Health with lectures and activities presented in distance education form via the Internet. Currently, the program is organized into three modules of application in biostatistics denominated: Exploratory Data Analysis, Probabilistic Modeling, and Statistical Modeling spanning a total of 269 hours of instruction. The program runs from June to December with 100

hours of "in attendance" instruction distributed into seven intensive periods of two days each (Friday and Saturday), and 169 hours of distance education, distributed into six periods.

To satisfy the needs of the health professionals who enroll in the program the DAB has been designed to achieve the following objectives:

- To uncover the relationship between statistics and its methodology to those of biomedical research.
- To recognize the most common study designs most commonly used in clinical and epidemiological research.
- To identify and to validate the probabilistic models most frequently encountered in practice.
- To evaluate the association between qualitative and quantitative random variables.
- To compare expected values, variances and proportions in different study designs.
- To estimate parameters for the models most commonly encountered in the area of the biomedical investigation.

To achieve these objectives the topics covered in the program have been organized into three modules: Exploratory Data Analysis, Probabilistic Modeling and Statistical Modeling. The contents of each of the modules are outlined below:

Module I: Exploratory Data Analysis

- The scientific method: Uncertainty, models, hypothesis, information and decision making
- Key designs in biomedical investigation: Observational studies and experimental designs.
- Health indicators: mortality, morbidity, and prevalence rates. Ratios and proportions.
- Tabular representation, graphical representation, and summary measures
- Biomedical applications.

Module II: Probabilistic Modeling

- Common probability models for discrete and continuous random variables.
- Formulation and analysis of the hypotheses most frequently encountered in biomedical research.
- Biomedical applications.

Module III: Statistical Modeling

- Sampling of human populations. Simple, stratified, systematic and cluster samples.
- Case studies
- Analysis of the association between two or more random variables.
- One and two-way analysis of variance, parametric and nonparametric.
- Linear and logistic regression models and other methodologies. Applications.
- Risk factors and protective factors. Case studies.

A summary of the program's contents and the program's calendar can be seen in detail at the Internet address www.saludpublica.uchile.cl.

During the "in attendance" instruction periods the classes are a mix of theory and practice that makes substantial use of the statistical software *STATA* (version 8.2.) A sizeable portion of the study materials is given to students at the beginning of each of these periods. The classes taught during the "in attendance" instruction periods address the fundamentals of the subject matter that the student will study during the subsequent distance learning period and provide a foundation that allows the student to continue learning the material on his/her own. It is important to remark that the students are encouraged to use databases of personal interest during their participation in the program. I should also be noted that all the faculty members who teach these courses have— in addition to their pedagogical experience—ample experience with concrete applications of statistics that they utilize as a rich source of examples involving real data for the classes they teach for the program.

During the distance learning periods the students receive, via Internet, additional documentation such as problem guides, and required and optional readings. These materials have been designed to promote critical analysis of publications, peer discussions, and discussions with the teaching staff. To support this segment of the program, the Division of Biostatistics and Demography maintains a computing platform that facilitates a permanent flow of information in

the form of announcements, documents, exercise guides and their solutions, and a discussion forum.

The students' degree of progress is assessed by means of formative evaluations via electronic mail and their work on problems that involve real data. At the beginning of each module the students take a cumulative written evaluation on the material covered on the previous modules. In the course of the final evaluation period the students present a work of personal interest centered in the planning and development of a research project. The students who complete all the evaluations satisfactorily receive the certification of Diploma.

RESULTS

To date, five versions of the DAB have been offered and 67 professionals have completed the program. The fields of occupation of those professionals are distributed as follows: Doctors (67%), Nurses (1.5%), Nurse Midwives (9%), Biologists (19.4%), Statisticians (11.9%), Veterinary Doctors (4.5%), Public Administrators (4.5%), Dentists (4.5%), and Translators (1.5%). The five versions of the program have differed in the number of "in attendance" instruction periods, total number of hours of instruction and the number of students. Table 1 exhibit this evolution. The number of "in attendance" periods increased from three to seven, the number of hours of instruction have leveled at 269 hours, and the last two versions of the program show a four-fold increase in the number of students.

Table 1: Number of "in attendance" instruction periods, number of hours, and number of students in the five versions of the DAB program

Year	Number of "in attendance" instruction Periods	Total Number of Hours	Number of Students
2001	3	200	5
2002	4	300	8
2003	4	264	18
2004	6	264	24
2005	7	269	21

In the 2004 year version the average grade of the students who chose the formal evaluation was 5.83 in a scale of 1 through 7 (where 7 is best). Sixty-three percent of the students attended all the "in attendance" instruction periods regularly and the rate of desertion was of 12.5%. The 2005 version of the program is underway.

At the end of each offering of the program the students' opinions and suggestions about what works well and what needs improvement in all the aspects of the program have been gathered; this information has been extremely valuable and has been dutifully used for planning later versions.

DISCUSSION

This presentation describes our experience developing five successive versions of the "Diploma in Applied Biostatistics" (DAB) in the School of Public Health of the University of Chile.

The "at distance" component of the program facilitates the participation of professional residents far from Santiago, the city headquarters of the University of Chile, recovering the character national global institution that this university had up to 1980; this is really appreciated by people that don't have the possibility to move (mainly for labour reasons) for long periods to the capital to develop activities of professional improvement.

On the other hand, the "in attendance" component is valued very positively by the participants in the program, so much in the formal evaluations that they make when concluding this, as well as in the informal conversations; they recognize that the criteria of statistical analysis that are built with relative easiness in the personal exchange, would be difficult to apprehended in

an only virtual interaction; by the way, such only virtual interaction it can be adequate and enough to deal with other subject matters.

These five versions of the DAB have been limited to a share of 25 students to guarantee that the "in attendance" sessions developed in the Computation Laboratory can be developed without difficulties. The activities of the "at distance" periods could be developed simultaneously for an unlimited number of participants devoting more academic time to that dialogue. If the number of potential students continued growing, it could be considered the possibility to offer the program twice every academic year.

WEB REFERENCES
School of Public Health, College of Medicine, University of Chile, www.saludpublica.uchile.cl.