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Abdul Rahman Al-Azri, Jane Harford and Helen James

Awareness of forensic odontology among dentists in Australia; are they keeping forensically valuable dental records?

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Title Page

Title: Awareness of forensic odontology among dentists in Australia; are they keeping forensically valuable dental records?

Authors: Abdul Rahman Al-Azri^{1,2}
Jane Harford³
Helen James¹

Affiliation: 1. Forensic Odontology Unit, University of Adelaide, SA 5005
2. Al-Nahdha Hospital, Ministry of Health, Muscat, Oman
3. Australian Research Centre for Population Oral Health (ARCPOH), University of Adelaide, SA 5005

Correspondence:

Abdul Rahman Al-Azri
School of Dentistry, Oliphant Building, University of Adelaide, Adelaide, SA 5005, Australia
Email: al-azri@outlook.com
Phone: +61 8 83133690
Fax: +61 8 83033444

Short running title: Forensic odontology in Australia

Abstract:

Background: Forensic odontologists provide an important service to the community by identifying unknown deceased people, allowing both legal outcomes and family closure. Non-visual identification may be achieved by comparison of post-mortem data with ante-mortem dental records provided by oral health practitioners. Success is dependent largely on the accuracy and adequacy of data in the dental records.

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Methods: An online self-administered questionnaire evaluated Australian dentists' knowledge and behaviours relevant to forensic odontology. Reported record keeping practices were assessed for detail, legibility, accessibility and retention. Behaviours were classified according to the frequency of response.

Results: Dentists reported overall reasonable awareness of the major applications of forensic odontology. Personal information and details of restorative treatment were recorded at high levels, while tooth anomalies, photography, additional patient details and denture marking were recorded inadequately. Legible tooth coding was reported at a high level, while other key legibility practices were recorded inadequately. Few of the behaviours related to retention or to maximise accessibility were recorded at a high level.

Conclusions: Australian dentists have high expectations of the forensic value of their dental records; however many practices that would enhance the diagnostic, medico-legal and forensic value of dental records are not routinely applied.

Key words: Forensic odontology, Australia, survey, dental records, record keeping

Introduction:

Forensic odontology is defined by the Australian Society of Forensic Odontology Inc. as the branch of dentistry that applies dental science as evidence in the interest of the law.¹ It involves the recognition, documentation, interpretation and presentation of dental evidence. The Dental Board of Australia recognises forensic odontology as one of thirteen registrable dental specialties.²

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Forensic odontologists provide a range of important services to the community, most notably identifying unknown deceased people. Confirmation of human identity in modern societies is a necessity for social, financial and legal reasons; and to enable the body to be handed over to relatives according to the culture of the relevant community.^{3,4} A primary method of identification is by dental comparison of data obtained from the deceased person with data noted by dentists during the person's life in the form of dental records.³ The success of this method, however, is highly dependent on the accuracy and adequacy of the available dental data.^{3,5}

Dental records consist of all written or electronic notes, communications, dental study casts, photographs, radiographs and any other investigations during treatment.⁶ Dentists have legal and professional obligations to create and maintain dental records which both serve the best interests of patients and contribute to the safety and continuity of their dental care.⁷ Records need also to comply with insurer, other third party payer and government-subsidised dental program requirements.⁸ It has long been argued that it is in the best interests of patients to be identified, and that use of patients' records for this forensic purpose is an extension of dentists' record keeping obligations.⁹ Good record keeping for clinical treatment and, by implication, dento- legal defence, is the basis of good quality records for forensic purposes.

Forensically adequate records are detailed, accurate and legible in compliance with the laws and regulations of patient record keeping. Records must be accessible to enable prompt comparison of data to an unknown deceased person. The forensic value of records is heightened when diagnostic and treatment information is supported by inclusion of descriptions and images of specific features found in the teeth, dental work and other oral and dental structures to decisively link them to the deceased person. A key issue for forensic odontology as a specialty is whether dentists' record keeping is of a form and level of detail that facilitates confirmation of identity post-mortem.

In this study, a survey of dentists in Australia was conducted to evaluate the background knowledge and awareness of forensic odontology and to investigate their practices related to dental records. This study is the first of its design in Australia since the designation of forensic odontology as a specialist branch of dentistry. The aim of this paper is to report on a sample of Australian dentists' awareness of forensic odontology, exposure to forensic odontology, self-reported record keeping practices for a list of items that are potentially useful to forensic odontology, and perceived barriers to good record keeping.

Materials & Methods:

This study received ethical approval from the Human Research Ethics Committee of the University of Adelaide (HS-2013-024). An online self-administered questionnaire evaluated Australian dentists' awareness, beliefs and behaviours relevant to forensic odontology. A sample of practicing dentists, consisting of Australian Dental Association members, was selected. The invitation to participate package was modified from Dillman's Total Survey Design¹⁰ and included Participants' Information Sheet, information about the independent complaints procedure for the study, single-use link to the online survey and link to anonymously enter the prize draw. An email reminder was sent two weeks after the first invitation email. Questions were designed as both open-ended and closed-ended types. The closed-ended questions were either multiple choice questions or included visual analogue (Likert-type) scales to allow respondents to specify their level of agreement or disagreement to the statements.

The self-complete questionnaire collected details on dentists' socio-demographic and primary practice characteristics, exposures and experiences in forensic odontology, awareness of the activities of forensic odontology and their record keeping practices (Table 1). Awareness was assessed by correct identification of the relevance of forensic odontology to six possible

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applications of forensic data. Exposure was recorded for undergraduate, post-graduate and continuing professional education activities. Frequencies of key components of behaviours that support forensically relevant records were assessed on a 6-point scale. Behaviours were classified as occurring at a high level if responses of often or always occurred 80% of the time, intermediate if they often or always occurred less than 80% and 60% or more of the time and inadequate if these responses occurred less than 60% of the time. Perceived barriers to good record keeping are reported as frequencies and proportions of respondents who reported each barrier as 'relevant' or 'very relevant' barriers to accurate and complete records.

Respondents were included in this sample if they were currently practicing dentistry and completed the survey.

Results:

A total of 418 dentists responded to this survey (response rate: 3.9%). Of these 19 were excluded; 13 respondents were not currently working in dental practice and 6 surveys were incomplete leaving 399 surveys usable for analysis. The mean age of dentists included in this analysis was 45.1 years (range 23.8 – 76.8) and more respondents were male than were female (57.4% versus 42.6%). The mean practice duration was 21.9 years (range 1.8 – 54.8.8). The majority of respondents obtained their basic degree from Australia or New Zealand (85.5%) and most of them were in private general dental practices located in urban areas. Basic dentists' demographics and dental practice characteristics as well as past exposure and experience to forensic odontology are summarised in Table 2.

Comparison of basic demographic and geographic profiles of the study sample with the characteristics of the dental workforce in Australia reported for 2011 by the Australian Institute of Health and Welfare.¹¹ The parameters used in the comparison show that the study

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sample has slightly more females and was slightly older than the employed dentist population. Higher response rates from females and older persons are consistent with response patterns for surveys of both the general public.¹² There were also geographical differences, with a higher percentage of respondents from South Australia and Western Australia. Despite these differences, the study sample was cautiously considered as representative of the Australian dentists' workforce.

Awareness:

Dentists reported overall reasonable awareness of the major applications of forensic odontology (mean score 4.58 / 6). Respondents were most likely to recognise identification by dental record comparison functions for forensic odontology and least likely to identify dental malpractice and personal identification by DNA extracted from teeth.

Exposure to forensic odontology:

A significant minority of dentists reported that they had no undergraduate exposure to forensic odontology or no previous Continuing Professional Development (CPD) related to this field (Table 3). The majority had no post-graduate exposure. However, almost half of all respondents had received a previous request for records for forensic purposes.

Perception of value of dental records:

The overwhelming majority of respondents indicated that they thought that all or most of the records they kept in their primary practice would be helpful in forensic odontology cases (80.7%). Only one per cent believed that their records would be of no help.

Record keeping practices:

Practices related to record keeping were assessed (Fig. 1). Indicators of the level of detail of records show that basic personal information and details of restorative treatment and prostheses were recorded at high levels. Notations of dental anomalies, routine orthopantomographs, dental photography, retention of dental casts, additional patient details

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and denture marking (all of which may be highly useful for identification) were recorded inadequately. Legibility indicators signify that the majority of dentists use a unified coding system for teeth and treatment type, while other key legibility practices were less commonly utilised. None of the behaviours related to accessibility were recorded at a high level. A significant proportion reported that they had ever lost or misplaced dental records. This was more like to have been experienced with physical items such as paper notes and radiographic films. It is not clear whether this is because they have been used more widely or whether physical records are at greater risk of being lost or misplaced.

Barriers to good practice:

This survey highlighted potential factors that dentists perceive as barriers for keeping accurate and complete dental records. Increased workload was identified by almost half of respondents 'relevant' or 'very relevant' barriers and around 40% nominated either lack of time or lack of storage space as 'relevant' or 'very relevant' barriers. Lack of experience, lack of refresher courses or CPD and lack of quality check personnel were also reported as barriers to keeping good records by large numbers of respondents. Storage space was considered as a relevant barrier for retaining complete dental records according to many dentists (Table 4).

Discussion:

Although forensic odontologists are the key specialists involved in the process of identification by dental means, the role of all dentists is important in providing the ante-mortem data in the form of dental records that can be used to confirm or exclude identity. These records include written or electronic notes, radiographs, casts and photographs. One of the challenges faced by forensic odontologists is dealing with deficient or inaccurate dental records, which may hamper or delay the process of identification.^{9,13}

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Forensically valuable dental records are accurate, detailed, legible, and accessible. Accuracy indicates that the recorded dental information reflects the current oral status of the patient; without bias, personal interpretation or filtering. Examples include a current pictorial chart (odontogram), correct tooth designation of anomalies and treatments, and correct treatment codes. Detail involves the inclusion of all diagnostic and treatment information; for example, tooth status (presence or absence), restoration materials and surfaces, and details of occlusion and periodontal condition. This should be supported by adding descriptions of specific features found in the teeth, dental work and other oral structures that could help to decisively linking the records to the deceased person; for example, anomalies in tooth number, morphology or position, and current dated and labeled radiographs. Legibility reflects the clarity of inscription, data format and presentation logic which allows data to be clearly understood by appropriately trained third parties. Accessibility reflects the ready availability of the complete case record. Retention is the process of keeping patients' records including written, electronic and physical items free of data corruption, environmental damage and deterioration, for the period of time prescribed by the Law or recommend by relevant professional bodies.

This survey of Australian dentists' self-reported record-keeping practices indicates that, from a forensic perspective, there are considerable shortcomings in detail, in accuracy and in accessibility of dentists' records. This may reflect the relative youth of forensic odontology as a dental specialty in its own right. There is no indication in record keeping guidelines from either the registration authority⁷ or the professional association⁸ that the needs of forensic practitioners have been explicitly taken into account when developing guidelines. Many dentists would be unaware of where their patient care responsibilities cease. Most may not be cognisant of the fact that a person is not considered deceased until after their records have been used and the Coroner has declared the person identified as the deceased. Dentists may

also be unaware that, if requested, all material pertaining to the patient should be released to investigators.

From a professional prospective, several factors may lead to keeping incomplete or inaccurate records, or can lead to erroneous entries in the records. While dentists in this sample exhibited a high degree of awareness of forensic odontology, lack of awareness of the forensic value of the documents might be one of those reasons.^{14,15} While the majority of respondents recalled exposure to forensic odontology in their undergraduate educations, this exposure may not have been sufficient to instill interest or awareness of the kinds of dental records needed to support forensic work. Teaching institutions, depending on the staff at the time and their influence, experience, institutional recording system and interpretation of recording guidelines will mandate different levels of emphasis in training undergraduates and post-graduates. In busy dental practices, the lack of time to be thorough in recording details increases the likelihood of making errors³ and this is evident in this sample with 'lack of time' and 'workload' each nominated by approximately 40% of respondents as barriers to accurate and complete record keeping. Quality check protocols may be implemented to ensure accuracy and completeness, but these may differ from one country or institution to another. The modern use of electronic patient files has provided an efficient and economical way to store records for long terms¹³, however this method may have shortcomings such as high cost, demands of security and advanced technical skills.

There are some limitations with this study that should be considered when interpreting the results. The sample was drawn from the Australian Dental Association membership which represents the large majority of dentists in private practice in Australia. While not all practicing dentists are members, the ADA claims membership of over 90% of dentists in Australia (<http://www.ada.org.au/publications/adj.aspx>). The response rate for this survey was below the optimal level at 3.9% and below that which could be expected from the dental

profession.¹⁶ Possible explanations for this include the fact that the sample were approached through a third party and via a non-personalised letter rather than by a personal approach from the researchers; the online format, which has had a low response rate in at least one other survey of dentists¹⁷; the fact that this survey was conducted over a time period when at least four other surveys of Australian dentists were in the field; or possibly, the low profile of forensic odontology, given its youth as dental specialty.

Comparison of the responding dentists with the population of dentists in 2012 indicates that respondents were fairly representative of dentists and patients in 2012. However, caution should be exercised in generalising these results to the Australian Dentist population as even when survey respondents are closely matched to the demographic characteristics of the underlying population, non-response bias is still possible.¹⁸ In the case of this survey, it is possible that respondents were dentists with either an interest in forensic odontology or a high degree of confidence in their record keeping practices and if that is the case, these results are likely to over-estimate the frequency of behaviours in the Australian dentist population. It is known that participants in electronic surveys are more likely to be computer literate¹⁹ and thus are more likely to be early adopters of new technologies, so again, may have different record keeping practices to the general population.

Practitioners of forensic odontology casework regularly are faced with sub-optimal dental records, suggesting that there are deficiencies in record keeping in Australia. This survey suggests that Australian dentists have high expectations of the forensic value of their dental records; however many practices that would enhance the diagnostic, medico-legal and forensic value of dental records are not routinely applied.

This study will provide a baseline for future studies in the Australia or other countries of the similar target population (practicing dentists). Findings from this study may help provide evidence-based recommendations for promoting focuses in the area of forensic odontology during undergraduate training and also emphasising its importance in continuous professional education events. The goal of these recommendations should be to improve record-keeping guidelines and practices to increase the level of details and the extent and period of retention of records so that the information needs of forensic odontology activities are met.

Conclusion

Dental record are created and maintained to contribute to the safety and continuity of patient dental care; for treatment decisions, treatment planning, and legal purposes. Forensic usage is a collateral extension that also serves the best interests of patients. Given the very low frequency of reporting consistent practices to support aspects of detail, accuracy/legibility and accessibility, profession-wide strategies to improve the forensic value of records should be implemented, including provision by the Australian Society of Forensic Odontology of forensic information to practicing dentists and development of Continuing Professional Development modules.

Acknowledgements

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Table 1: Survey Data Items

A. Independent variables: Dentists' socio-demographics and primary practice characteristics:

- Sex
- Age (categorical)
- Years of experience (categorical)
- Country of basic degree
- City of basic degree
- Practice location (City)
- Working in multiple practices
- Have specialist qualification
- Type of practice (Public, private and academic)
- Location: State/Territory
- Location: Rural v Urban

B. Awareness of forensic odontology

- Identification of victims in mass disasters
- Person identification by dental comparison
- Person identification by DNA extracted from teeth
- Bitemark investigation in assaults and child abuse
- Dental malpractice
- Age estimation

C. Exposures to forensic odontology

- Exposure at undergraduate level
- Exposure at postgraduate level
- Past CPD exposure
- Previous requests to provide records for forensic odontology

D. Practices of dentists related to dental record keeping

- Duration of record keeping
- Average number of dental patients per day
- Methods of record keeping
- Use of pre-printed forms and electronic templates
- Use of dental charts
- Use of abbreviation
- Recording basic patients' personal data
- Recording additional patients' personal details
- Recording past medical and dental history
- Retaining previous radiographs
- Retaining reports and referral
- Retaining previous dental casts
- Discarding faulty intra-oral radiographic films
- Discarding faulty panoramic radiographic films
- Deleting faulty digital radiographic images
- Performing full dental examination on first visit
- Recording full dental status on first visit
- Tooth numbering system used
- Recording common dental anomalies/unusual features
- Recording less common dental anomalies/unusual features

- Recording basic details for restorative procedures
 - Recording basic details for denture/bridge work
 - Using denture marking
 - Recording basic details for dental implant treatment
 - Recording basic identifying details on dental casts
 - Recording less identifying details on dental casts
 - Recording basic identifying details for intra-oral digital and film radiographs
 - Recording basic identifying details for panoramic digital and film radiographs
 - Using extra-oral photography in primary practice
 - Keeping printed copy of photographs
 - Keeping digital copy of photographs
 - Using intra-oral camera in primary practice
 - Keeping digital or printed copy of intra-oral camera captures
 - Past incidents of losing paper notes or radiographic films
 - Past incidents of losing electronic data or digital radiographic images
 - E. Perceived barriers to good record keeping
 - Lack of time
 - Lack of computer facilities
 - Lack of record quality check personnel
 - Lack of experience
 - Lack of refresher courses or CPD lectures
 - Lack of storage space
 - Increased workload in practice
-

Table 2: Sample characteristics and comparison to national employed workforce

| | | Frequency | Percent | Employed workforce (AIHW 2013) |
|---------------------------|-------------|-----------|---------|-----------------------------------|
| Age (Mean=45.1) | 20-<35 | 122 | 30.6 | N/A† |
| | 35-<45 | 78 | 19.5 | N/A |
| | 45-<54 | 83 | 20.8 | N/A |
| | 55 and over | 116 | 29.1 | 23.0 |
| Sex | Male | 229 | 57.4 | 63.5 |
| | Female | 170 | 42.6 | 36.5 |
| Years Since Graduation | 0-5 years | 80 | 19.8 | N/A |
| | 6-10 years | 48 | 12.1 | N/A |
| | 11-15 years | 27 | 6.8 | N/A |

| | | | | |
|---------------------------------------|---|-----|------|-------|
| | 16-20 years | 41 | 10.3 | N/A |
| | 21-25 years | 38 | 9.5 | N/A |
| | More than 25 years | 165 | 41.5 | N/A |
| Country of basic dental degree | Australia or New Zealand | 341 | 85.5 | 73.5‡ |
| | UK and Ireland | 26 | 6.5 | N/A |
| | Others | 32 | 8.0 | 23.0‡ |
| | Not stated | | | 3.6‡ |
| Location of primary dental practice§ | Urban | 316 | 79.0 | 79.7 |
| | Rural | 81 | 20.3 | |
| State/Territory | New South Wales/ Australian Capital Territory | 14 | 3.5 | 35.2 |
| | Victoria | 77 | 19.3 | 24.3 |
| | Queensland | 10 | 2.5 | 19.8 |
| | Western Australia | 115 | 28.8 | 10.5 |
| | South Australia | 147 | 36.8 | 7.9 |
| | Tasmania | 21 | 5.3 | 1.5 |
| | Northern Territory | 13 | 3.3 | |
| | Not stated | 2 | 0.5 | |
| Specialist qualification | Yes | 56 | 14.0 | N/A |
| | No | 343 | 86.0 | |
| Type of dental practice Total =416 | Public Service | 69 | 17.3 | 10.8‡ |
| | Academic | 26 | 6.8 | 0.7‡ |
| | Private Practice | 321 | 80.5 | 79.7‡ |
| | Other/Not stated | | | 8.8‡ |
| Work in multiple practices | Yes | 128 | 32.1 | |
| | No | 271 | 67.9 | |
| | No undergraduate exposure to forensic odontology | 84 | 21.1 | N/A |
| | No exposure to forensic odontology at graduate level | 297 | 74.4 | N/A |
| | No CPD related to forensic odontology in the past | 188 | 47.1 | N/A |
| | No CPD related to forensic odontology in 2012 | 333 | 83.5 | N/A |
| | Previously requested to supply dental records for forensic purposes | 175 | 43.9 | N/A |
| | Total participants | 399 | 100 | |

†, Not available/not reported

‡, Percentage is for practicing clinician (dentists)

§, Urban for study sample, Major cities for employed workforce

¶, NSW and ACT is a single ADA branch

Table 3: Awareness of, exposure to and perception regarding forensic odontology

| | Number | Per cent | 95% CI |
|---|--------|----------|-------------|
| Awareness | | | |
| Identification of victims in mass disasters | 364 | 94.8 | 92.1—96.6 |
| Person identification by dental comparison | 361 | 94.0 | 91.2—96.0 |
| Person identification by DNA extracted from teeth | 243 | 63.3 | 58.4—67.0 |
| Bitemark investigation in assaults and child abuse | 274 | 71.4 | 66.6—75.7 |
| Dental malpractice | 215 | 56.0 | 51.0—60.9 |
| Age estimation | 303 | 78.9 | 74.6—82.7 |
| | | Mean | 95% CI |
| Mean number of correct answers (of 6) | | 4.58 | 4.45—4.72 |
| Exposure | | | |
| No undergraduate exposure to forensic odontology | 84 | 21.1 | 17.3 — 25.3 |
| No exposure to forensic odontology at graduate level | 297 | 74.4 | 70.0 — 78.5 |
| No CPD related to forensic odontology in the past | 188 | 47.1 | 42.3 — 52.0 |
| No CPD related to forensic odontology in 2012 | 333 | 83.5 | 79.5 — 86.8 |
| Previously requested to supply dental records for forensic purposes | 175 | 43.9 | 39.0 — 48.8 |
| Perception of forensic value of dental records | | | |
| Records would not be helpful in forensic odontology cases | 4 | 1.0 | † |
| Don't know if records would be helpful | 8 | 2.0 | 0.1—3.9 |
| Some records would be helpful | 60 | 15.0 | 11.9—18.9 |
| Most records would be helpful | 177 | 44.4 | 39.6—49.3 |
| All record would be helpful | 145 | 36.3 | 31.8—41.2 |
| Missing | 5 | 1.3 | 0.5—3.0 |

† Insufficient number to produce CI

Table 4: Perceived barriers to accuracy and completeness of dental records

| | Relevant or very relevant (per cent) | 95% CI |
|---|--------------------------------------|-----------|
| Lack of time | 41.1 | 36.4—46.0 |
| Lack of computer facilities | 25.8 | 21.8—30.3 |
| Lack of record quality check personnel | 34.8 | 30.3—39.6 |
| Lack of experience | 38.1 | 33.5—43.0 |
| Lack of refresher courses or CPD lectures | 36.8 | 32.3—41.9 |
| Lack of storage space | 41.4 | 36.6—46.3 |
| Increased workload in practice | 48.4 | 43.5—53.3 |

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Figure 1: Data items recorded/retained. (Blue shading = 80% or more, orange= 60%-<80%, red=<60%)

