

# Designing and Evaluation of a Professional Iranian Software Package for Electronic Medical Record Documentation of Patients Referred to Periodontics Departments

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## Abstract

**Background.** This project aimed to design, develop and evaluate an integrated professional software package for filing the medical records of patients referred to periodontics departments. The software was intended to provide a range of features, including the availability of voice commands and retrieval of patient information based on different indices and characteristics.

**Methods.** The overall percentage of satisfaction with the software was 90%. Moreover, 86.66% of the respondents preferred digital dental records to conventional records. Satisfaction in the reduced time of information registration and the advanced search options and availability of voice commands were 84% and 100%, respectively.

**Results.** The overall percentage of satisfaction with the software was 90%. Moreover, 86.66% of the respondents preferred digital dental records to conventional records. Satisfaction in the reduced time of information registration and the advanced search options and availability of voice commands were 84% and 100%, respectively.

**Conclusion.** According to the users' opinions, different features of the software, availability of voice commands and advanced search options, facilitated its use and decreased the time required for filing medical records. These features increased the users' interest in the software.

**Key words:** Electronic health records, information management system, periodontics, software development.

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## Introduction

Maintenance of high-quality medical and dental records is of utmost importance in promoting

healthcare quality.<sup>1</sup> Archiving such records would not only provide easy access to patients' medical history and medical encounters, but also facilitate the choice of appropriate measures (based on previous

treatments) and prevent procedures which could potentially threaten each individual's general health. Physicians and other health care providers are hence legally obliged to fill out medical records for all patients. However, due to time limitations, these records generally remain incomplete and some important examinations are neglected. As a result, the prevention and diagnosis processes are negatively affected and serious problems arise in patients' treatment. Medical records are currently the only method of communication among all health care personnel and should thus accurately reflect the applied care and treatment processes.<sup>2</sup>

Some sort of documentation has always existed in the history of medical practice. Although the documents and images from the old medical files may not be classifiable as medical records based on modern definitions, the mere existence of such documents highlights the significance of maintaining medical records.<sup>3</sup> Quality improvement programs in hospitals use a variety of instruments to assess the diagnosis and treatment processes. Since medical records contain detailed information about disease courses and all the provided care, they are considered as valuable medical care quality assessment tools and major components of the mentioned programs.<sup>4,5</sup>

Medical records, consisting of crucial documents about patients' health status, aim to facilitate health care team education, enhance communication among the health care personnel, allow other involved organizations (e.g. insurance companies) to assess the quality of the provided care, and ultimately promote patients' health through the provision of reliable health information.<sup>6</sup>

In university hospitals, physicians and medical students are more involved in writing medical records than other health staff. Therefore, easy, fast, and accurate preparation of medical records in such hospitals would depend on the provision of appropriate facilities based on the needs of this group of health care providers. These facilities should not only ensure simplicity and accuracy, but also remind the physicians of the required information and guide them by recommending possible choices.

The present study used one of the most productive and powerful programming languages to design and evaluate an integrated professional software package for filing medical records of patients suffering from periodontal diseases. The designed package ensured simplicity, accuracy, integrity and speed through the provision of a user-friendly interface and a range of features, including easy retrieval of patient information based on different indices, storage of disease-

related images as digital files, simple charting, availability of printable versions of patient files, and easy calculation of clinical indices such as the plaque index.

## Methods

This applied qualitative project started by holding a meeting with a number of periodontology professors, associate and assistant professors, and students, a dentistry student (all from Isfahan, Iran) and a software developer familiar with artificial intelligence. During this meeting, different modes and contents of medical records, the needs of a researcher, the features and design of the software, ease of access, the educational requirements of electronic record registration, integrity of the records, the required storage space for the records and the specialized topics related to the registration of the records were discussed. After reaching a consensus about the mentioned issues, an algorithm was developed to organize the preliminary data. The algorithm was then divided into several parts and the necessary parts were converted into flowcharts.

All programming was performed using Visual Basic in Microsoft Visual Studio 2010. After several times of debugging, different parts of the package were separately prepared as Alpha and Beta versions (Figure 1). The program was tested by 30 recently graduated dentists who were completely familiar with periodontal record writing. The comments of these individuals were then used to improve the program. The project was compiled using Ultimate Visual Basic 2010 in Microsoft Windows 8.0 and the final version, called the Gold version 1.1.1.1, was finally released.

In the next stage, 30 recently graduated dentists who were familiar with manual writing of medical records for patients with periodontal diseases were trained to work with the software. They were then provided with a 26-item questionnaire which measured their satisfaction with different parts of the package. The collected comments were qualitatively evaluated and reported in percentages (Appendix 1).

Each item had five or six qualitative choices (including perfect, very good, good, moderate, bad, and very bad) and a total of 100 points. Therefore, for five-choice items the scores were 20, 40, 60, 80, and 100 for very bad, bad, moderate, good and very good, respectively. The choices of six-choice items were scored as multiples of 100/6. Reverse scoring was performed in cases of items #3 and #24 (asking about the need for further revisions). The partici-

pants' scores of each item were finally summed and reported as percentages.

The problems reported by the participants, including grammatical and typographical errors, the use of decimals instead of integers, and more comprehensive use of voice commands, were resolved in the first stage.

In order to minimize the printing costs, during all stages, all information was printable on two sides of a single paper.

**Results**

Features and advantages of the software package in practice:

- Easy registration of information through voice commands;
- Considerable increase in infection management following the reduction in the manual registration of information;
- Retrieval of patient information based on different indices and characteristics;
- Possibility of saving files and disease-related images;
- Easy charting;
- Printability of electronic patient files (Figure 2);
- Simple calculation of clinical indices such as the plaque index;
- User-friendly interface;
- Accessibility of information for future research and research infrastructure develop-

ment;

- Integrity of information registration;
- Guidance in selecting appropriate indices for each individual patient;
- Reminders to provide the unregistered information;
- Decreased size of the printable version (plus the required images) without eliminating information; and
- Upgradability of the software.

The participants' overall satisfaction with the software was 90%. Moreover, 86.66% of the respondents preferred digital dental records to conventional records. The percentages of satisfaction with the reduced time of information registration, simplicity of the system, and the advanced search options and availability of voice commands were 84%, 76% and 100%, respectively (Table 1, Figure 1).

**Discussion**

Most available software packages for electronic registration of medical, particularly dental, records are solely commercial. They are actually very similar to accounting software programs with specific fields for the registration of patient complaints and diagnoses. Consequently, they have no use other than recording the comments of physicians. The present research project was designed to fulfil the need for a more specialized tool for simple registration of more scientific information in medical records.

Ghafari et al evaluated the knowledge, attitudes

**Table 1. The users' answers to the questions related to the satisfaction with the program (based on number)**

Question	****	****	****	****	****	****
1	16	10	4	0	0	0
2	-	16	10	3	1	0
3	-	6	12	12	0	12
4	-	2	21	6	1	0
5	-	7	15	8	0	0
6	-	5	14	10	1	0
7	-	0	16	14	0	0
8	-	0	15	15	0	0
9	-	4	20	6	0	0
10	-	7	20	3	0	0
11	-	23	7	0	0	0
12	-	0	7	23	0	0
13	-	0	12	18	0	0
14	-	5	19	6	0	0
15	-	0	0	29	1	0
16	-	13	16	1	0	0
17	-	30	0	0	0	0
18	-	10	16	4	0	0
19	-	30	0	0	0	0
20	-	10	17	3	0	0
21	-	23	7	0	0	0
22	8	19	-	-	2	1
23	-	16	10	4	0	0
24	-	0	3	7	17	5
25	-	17	8	5	0	0



Figure 1. Schematic representation of one of the completed pages.

and performance of medical students in Mazandaran University of Medical Sciences (Iran) and concluded that 77.8% of the studied population had poor knowledge about the principles of filing medical records. However, 54.1% of the participants had a favorable attitude toward the significance of medical records in not only patient treatment, but also medical education and research. Moreover, 21.8% of the students had poor performance in filing medical records.<sup>7</sup> Kahouie et al reported similar findings in a study on the knowledge and performance of medical students and residents of Semnan University of Medical Sciences (Iran) about the documentation of the provided care.<sup>8</sup> Therefore, by providing the user with a multiplicity of options for each part, the software program de-

signed in this study helped the users remember to include all the required information. With the increasing popularity and availability of personal computers and microcomputers, such a software program can be used by literally every dentist.<sup>9</sup>

Overall, the participants in this study rated the nature of the program as “good” or “very good”. Two distant items with similar content and different phrasing were used to ensure the accuracy of responses. Since the responses to these items were 100% similar, the participants seem to have completed the questionnaire with acceptable accuracy.

The availability of voice commands and advanced search options were associated with the greatest levels of satisfaction. In fact, all the participants rated

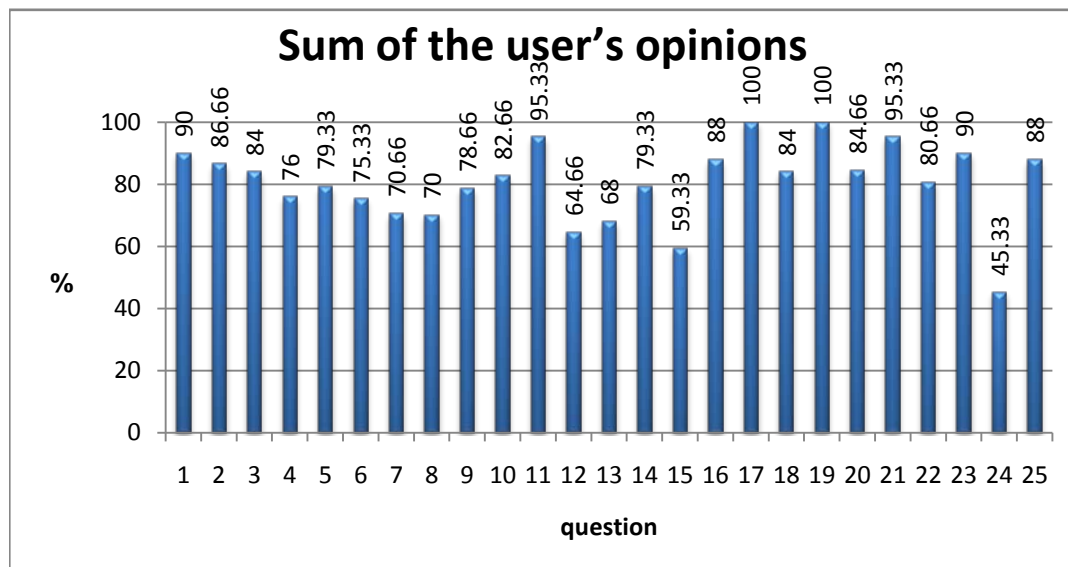


Diagram 1. Sum of users` scoring to the questions related to the satisfaction with the program (by percentage).

The screenshot displays a comprehensive medical record for a patient. The interface is divided into several sections:

- Patient Information:** Includes name, age (27), sex (Male), and a clinical note: "+HBV".
- MEDICAL HISTORY:** Lists conditions such as "MD Cardiovascular Disease, Hypertension, History Of Allergy, Mouth Swallowing, History of Myocardial Infarction In 6 month ago".
- EXAMINATION:** Details findings for various teeth, including "Upper Central Incisor" and "Lower Central Incisor".
- GINGIVA:** Notes "Pinkish, Shiny, Bleed, Loose, 100% Swelling (red, enlarged)".
- MASTICATION:** Describes occlusion as "Overbite 3mm, Overbite 3mm" and excursion as "Working: Good, Nonworking: No Contact".
- ETIOLOGY:** Identifies factors like "Lateral Incisor Plaque, Swallow, Mouth Swallowing, Periodontal Bacterial Plaque".
- RADIOGRAPHIC ASSESMENT:** Notes "PDL: 0", "Shor root: No", and "Lamina Dura: Present".
- OVERALL PROGNOSIS:** A summary table with a result of "Fair".
- DIAGNOSIS:** "Localized Moderate Chronic Periodontitis".
- INDIVIDUAL PROGNOSIS Table:**

TOOTH NO.	Abutment	Attachment Loss (mm)	Bone Loss (%)	Type Of Bone Resorption	Function Involvement	Result
12	Yes	22mm	18%	Horizontal	3	Questionable
36	No	24mm	28%	Vertically	3	Fair
		mm	%			
		mm	%			
- TREATMENT PLAN:** Includes "Scaling and Root Planing".
- Meeting 1:** "Charting, Scaling and Root Planing".
- Meeting 2:** (Empty).

Figure 2. Schematic representation of one copied file by using entered information in the program's questionnaire.

these two features as “very good”. Apparently, all the users of such systems are interested in simpler and faster methods of completing medical records.

Specifically designed software programs are currently used in different fields of dental sciences, including root canal therapy,<sup>10,11</sup> dental emergencies,<sup>12,13</sup> dental prostheses<sup>14</sup> and diagnosis.<sup>15</sup> During software development in this project, the research team attempted to consider all the needs of the dentists in the treatment and follow-up of periodontal diseases.

Since the software developer trained the users to work with the software, the advantages and features of the software might have been inadvertently exaggerated (although every effort was made to prevent such bias).

Finally, the upgradability of the software provides the opportunity to create a more dynamic tool to meet the ever-increasing needs raised by scientific developments in the field of periodontal diseases.

**Conclusion**

According to the users, different features of the software, e.g. availability of voice commands and advanced search options, facilitated its use and decreased the timerequired for filing medical records. These features increased the users’ interest in the software.

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