

# Evaluation of Dental Patient Record's Content: Preliminary Results

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## **Abstract**

*Objective was to evaluate the content of the patient's dental record. Ten records of active patients, at least two years old with minimum three treatment procedures, maintained at the University of Pittsburgh's School of Dental Medicine were reviewed. Two dentists trained in biomedical informatics compared the contents of the records to a Baseline Dental record (BDR) developed in an earlier study. Total of 187 data-fields were identified from the dental record forms and an average of 137 data-fields were documented. 66 data-fields (35%) were classified as administrative and 121 (65%) as clinical. Out of 121 clinical fields, only 68 data-fields could be cross-mapped to the BDR. The remaining 53 data-fields were updated to the BDR as explicit data-fields. 17 data-fields were defined and updated to the BDR as implicit data-fields. Absence of appropriate data-fields in the dental record contributes to the incomplete documentation of patient information by the dentists.*

**Keywords:** *electronic dental records; computer-based patient records; dental record content and format; dental record data elements; evaluation of dental record content; dental informatics*

## **Introduction**

For more than a century dental patient records are used as a tool to document patient findings and to

assist clinicians during patient care. The American Dental Association (ADA) defines dental patient record as "the official office document that records all diagnostic information, clinical notes, treatment performed and patient-related communications that occur in the dental office, including instructions for home care and consent to treatment" [1]. As stated in the frequently quoted statement, "dentists and patients forget but good records remember", complete and comprehensive patient records are essential to support the decision-making process and to perform outcomes research [2]. Unfortunately current evidence suggests that dental records vary significantly in the degree to which they meet this standard and may be inadequate [3, 4]. The standard of record keeping may be improved by the existence of structured record cards or computerized record keeping systems that guide the dentist through the examination in a logical manner [5]. Today as more and more dentists adopt electronic dental records to deliver patient care, it is essential we address the question of what information needs to be documented during a typical patient visit and how it should be structured in an electronic patient record [6].

The scope and completeness of patient records differ among dentists, and many non-standardized and idiosyncratic approaches to documenting care are in use. Despite the significance of a complete patient record documentation, several studies in the last two decades demonstrated the poor dental record keeping maintained by dentists [3-5, 7, 8]. The inadequate

documentation was found not only in United States but also in other countries such as the United Kingdom, Australia and Scandinavia. In an early study performed by the Wisconsin Dental Association (WDA), it was found that each dentist made his own record keeping system thus resulting in a lack of standardization or uniformity in the patient records maintained by dentists [2]. This in turn made it impossible to evaluate the quality of dental care provided to the patients. As a result, the WDA Council on Dental Care developed criteria for the characteristics, format and content of a quality dental record that could potentially be used as a standard by dentists. Meanwhile, several other dental organizations ranging from state, national and international level worked on developing the essential components in a patient record. Notable among them are the guidelines developed by Shoen et al in 1989 [9], the minimum record keeping standards for patient records developed by the Minnesota State Board of Dentistry in 1997 [10], 'The Dental Patient Record: Structure and Function Guidelines' developed by the American Dental Association in 1987 [11] and guidelines on the content of clinical records developed by the Faculty of General Dental Practitioners (UK) [12].

In spite of all these work, a study performed by Osborn et al [13] found that the records maintained by dentists in Minnesota were inadequate even when they perceived them to be adequate. A high percentage of dentists who perceived their documentation to be adequate and inadequate did not record certain aspects of medical documentation such as medication dosage and relevant family history. They also failed to record dental phobias and last dental visit in the dental history documentation and missed documenting complete clinical findings such as existing restorations and their condition, prostheses and their condition, occlusal status, endodontic status and temporomandibular joint status. Similar observations were found in an earlier study conducted by Minden among Florida dentists [14]. In addition, both studies found significant variation in the forms used by dentists and stressed the need for implementation and further development of guidelines for information in an electronic dental record [13-14].

Currently dentists are increasingly using computer-based patient records for patient care [15]. A recent study that investigated the content of paper records and computer-based dental patient records confirmed that there is limited agreement on what information dental records should contain [16]. They also found that the four major computer-based dental records cover this information only partially. This is a major

barrier to realizing the benefits of having computer-based patient record such as exchanging patient information among providers, patients and other stakeholders in healthcare and having access to the best evidence at the point of care during patient care. Therefore the need to develop a national standard for the structure and content of electronic dental patient records is significant in order to realize the full benefits of computer-based patient records.

The objective of this study was to evaluate the content of the patient's dental records to build a set of clinical data fields that would aid in standardizing the documentation architecture of an electronic dental record. This study builds directly on a previous study [16], in which the dental record forms were analyzed to compile a Baseline Dental Record (BDR). The structure of the BDR was based on the 'ANSI/ADA Specification No.1000: Standard Clinical Data Architecture for the Structure and Content of an Electronic Health Record' [17]. The BDR was designed by merging and categorizing all data elements from paper records of four dental practices, two dental schools, four record vendors and three textbooks. The study revealed a large variation in the structure and content of both paper and computer-based dental records.

## Methods

While the previous study examined only the dental record forms, this study focused on what was actually documented in the patient's dental records. The BDR, a structured collection of 363 data fields organized under 20 information categories was used as a reference to classify the documented patient information in the reviewed dental records and updated.

To achieve the objective of this study, two dentists trained in biomedical informatics (AA, TW) (henceforth called as reviewers in the manuscript) compared and classified the contents of ten paper-based patient dental records to the content of the BDR. The reviewers identified data fields from the University of Pittsburgh's School of Dental Medicine (SDM) record format. The clinical documentation in each of the ten dental records was also examined to define any specific data fields that were missing from the record format. The list of identified data fields were then mapped to the BDR data fields to examine if they were present in the BDR. The data fields that were not present in the BDR were added to it as either *explicit* or *implicit data fields*.

The reviewed patient records were maintained by the dental students at the University of Pittsburgh's School of Dental Medicine. The criteria for the selection of dental records for the study were that the

records had to be of active patients in the care of the school for at least two years and contain three or more treatment procedures. The main purpose for setting these selection criteria was to facilitate a wide range of patient documentation from the patients' dental record.

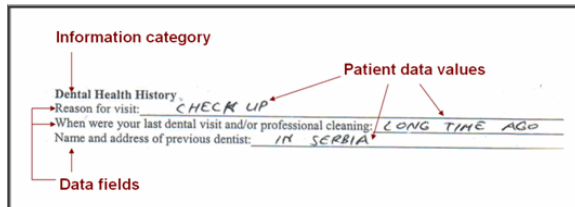


Figure 1: Example of Data field and Patient data values from a dental patient record

The reviewers identified all the data fields from the selected dental record forms through a face to face discussion and a process of consensus agreement. For example, the data fields 'Reason for visit', 'When were your last dental visit and/or professional cleaning' and 'Name and address of previous dentist' (see Figure 1) from the dental record forms were identified and agreed as separate data fields by the reviewers and compiled into a list. Any duplicate data fields were eliminated from the list after a thorough examination.

Once the list of data fields were compiled from the dental record forms, the reviewers individually mapped all the identified data fields to the contents of the BDR by following a set of developed criteria:

- If an extracted data field from the dental record already exists in the BDR data field, then it was coded as present – *direct cross mapping*.
- If an extracted data field from the dental record is absent in the BDR data fields then it was added to the BDR as an *explicit data field*.
- The presence or absence of the corresponding patient data value was coded against each of the extracted data fields.
- If specific patient data value from the dental records could not be assigned to a BDR data field, then an *implicit data field* is created to hold the patient data value and added to the BDR.

Through the process of mapping, the reviewers not only validated the BDR structure but also added new data fields to the BDR that were initially absent. Each individual patient record was examined based on data fields and the corresponding data values associated with it. The documentation of the data values

corresponding to each data field from the compiled list were examined for its presence or absence in the dental records. For e.g. Figure 1 illustrates that the documentation of the data values corresponding to the data field 'Reason for visit' was present and the corresponding data value was 'Check up' in one of the reviewed patient record. In the event when a data field identified from the dental record could not be mapped to the BDR it was added to it as an *explicit data field* under one of its appropriate category. A data element was considered *explicit* if it was identified by a label in the reviewed dental record forms. For instance, the medical history form from the School of Dental Medicine contained the phrase "Are you on special diet? y/n," which indicated the presence of a data field termed 'Special Diet', but was not present in the BDR. So the data field 'Special Diet' was added to the BDR as an *explicit data field*. Conversely, many data fields were not labeled specifically, but could be inferred from the text. One example is the phrase "130/68 m.m of hg," which was contained in a generic data field labeled "Blood Pressure". In this case, the reviewers defined two *implicit data fields*, "Systolic Blood Pressure" and "Diastolic Blood Pressure" and updated it to the BDR.

The information stored in the hard tissue and soft tissue charting in the patient dental record was excluded for mapping as it consisted of graphical values.

The inter-rater reliability between the two reviewers was calculated using Cronbach's alpha and Intra-class Correlation coefficient.

This study was classified as "exempt" under section 45 CFR 46.101(b) (4) by the University of Pittsburgh Institutional Review Board. IRB number PRO07020100.

## Results

A total of 187 data fields were extracted from the reviewed dental record format and an average of 137 of these data fields were documented in the ten reviewed dental records. Out of the 187 data fields identified from dental record forms 66 data fields (35%) were classified as administrative data fields and 121 data fields (65%) as clinical data fields. An average of 111 clinical data fields were documented in the reviewed records.

Only the 121 data fields which represented the clinical components of the dental records were mapped to the BDR as the focus of this study was on the clinical aspect of the dental record.

Table 1: Summary of Patient's Dental Record Mapping to Baseline Dental Record

Clinical Process	BDR Category	Data Fields			Data Values									
		BDR	Dental Record	Mapping Frequency	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Obtain Clinical Data	Chief complaint	3	1	0	1	1	2	1	1	1	1	1	1	1
	Medication history	8	5	1	1	2	1	1	2	2	1	2	2	1
	Medical history	120	40	16	34	51	40	39	38	36	37	35	37	36
	Dental/social history	78	8	4	7	6	8	7	8	7	6	7	7	7
	Hard tissue and Periodontal charts	Not Scored			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Intraoral soft tissue examination	26	16	13	16	16	17	16	16	16	16	16	16	16
	Extraoral head and neck examination	7	6	6	6	6	6	6	6	6	6	6	6	6
	Temporomandibular joint/occlusion	32	1	1	1	1	2	1	2	1	1	2	4	3
	Radiographic history and findings	18	4	3	9	9	7	9	8	10	6	6	9	6
	Physician information	6	5	2	1	5	4	1	2	2	3	4	1	1
	Alert/Summary box	2	1	0	1	1	1	1	1	1	1	1	1	1
	Medical history update	6	15	3	13	11	11	12	14	12	10	14	12	11
	Consultations	7	5	5	3	5	3	3	0	2	3	3	3	3
Sub Total		313	107	54	93	114	102	97	98	96	91	97	99	92
Determine Health Status	Systemic diagnoses	3	0	0	0	0	0	0	0	0	0	0	0	0
	Dental diagnoses	9	0	0	0	0	1	1	0	1	1	1	1	2
	Problem list	7	1	1	1	1	1	1	1	1	0	0	0	0
	Prognosis, risk assessment and etiology	3	2	2	1	1	1	1	1	1	1	1	1	1
Sub Total		22	3	3	2	2	3	3	2	3	2	2	2	3
Determine Plan	Treatment plan	18	8	8	8	7	7	8	5	8	8	8	9	9
Sub Total		18	8	8	8	7	7	8	5	8	8	8	9	9
Deliver Care	Progress notes	9	3	3	2	3	2	3	2	3	3	3	3	3
	Prescription	1	0	0	0	0	0	0	0	0	0	0	0	0
Sub Total		10	3	3	2	3	2	3	2	3	3	3	3	3
Total		363	121	68	105	126	114	111	107	110	104	110	113	107

There were no identified data fields from the reviewed dental record forms that could be organized under the information category ‘systemic diagnoses’, ‘dental diagnoses’ and ‘prescription’.

On the other hand, all the identified data fields organized under ‘extra-oral head and neck examination’, ‘temporomandibular joint/occlusion’, ‘consultations’, ‘problem list’, ‘prognosis’, ‘risk assessment and etiology’, ‘treatment plan’ and ‘progress notes’ could be *directly cross-mapped* to the existing BDR data fields on a one-to-one basis. Summary of the data fields’ mapping frequency to BDR categories and the documentation of the data values in each of the 10 reviewed records with respect to the different BDR categories are illustrated in *Table 1*.

Out of the 121 clinical data fields, only 68 data fields could be *directly cross-mapped* to the data fields previously present in the BDR. The remaining 53 data fields were added to the BDR under appropriate categories. 24 data fields (45.28%) were added under the ‘medical history’ category and 12 data fields

(22.64%) were added under the ‘medical history update’. A total of 17 data fields were defined and updated to the BDR as *implicit data fields*, out of which 9 data fields were under ‘medical history’ and 8 data fields under ‘radiographic history and findings’.

The addition of the *implicit data fields* clearly indicated the lack of appropriate data fields in the reviewed records for documenting relevant patient information. The *explicit* and the *implicit data fields* added to the BDR collectively increased the data field count from 363 (previously present) to a new total of 433 data fields after the record review. This study further validates and extends the BDR data fields. A summary of the BDR update in terms of the explicitly and implicitly added data fields are illustrated in *Table 2*.

The inter-rater reliability between the two reviewers was 0.998 when using Cronbach’s alpha and 0.996 (95% CI) when using Intra-class Correlation Coefficient.

Table 2: Summary of Baseline Dental Record Update

Clinical Process	BDR Category	BDR Data Fields			
		Previously Present	New Addition		New Total
			Implicit	Explicit	
Obtain Clinical Data	Chief complaint	3	0	1	4
	Medication history	8	0	4	12
	Medical history	120	9	24	153
	Dental/social history	78	0	4	82
	Hard tissue and Periodontal charts	Not Scored			
	Intraoral soft tissue examination	26	0	3	29
	Extraoral head and neck examination	7	0	0	7
	Temporomandibular joint/occlusion	32	0	0	32
	Radiographic history and findings	18	8	1	27
	Physician information	6	0	3	9
	Alert/Summary box	2	0	1	3
	Medical history update	6	0	12	18
	Consultations	7	0	0	7
Sub Total		313	17	53	383
Determine Health Status	Systemic diagnoses	3	0	0	3
	Dental diagnoses	9	0	0	9
	Problem list	7	0	0	7
	Prognosis, risk assessment and etiology	3	0	0	3
Sub Total		22	0	0	22
Determine Plan	Treatment plan	18	0	0	18
Sub Total		18	0	0	18
Deliver Care	Progress notes	9	0	0	9
	Prescription	1	0	0	1
Sub Total		10	0	0	10
Total		363	17	53	433

## Discussion

The results of this study suggest the significance of reviewing the content of patient records to build the clinical document architecture of an electronic dental record. A total of 53 new data fields were added to the BDR that was previously built from dental record formats. It also indicates the need to review a larger sample of patient records to validate the existing data fields and to ensure appropriate representation of all data values in a comprehensive patient record.

The high percentage of the extracted data fields categorized under the medical history may suggest that dentists find it important to document the systemic findings and conditions. Based on this observation it would be advantageous to design an integrated systemic-oral computer-based patient records environment.

The lack of data fields under the diagnoses section of the dental records is a serious problem that needs to be addressed. It may also reflect the documentation

habits of dentists when it comes to writing the diagnosis in the patient records.

The progress notes section was a very important segment of the reviewed dental records. Dentists tend to document a whole array of patient information under this segment, highlighting the need for appropriate data fields under other segments of the dental records.

Although the study evaluated the contents of only ten patient records, the next logical step would be to review a larger national sample of both paper-based and computer-based patient records to develop a more comprehensive and robust clinical data architecture for the electronic dental record. A standardized architecture can not only support the documentation needs of the clinicians but also help realize the full potential benefits of the computer-based medium.

By adopting the set of criteria developed in this study to extract data fields, we are currently performing a

nation-wide study to review the content of the dental records maintained by U.S general dentists.

## Conclusion

It is important that complete patient information be available in a standardized and structured format for the clinician to make the right decision and deliver comprehensive care. The absence of appropriate data fields in the dental records may contribute to the incomplete documentation of patient information by the dentists. Extraction of clinical data fields using the developed set of criteria will facilitate the development of a list of data fields. This comprehensive list can in turn inform the clinical data architecture of electronic dental records.

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