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Increasing the forensic relevance of oral health records – development and evaluation of online education for the dental professional

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Abstract

Background: Dental comparison can confirm human identity to a high degree of certainty and has always played a major role in Disaster Victim Identification. However, a significant issue for human identification by dental comparison is a lack of adequate antemortem information. Previous research examining Australian-made clinical case notes demonstrated suboptimal recording of dental traits that are important for both forensic dental identification and compliance with Dental Board of Australia record keeping guidelines. In view of this, I have developed and evaluated an online programme of education to improve the clinical and forensic recording practices of oral health providers.

Methods: To determine the practical influence of inadequate oral health case note recording on forensic identification, the outcomes of identification case investigations undertaken by the Forensic Odontology Unit of South Australia (FOU SA) over a five year period (2011-2015) were assessed. Subsequently, an online Interactive Learning Module (ILM) was constructed using Articulate Storyline 2 software (Articulate Global Inc.), with the aim to improve skills related to accuracy, detail, legibility, accessibility and retention of dental records. The ILM was initially made available to two focus groups – Australian Society of Forensic Odontology (AuSFO) Inc. members and third year students from the University of Adelaide's Bachelor of Dental Surgery (2016) program. The ILM was subsequently released to the wider dental community via various professional groups. For all release phases of the study, Likert-style feedback was obtained before and after participation, with percentage, mean, broad

agreement and standard deviation being determined for each survey statement. The statistical significance of differences between paired pre- and post-course survey responses were also determined, where relevant. Participants' country of education, current occupation and level of experience were considered in analysing results.

Results: The preliminary investigation into forensic identification cases carried out over a five year period revealed that in 25% of these cases, identity was not able to be established. Furthermore, in 100% of the non-established cases, deficiencies in antemortem dental data contributed to the inability of forensic odontologists to be specific with the identification outcome. This result highlighted the need for further education with regards to clinical record keeping. Surveyed participants from all three study phases reported satisfaction regarding the subsequently-released ILM related to improving antemortem dental case note recording, as considered by Kirkpatrick's Levels of Training Criteria. Additionally, improvements in the recognition of the importance, knowledge, confidence, skill and motivation to learn regarding the subject matter were seen following participant interaction. Results were particularly noteworthy for participants whose highest degree of education was from Australia, as well as those with only 3-5 years of experience in their current occupation. Individual outlying opinions were recognised and discussed.

Conclusion: Lack of antemortem data was shown to limit the ability of forensic odontologists to provide an optimal dental identification. The ILM that was

subsequently released to improve education in this area proved valuable in increasing the self-reported awareness, understanding and attitude of participants that had identifiably different levels of previous case note recording experience. By prompting learning, this ILM has the potential to improve record keeping practices and hence aid in forensic dental identification. The information gathered in the process of creating this ILM can also aid forensic odontologists to determine how confident they should be about the accuracy of antemortem records as forensic evidence.

Declaration

This work is submitted for fulfilment of the Master of Philosophy in Forensic Odontology. I declare that it contains no material which has been accepted for the award of any other degree or diploma in any tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference is made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree. I give consent to this copy of my thesis when deposited in the University Library, being made available for loan and photocopying, subject to the provisions of the Copyright Act 1968. I acknowledge that copyright of published works contained within this thesis resides with the copyright holder(s) of those works. I also give permission for the digital version of my thesis to be made available on the web, via the University's digital research repository, the Library Search and also through web search engines, unless permission has been granted by the University to restrict access for a period of time.

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CHAPTER 1

INTRODUCTION

1. INTRODUCTION

The primary purpose for the creation of patient records by oral health care providers is to aid in the treatment of the patient during their life. These records however, may also be used for the purpose of identification of the patient upon their death. A dental record or case note should provide comprehensive evidence of the history of illness, examination, clinical diagnoses, treatment and management of a patient by an oral health practitioner. Case notes consist of a written or electronic account made by the treating health provider about patient visits and the treatment that was provided, along with important patient details, diagnostic aids such as radiographs, dental casts, extra-oral and intra-oral photographs, and additional information such as laboratory forms and referrals. Dental case notes should be of high quality to allow for appropriate continuity of care (McAndrew, Ban and Playle, 2011).

Maintaining accurate and complete dental case notes is an oral health practitioner's ethical and legal obligation (Devadiga, 2014). In Australia, all oral health care workers must produce and manage patient case notes in line with professional guidelines. Such guidelines were made available to the dental profession through the Australian Dental Association Inc. (ADA Practical Guides, 2006). More recently, the Dental Board of Australia's Guidelines (Dental Board of Australia, 2010a) on record keeping have stated that, 'dental practitioners must create and maintain dental records that serve the best

interest of patients, clients or consumers and that contribute to the safety and continuity of their dental care'. Dental professional agencies and policies similarly endorse these guidelines for dental workers in Australia (The Health Practitioner Regulation National Law Act 2009; Australian Health Practitioner Regulation Agency (AHPRA); and the ADA Dental records policy, 5.17, 2012).

AHPRA and National Dental Board guidelines for record keeping are, in effect, mandatory. An approved registration standard for a health profession, or a code or guideline approved by a National Board, is admissible in proceedings under the Health Practitioner Regulation National Law (South Australia) Act 2010; hence, they can be used against a health practitioner registered by the Board as evidence of what constitutes appropriate professional conduct or practice for the health profession. In effect, good clinical case notes are sound dento-legal case notes. Failure to comply with professional record keeping guidelines leaves practitioners open to indefensible litigation action.

Unfortunately, despite best intentions, it is my opinion that the record keeping guidelines that govern the dental profession in Australia continue to lack specificity. As a consequence, individual practitioners are required to interpret each guideline and make records that they, personally, perceive to meet requirements.

There is limited historical literature concerning the quality of clinical record keeping in primary dental care in Australia; the only available data demonstrate significant room for improvement in dental record keeping in this country (Brown, Kiely and Spencer, 1994; Brown, 2015). This has clear ramifications for patients and their dental care providers, as well as for the use of these records in human identification. This issue is not unique to Australia. A United Kingdom-based study demonstrated that the quality of dental record keeping was poor, showing that a full dental chart had only been completed in 70% of randomly assessed case notes (Morgan, 2001). This study also showed that a completed medical history was present in less than 45% of dental case notes, a diagnosis in less than 10% and a documented treatment plan was obvious in only 17% of cases. An assessment of record keeping by undergraduate students following United Kingdom guidelines found that items such as an updated medical history and patient complaint were frequently missed (Pessian and Beckett, 2004). Chong et al. (2014) demonstrated similar findings in a Malaysian cohort of senior dental undergraduate students.

As highlighted, dental case notes are primarily used for optimal patient care. However, suboptimal recording is additionally of significant concern with regard to forensic odontology casework. Forensic Odontology is the application of dental science to the law. According to the Australian Society of Forensic odontology Inc. (2011), it involves the recognition, documentation, interpretation and presentation of evidence on issues such as human

identification, orofacial trauma, bitemarks, age estimation and various opinions relevant to a dentist's scope of practice.

The use of dental records in forensic identification situations has long been documented (Avon, 2004; Rothwell, 2001). This method of identification is facilitated by the fact that dental records are more readily available than fingerprint or DNA records in many countries (Devadiga, 2014). As teeth are highly individual, resist destruction and have generally been documented in some form during the life of a person, detailed information about the dentition can be compared between antemortem and postmortem situations (Hinchliffe, 2011a). Identification by dental means can be quick, inexpensive and highly accurate. Accurate dental records, updated frequently, can be a major factor in identifying an individual (Ata-Ali and Ata-Ali, 2014) and forensic odontology has previously played a major role in identifying severely disfigured and visually non-recognisable deceased individuals in mass disaster situations. Most recently in Australia, this included identification of the majority of the 173 severely incinerated victims of the February 7th, 2009 Black Saturday Victorian bushfires (Hinchliffe, 2011b; Cordner, Woodford and Bassed, 2009). Australian forensic odontologists were also involved in the dental identification process for the MH17 Malaysian airline disaster undertaken in the Netherlands (Attorney General Press Release, 2014).

The success of human identification by dental means relies on both the condition of the unknown deceased's dental remains and the quality of the recorded antemortem dental information available for comparison. To be optimally useful for forensic identification, dental case notes need to document the oral health status of a patient in its entirety. As such, the case notes should be detailed, accurate and legible. In addition, they need to be accessible when requested by the appropriate authorities. Ideally, dental records should be retained beyond the Dental Board of Australia's recommended 7-10 years. The forensic value of case notes is heightened when diagnostic and treatment information is supported by inclusion of descriptions and photographic or radiographic images of specific features found in the teeth, dental work and other oral and dental structures (Al-Azri, Harford and James, 2016; Delattre and Stimson, 1999).

In a 2015 study regarding the awareness of forensic odontology among dentists in Australia, over 80% of respondents believed that their patient's case notes would be of appropriate value, should they be called upon to assist in a forensic situation. However, unfortunately the results also confirmed that a high number of forensically important recording practices are currently inadequately understood by Australian dentists and that recording practices could be improved (Al-Azri, Harford and James, 2016).

Despite the appreciation of some forensic requirements in case note recording, there remains limited statistical data as to what details Australian dentists actually record in their patients' case notes. A recent study (Stow, James, and Richards, 2016) surveyed the type of dental information Australian forensic odontologists considered most useful and valuable in case note records when carrying out forensic services. Taking in to consideration the results of this survey, the Australian Dental Association's Policy Statement on dental records (Dental records policy 5.17, 2012) and the Dental Board of Australia's Guidelines on dental records (Dental Board of Australia, 2010a), the general clinical and forensic value of a selection of Australian-made dental records received as antemortem data by the Forensic Odontology Unit of South Australia, in the period 2008-2013, was determined. This review provided statistical evidence to demonstrate that many records lacked detail from a forensic-specialist perspective, as well as sub-optimal recording with respect to the forensically-relevant Dental Board of Australia (DBA) guidelines. In some cases, the lack of detail noted was described to preclude expedited forensic dental identification; there was a link between having fewer details in the dental records and a longer time period for an identity confirmation.

Results from these previous studies indicated that changes to current recording practices should be actively encouraged in order to enhance the specificity and value of dental case notes. As such, a need to ensure that relevant professionals are trained to a suitable and standardised level in creating

clinically and forensically significant oral health records was identified. The challenge remained in identifying standard protocol that can be easily taught via continuing professional development (CPD), recalled as necessary and routinely carried out by dental practitioners.

Many dental registration authorities throughout the world mandate CPD as a requirement for continued registration. In 2013, Bailey et al. completed a survey of the views of dental educators toward compulsory CPD topics for European Union-based dentists and found that 42% of respondents considered that record keeping should be a compulsory up-skilling requirement. Hopcraft, Marks and Manton (2008) and Hopcraft et al. (2010) assessed the participation of Victorian-registered dental care providers in CPD activities in 2004 and 2007 respectively, finding that although there was a high level of participation in CPD, nearly half of the respondents to their cross-sectional survey of dentists and dental specialists attended less than 20 hours of CPD in the surveyed year. In fact, one in five respondents indicated that the main reason they attended CPD was to comply with mandatory requirements. Limited Australian-based data exists regarding the benefits of participation in CPD; there is no information as to whether Australian practitioners consider record keeping to be an appropriate (or necessary) area for post-graduation learning.

Australian dental professionals are required to complete a minimum of 60 hours of CPD over a three-year period to maintain registration (Dental Board of Australia 2010b and Health Practitioner Regulation National Law Act 2009). A comprehensive search on available dental CPD education reveals there is insufficient material available for self-training with regard to appropriate record keeping. Indeed, over 60% of respondents to a survey regarding oral health recording noted that lack of information and CPD may be a barrier to good record keeping (Al-Azri, Harford and James, 2016). There is no reason to infer that this finding is isolated to those surveyed. This lack of record keeping-related CPD should be viewed as a serious problem, given that the Dental Practice Board of Victoria, AHPRA and the Australasian Legal Information Institute had, following proceedings related to dental complaints in the period 2011-2014, all determined that practitioners involved in the complaint cases needed to undertake further education in record keeping (Brown, 2015).

Research has shown that training can enhance a practitioner's accuracy and consistency in clinical diagnostic tasks (Lanning et al., 2006). Of course, education needs to be targeted in order to engage and affect the audience. Effective targeting includes balancing stimulating academic content with examples of practical application; it is also ensuring that participants can access learning material easily. In recent years, there has been increased availability of teaching and learning content online in all facets of education, thus ensuring

that today's busy trainees can digest information at a time suitable to their personal schedule.

Given the significant movement to online learning, it is reassuring to note that computer-aided, self-instructional programs have been shown to be useful in dental education (Woelber, Hilbert and Ratka-Kruger, 2012; Rosenberg, Grad and Matear, 2003). Learners have commented that e-learning is effective and improves education and training (Childs et al., 2005). Additionally, a review of the e-learning literature (Ruiz, Mintzer and Leipzig, 2006) showed that learners using computed-based instruction learned more efficiently and demonstrated better retention. In 2002, Chumley-Jones, Dobbie and Alford reviewed 76 studies from the medical, nursing and dental literature on the utility of online learning. They demonstrated that in terms of learners' achievements in knowledge, e-learning was equivalent to more traditional methods.

Interestingly, a survey by Chan et al. (2006) on the preference for continuing professional dental education amongst general practitioners who attended the 26th Asia Pacific Dental Congress in 2004 showed that whilst some respondents preferred learning online, the vast majority (81.7%) preferred didactic courses. Similarly, a Victorian-based study reported the percentage of dentists with a preference for online learning to be as low as 2.9%, with 30.9% preferring

hands-on courses and 33.8% indicating they preferred lecture-style learning (Hopcraft et al., 2010).

Clearly, preferred mode of learning is unique to the given individual; it is also subject-specific. There comes a time in any student's training in a practical health profession when learning needs to move beyond the page (or electronic device) and into the real world e.g. giving a patient a dental anaesthetic for the first time. This, however, can only happen once the fundamental principles of a topic have been grasped and demonstrated. Whilst it may be that those who work in a more hands-on profession (such as general dental practice) prefer a more physical, or kinaesthetic, style of learning, there remains a place for online learning for more basic concepts.

For this research project, an online training package featuring repetitive, clinically relevant tasks with sufficient and timely feedback was developed to provide standardised teaching and learning with regard to dental case note recording. Focus groups of dental health care providers were then targeted to participate in the training. Linked pre- and post- participation surveys were used to assess how successful the training package was in aiding awareness, knowledge, confidence, skill and motivation to improve dental case note recording using a well-established measure of effectiveness (Belfield et al., 2001; Kirkpatrick, 1959).

The main findings of this research have been compiled into a manuscript, which has been published in The Australian Dental Journal ('Development and evaluation of online education to increase the forensic relevance of oral health records', doi:10.1111/adj.12545). In addition, to augment this research, I examined identification cases undertaken by the Forensic Odontology Unit in Adelaide over a five year period, in order to gain a better understanding of the effect of inadequate antemortem dental records on the ultimate forensic identification outcomes. This research was also written as a manuscript and is published in the Australian Journal of Forensic Sciences ('The importance of increasing the forensic relevance of oral health records for improved human identification outcomes',http://dx.doi.org/10.1080/00450618.2017.1310923). Both of these manuscripts are included as appendices.

CHAPTER 2

LITERATURE REVIEW

2. LITERATURE REVIEW

2.1 Forensic odontology

Forensic odontology is the branch of dentistry that applies dental science to the law (Australian Society of Forensic Odontology Inc., 2011). It is the intersection of the dental and legal professions, involving the recognition, documentation, interpretation and presentation of dental evidence regarding a specified investigation. Forensic odontology is recognised as one of thirteen registrable dental specialities (Dental Board of Australia, 2010c). In Australia, a forensic odontologist's scope of practice includes identification of human remains based on dental features, examination and interpretation of orofacial injuries, assessment of alleged bitemark injuries and child abuse evidence, estimation of chronological age of an individual based on dental development and various civil litigation proceedings.

2.2 The role of forensic odontologists in human identification

Although no longer considered 'unique', each person's dentition is highly individual and can potentially display sufficient features to allow forensic determination of an identity (Bush, Bush and Sheets, 2011; Page, Taylor and Blenkin, 2010).

Remains of the human body can become unrecognisable over time (Pretty and Sweet, 2001) due to heat, trauma and prolonged water immersion, as well as the natural processes that occur after death (decomposition, mummification or skeletonisation). The processes that make a human body unrecognisable, however, often have little to no effect on tooth structure. Teeth can withstand extreme conditions due to their highly crystalline outer structure (enamel) and more resilient underlying layer (dentine), which contains shock-absorbing inorganic material. Due to the dentition's structural ability to protect itself, the teeth have long been used as a primary identifier in forensic investigations (Hinchliffe, 2011a; Rothwell, 2001).

Forensic odontology has been a significant contributor to identification of deceased individuals who are beyond visual recognition since the 1897 Bazar de la Charite in Paris, France, in which 126 people perished as a result of a gas explosion and the subsequent human panic to escape. In his doctoral thesis 'L'Art dentaire en Medecine Legale', Amoedo reported that the thirty bodies that were burned beyond visual recognition in this explosion were matched through dental comparison via information from friends, family and care providers (Hill, 1984).

Since this time, forensic odontology has been applied to instances of individual and multiple deaths: the 2001 World Trade Centre disaster in New York, where

dental investigation assisted identification of some 76% of victims (MacKinnon and Mundorff, 2007); the Bali bombings of 2002, where around 60% of victims were identified with the aid of odontology services (Lain, Griffiths and Hillton, 2003); the Boxing Day 2004 tsunami in Thailand, where early reports suggested that some 70-79% of the deceased were primarily identified by dental comparison (Schou and Knudsen, 2012; James, 2005); and the majority of victims of the 2009 Black Saturday bushfires in Victoria (Hinchliffe, 2011b). Many of the victims of the July 17th 2014 Malaysia Airlines MH-17 disaster, which was reportedly shot down by a surface-to-air missile near the Ukraine-Russian border, were identified through various forensic investigations, including dental comparison by Australian-registered (and other) forensic odontologists. It is anticipated that a similar recovery and identification effort will exist for passengers of the presumed-submerged Malaysia Airlines flight MH-370, which disappeared on March 8th 2014, if it is eventually located. The process of identification relating to an underwater disaster presents specific problems not encountered during land investigations (Winskog, 2012). However, the ability to perform an odontology assessment and interpretation remains the same and, having been submerged and at the mercy of the deep-sea environment for a number of years, there would remain scant other information for victim identification.

Human identification via dental means is, in the majority of cases, achieved through comparison of dental structures in the unknown body with available

dental records of the suspected deceased person (Lessig, 2014; Hinchliffe, 2011a). As such, dental records are an invaluable source of antemortem data for forensic dental identification (Charangowda, 2010). In the minority of cases, dental identification may be aided through other methods of comparison, such as facial comparison, superimposition and collection of DNA from tooth structure for comparison to a sample from a known person (Rai and Kaur, 2013; Christensen and Anderson, 2012). In cases where there are no clues as to the identity of a person, it is possible to 'profile' a person in order to restrict the population pool to which the deceased is likely to belong. Such 'profile' information may include age, ancestral background, occupation, habitual behaviours and systemic conditions; this may then narrow the search for the individual's antemortem dental records (Manjunatha and Soni, 2014; Pittayapat et al., 2012). It is also now possible to characterise the body (age, sex and geographic origin) by determining the person's bomb pulse carbon levels and comparing them to known population standards (Alkass et al., 2013). This can also limit and focus identity matching.

As stated, dental comparison involves the interpretation and reconciliation of two sets of data – antemortem and postmortem. Vigil et al. (1990) described the main concept of identification via dental means – that dental change is unidirectional, i.e. if a tooth has been extracted antemortem, it will not be present at the postmortem examination. An odontologist should be provided with all data that were recorded before the death of the individual whose

identity is in question. All antemortem data needs to be interpreted, combined and presented in a standardised format (Berketa, James and Lake, 2012; Pretty and Sweet, 2001). Postmortem data will then be collected from the deceased individual through clinical examination and similarly presented in a standardised format, allowing ease of comparison to the antemortem data. Depending on the degree of concordance between the evidence, as well as the ability to explain any discrepancies, the forensic odontologist must then decide whether the identity of the antemortem and postmortem persons can be paired. Such identification by dental methods has proven extremely reliable, especially when available antemortem data are adequate and accurate (Avon, 2004). People who often visit dental practitioners for restorative treatment are likely to be identified in a more timely manner via this method (Shanbhag, 2016).

Different classification criteria are used worldwide to describe the certainty in the reconciliation and consequent identification process relating to antemortem and postmortem dental records (Higgins and James, 2006; International Organization For Forensic Odonto-stomatology, 2005; American Board of Forensic Odontology, 1994). In South Australia, the identification categories currently used are those specified by Interpol (Interpol Disaster Victim Identification Guide, 2009), as shown in Table 1.

Identification category	
Established	Absolute certainty that the antemortem and postmortem records are from the same person.
Probable	Specific characteristics correspond between the records but either antemortem data or postmortem data or both are minimal.
Possible	There is nothing to exclude identity but either the antemortem data or postmortem data or both are minimal.
Insufficient	No comparison can be made with the data available.
Excluded	Antemortem and postmortem records are from different persons.

TABLE 1 – Deceased individual identification categories utilised in South Australia, as per the Interpol Disaster Victim Identification Guide, 2009.

World-wide, there is increasing pressure being placed on forensic science disciplines to justify the accuracy, reliability and scientific basis of the processes that they utilise. Comparative sciences that are used in human identification, i.e. dental comparison, fingerprint matching and DNA analysis, also need to meet this increasing scrutiny. Antemortem dental records comprise a major component of the evidence base for identification by dental comparison; hence forensic odontologists need to have an understanding of the reliability of these records and be able to make an educated decision in the reconciliation process.

2.3 The role and regulation of dentist record-keeping

Dental record comparison between an antemortem and postmortem situation could not exist without information provided by oral health carers. In short, forensic odontologists could not be successful in their role without the existence of appropriate antemortem dental records, as provided by dental and paradental health care workers.

Awareness of the application of dental records to clinical, legal and forensic purposes is significantly determined by the training of the professional at the undergraduate level. After qualification, some continuing professional education is available to improve record keeping skills and practices but it is limited. Ultimately, varied levels of understanding and awareness exist amongst practitioners.

Professionals should be of the understanding that records must routinely include written or electronic notes made by the provider and/or the patient (such as a medical history), as well as diagnostic aids such as radiographs and dental casts. Whilst records should be of appropriately high quality to allow good standard and sequence of care throughout the life of an individual, dental graduates should additionally appreciate the possible importance of detailed records for any dento-legal proceedings, including postmortem (Hermsen and Johnson, 2012; Stoeckel, Merkley and McGivney, 2007).

In Australia, regulations regarding the management and maintenance of dental records are specified under the Health Practitioner Regulation National Law Act 2009 (Commonwealth of Australia, 2009) and advice is subsequently delivered to Australian-practicing dentists and oral health care workers via the minimum standards specified by the Dental Board of Australia (Dental Board of Australia, 2010a). Advice relates to confidentiality, retention and transfer of records in

the interest of the patient, general recording principles and the nature of information to be recorded, such as patient and clinical details. Section 2.7 of the guidelines states that patient records should be retained for 7-10 years but no mention is made of the consideration of forensic services, which may be required long after the minimum retention period for clinical practice has passed. It should be noted that the Australian Dental Association provides additional guidelines to its members with relevance to the importance of suitable record keeping. Here, there is specific mention of the use of dental records in forensic circumstances and the obligation of oral health carers to make their records available for such purposes (Australian Dental Association, 2012).

Whilst AHPRA and the DBA regulate practices related to the clinical use of dental records at a national level, practitioners should also be aware of the influence of their relevant state's Coroner's Act and the Commonwealth Privacy Act (Commonwealth of Australia, 1988) on compliance to requirements. It is of particular relevance in the Privacy Act that authorities can request the use and release, by dentists and other oral health workers, of personal information (including dental records) for forensic services, even though this was not their original intended use.

2.4 The clinical and forensic value of dental records

Dentists should record the baseline health status of the teeth and oral structures when a patient initially presents to them. Performed procedures then need be documented in written or typed form on the records and added to a dated pictorial view of the patient's dentition, called an odontogram (Pretty and Sweet, 2001; Delattre and Stimson, 1999).

Various radiographic views of teeth are also important in revealing information that may not initially be obvious during a routine examination (Pretty and Addy, 2002; Khamis, 2001). Clinically, this is most useful in detecting tooth decay and otherwise 'hidden pathologies' in inaccessible areas. Radiographs represent a two-dimensional view of the form of various cavities and restorative works, giving far more information than a visual examination alone and this is particularly useful for comparison in forensic circumstances (Bowers and Johansen, 2002). When performing a postmortem examination, it has been thought useful to have the pre-existing antemortem radiographic records available so as to attempt to reproduce the angulation of radiation penetration to the film (or sensor) in the postmortem situation (Forrest, 2012; Goldstein, Sweet and Wood, 1998); this can allow more timely reconciliation and determination of an identity.

The most forensically-valuable patient records are those which include multiple types of documented information and so offer a complete picture of the patient's oral status. This may include written descriptions, radiographs, dental casts (often taken for orthodontic assessment or denture construction), intra-oral photographs (taken to demonstrate individual areas of oral health concern to patients) and oral appliances such as sporting mouthguards.

Many dentists believe that they are keeping records which are both clinically and forensically valuable. It has been shown, however, that this is not always the case. In 1995, Borman et al. published findings from a review of forensic odontology cases in the period 1983-1992 from the Department of Forensic Medicine in Goteborg. Based on their assessment criteria, they considered that only 68% of the cases were complete with regards to information on dental characteristics, normal anatomical findings and restorative work. In a United States (US) study by Delattre and Stimson (1999), Texan dentists reported recording identifying features in routine dental records other than restorations and areas of decay; however, these features were less frequently recorded. Osborn et al.'s 2000 study regarding the adequacy of dental records in clinical practice in Minnesota, US, demonstrated statistically significant differences between dentists' perceptions of record adequacy and the actual presence or absence of criteria listed by the American Dental Association as required record components. In fact, it was shown that information was absent between 9-87% of the time across various criteria.

In 2001, Khamis found that 45% of sampled Malaysian dentists did not consider the forensic value of their dental records when they created them and only 35% of respondents to a survey thought their records would contain sufficient data for identification purposes. In the same study, 84% of antemortem records in sampled cases from the Forensic Odontology Unit of South Australia were found to contain sufficient information to allow an individual's identity to be established (although it is not possible to infer that this meant the information available was optimal). In 2003, van Niekerk and Bernitz's investigation into the standard of dental record keeping in a sample of forensic records in Pretoria, South Africa found that dentists were not complying with requirements for dental charting and record keeping. A similar result was found by Cole and McMichael (2009) in relation to their audit of dental practice record keeping in Worcestershire, United Kingdom – recordings of soft tissue (in only 36% of records), periodontal status (30%), radiographic review (27%) and note-taking (25%) all fell below the satisfactory standard set.

In 2013, a Sudan-based study of case notes made within government versus private dental hospitals by Petro and Philips showed a total absence of dental charting prior to treatment in government clinics, with only 8.3% in private clinics (which are purported to supply 'good quality treatment'). Additionally, records of the government clinics contained no medical history information and no radiographs because they 'were given to the patients'. The researchers

concluded that general record keeping in Sudan was poor compared to other countries.

Consequently, in 2015, Waleed et al. published a study on the importance of dental records in forensic dental identification, comparing case note recording of dentists in private dental clinics to dental students in academic hospitals in the Khartoum area of Sudan. The study used the Australian Dental Association (Dental Board of Australia) guidelines on dental record keeping for assessment of the quality of the case notes selection. Interestingly, they found that the overall awareness of the importance of maintaining dental records for medico-legal reasons was higher and statistically significant ($p=0.002$) in those working or studying in academic hospitals (37%), compared to private dental practitioners (13%). In total, only 48% of those surveyed were aware of the importance of dental records for medicolegal purposes. When considering all case notes that Waleed et al. assessed, they found that personal details of patients were generally very well recorded, with a completed medical history within 57.1% of records and a full dental chart being present in 76.8%. It was interesting to note that a full dental chart was much more likely to be present in a case note compiled in a teaching hospital (56%) than in a private clinic (21%). Clinical photographs were more commonly present in student-formulated case notes (28%) than those produced by private dental practitioners (8%). Another noteworthy finding was that 100% of the combined case note sample contained a dental radiograph of some sort (72% had one or

more periapical views, 35% a panoramic view), perhaps suggesting some sort of screening process that may be routine within the study location.

In a 2016 Indian study by Shanbhag, it was noted that several dentists and legal professionals remain 'quite ignorant of the importance of dental records in the identification of unknown persons in the field of forensics'. In Australia, there is limited research assessing the standard of record keeping for clinical and forensic purposes. Brown, Keily and Spencer (1994) found that periodontal diagnostic and preventive services were infrequently noted on the patient records of their sample group of practitioners. The same study also found that over 40% of records did not contain enough information to determine the number of teeth that were present and almost 25% had no record of the patient's age or date of birth. A review of published rulings of formal complaints and notifications brought before disciplinary hearings in Victoria during 2000-2014 was published by Brown in 2015. In the review, Brown demonstrated that up to 75% of the cases had a finding of unprofessional conduct against a dental practitioner on the basis of inadequate record keeping (usually in conjunction with an additional breach of conduct). Disturbingly, Brown additionally reported the then-President of the Dental Board of Victoria had testified that 'woeful dental records' were 'more common than not'! (Tai v Dental Board of Australia, 2005).

Recently, Al-Azri, Harford and James (2016) demonstrated that over 44% of respondents thought most of their Australian-made dental records would be useful in forensic circumstances and 36% thought that all of their records would be useful. However, their survey of current practices showed that limitations existed with regard to type and amount of details recorded (such as personal details, medical history update, name of previous dentist, previous dental investigations etc.), retention of items (radiographs from previous dentist, referral letters, dental casts) and examination and recording at first dental visit. In addition, reported recording of specific forensically valuable traits ranged from moderate (supernumerary teeth, diastemata) to low (hypoplasia/fluorosis, tori, direction of tooth rotation).

A previous study (Stow, James and Richards, 2016) showed that, within the sampled case notes, the patient's first and last name and date of birth were recorded in the majority of instances. However, only 68% contained a medical history form, and only 23% included the name of the treating practitioner. Thirty six percent of radiographs were not labelled with a date that matched that in the written documentation and 25% were not labelled with the correct patient's name. Only 14% of case records contained a written documentation of the patient's occlusion pattern and 17% of case notes featured a record of tooth anomalies.

When other, more common treatment features do not allow identification, it is minor detail that can assist forensic services. As an example, many dentists may not consider it important to record wear patterns if it does not represent a pathological process. However, it is this very pattern of wear which may assist a forensic identification in the absence of other data. Similarly, records of the presence of diastemata (tooth spacings) and tooth rotation/angulation, altered tooth shape and discolouration can all assist the work of an odontologist.

Having complete and accurate records of the dental condition of a particular individual is vital (Bell, 2001). Just one of the frustrating issues faced by forensic odontologists is this noted lack of detail recorded in dental case notes (Stow, James, and Richards, 2016; Sarode et al., 2009). In my own casework experience, it is common to note specific, individualising features at a postmortem examination that had not been documented in antemortem records and could have proven extremely important in establishing a timely identity of the deceased.

Other challenging issues that odontologists face relating to dental records include the use of unfamiliar terminology or abbreviations, illegibility, inaccurate or outdated odontograms and poor retention of diagnostic aids (such as radiographs). In fact, recent research (Stow, James and Richards, 2016) found that only 95% (CI=88.54-98.13), of the case notes sampled were legible,

29% (CI=20.98-38.57) of odontograms were either entirely or partially incomplete and 25% (CI=17.50-34.35) of case notes contained omissions of documentation related to patient care (eg. written evidence that a radiograph had been taken but it was not present in the case file).

A review of forensic odontology reports written by the Joint Prisoner of War/Missing in Action Accounting Command (JPAC) Central Identification Laboratory for remains identified from the Korean war provided an interesting appreciation of the value of dental records (Shiroma, 2016). Some 234 remains from the three-year conflict (1950-1953) had been identified with the aid of dental elements (as well as additional information). Only 31% of those identified had antemortem dental records concordant with their postmortem profiles; 69% contained discrepancies which were explainable. Discrepancies in their profiles included: erroneous charting of missing third molars in 50% of cases (understandable as dental care providers during this time period routinely performed examinations without radiographs); undocumented subsequent treatment in 69% of cases; and misidentification of specific teeth missing and/or an error in treatment record documentation in 14% of cases. A review by Shiroma documented a case in which incomplete collection of dental records initially impeded identification of an unknown body for more than 50 years. Additionally, he discussed an instance where confusion in the identification of specific missing and present teeth (and an erroneous case note

entry) was likely to have led to the inadvertent exclusion of an identity for over 55 years.

2.5 Bridging the gap in valuable dental record keeping

Clearly, dental recording can be improved; doing so would benefit patients and their health providers. This potentially has flow on effects to casework in forensic odontology and family members of those whose identity is in question.

There are existing barriers to maintaining forensically valuable dental records and these can be divided into two broad categories – lack of knowledge and lack of application of knowledge on the part of the producer of the record. Practitioners may simply be unaware of the requirements for clinical and forensic services. Indeed, of the 72 cases that went before the formal tribunal in Victoria in the period 2000-2014 (as reported on the Australasian Legal Information Institute website), Brown (2015) noted that 28 of these included allegations of poor record keeping and that, in all 28 cases, orders were made for these practitioners to better educate themselves regarding record keeping. Similarly, Brown reported that 23 out of 31 cases (74%) reviewed by a Professional Standards Panel commissioned by the National Dental Board of Australia in the same period contained findings that the practitioner had engaged in unprofessional conduct in respect to poor record keeping. Again, in

all 23 of these cases, practitioners were ordered to undertake further education in record keeping.

Other existing barriers to producing optimal records include the taking of liberties due to the lack of strict regulation on the record keeping process. Additionally, genuine issues arise regarding time constraints in a busy practice, leading to a disparity between real and perceived value of dental records.

It is logical to believe that incorporation of topics related to record keeping and the role of dentists and odontologists in forensic services during undergraduate and postgraduate training and professional development courses could reinforce the important role to be played by all oral health care workers (Astekar et al., 2011).

2.6 Online education in health care

Online learning has exploded in popularity over the past few years. In most developed countries, it is the most accessible pathway to new knowledge for people in all aspects of their private and working lives. In fact, Kuo et al. (2013) determined that academic leaders in the United States believe online learning to be critical to the long-term growth of their institutions, reporting that the increase in demand for online programmes was actually greater than for face-

to-face courses. Online is a recognised method for delivering educational material and has the benefit of enabling participants to choose the time, place and pace of study. This is particularly relevant for today's busy working professionals.

Allen and Seaman (2010) reported that academics in their survey of 4511 college institutions in the United States had varied opinions on online learning; over three quarters of academic leaders at public institutions reported that online is as good as or better than face-to-face instruction. In fact, they reported that 67% of participating academics in the entire study rated the online learning outcomes of their students as either the same or superior to face-to-face measures; this percentage had risen from 57% in 2003.

Health-based studies with participating student populations have actually shown that online learning can be equally effective in imparting knowledge as traditional learning methods. A plethora of software tools are available to develop online learning courses in forms that academic staff determine will meet the learning objectives of their student cohort. Articulate Storyline 2 (Articulate Global Inc.) online training software is one such tool that has been shown to promote effective learning whilst maintaining student satisfaction (Belfield et al, 2015; Thomas et al. 2015).

In a 2004 study evaluating the relative effectiveness of e-learning verses lecture learning in two distinct groups (new dentist graduates and their experienced practitioner mentors), Browne et al. found greater knowledge retention in the new graduates with lecture style, face-to-face learning but significantly more success in e-learning outcomes for the more experienced practitioner group. In 2005, Wutoh, Boren and Balas' review of current literature related to the effectiveness of online learning verses traditional learning in medical education demonstrated no difference between the formats. They did, however, note that little is known about whether the positive changes in knowledge brought about by any style of learning actually translates into changes in practice.

2.7 Measuring effectiveness for best evidence health care education

Evidence-based practice is a clear 'buzz' phrase amongst educational institutions. In order to justify the implementation of a particular learning intervention, educators need to be able to define and clarify the effectiveness of their programme.

Inherently, effectiveness of health care education is difficult to measure. For one, some of the effects of education may not be apparent for years after the programme has been completed (Belfield et al., 2001). Additionally, some practitioners may actually learn from an educational intervention but not have the resources available (eg. time, attitudes of colleagues, finances, lack of

support) to implement a preferred change in practice. By definition, this might mean that a learning intervention was not actually judged effective, as the goals of the education were not met. The reality is, however, that a broad range of factors might influence the true effectiveness of education. Despite awareness of the limitations and difficulties of measuring true effectiveness, evaluation models have been proposed to offer some standardisation to outcome measures.

The most well-known and popular approach to education evaluation to this day was first proposed by Kirkpatrick in 1976. He described effectiveness based on evaluation of four levels – participant reaction or satisfaction (level one), change in learning or knowledge (level two), change in behaviour (level three) and results or health care outcomes (level four).

Clearly, the ultimate test of the effectiveness of an educational intervention is its impact and improvement of patient health care outcomes (level four). However, a review of the current literature suggests that 'healthcare outcomes' are neither easily measured nor defined in a standardised manner for a variety of reasons in addition to those already highlighted: the goals of each intervention are so varied depending on the area of research; effects are difficult to attribute to the specific learning intervention; and outcomes are difficult to follow in the long term (Goldstein and Blatchford, 1998). In the

current context, one can appreciate the difficulties in determining whether a practitioner's participation in the online interactive learning module (ILM) on improving dental case note recording for forensic purposes actually led to a more expedited forensic dental identification for their patient!

There is limited systematic literature review evidence specific to effectiveness of continuing dental education. In 2013, Firmstone et al. completed a systematic review of the effectiveness of continuing professional development on learning, behaviour or patient outcomes in dentistry. They utilised a modified Kirkpatrick framework (level one - participation, level two - participant's reaction to education, level three – learning or knowledge, level four – performance and level five – health care outcomes) and they could find only 25 studies conducted over the last 25 years. Of those, only 10 were deemed of appropriate quality to include in their review. Only five studies used an outcome measure based on patient health care (ie. the highest level of effectiveness) and only three did this using patient records rather than relying on dentist self-reporting. In short, they not only found a lack of robust systematic review evidence in international literature to demonstrate the best way to educate dentists, they also noted that it was important that future evaluations of dental continuing professional development outcomes are based on attaining higher levels in the Kirkpatrick framework, in order to move the evidence base of effective practice forward. This is easy to propose but difficult to pursue, in practical terms.

Many evaluations of learning interventions avoid the use of health care outcomes as their measure of effectiveness (Davis, 1998; Davis et al., 1995) because it is an almost impossible task to maintain a robust methodology. It is true to say that the vast majority of the literature available on continuing education outcomes is specific to the medical field; and, in fact, Belfield's 2001 review of over 200 abstracts on effectiveness of education for medical clinical practice found that only 2% reported on health care outcomes.

Whilst health care outcomes are difficult to discern, assessment of changes to level three of Kirkpatrick's hierarchy (practitioner behaviour) can also be challenging to determine. It is difficult to argue that a change in behaviour or performance can always be equated to outcomes. In 1997, Allery et al., described how practitioners may consider that they have been effectively educated regarding delivery of smoking cessation information to patients. However, any given patient may continue to smoke despite information provided by an effectively trained practitioner. The same is true for an oral health provider who delivers targeted oral hygiene instruction that is not adopted by a patient for reasons unrelated to the education of the practitioner. Again with reference to the research task at hand, it is difficult to say whether effectively-trained dental practitioners, who improved their awareness of appropriate forensic recording practices by engaging with the ILM, will actually aid forensic outcomes because there simply might not be any forensically valuable traits to record for any given patient.

Despite these challenges, level three changes in education effectiveness are more frequently assessed in the literature than health care outcomes. How appropriately this is done, however, is a subject of conjecture, as there is often little evidence to substantiate such claims of true change to practitioner behaviour. The vast majority of evaluations of educational interventions are based on levels one and two of Kirkpatrick's hierarchy.

Level two (learning) is often measured in the educational setting via written examination or testing, OSCE (Objective Structured Clinical Examination) or viva, conclusively linked to the stated curriculum outcomes. Whilst acknowledgement is made of the reportedly weak link between performance in tests or examinations and changes in practice behaviour (Harden et al., 1999; Bishop, 1989), there exists evidence that CPD in dentistry is judged by participants to have a positive effect on learning and understanding (Bullock et al., 2010). In the study, Bullock et al. summarised works that have been previously completed with regards to practitioner views on CPD effectiveness: longer, multi-phase methods are seen to have greater impact than short course learning (Davis, 1998) and CPD is most effective when linked to clinical practice and reinforcement of the desired learning outcomes (Cantillon and Jones, 1999). Given the purported practitioner views, there is some evidence to suggest that learning may be an appropriate effects measure in certain circumstances.

Participant completion and satisfaction (level one) indicators provide teachers with immediate feedback which not only identifies the level of student engagement but also informs future course modification (Belfield et al., 2001). Student satisfaction is an important indicator of the quality of the learning experience (Yukselturk and Yildirim, 2008). It is important to note that online learners who are unable to regulate their own learning efficiency are unlikely to be satisfied with the approach (Puzziferro, 2008).

Over the years, limitations on the assumptions of Kirkpatrick's hierarchy of effectiveness of learning have been noted and discussed (Bates, 2004; Allinger and Janak, 1989). These limitations include assumptions that each level is more effective than the last and that each level needs to be effective before the subsequent level can be achieved. Detailed discussions of this remain outside the scope of this current project but provide a framework for informing evaluation practices for the task at hand.

CHAPTER 3

RATIONALE, AIMS and SIGNIFICANCE

3. RATIONALE, AIMS AND SIGNIFICANCE

3.1 Rationale

A recent study (Stow, James, and Richards, 2016) demonstrated significant deficiencies in dental case note recording practices, both with regard to the Dental Board of Australia's record keeping guidelines and those traits considered favourable by Australian forensic odontologists. This demonstrated the need for education with regard to appropriate record keeping skills, which can be delivered in the form of continuing professional development.

3.2 Aims

This project aimed to enhance the understanding of dental professionals with regard to forensic oral health record-taking requirements by developing, implementing and evaluating an interactive e-learning module. Additionally, this project aimed to increase the awareness of the importance of accurate and appropriate record keeping for the practice of human identification based on dental comparison.

The aims were fulfilled by the development and testing of an online training package (ILM, or Integrated Learning Module) for educating dental health professionals on improving the detail, accuracy, legibility, accessibility and retention of dental records, with specific reference to forensic odontology.

Data collected from participants in this learning module were analysed and has been disseminated in the form of scientific publications (appendices to this document) to encourage future education with regards to record keeping.

3.3 Significance

The online training module was expected to provide standardisation of basic learning by each participating member of the dental community and hence, potentially reduce the disparity between the perceived and real value of dental records. The pre- and post-course surveys were designed to provide feedback allowing future advances in CPD in the area of record keeping.

The presentation of the results of this research in the form of journal publications and at professional conferences is expected to increase the awareness of the legal requirements for dental record keeping and of the importance of accurate oral health records in the practice of forensic odontology. Additionally, the information collected during this research project informs forensic practitioners on the potential evidentiary weight of antemortem records by providing an insight to the accuracy and reliability of dental records.

CHAPTER 4

DEVELOPMENT OF THE INTERACTIVE LEARNING MODULE

4. DEVELOPMENT OF THE INTERACTIVE LEARNING MODULE

A 60 minute online, interactive educational module was developed using Articulate Storyline version 2 software (Articulate Global Inc.). The software allowed presentation of relevant, referenced educational material (like a traditional slide-based, face-to-face lecture), with the ability to additionally insert interactive feedback for the participant (via quizzes).

The ILM contained six separate sub-headings related to dental records in Australia: introduction, detail, accuracy, legibility, accessibility and retention.

Introduction

- Aim and justification for the interactive learning module
- An explanation of the Dental Board of Australia record keeping guidelines, with interactive buttons for further information as required by the participant (Figure 1)
- Interactive buttons explaining the need for dental records (clinical work, legal defense, research and forensic investigation). Examples for each of these categories were provided, with the forensic investigation section being extensive (Figure 2)
- Explanation and examples of what constitutes a dental record (Figure 3)

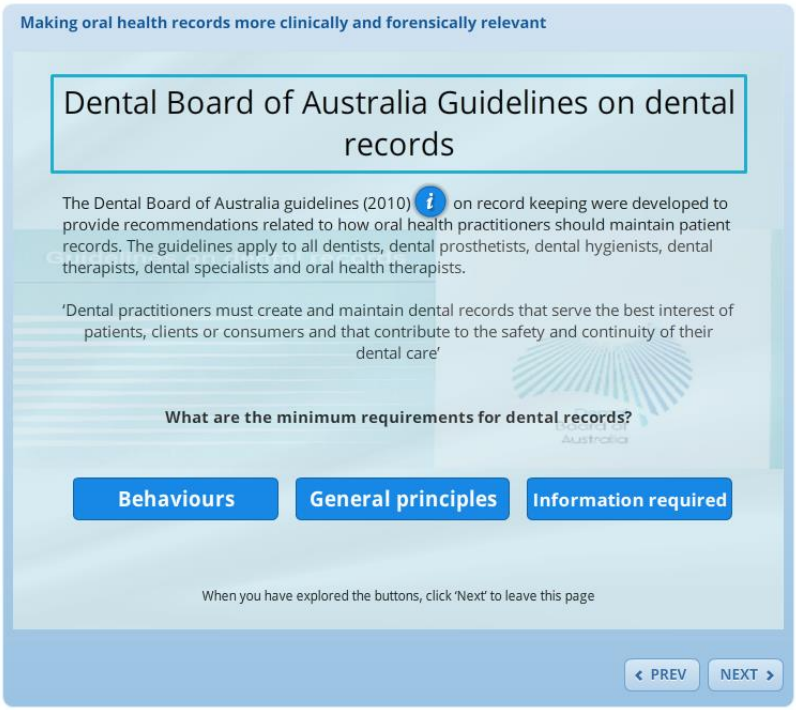


FIGURE 1: Dental Board of Australia record keeping guidelines screen capture, with interactive buttons to explore more about Behaviours, General Principles and Information required, in the 'Introduction' section of the Interactive Learning Module.

FIGURE 2: The need for dental records – forensic investigation screen capture in the 'Introduction' section of the Interactive Learning Module. Hyperlinks allowed further investigation of the topics marked in red font.

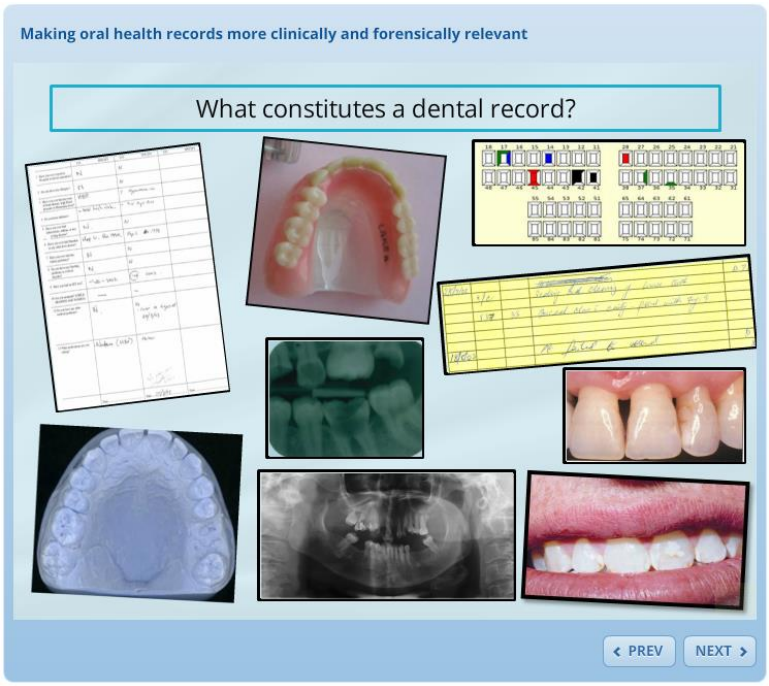


FIGURE 3: 'What constitutes a dental record?' screen capture in the 'Introduction' section of the Interactive Learning Module.

- Referenced documentation of the current state of dental record keeping in Australia and around the world, including the short-fall in real and perceived value (Figure 4)
- Suggestions for making improvements in dental record keeping (Figure 5)
- Quiz questions to gauge the participant's level of understanding of the introductory phase of the module. Multiple attempts were allowed, with the participant being unable to progress to the end of the introductory phase until the questions were correctly answered. One example is provided as Figure 6.

FIGURE 4: 'Current state of recording practices in Australia' primary screen capture, with one reference bubble enlarged, in the 'Introduction' section of the Interactive Learning Module.

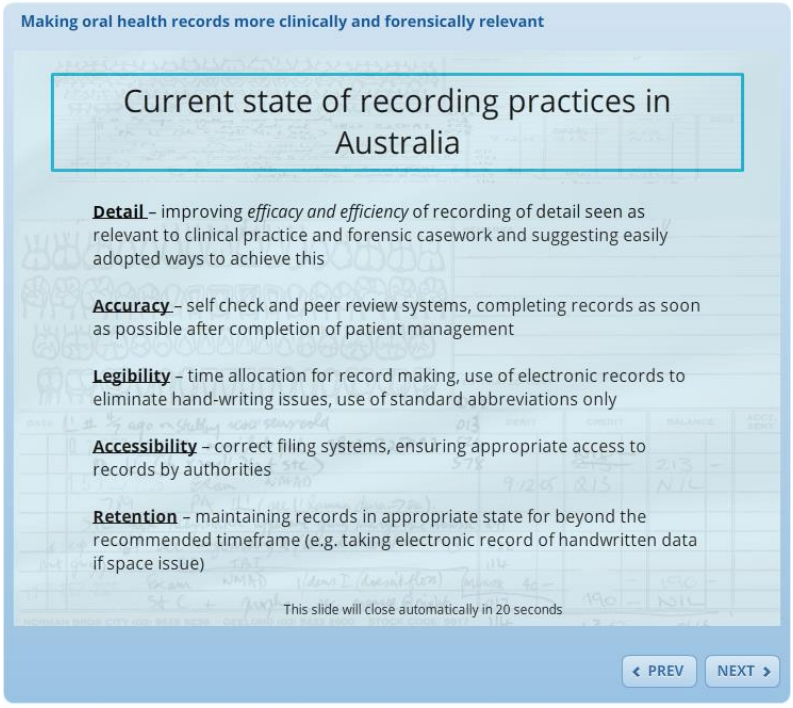


FIGURE 5: Overview of suggestions for making improvements in dental record keeping (detail, accuracy, legibility, accessibility and retention) in the 'Introduction' section of the Interactive Learning Module.

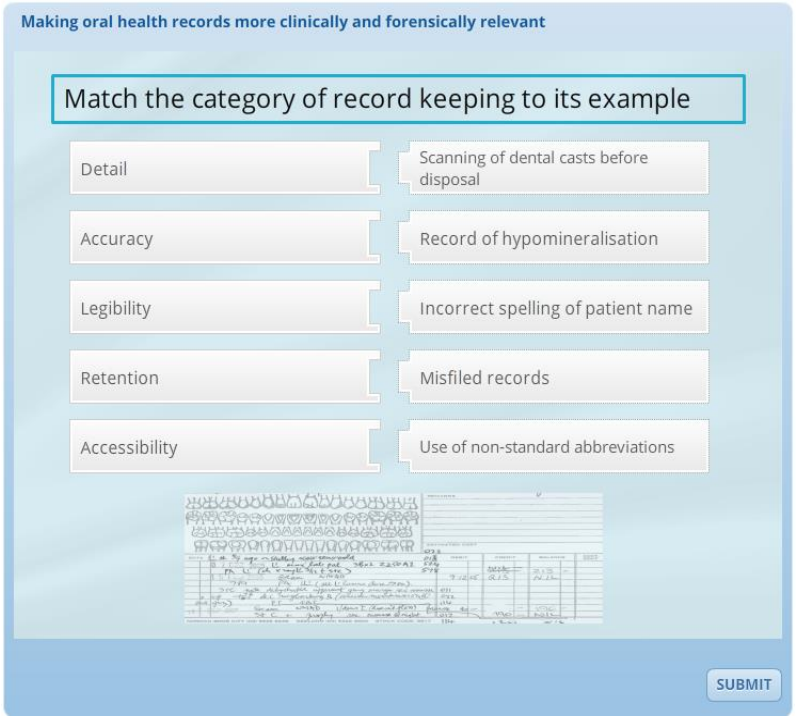


FIGURE 6: Screen capture of 'Drag and Drop'-type question to ensure participants had grasped key aspects of the 'Introduction' section of the Interactive Learning Module.

Detail

- Identification of the most common issues in case note detail (Figure 7)
- The types of detail that IS required (Figure 8), with interactive buttons to click on for further explanation of each of these categories. Some examination, radiograph and professional communication button examples are shown here as Figures 9-13.
- Quiz questions to gauge the participant's level of understanding of the detail phase of the module. Multiple attempts were allowed but once one answer was attempted and was submitted, a 'suggested' answer became visible to the participant. In this way, they received feedback about their learning. One example is provided as Figure 14.

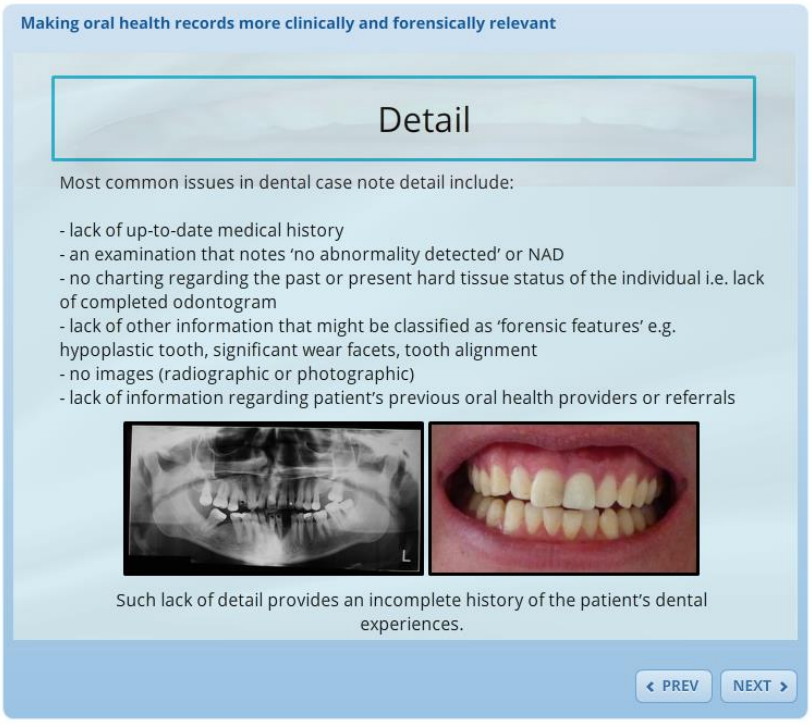


FIGURE 7: Identification of the most common issues related to detail recorded in dental case notes in the 'Detail' section of the Interactive Learning Module.

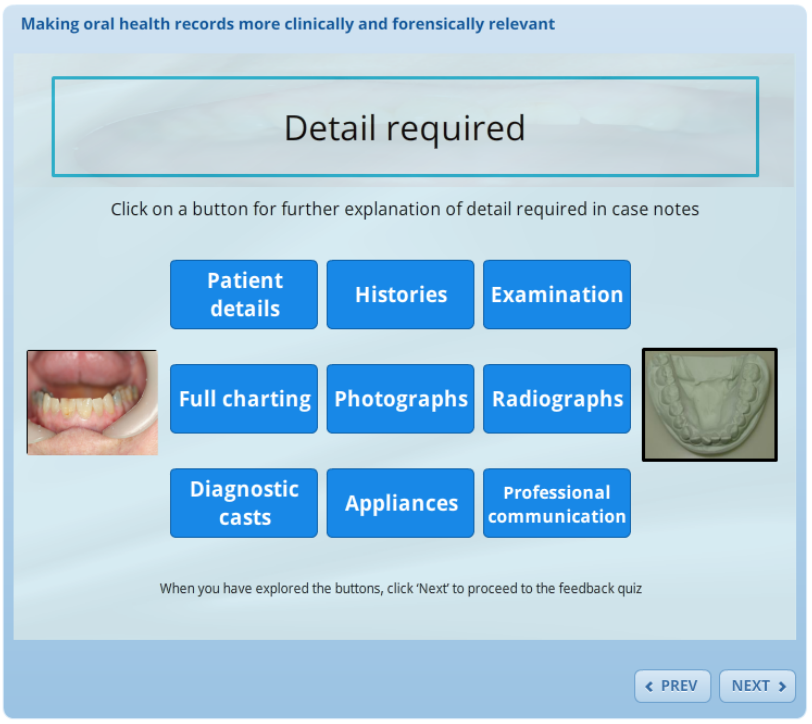


FIGURE 8: Categories of detail required in case notes, as interactive buttons to click for further explanation, in the 'Detail' section of the Interactive Learning Module.

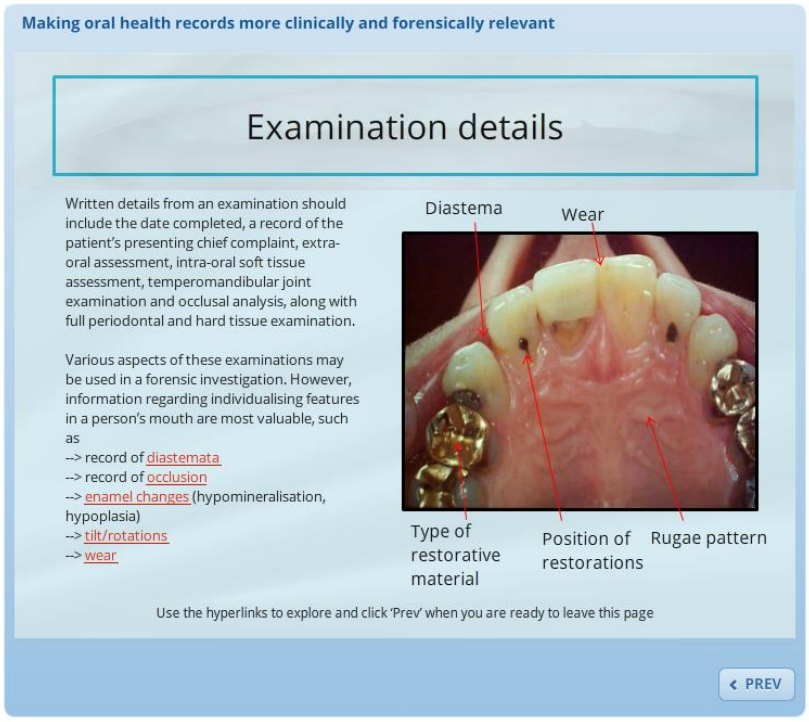


FIGURE 9: Exploration of the 'Examination' button in the 'Detail' section of the Interactive Learning Module reveals pictures, information and further red hyperlinks to explore.

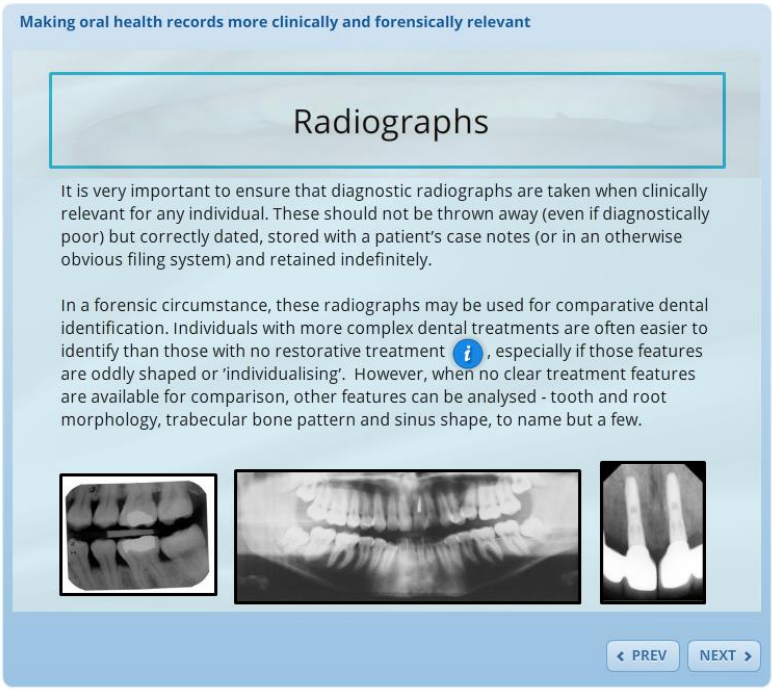


FIGURE 10: Exploration of the 'Radiographs' button in the 'Detail' section of the Interactive Learning Module reveals further explanation and radiographic example.

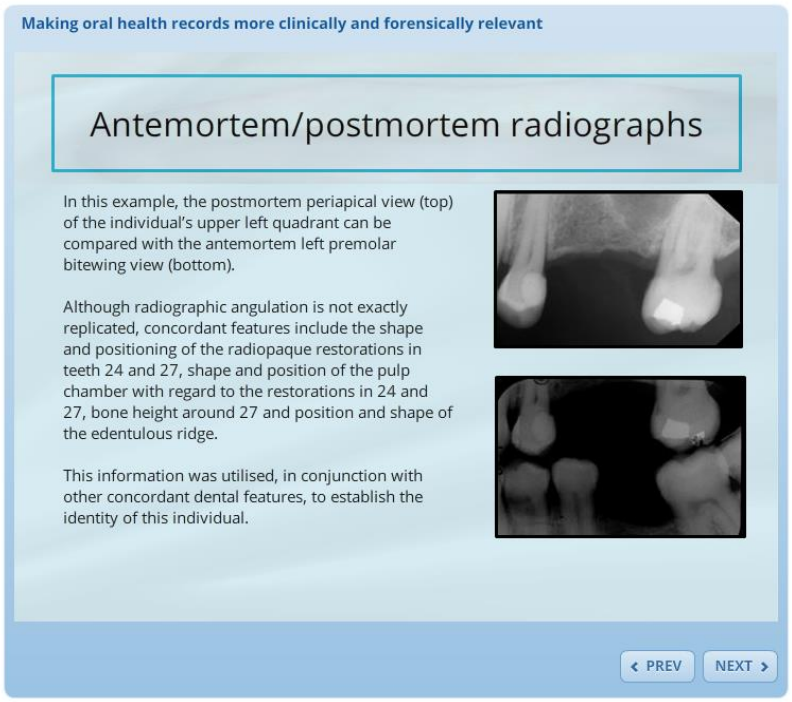


FIGURE 11: Further exploration of the 'Radiographs' button in the 'Detail' section of the Interactive Learning Module demonstrates a real-life example of antemortem/postmortem bitewing radiograph comparison.

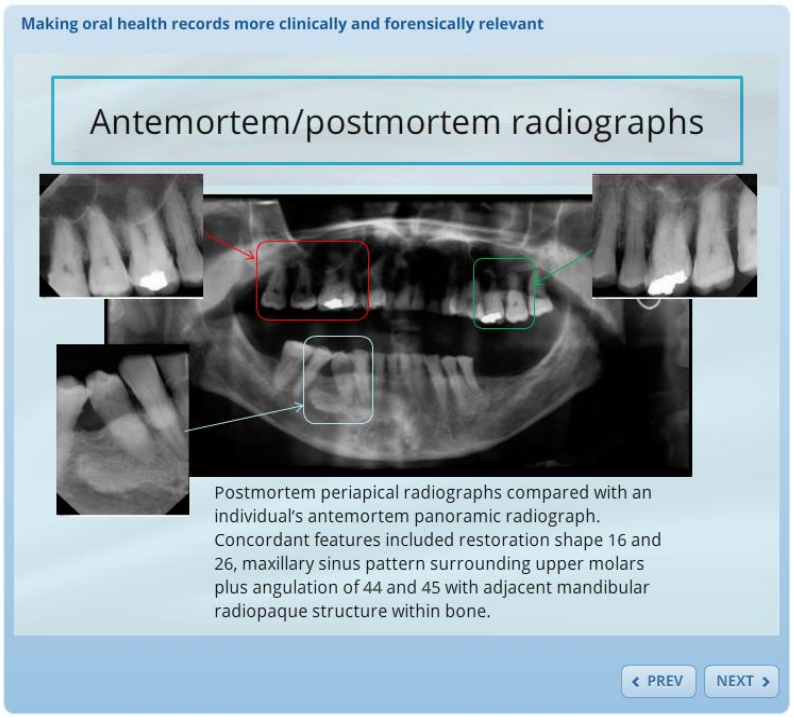


FIGURE 12: Further exploration of the 'Radiographs' button in the 'Detail' section of the Interactive Learning Module demonstrates a real-life example of antemortem OPG/postmortem periapical radiograph comparison.

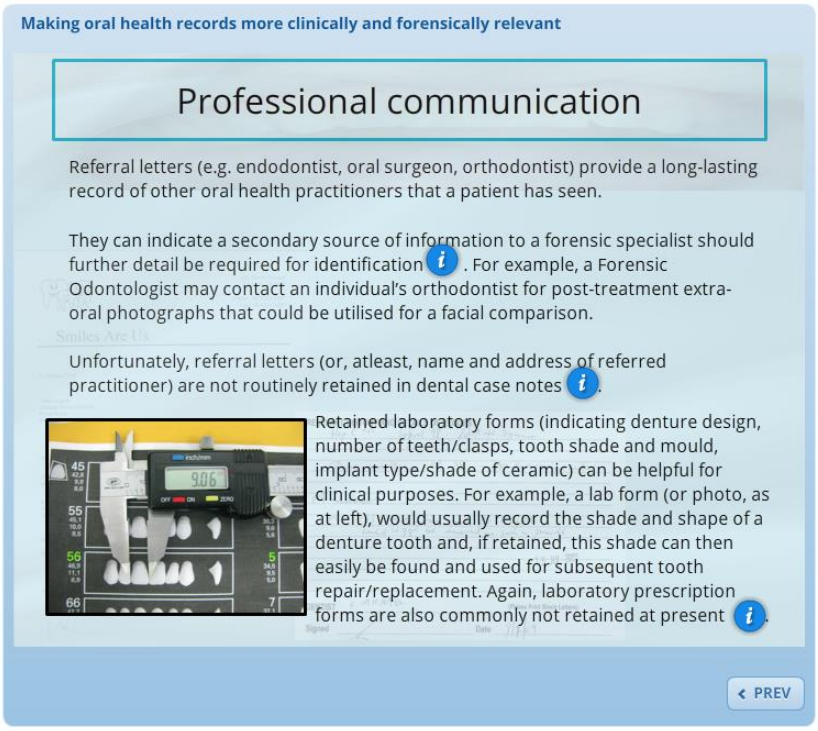


FIGURE 13: Further exploration of the 'Professional communication' button in the 'Detail' section of the Interactive Learning Module demonstrates how details of referral letters and laboratory requests can be helpful in both clinical and forensic circumstances.

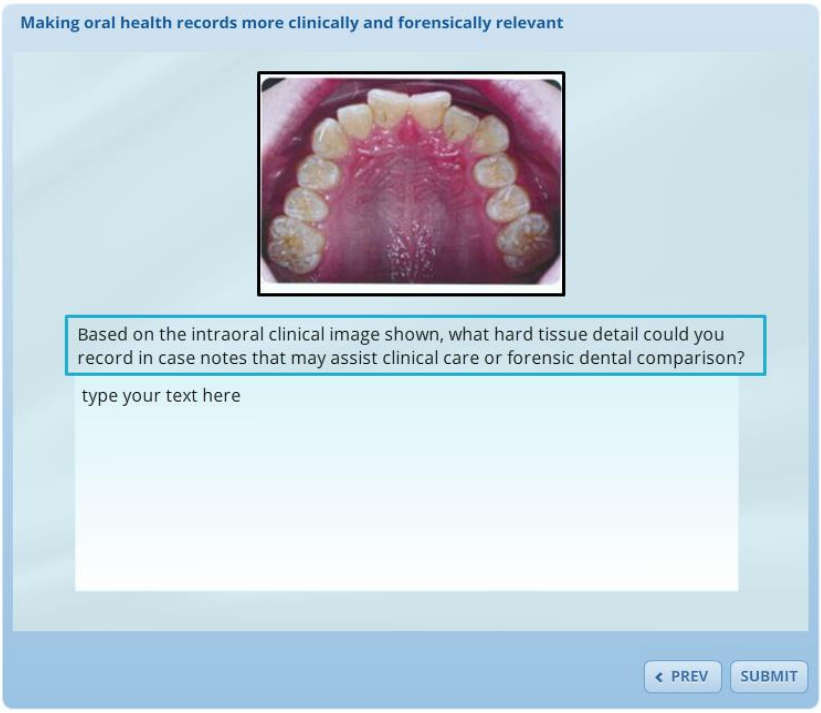


FIGURE 14: Screen capture of a short answer-type question to ensure participants had grasped key aspects of the 'Detail' section of the Interactive Learning Module. Once participants submitted their answer, a suggested answer was visible to them.

Accuracy

- An explanation of the need for optimal accuracy in dental case note recording (Figure 15)

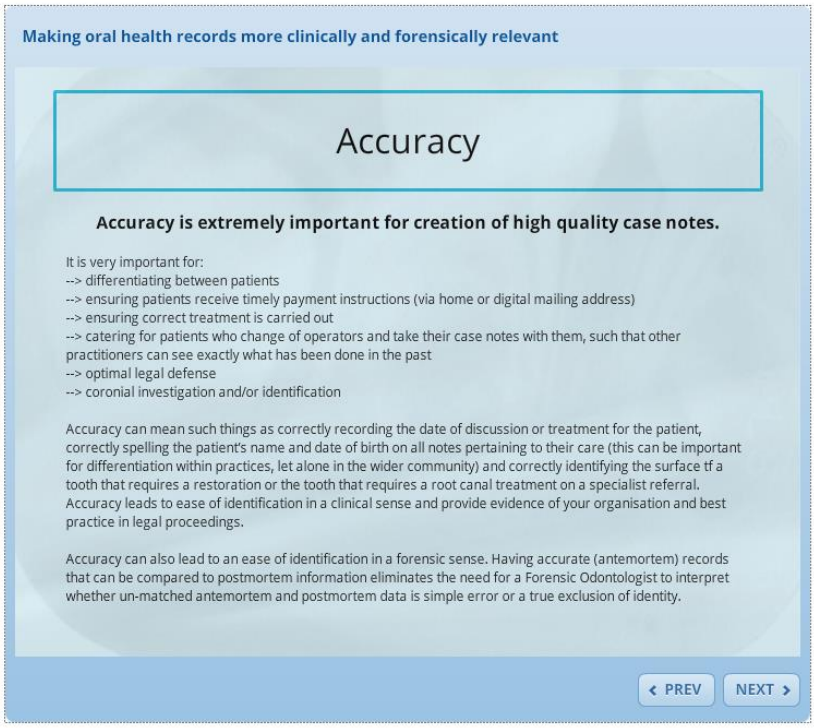


FIGURE 15: Screen capture of the initial slide explaining the need for accuracy in dental case note recording in the 'Accuracy' section of the Interactive Learning Module.

- Multiple examples of where inaccurate records can hinder forensic identification (Figures 16-18)
- Quiz questions to gauge the participant's level of understanding of the detail phase of the module (Figures 19-21)

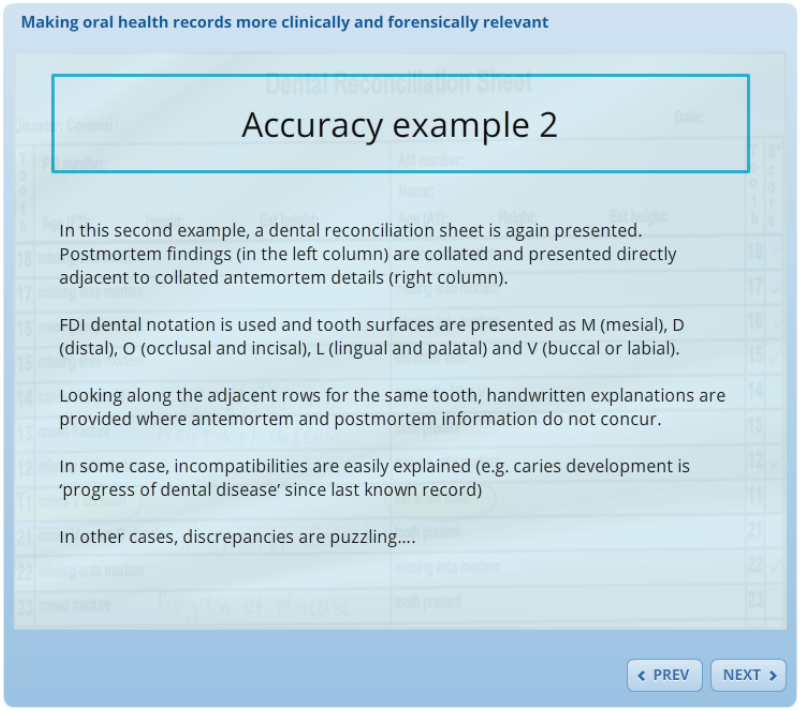


FIGURE 16: Screen capture of the explanation provided of antemortem/postmortem reconciliation of dental records by a forensic odontologist in the 'Accuracy' section of the Interactive Learning Module. The explanation precedes the example shown in Figure 17.

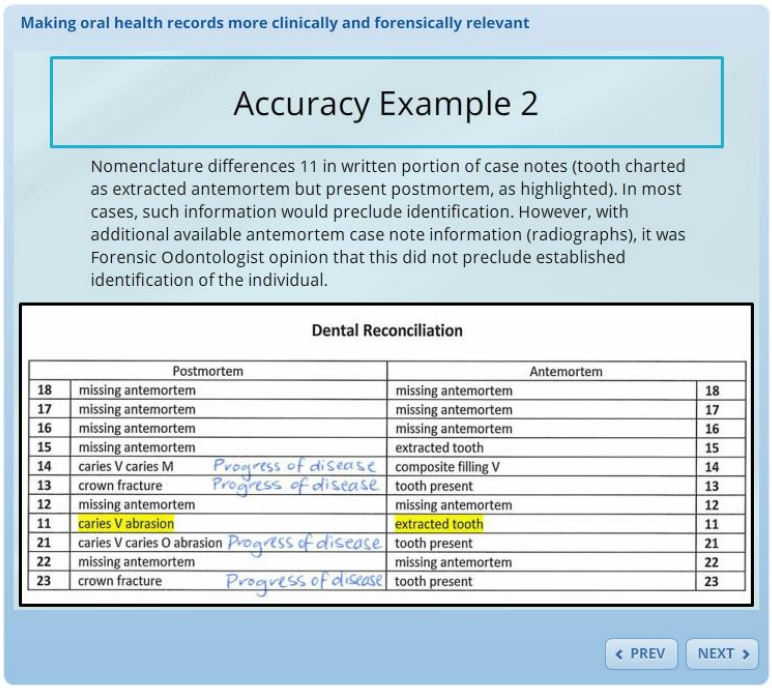


FIGURE 17: Example of a reconciliation demonstrating that antemortem and postmortem dental records did not entirely match (tooth 11 was said to be missing in the antemortem dental records but was present with dental disease at the postmortem examination) in the 'Accuracy' section of the Interactive Learning Module.

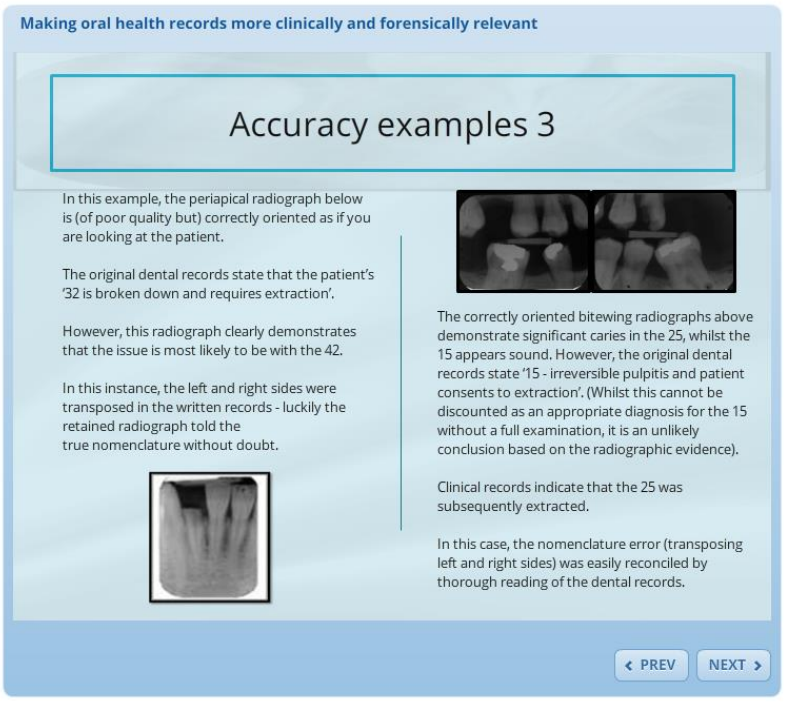


FIGURE 18: Further examples of forensic dental reconciliation demonstrating that antemortem and postmortem dental records did not entirely match in the 'Accuracy' section of the Interactive Learning Module.

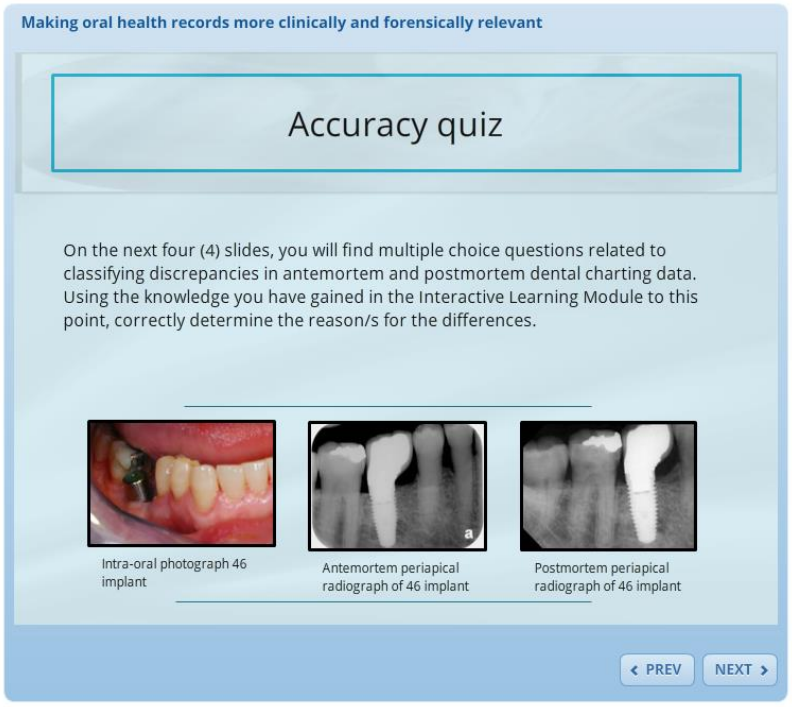


FIGURE 19: Explanation of the quiz in the 'Accuracy' section of the Interactive Learning Module.

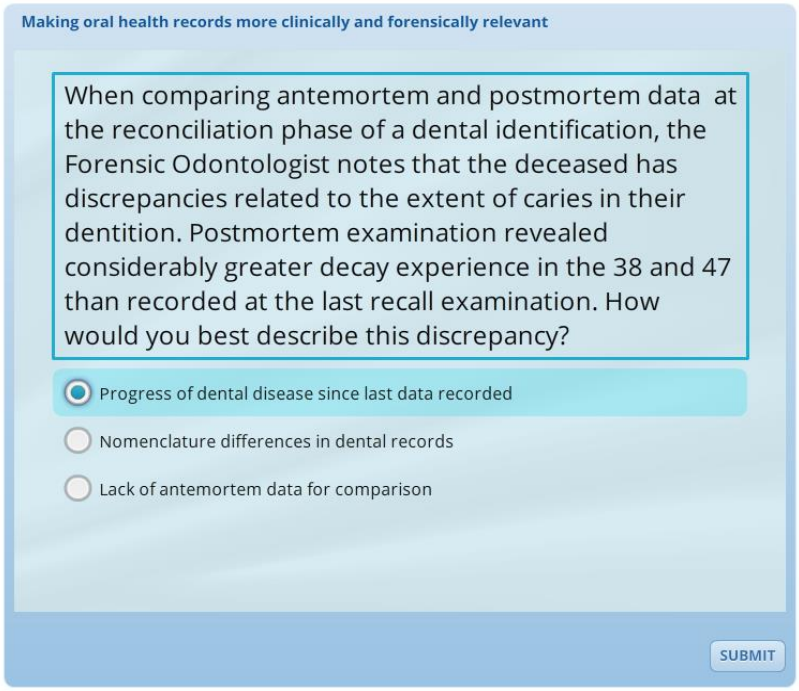


FIGURE 20: An example of one of the multiple choice quiz questions in the 'Accuracy' section of the Interactive Learning Module.

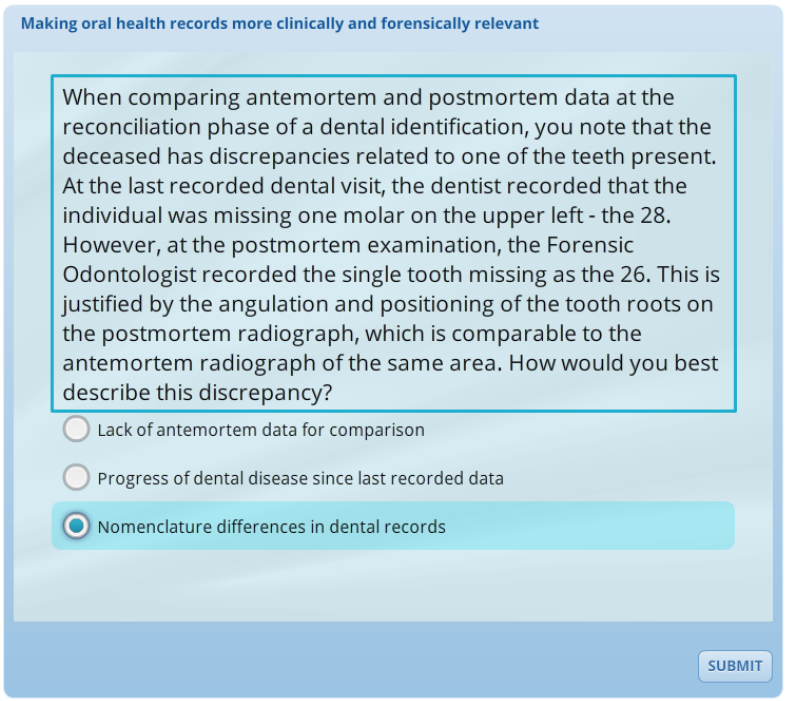


FIGURE 21: A further example of one of the multiple choice quiz questions in the 'Accuracy' section of the Interactive Learning Module.

Legibility

- An explanation that legibility of case notes incorporates not only the 'readability' of written word but also spelling and the use of abbreviations
- Multiple examples of illegible or poorly legible dental records (Figures 22-25)
- A single quiz question to consider in order to gauge the participant's level of appreciation regarding the need for optimal legibility in case note recording; 'How will you ensure that your patients' dental case notes are legible to you, other practitioners and relevant authorities?' (Figure 26)

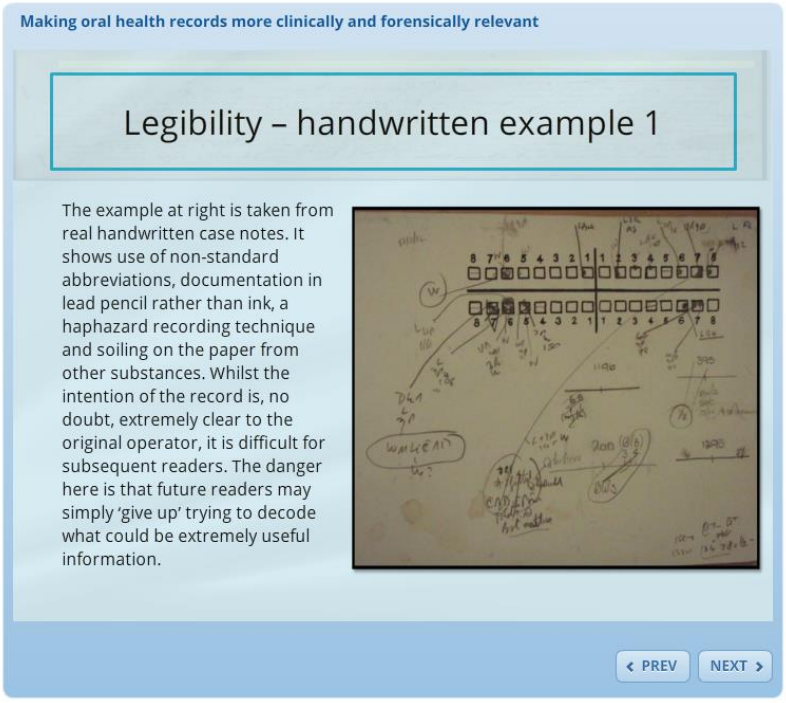


FIGURE 22: An example of indiscernible hand written dental records in the 'Legibility' section of the Interactive Learning Module.

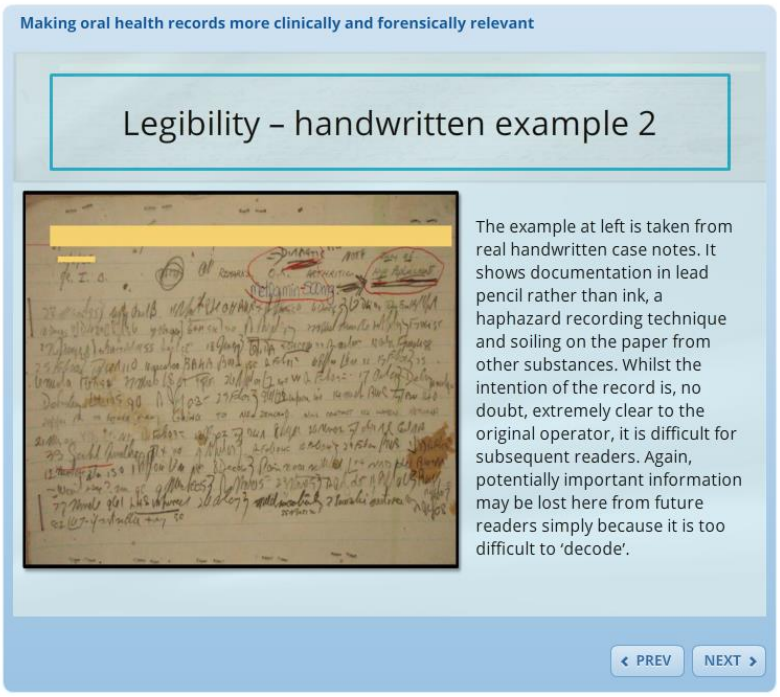


FIGURE 23: Another example of indiscernible hand written dental records, with additional soiling making interpretation all the more difficult, in the 'Legibility' section of the Interactive Learning Module.

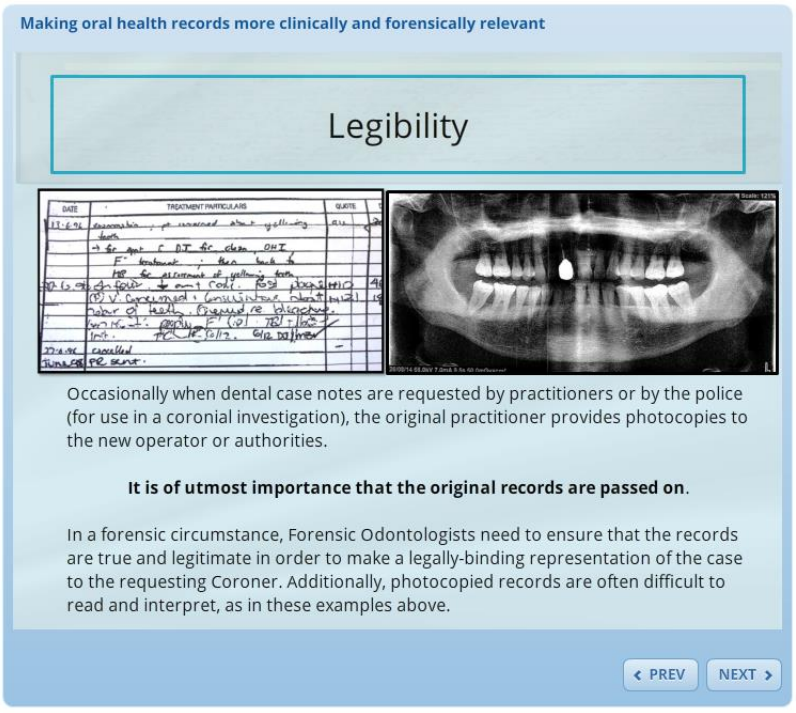


FIGURE 24: Education regarding the need to provide original dental records to police for an optimal forensic investigation in the 'Legibility' section of the Interactive Learning Module.

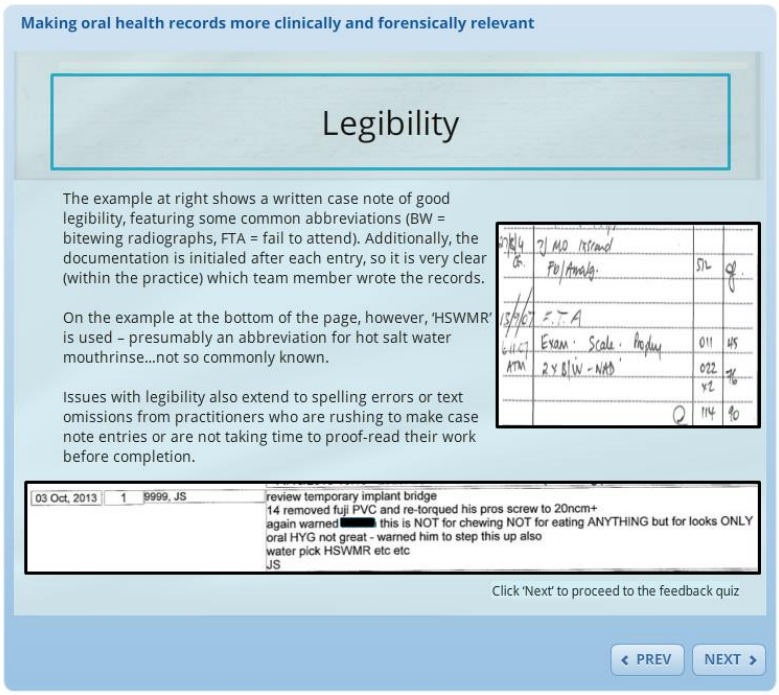


FIGURE 25: An example of use of abbreviations (common and uncommon) in hand written dental records in the 'Legibility' section of the Interactive Learning Module.

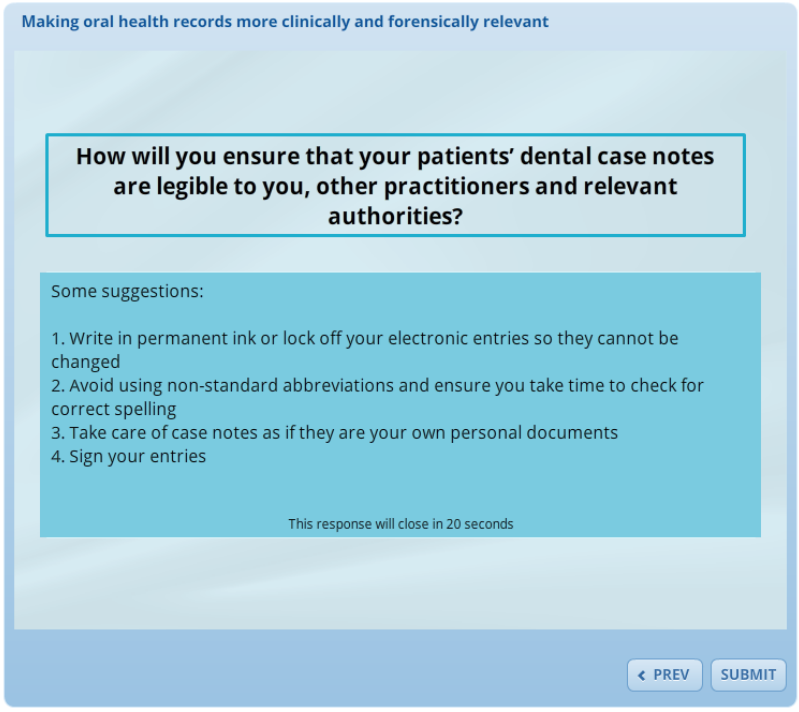


FIGURE 26: The singular quiz question in the 'Accuracy' section of the Interactive Learning Module; one to brainstorm, with some suggested answers (as shown) provided once the participant had submitted their own thoughts.

Accessibility

- Information about correct labelling and storage of dental records, so they can be easily located and retrieved (Figure 27)

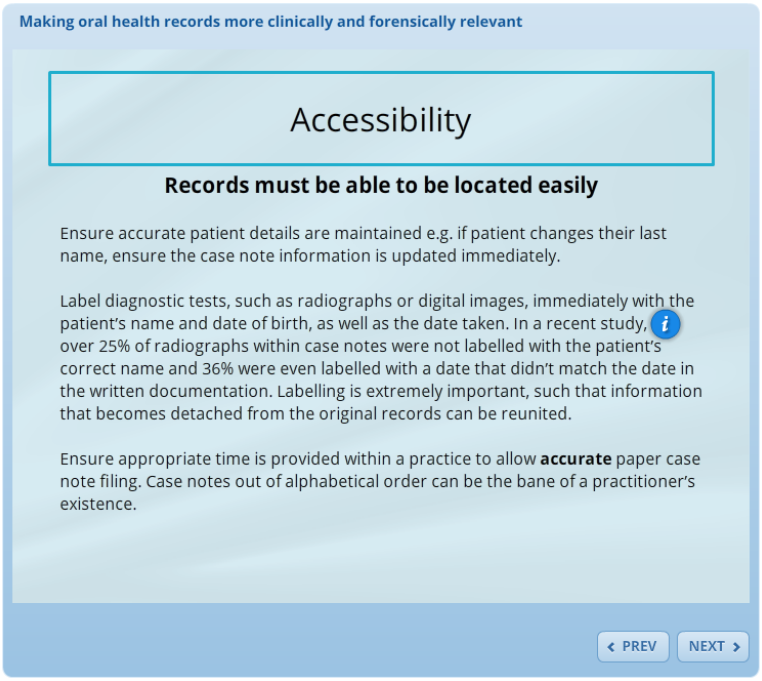


FIGURE 27: Ensuring easy retrieval of dental records in the 'Accessibility' section of the Interactive Learning Module.

- Identification of statutory laws which allow police officers to collect dental records from practitioners for legal investigation (Figure 28)
- What happens to dental records once a practitioner has handed them over to the authorities? (Figure 29)
- A single pop-up button asking participants how they can check legislation related to Accessibility in their particular state; provided suggestions included the Dental Board of Australia, the Australian Dental Association and government websites.

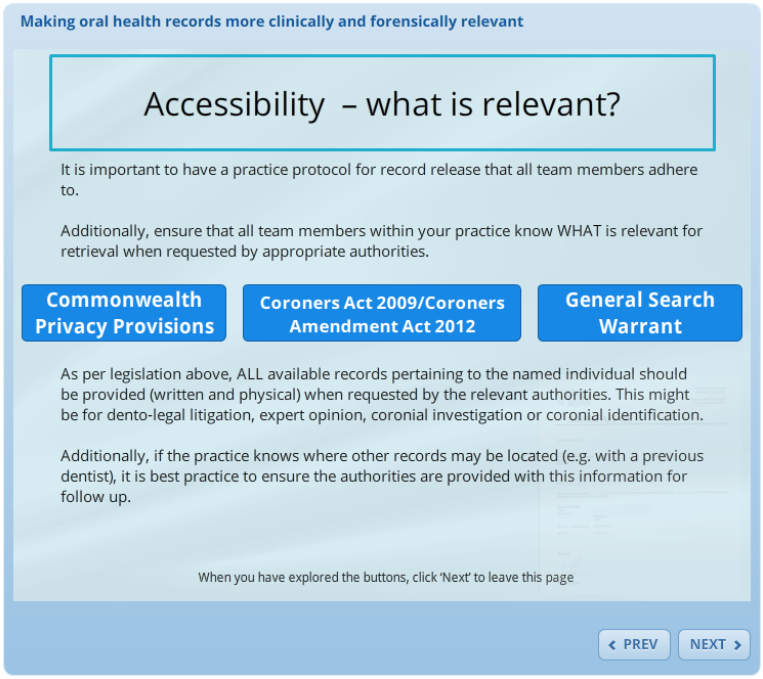


FIGURE 28: Relevant legislation for dental record collection in the 'Accessibility' section of the Interactive Learning Module. Each blue button opens to further information on the specified statutory law.

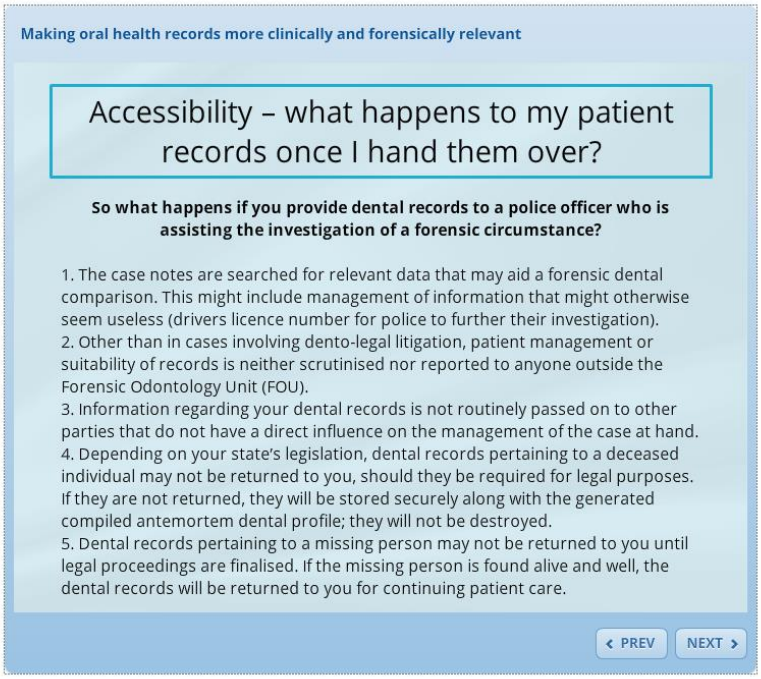


FIGURE 29: 'What happens to my patient records once I hand them over to authorities?' screen capture in the 'Accessibility' section of the Interactive Learning Module.

Retention

- Advice that the Dental Board of Australia's guidelines on record keeping are mandatory because any registration standard approved by a National Board is admissible in court under the Health Practitioner Regulation National Law Act 2009; failure to comply leaves a practitioner open to indefensible legal action and could also hinder forensic identification
- Quiz feedback advice on how to retain invaluable dental information without compromising on space-saving (Figure 30): scan records (written and casts) and save electronically; take digital photographs of records to save electronically; make a summary page (name, date of birth, address, dates seen at practice, most recent odontogram, all radiographs)

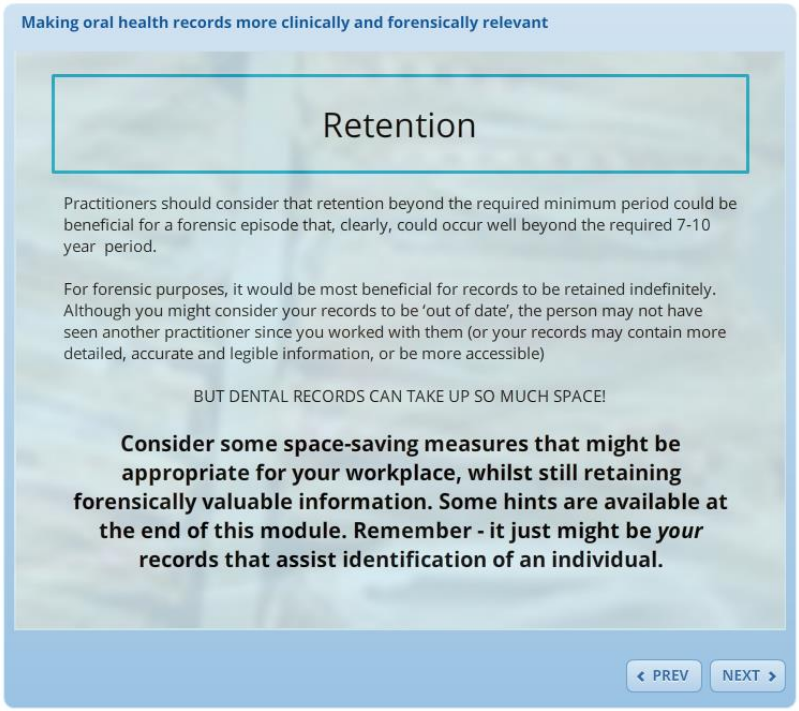


FIGURE 30: Keeping dental records beyond the required 7-10 year Dental Board of Australia guideline limit, 'Retention' section of the Interactive Learning Module.

- An example of inappropriate dental record retention practices during the Ash Wednesday fires of 1983 (Figures 31-34)
- The Missing Persons service (Figure 35)

FIGURE 31: Ash Wednesday 1983, 'Retention' section of the Interactive Learning Module.

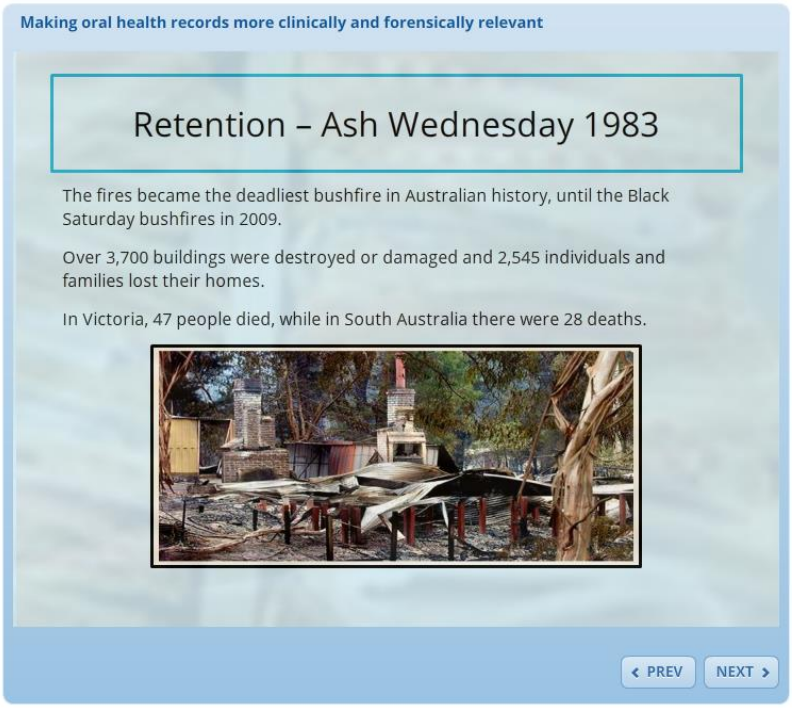


FIGURE 32: Ash Wednesday 1983, 'Retention' section of the Interactive Learning Module cont.(2)

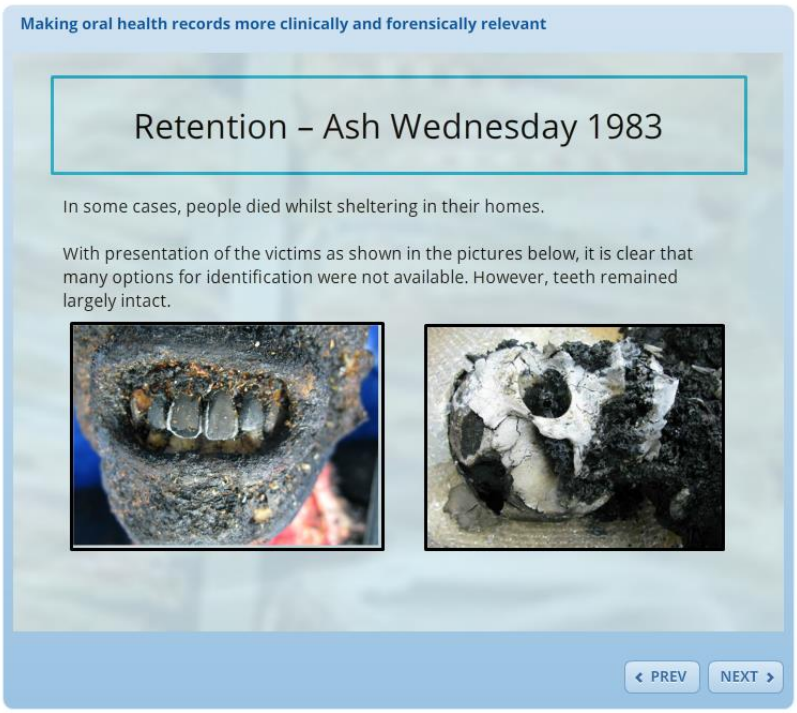


FIGURE 33: Ash Wednesday 1983, 'Retention' section of the Interactive Learning Module cont.(3)

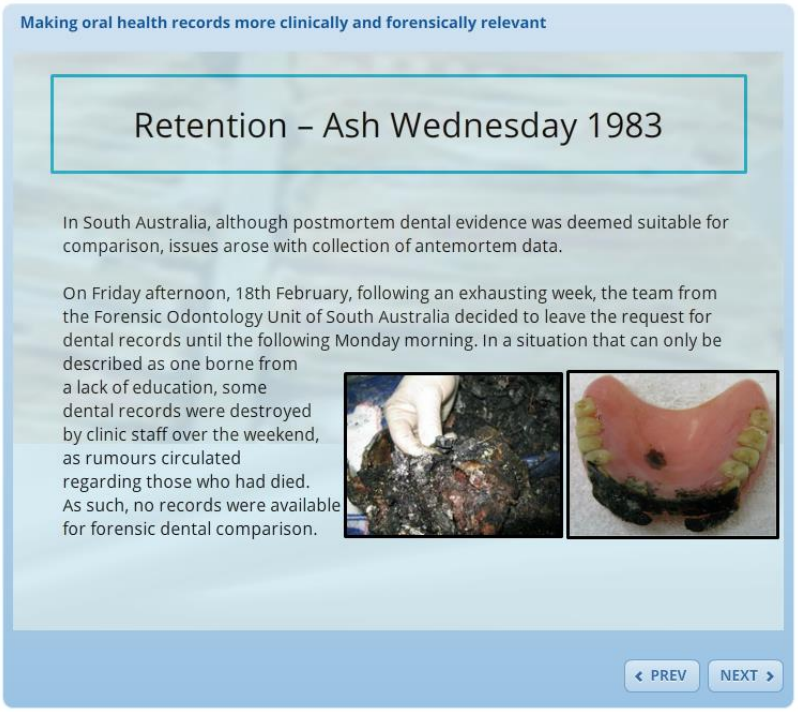


FIGURE 34: Ash Wednesday 1983, 'Retention' section of the Interactive Learning Module cont.(4)

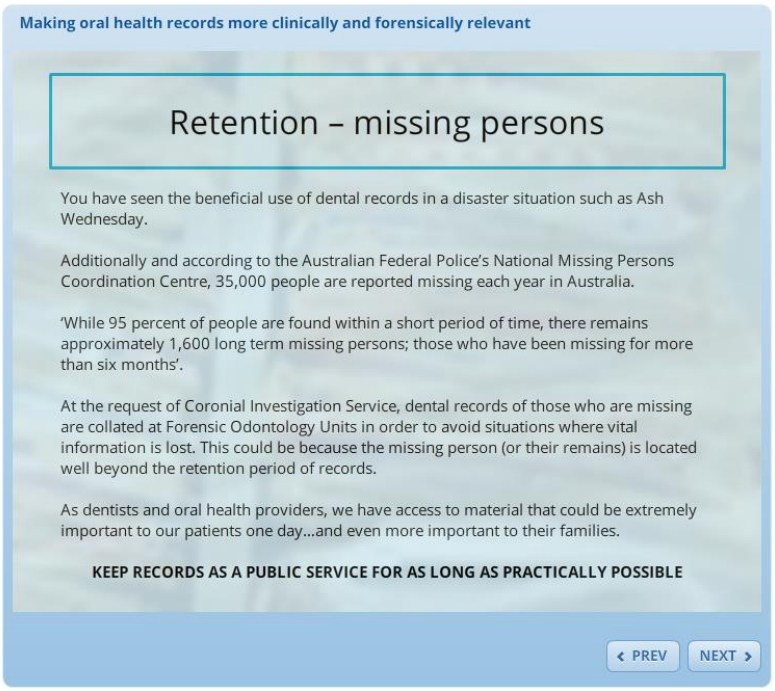


FIGURE 35: Missing persons, 'Retention' section of the Interactive Learning Module.

The ILM is contained in its entirely on the enclosed compact disc (CD). Instructions for use can be found on the CD cover.

CHAPTER 5

METHODS

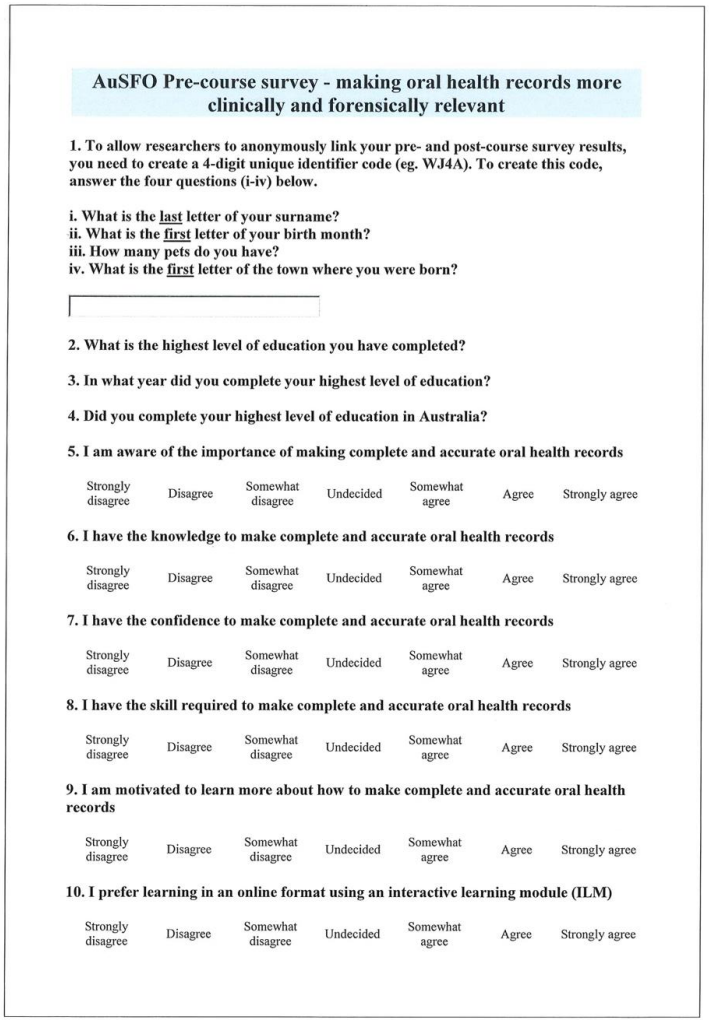
5. METHODS

5.1 Survey design

Pre- and post-course surveys were linked (via surveymonkey.com, SurveyMonkey Inc.) to the 'Introduction' and 'Finish' tabs of the educational module, so participants could provide feedback regarding their experiences with the module. For the purposes of this study, Kirkpatrick's levels one (completion and satisfaction) and two (learning) were assessed via the surveys and participant feedback. The participation rate was additionally examined to help inform future delivery modes.

Pre-course: Pre-course surveys featured 10 questions. As an example, the pre-course survey provided to AuSFO Inc members is supplied as Figure 36. The first question for all participants contained instructions to construct a four-digit anonymous pre- and post-course survey data could be paired. Question two asked for participants' previous level of education, as selected from a drop-down menu of options (Senior Secondary Certificate of Education, Diploma or Advanced Diploma, Bachelor Degree, Honours/Graduate Certificate/Graduate Diploma, Masters, Doctor of Philosophy); question three asked participants to indicate the year in which they completed their highest level of education, as selected from a drop-down menu of options (prior to 1980, 1981-1990, 1991-2000, 2001-2010, 2011 or after); and question four was a yes/no response question about whether the participant had completed their highest level of

education within Australia. These questions were asked in order to gauge whether the answers had any bearing on the participant's responses to a set of Likert-style questions consequently asked in the survey.



AuSFO Pre-course survey - making oral health records more clinically and forensically relevant

1. To allow researchers to anonymously link your pre- and post-course survey results, you need to create a 4-digit unique identifier code (eg. WJ4A). To create this code, answer the four questions (i-iv) below.

i. What is the last letter of your surname?
ii. What is the first letter of your birth month?
iii. How many pets do you have?
iv. What is the first letter of the town where you were born?

2. What is the highest level of education you have completed?

3. In what year did you complete your highest level of education?

4. Did you complete your highest level of education in Australia?

5. I am aware of the importance of making complete and accurate oral health records

Strongly disagree | Disagree | Somewhat disagree | Undecided | Somewhat agree | Agree | Strongly agree

6. I have the knowledge to make complete and accurate oral health records

Strongly disagree | Disagree | Somewhat disagree | Undecided | Somewhat agree | Agree | Strongly agree

7. I have the confidence to make complete and accurate oral health records

Strongly disagree | Disagree | Somewhat disagree | Undecided | Somewhat agree | Agree | Strongly agree

8. I have the skill required to make complete and accurate oral health records

Strongly disagree | Disagree | Somewhat disagree | Undecided | Somewhat agree | Agree | Strongly agree

9. I am motivated to learn more about how to make complete and accurate oral health records

Strongly disagree | Disagree | Somewhat disagree | Undecided | Somewhat agree | Agree | Strongly agree

10. I prefer learning in an online format using an interactive learning module (ILM)

Strongly disagree | Disagree | Somewhat disagree | Undecided | Somewhat agree | Agree | Strongly agree

FIGURE 36: Pre-course questions and survey design for AuSFO Inc members (same as for dental student cohort)

Questions five to ten, regarding oral health recording practices and online learning preference, required the participant to indicate their baseline subjective level of agreement to each statement on a seven-item Likert-style

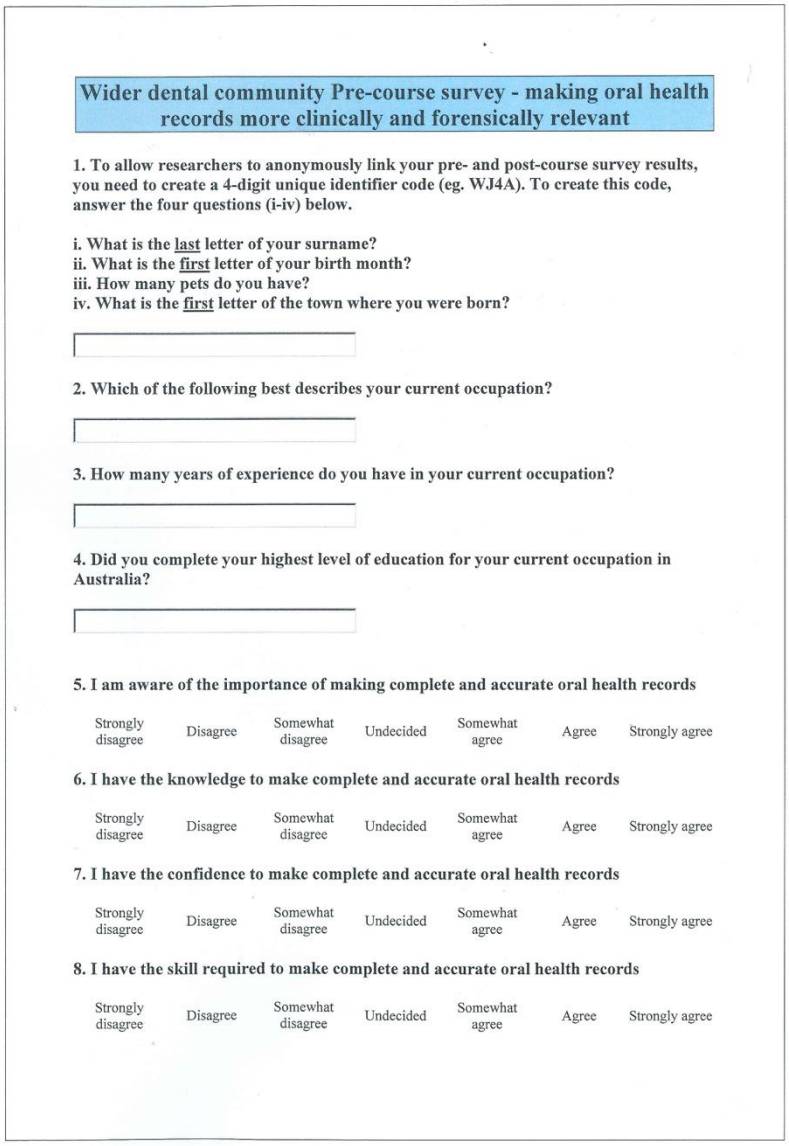
(Likert, 1932) scale (strongly agree, agree, somewhat agree, undecided, somewhat disagree, disagree, strongly disagree).

For the 2016 third year Bachelor of Dental Surgery student cohort at The University of Adelaide, the available options for the pre-course survey question regarding the year in which participants completed their highest level of education were amended to omit 'prior to 1980' and from '1981-1990', as these were deemed unnecessary time frames for the ages of the students. In all other aspects, the pre-course survey for the student cohort was identical to that for the AuSFO Inc group presented in Figure 36.

For the wider dental community cohort, pre-course survey questions were not all identical to those for the first two research phases and are shown in Figures 37(a) and 37(b).

Instead of asking for the participant's previous level of education, question two asked for current occupation, as selected from a drop-down menu of options (dental hygienist, dental therapist, dual qualified hygienist/therapist, Bachelor of Oral Health student, dentist, registered dental specialist, Bachelor of Dental Surgery student, dental prosthetist, or 'other'). Such information about occupation groups interested in the educational topic was appropriate to

collect in this phase of the study; it had not been relevant in the previous research phases. Additionally, instead of asking the year in which they finished



Wider dental community Pre-course survey - making oral health records more clinically and forensically relevant

1. To allow researchers to anonymously link your pre- and post-course survey results, you need to create a 4-digit unique identifier code (eg. WJ4A). To create this code, answer the four questions (i-iv) below.

i. What is the last letter of your surname?
ii. What is the first letter of your birth month?
iii. How many pets do you have?
iv. What is the first letter of the town where you were born?

2. Which of the following best describes your current occupation?

3. How many years of experience do you have in your current occupation?

4. Did you complete your highest level of education for your current occupation in Australia?

5. I am aware of the importance of making complete and accurate oral health records

Strongly disagree	Disagree	Somewhat disagree	Undecided	Somewhat agree	Agree	Strongly agree

6. I have the knowledge to make complete and accurate oral health records

Strongly disagree	Disagree	Somewhat disagree	Undecided	Somewhat agree	Agree	Strongly agree

7. I have the confidence to make complete and accurate oral health records

Strongly disagree	Disagree	Somewhat disagree	Undecided	Somewhat agree	Agree	Strongly agree

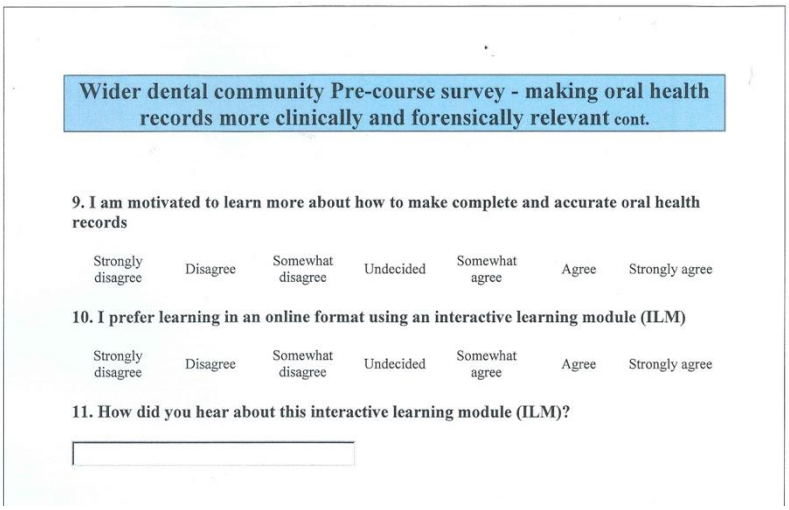
8. I have the skill required to make complete and accurate oral health records

Strongly disagree	Disagree	Somewhat disagree	Undecided	Somewhat agree	Agree	Strongly agree

FIGURE 37(a): Pre-course questions and survey design for wider dental community members.

their highest level of education, question three asked how many years of experience the participant had in their current occupation, again from a drop-down menu of options (over 30 years, 20-29 years, 10-19 years, 6-9 years, 3-5 years, or less than 2 years). This question was altered from the first two research phases because the correlation between subjective responses to the

survey questions and experience was already apparent. There was also an additional question (number 11) that asked participants how they had heard about the availability of the interactive learning module (ILM) – this was added to ascertain which professional groups had members who showed interest in the educational package.



Wider dental community Pre-course survey - making oral health records more clinically and forensically relevant cont.

9. I am motivated to learn more about how to make complete and accurate oral health records

Strongly disagree | Disagree | Somewhat disagree | Undecided | Somewhat agree | Agree | Strongly agree

10. I prefer learning in an online format using an interactive learning module (ILM)

Strongly disagree | Disagree | Somewhat disagree | Undecided | Somewhat agree | Agree | Strongly agree

11. How did you hear about this interactive learning module (ILM)?

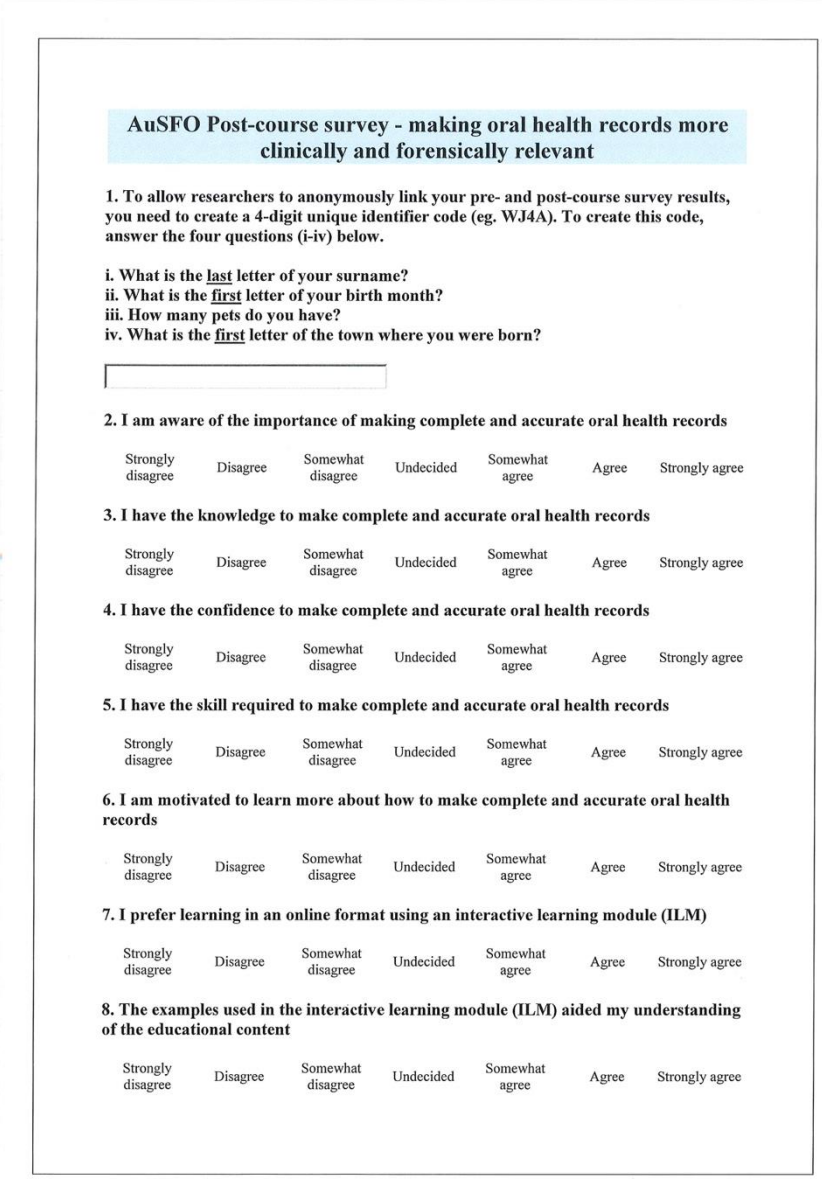
FIGURE 37(b): Pre-course questions and survey design for wider dental community members (cont.)

All other wider dental community pre-course questions were the same as the pre-course surveys for AuSFO Inc (phase one) and the dental student cohort (phase two).

Post-course: The post-course surveys featured 13 questions. As an example, the post-course survey provided to AuSFO members is supplied as Figures 38(a) and 38(b). Once again, question one supplied instructions to construct a four-digit anonymous code, thus allowing association of information from the same

source without actually identifying participants. The next six questions, regarding oral health recording practices and online learning preference, were identical to the pre-course survey and required the participant to indicate their subjective level of agreement to each statement about making accurate oral health records on a seven-item Likert-style scale. It was hypothesised that participants' subjective views regarding these statements would be altered following interaction with the ILM; hence they appeared on both the pre- and post-course surveys. Three questions specifically regarding the ILM content and its organisation, which also utilized the same Likert scale scoring system, were featured in the post-course survey in order to provide feedback for improvement of the ILM. Finally, there were three open-ended questions requesting specific feedback on what the participant liked most/least about the interactive educational module, as well as suggested areas for improvement. Again, these were included to aid future development of the ILM.

Post-course surveys provided to the 2016 Bachelor of Dental Surgery student cohort and the wider dental community were identical to that shown in Figures 38(a) and 38(b).



AuSFO Post-course survey - making oral health records more clinically and forensically relevant

1. To allow researchers to anonymously link your pre- and post-course survey results, you need to create a 4-digit unique identifier code (eg. WJ4A). To create this code, answer the four questions (i-iv) below.

i. What is the last letter of your surname?
ii. What is the first letter of your birth month?
iii. How many pets do you have?
iv. What is the first letter of the town where you were born?

2. I am aware of the importance of making complete and accurate oral health records

Strongly disagree | Disagree | Somewhat disagree | Undecided | Somewhat agree | Agree | Strongly agree

3. I have the knowledge to make complete and accurate oral health records

Strongly disagree | Disagree | Somewhat disagree | Undecided | Somewhat agree | Agree | Strongly agree

4. I have the confidence to make complete and accurate oral health records

Strongly disagree | Disagree | Somewhat disagree | Undecided | Somewhat agree | Agree | Strongly agree

5. I have the skill required to make complete and accurate oral health records

Strongly disagree | Disagree | Somewhat disagree | Undecided | Somewhat agree | Agree | Strongly agree

6. I am motivated to learn more about how to make complete and accurate oral health records

Strongly disagree | Disagree | Somewhat disagree | Undecided | Somewhat agree | Agree | Strongly agree

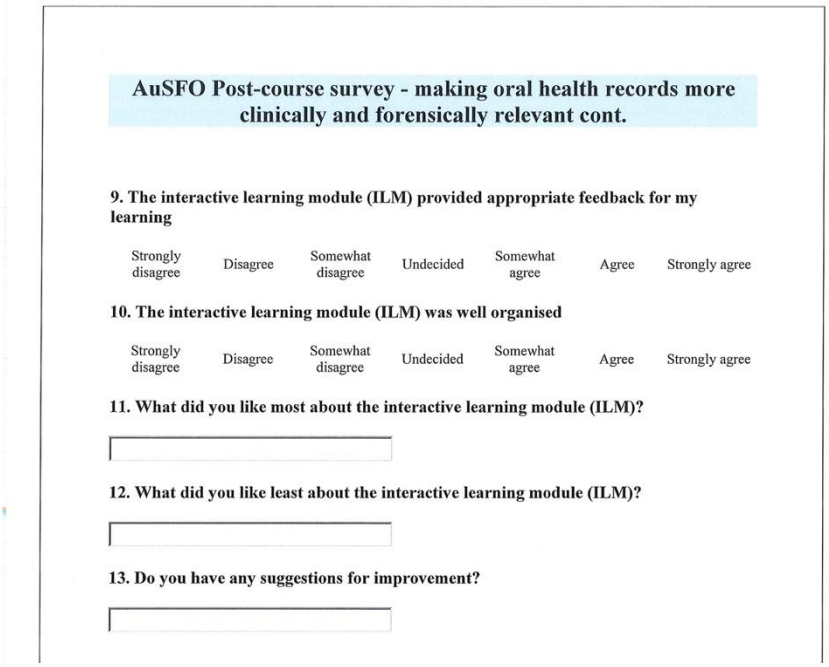
7. I prefer learning in an online format using an interactive learning module (ILM)

Strongly disagree | Disagree | Somewhat disagree | Undecided | Somewhat agree | Agree | Strongly agree

8. The examples used in the interactive learning module (ILM) aided my understanding of the educational content

Strongly disagree | Disagree | Somewhat disagree | Undecided | Somewhat agree | Agree | Strongly agree

FIGURE 38(a): Post-course questions and survey design for AuSFO Inc members (same as for dental student cohort and wider dental community)



AuSFO Post-course survey - making oral health records more clinically and forensically relevant cont.

9. The interactive learning module (ILM) provided appropriate feedback for my learning

Strongly disagree	Disagree	Somewhat disagree	Undecided	Somewhat agree	Agree	Strongly agree

10. The interactive learning module (ILM) was well organised

Strongly disagree	Disagree	Somewhat disagree	Undecided	Somewhat agree	Agree	Strongly agree

11. What did you like most about the interactive learning module (ILM)?

12. What did you like least about the interactive learning module (ILM)?

13. Do you have any suggestions for improvement?

FIGURE 38(b): Post-course questions and survey design for AuSFO Inc members (same as for dental student cohort and wider dental community)

5.2 RELEASE

5.2.1 PHASE ONE – Australian Society of Forensic Odontology Inc. members

This study received ethical approval from the Human Research Ethics Committee of the University of Adelaide (HS-2015-086, Appendix I). The package was uploaded to the members-only area of the Australian Society of Forensic Odontology (AuSFO) Inc. website. An email invitation to participate in the research survey was sent to all members of AuSFO (n=65), via their secretary (Appendix II). A Participant Information Sheet (Appendix III) was provided as an attachment to the email and supplied the following information: project aims; details regarding the researchers; who to contact for questions, complaints or concerns; details of participant recruitment; requirements of

participants; the projected risks/benefits of participation; and the ethical approval statement.

To improve response rate, a reminder email (from the AuSFO secretary, to all AuSFO members) was sent two weeks after the initial participation invitation package. A second reminder was sent after an additional fortnight. A third and final reminder was then sent after a further two weeks. No further survey responses were collected at seven weeks after original issue.

Participation in the online educational module and two surveys was voluntary and participants could withdraw at any stage. Responses to the survey were strictly confidential. In order to conform to the Commonwealth Privacy Act and other regulations concerning the disclosure of personal information of members of the Australian Society of Forensic Odontology Inc. (AuSFO), all emails were sent through the society secretary. I did not have direct access to the AuSFO database at any stage and received anonymous completed surveys via the surveymonkey.com website for analysis.

5.2.2 PHASE TWO – third year Bachelor of Dental Surgery students

The interactive learning module was upgraded following advice from AuSFO members. Specifically, the quiz inputs were designated to be 'required' by the

programme, so that participants could not skip past them. The package was then uploaded to Dental Science and Practice 3 Part I LMS MyUni site for access by Bachelor of Dental Surgery students enrolled in the third year of the course in 2016.

This study received ethical approval from the Human Research Ethics Committee of the University of Adelaide (HS-2015-086 amendment dated Jan 6th 2016, Appendix IV). Participation in the online educational modules and two surveys was voluntary and participants could withdraw at any stage. Responses to the survey were strictly confidential. Anonymous completed surveys were received for analysis via the surveymonkey.com website.

Seventy three students were enrolled in the BDS3 course during 2016. As they were enrolled, they had access to the ILM via their learning management system MyUni.

Students were made aware of the availability of the ILM at the end of an unrelated preclinical class meeting of the Preparation for Comprehensive Patient-centered Care (PCPC) block. Students were advised that the information presented in the ILM was a compilation of material that had been presented in a face-to-face lecture during the PCPC block during the previous five years of the Bachelor of Dental Surgery 3 (BDS3) curriculum at the

University of Adelaide. The ILM complemented information that had already been presented to this particular cohort as face-to-face lectures during the first and second years of the BDS course.

Following the in-class introduction to the ILM ('class meeting'), the student participant invitation package was circulated. This included an email requesting participation by the student via MyUni (Appendix V) and the Participant Information Sheet (Appendix VI), as in phase one of the project.

No reminder emails were sent. Students had a vested interest in reviewing the academic content of the ILM as it was assessable as part of their PCPC written examination paper, which was held towards the end of the period in which the ILM was available to them. Given that the survey feedback portion of the study was voluntary, it was not deemed appropriate or necessary to remind students to view the material.

5.2.3 PHASE THREE – wider dental community

The ILM was upgraded based on feedback from BDS3 students. Specifically, pictures relevant to the quizzes were made enlargeable, some superfluous words were removed from slides and the time limit on quiz questions was removed.

This part of the study also received ethical approval from the Human Research Ethics Committee of the University of Adelaide (HS-2015-086, Appendix 1).

Various Australian professional groups that may logically be considered to have an interest in the subject matter at hand were contacted for participation. The full list of professional groups contacted and their response is shown in Table 2. It should be noted that those professional groups who replied but declined participation on behalf of their members indicated that they felt the project was worthwhile.

The provided participant invitation package included an email request for participation by the member specific to the organisation (Appendix VII, ADA SA member request shown), with the Participant Information Sheet (Appendix III) as for the AuSFO members attached.

To improve response rate, a reminder email to the professional groups' administration staff was sent three to four weeks after the initial participation invitation package, requesting that a further invitation be sent to all members.

Professional group contacted	Involvement	Further information
AHPRA (Australian Health Practitioner Regulation Agency)	Declined	'Not in the public interest to use the personal information of practitioners in this way'
DBA (Dental Board of Australia)	Declined	'The Dental Board of Australia are unable to provide you with the details you have requested for your venture'
ADC (Australian Dental Council)	Declined	'Not a matter for the ADC'
CPDent Adel (Continuing Professional Development Adelaide)	Agreed	795 members on mailing list
Bite Magazine	Agreed	Agreed, in principle, to assist but no further contact could be made
ADA SA (Australian Dental Association state branch)	Agreed	795 members on mailing list
ADA NT (Australian Dental Association state branch)	No reply	Three contact attempts made
ADA WA (Australian Dental Association state branch)	Agreed	1493 members on mailing list
ADA NSW (Australian Dental Association state branch)	Declined	'ADA NSW are developing our own record-keeping initiative'
ADA Vic (Australian Dental Association state branch)	Declined	'ADA Vic are mindful of the risk of over emailing [their] members and therefore the decision has been made not to approve any further external requests at this time'
ADA Q (Australian Dental Association state branch)	No reply	Three contact attempts made
ADA Tas (Australian Dental Association state branch)	Agreed	167 members on mailing list
ADA ACT (Australian Dental Association state branch)	No reply	Three contact attempts made
ADOHTA (Australian Oral Health Therapists Association)	Agreed	1044 members on mailing list
DAPA (Dental Assistants Professional Association)	No reply	Three contact attempts made
OHPA (Oral Health Professionals Association)	No reply	Three contact attempts made
DHAA (Dental Hygienists Association of Australia)	Agreed	1023 members on mailing list
Henry Schein Halas	No reply	One contact attempt made
ADIA (Australian Dental Industry Association) and ADRF (Australian Dental Research Foundation Inc)	Declined	ADIA - 'Unable to assist with your request' ADRF – 'ADRF itself don't have a mailing list'
ASO (Australian Society of Orthodontists)	Agreed	550 members on mailing list
ASP (Australian Society of Periodontology)	Agreed	294 members on mailing list
ASID (Australian Society of Implant Dentistry)	Agreed	303 members on mailing list
APS (Australian Prosthodontic Society Inc)	No reply	

TABLE 2 – Dental professional groups contacted to participate in phase three of the study plan (release of interactive learning module and feedback surveys to wider dental community).

Again, participation in the online educational modules and two surveys was voluntary; participants could withdraw at any stage and responses to the survey were strictly confidential. In order to conform to the Commonwealth Privacy Act and other regulations concerning the disclosure of personal information of members of the professional societies, all emails were sent through the society secretary or professional/administration staff member. There was no researcher direct access to the professional society databases at any stage and anonymous completed surveys were received for analysis via the surveymonkey.com website.

5.3 Statistical analysis

Percentage responses for each of the research questions (excluding the one regarding construction of an anonymous identifier) was identified for each valid response. For those questions involving a Likert-style scale, percentage of broad agreement, mean (weighted average) and standard deviation were identified and reported. For the open-ended questions, responses were considered in the Discussion portion of this manuscript. For the participants who had completed both pre- and post-course valid surveys, the differences between their individual responses also formed part of the Discussion portion of this thesis. Participation rate from the different pathways of release was reviewed to inform and improve future delivery.

CHAPTER 6

RESULTS

6. RESULTS

6.1 Participation rate

Participation rates for all three phases of the research were highest in the dental student cohort but overall were very low. These findings are presented in Table 3.

Phase	Invitations sent (n)	Pre-course surveys completed: n (%)	Post-course surveys completed: n (%)	Both surveys completed: n (%)
One (AuSFO Inc)	65	13 (20%)	7 (11%)	7 (11%)
Two (BDS3 student cohort)	73	32 (44%)	37 (51%)	26 (36%)
Three (wider dental community)	6464	86 (1.3%)	65 (1%)	46 (0.7%)
TOTAL	6602	131 (2%)	109 (1.7%)	79 (1.2%)

TABLE 3 – Participation rates for surveys linked to the Interactive Learning Module

6.2 Statistical analysis for pre-course surveys

There were 10 questions on the pre-course survey for phases one (AuSFO Inc) and two (Bachelor of Dental Surgery student cohort). There were 11 questions on the pre-course survey for phase three (wider dental community). Questions that differed between the phases were questions two and three.

Question one was related to creating an anonymous identifier code (for association by me at the analysis stage) and hence was not directly relevant to the statistical portion of this research. At question two, phases one and two participants were asked to identify the highest level of education they had attained (labelled Ai) and the year in which they had completed this (labelled Bi); at the second question, phase three participants were asked to select their current occupation from a provided list (labelled Aii) and question three asked

them the number of years of experience they had in their current occupation (labelled Bii). For the third analysable question, all participants were asked to advise whether they had completed their highest level of education within Australia (labelled C). For the remaining six common questions, participants were asked to indicate their level of agreement (via a seven-item Likert style scale) with the given statement. Percentage results for each category (including weighted average), standard deviation and broad agreement are presented for each statement (labelled D-I). Finally, participants in phase three were asked to indicate how they heard about the ILM (labelled J).

Ai. What is the highest level of education you have completed?

Results for phase one and two participants reveal that the majority of dental students had a senior secondary certificate as their highest level of education but all AuSFO members had tertiary qualifications, with a large number reporting post graduate training. These results are shown at Table 4.

What is the highest level of education you have completed?	AuSFO members n (%)	BDS3 student cohort n (%)
Senior secondary Certificate of Education	0 (0.00)	25 (78.13)
Diploma or Advanced Diploma	1 (7.69)	0 (0.00)
Bachelor Degree	7 (53.85)	3 (9.38)
Bachelor Degree with Honours, Graduate Certificate or Graduate Diploma	1 (7.69)	3 (9.38)
Masters	3 (23.08)	1 (3.13)
Doctor of Philosophy	1 (7.69)	0 (0.00)
TOTAL	13 (100)	32 (100)

TABLE 4 – Pre-course survey results for 'What is the highest level of education you have completed?' for Australian Society of Forensic Odontology Inc. members (phase one) and third year dental students (phase two).

Aii. Which of the following best describes your current occupation?

Results for phase three participants showed that the vast majority of participants were dentists, followed by those with dental hygiene qualifications. These results are shown at Table 5.

Which of the following best describes your current occupation?	Wider dental community n (%)
Dental Hygienist	17 (19.77)
Dental Therapist	7 (8.14)
Dual qualified dental hygienist/therapist	11 (12.79)
Bachelor of Oral Health student	0 (0.00)
Dentist	44 (51.16)
Registered dental specialist	7 (8.14)
Bachelor of Dental Surgery student	0 (0.00)
Dental prosthetist	0 (0.00)
Other (please specify)	0 (0.00)
TOTAL	86 (100)

TABLE 5 – Pre-course survey results for 'Which of the following best describes your current occupation?' for the wider dental community.

Bi. In what year did you complete your highest level of education?

Results for the year in which participants from phases one and two attained their highest degree are shown at Table 6. All AuSFO members had finished their education prior to 2010 but most students completed theirs in or after 2011.

In what year did you complete your highest level of education?	AuSFO members n (%)	BDS3 student cohort n (%)
Prior to 1980	4 (30.77)	0 (0.00)
1981-1990	1 (7.69)	0 (0.00)
1991-2000	2 (15.38)	0 (0.00)
2001-2010	6 (46.15)	5 (15.63)
2011 or after	0 (0.00)	27 (84.38)
TOTAL	13 (100)	32 (100)

TABLE 6 – Pre-course survey results for 'In what year did you complete your highest level of education?' for Australian Society of Forensic Odontology Inc. members (phase one) and third year dental students (phase two).

Bii. How many years of experience do you have in your current occupation?

A cross section of experience was represented by the participants in phase three (Table 7). The largest group of participants had over 30 years of experience.

How many years of experience do you have in your current occupation?	Wider dental community n (%)
Over 30 years	34 (39.53)
20-29 years	9 (10.47)
10-19 years	17 (19.77)
6-9 years	14 (16.28)
3-5 years	6 (6.98)
Less than 2 years	6 (6.98)
TOTAL	86 (100)

TABLE 7 – Pre-course survey results for 'How many years of experience do you have in your current occupation?' for the wider dental community.

C. Did you complete your highest level of education in Australia?

The vast majority of participants in phases one and three had completed their education in Australia. For the dental student cohort (phase two), a little under half of participants had attained their highest qualification outside of Australia. Results are shown in Table 8.

Did you complete your highest level of education in Australia?	AuSFO members n (%)	BDS3 student cohort n (%)	Wider dental community n (%)
Yes	10 (83.33)	17 (53.13)	69 (80.23)
No	2 (16.67)	15 (46.88)	17 (19.77)
TOTAL	12 (100)	32 (100)	86 (100)

TABLE 8 – Pre-course survey results for 'Did you complete your highest level of education in Australia?' for all study phases.

D. I am aware of the importance of making complete and accurate oral health records

All participants indicated that they agreed with this statement, with most selecting 'strongly agree'. Complete results are shown in Table 9.

Group (phase)	Likert score n (%)							Total n	W Av	SD	BA
	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Undecided (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)				
AuSFO members (1)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (8.33%)	11 (91.67%)	12	6.92	0.28	100%
BDS3 student cohort (2)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	4 (12.50%)	14 (43.75%)	14 (43.75%)	32	6.31	0.69	100%
Wider dental community (3)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	3 (3.49%)	21 (24.42%)	62 (72.09%)	86	6.69	0.72	100%
AVERAGE TOTAL	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	2.33 (5.33%)	12 (27.69%)	29 (69.92%)	43	6.64	0.56	100%

TABLE 9 – Pre-course survey results for 'I am aware of the importance of making complete and accurate oral health records' for all study phases. W Av = weighted average, SD = standard deviation, BA = broad agreement.

E. I have the knowledge to make complete and accurate oral health records

AuSFO members demonstrated the highest self-reported knowledge of how to make complete and accurate oral health records. The greatest variability in opinion related to the statement was shown by the dental students. Results are shown in Table 10.

Group (phase)	Likert score n (%)							Total n	W Av	SD	BA
	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Undecided (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)				
AuSFO members (1)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	3 (23.08%)	10 (76.92%)	13	6.77	0.44	100%
BDS3 student cohort (2)	0 (0.00%)	0 (0.00%)	2 (6.25%)	4 (12.50%)	13 (40.63%)	12 (37.50%)	1 (3.13%)	32	5.19	0.84	82%
Wider dental community (3)	1 (1.16%)	0 (0.00%)	0 (0.00%)	1 (1.16%)	11 (12.79%)	51 (59.30%)	22 (25.58%)	86	6.05	0.85	98%
AVERAGE TOTAL	0.33 (0.76%)	0 (0.00%)	0.67 (1.53%)	1.67 (3.82%)	8 (18.32%)	22 (50.38%)	11 (25.19%)	43.67	6.00	0.71	93%

TABLE 10 – Pre-course survey results for 'I have the knowledge to make complete and accurate oral health records' for all study phases. W Av = weighted average, SD = standard deviation, BA = broad agreement.

F. I have the confidence to make complete and accurate oral health records

Again, AuSFO members demonstrated the greatest self-reported confidence in making complete and accurate oral health records. The widest variation in response was seen in the wider dental community cohort for this statement. Results are shown in Table 11.

Group (phase)	Likert score n (%)							Total n	W Av	SD	BA
	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Undecided (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)				
AuSFO members (1)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (7.69%)	2 (15.38%)	10 (76.92%)	13	6.69	0.63	100%
BDS3 student cohort (2)	0 (0.00%)	0 (0.00%)	2 (6.25%)	3 (9.38%)	17 (53.13%)	10 (31.25%)	0 (0.00%)	32	5.09	0.82	84%
Wider dental community (3)	1 (1.18%)	0 (0.00%)	0 (0.00%)	1 (1.18%)	10 (11.76%)	52 (61.18%)	21 (24.71%)	85	6.05	0.84	98%
AVERAGE TOTAL	0.33 (0.80%)	0 (0.00%)	0.67 (1.54%)	1.33 (3.08%)	9.33 (21.54%)	21.33 (49.23%)	10.33 (23.85%)	43.33	5.94	0.76	94%

TABLE 11 – Pre-course survey results for 'I have the confidence to make complete and accurate oral health records' for all study phases. W Av = weighted average, SD = standard deviation, BA = broad agreement.

G. I have the skill required to make complete and accurate oral health records

The majority of participants indicated agreement with this statement (Table 12). Dental students were least likely to indicate that they were optimally confident with their skill level.

Group (phase)	Likert score n (%)							Total n	W Av	SD	BA
	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Undecided (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)				
AuSFO members (1)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (7.69%)	3 (23.08%)	9 (69.23%)	13	6.62	0.65	100%
BDS3 student cohort (2)	0 (0.00%)	0 (0.00%)	1 (3.13%)	4 (12.50%)	15 (46.88%)	11 (34.38%)	1 (3.13%)	32	5.22	0.83	84%
Wider dental community (3)	1 (1.16%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	11 (12.79%)	49 (56.98%)	25 (29.07%)	86	6.10	0.84	99%
AVERAGE TOTAL	0.33 (0.76%)	0 (0.00%)	0.33 (0.76%)	1.33 (3.05%)	9 (20.61%)	21 (48.10%)	11.67 (26.72%)	43.67	5.98	0.77	94%

TABLE 12 –Pre-course survey results for 'I have the skill required to make complete and accurate oral health records' for all study phases. W Av = weighted average, SD = standard deviation, BA = broad agreement.

H. I am motivated to learn more about how to make complete and accurate oral health records

Motivation to learn more about the subject matter was very high amongst the majority of participants (Table 13).

Group (phase)	Likert score n (%)							Total n	W Av	SD	BA
	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Undecided (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)				
AuSFO members (1)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (7.69%)	1 (7.69%)	11 (84.62%)	13	6.77	0.60	100%
BDS3 student cohort (2)	0 (0.00%)	0 (0.00%)	0 (0.00%)	2 (6.25%)	4 (12.50%)	14 (43.75%)	12 (37.50%)	32	6.13	0.87	94%
Wider dental community (3)	0 (0.00%)	0 (0.00%)	0 (0.00%)	2 (2.33%)	5 (5.81%)	27 (31.40%)	52 (60.47%)	86	6.50	0.72	98%
AVERAGE TOTAL	0 (0.00%)	0 (0.00%)	0 (0.00%)	1.33 (3.05%)	3.33 (7.63%)	14 (32.10%)	25 (57.30)	43.67	6.47	0.73	97%

TABLE 13 – Pre-course survey results for 'I am motivated to learn more about how to make complete and accurate oral health records' for all study phases. W Av = weighted average, SD = standard deviation, BA = broad agreement.

I. I prefer learning in an online format using an interactive learning module (ILM)

This statement provided the most varied responses for the research project. There were a significant number of participants (across all three phases) who were 'undecided' about how to respond to this question. Results are shown in Table 14.

Group (phase)	Likert score n (%)							Total	W Av	SD	BA
	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Undecided (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)				
AuSFO members (1)	0 (0.00%)	0 (0.00%)	0 (0.00%)	3 (23.08%)	4 (30.77%)	2 (15.38%)	4 (30.77%)	13	5.54	1.19	77%
BDS3 student cohort (2)	0 (0.00%)	1 (3.13%)	1 (3.13%)	5 (15.63%)	4 (12.50%)	16 (50.00%)	5 (15.63%)	32	5.50	1.22	78%
Wider dental community (3)	1 (1.16%)	0 (0.00%)	1 (1.16%)	17 (19.77%)	22 (25.58%)	33 (38.37%)	12 (13.95%)	86	5.40	1.11	78%
AVERAGE TOTAL	0.33 (0.76%)	0.33 (0.76%)	0.66 (1.53%)	8.33 (19.10%)	10 (22.90%)	17 (38.93%)	7 (16.03%)	43.67	5.48	1.17	78%

TABLE 14 – Pre-course survey results for 'I prefer learning in an online format using an interactive learning module (ILM)' for all study phases. W Av = weighted average, SD = standard deviation, BA = broad agreement.

J. How did you hear about this interactive learning module (ILM)?

Most participants were recruited through the ADA and CPDent Adelaide. Results are shown in Table 15.

How did you hear about this interactive learning module (ILM)?	Wider dental community n (%)
Bite Magazine	2 (2.33)
AHPRA or Dental Board of Australia	2 (2.33)
Bulletin	1 (1.16)
Dental School	5 (5.81)
CPDent Adelaide	19 (22.09)
Australian Dental Association	31 (36.05)
Other (please specify)	26 (30.23)
TOTAL	86 (100)

TABLE 15 – Pre-course survey results for 'How did you hear about this interactive learning module (ILM)?' for the wider dental community.

Note that participants indicating 'other' to the question posed at J. provided the following responses: 'Forensic Dentistry Association (one response), Australian Dental Association Western Australia (one response), Australian Dental and Oral Health Therapists' Association (two responses), Dental Hygienists Association of Australia (16 responses), 'a google of online CPD' (one response), a 'personal email' (one response), Australian Society of Implant Dentistry (two responses), Australian Society of Orthodontists (one response) and Australian Society of Periodontology (one response).

6.3 Statistical analysis for post-course surveys

The results of the 12 post-course survey questions were analysed and reported. For the first six analysable questions, participants were asked to indicate their

level of agreement with a given statement (labelled A-F). Questions labelled G-I specifically related to the interactive learning module. Percentage results for each category (including weighted average), standard deviation and broad agreement are presented for A-I. Questions labelled J-L were open-ended questions, asking for feedback from the individual in their own words. Questions related to what they liked most and least about the interactive learning module, as well as any suggestions for improvement.

A. I am aware of the importance of making complete and accurate oral health records

Participants demonstrated a high level of post-course awareness regarding the importance of making complete and accurate oral health records. Responses clumped at the highest level of agreement (Table 16).

Group (phase)	Likert score n (%)							Total n	W Av	SD	BA
	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Undecided (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)				
AuSFO members (1)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	7 (100.00%)	7	7.00	0.00	100%
BDS3 student cohort (2)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	11 (31.56%)	25 (69.44%)	36	6.69	0.48	100%
Wider dental community (3)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	9 (13.85%)	56 (86.15%)	65	6.86	0.35	100%
AVERAGE TOTAL	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	6.66 (18.52%)	29.33 (81.50%)	36	6.85	0.28	100%

TABLE 16 – Post-course survey results for 'I am aware of the importance of making complete and accurate oral health records' for all study phases. W Av = weighted average, SD = standard deviation, BA = broad agreement.

B. I have the knowledge to make complete and accurate oral health records

Almost all participants broadly agreed with this statement (Table 17); there was one significantly outlying response within the wider dental community cohort.

Group (phase)	Likert score n (%)							Total n	W Av	SD	BA
	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Undecided (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)				
AuSFO members (1)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	7 (100.00%)	7	7.00	0.00	100%
BDS3 student cohort (2)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	3 (8.11%)	20 (54.05%)	14 (37.84%)	37	6.30	0.62	100%
Wider dental community (3)	1 (1.54%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	3 (4.62%)	18 (27.69%)	43 (66.15%)	65	6.54	0.92	98%
AVERAGE TOTAL	0.33 (0.92%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	2 (5.50%)	12.67 (34.86%)	21.33 (58.72%)	36.33	6.61	0.51	99%

TABLE 17 – Post-course survey results for 'I have the knowledge to make complete and accurate oral health records' for all study phases. W Av = weighted average, SD = standard deviation, BA = broad agreement.

C. I have the confidence to make complete and accurate oral health records

Again, almost all participants broadly agreed with this statement (Table 18); there was one significantly outlying response within the wider dental community cohort. The greatest amount of variation in response was seen in the dental student phase.

Group (phase)	Likert score n (%)							Total n	W Av	SD	BA
	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Undecided (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)				
AuSFO members (1)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (14.29%)	6 (85.71%)	7	6.86	0.38	100%
BDS3 student cohort (2)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (2.78%)	2 (5.56%)	24 (66.67%)	9 (25.00%)	36	6.14	0.64	97%
Wider dental community (3)	1 (1.54%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	3 (4.62%)	22 (33.85%)	39 (60.00%)	65	6.48	0.90	98%
AVERAGE TOTAL	0.33 (0.93%)	0 (0.00%)	0 (0.00%)	0.33 (0.93%)	1.67 (4.63%)	15.67 (43.52%)	18 (50.00%)	36	6.49	0.64	98%

TABLE 18 – Post-course survey results for 'I have the confidence to make complete and accurate oral health records' for all study phases. W Av = weighted average, SD = standard deviation, BA = broad agreement.

D. I have the skill required to make complete and accurate oral health records

Almost all participants broadly agreed that they had the skill required to make complete and accurate oral health records at the post course stage of the ILM. Again, one participant in the wider dental community strongly disagreed with the statement; this was the same outlying responder from statements at B and C. Results are presented in Table 19.

Group (phase)	Likert score n (%)							Total n	W Av	SD	BA
	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Undecided (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)				
AuSFO members (1)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	3 (42.86%)	4 (57.14%)	7	6.57	0.53	100%
BDS3 student cohort (2)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	6 (16.67%)	21 (58.33%)	9 (25.00%)	36	6.08	0.65	100%
Wider dental community (3)	1 (1.54%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	2 (3.08%)	21 (32.31%)	41 (63.08%)	65	6.52	0.89	98%
AVERAGE TOTAL	0.33 (0.93%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	2.67 (7.41%)	15 (41.67%)	18 (50.00%)	36	6.39	0.69	99%

TABLE 19 – Post-course survey results for 'I have the skill to make complete and accurate oral health records' for all study phases. W Av = weighted average, SD = standard deviation, BA = broad agreement.

E. I am motivated to learn more about how to make complete and accurate oral health records

The majority of participants were motivated by education in the subject matter (Table 20). The highest level of motivation was seen in the AuSFO group.

Group (phase)	Likert score n (%)							Total n	W Av	SD	BA
	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Undecided (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)				
AuSFO members (1)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (14.29%)	0 (0.00%)	6 (85.71%)	7	6.71	0.76	100%
BDS3 student cohort (2)	0 (0.00%)	0 (0.00%)	1 (2.70%)	1 (2.70%)	2 (5.41%)	18 (48.65%)	15 (40.54%)	37	6.22	0.89	95%
Wider dental community (3)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (1.59%)	3 (4.76%)	17 (26.98%)	42 (66.67%)	63	6.59	0.66	98%
AVERAGE TOTAL	0 (0.00%)	0 (0.00%)	0.33 (0.93%)	0.66 (1.87%)	2 (5.61%)	11.67 (32.71%)	21 (58.88%)	35.67	6.51	0.77	98%

TABLE 20 – Post-course survey results for 'I am motivated to learn more about how to make complete and accurate oral health records' for all study phases. W Av = weighted average, SD = standard deviation, BA = broad agreement.

F. I prefer learning in an online format using an interactive learning module (ILM)

All AuSFO members indicated a preference to learn online. Students demonstrated the greatest level of variation in their response to this statement. All results are presented in Table 21.

Group (phase)	Likert score n (%)							Total n	W Av	SD	BA
	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Undecided (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)				
AuSFO members (1)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	2 (28.57%)	2 (28.57%)	3 (42.86%)	7	6.14	0.90	100%
BDS3 student cohort (2)	0 (0.00%)	1 (2.70%)	2 (5.41%)	7 (18.92%)	4 (10.81%)	17 (45.95%)	6 (16.22%)	37	5.41	1.28	73%
Wider dental community (3)	0 (0.00%)	0 (0.00%)	0 (0.00%)	7 (10.94%)	14 (21.88%)	21 (32.81%)	22 (34.38%)	64	5.91	1.00	89%
AVERAGE TOTAL	0 (0.00%)	0.33 (0.93%)	0.66 (1.85%)	4.67 (12.96%)	6.67 (18.52%)	13.33 (37.04%)	10.33 (28.70%)	36	5.82	1.06	87%

TABLE 21 – Post-course survey results for 'I prefer learning in an online format using an interactive learning module (ILM)' for all study phases. W Av = weighted average, SD = standard deviation, BA = broad agreement.

G. The examples used in the interactive learning module (ILM) aided my understanding of the educational content

The vast majority of participants indicated that the examples in the educational package were helpful to their learning (Table 22).

Group (phase)	Likert score n (%)							Total n	W Av	SD	BA
	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Undecided (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)				
AuSFO members (1)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	3 (42.86%)	4 (57.14%)	7	6.57	0.53	100%
BDS3 student cohort (2)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	4 (10.81%)	19 (51.35%)	14 (37.84%)	37	6.27	0.65	100%
Wider dental community (3)	0 (0.00%)	0 (0.00%)	1 (1.54%)	0 (0.00%)	4 (6.15%)	25 (38.46%)	35 (53.85%)	65	6.43	0.75	98%
AVERAGE TOTAL	0 (0.00%)	0 (0.00%)	0.33 (0.92%)	0 (0.00%)	2.67 (7.34%)	15.67 (43.12%)	17.67 (48.62%)	36.33	6.42	0.64	99%

TABLE 22 – Post-course survey results for 'The examples used in the interactive learning module (ILM) aided my understanding of the educational content' for all study phases. W Av = weighted average, SD = standard deviation, BA = broad agreement.

H. The interactive learning module (ILM) provided appropriate feedback for my learning

Most participants saw value in the feedback that was provided by the ILM. The responses were rated at a higher level of agreement within the AuSFO group. Results are presented in Table 23.

Group (phase)	Likert score n (%)							Total n	W Av	SD	BA
	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Undecided (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)				
AuSFO members (1)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	4 (57.14%)	3 (42.86%)	7	6.43	0.53	100%
BDS3 student cohort (2)	0 (0.00%)	1 (2.70%)	1 (2.70%)	3 (8.11%)	2 (5.41%)	23 (62.16%)	7 (18.92%)	37	5.78	1.11	86%
Wider dental community (3)	0 (0.00%)	1 (1.56%)	1 (1.56%)	2 (3.13%)	4 (6.25%)	27 (42.19%)	29 (45.31%)	64	6.22	0.99	94%
AVERAGE TOTAL	0 (0.00%)	0.66 (1.85%)	0.66 (1.85%)	1.67 (4.63%)	2 (5.56%)	18 (50.00%)	13 (36.11%)	36	6.14	0.88	93%

TABLE 23 – Post-course survey results for 'The interactive learning module (ILM) provided appropriate feedback for my learning' for all study phases. W Av = weighted average, SD = standard deviation, BA = broad agreement.

I. The interactive learning module (ILM) was well organised

Again, most participants indicated that the ILM was organised appropriately for their learning (Table 24).

Group (phase)	Likert score n (%)							Total n	W Av	SD	BA
	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Undecided (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)				
AuSFO members (1)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (14.29%)	0 (0.00%)	6 (85.71%)	7	6.71	0.76	100%
BDS3 student cohort (2)	0 (0.00%)	0 (0.00%)	1 (2.70%)	1 (2.70%)	1 (2.70%)	22 (61.11%)	11 (30.56%)	36	6.14	0.83	94%
Wider dental community (3)	0 (0.00%)	0 (0.00%)	3 (4.62%)	0 (0.00%)	2 (3.08%)	24 (36.92%)	36 (55.38%)	65	6.38	0.93	95%
AVERAGE TOTAL	0 (0.00%)	0 (0.00%)	1.33 (3.70%)	0.33 (0.93%)	1.33 (3.70%)	15.33 (42.59%)	17.67 (49.07%)	36	6.41	0.84	96%

TABLE 24 – Post-course survey results for 'The interactive learning module (ILM) was well organised' for all study phases. W Av = weighted average, SD = standard deviation, BA = broad agreement.

J. What did you like most about the interactive learning module (ILM)?

Ninety seven participants (89%) provided an answer to this open-ended question. Results are collated in Table 25.

Group (phase)	AuSFO members (1) responses	BDS3 student cohort (2) responses	Wider dental community (3) responses
Category of answer			
Convenience of module	2	10	13
Relevant examples/detail	3	7	12
Organised/referenced	1	10	24
Thorough	1	0	0
Quizzes	0	6	7
It made me think more!	0	0	1
Everything	0	0	1
TOTAL n participant responses (%)	**7 (100%)**	**32 (86%)**	**58 (89%)**

TABLE 25 – Post-course survey results for 'What did you like most about the interactive learning module (ILM)' for all study phases. Answers were reviewed and classified into categories of response as listed.

K. What did you like least about the interactive learning module (ILM)?

Seventy four individual participants (68%) provided an answer to this open-ended question. Most results are collated in Table 26. Nine participants in phase three provided an answer in more than one tabulated category. One interesting response (from phase three participant r20s) is presented in its entirety and commentary is provided on this in the Discussion portion of this thesis.

Group (phase)	AuSFO members (1) responses	BDS3 student cohort (2) responses	Wider dental community (3) responses
Category of answer			
Length of time it took	1	1	3
Problem with quizzes eg. lack of photo enlargement, submission of quiz answers, confusing quiz question	3	11	12
Too much coverage of 'common sense' material	0	1	4
Slides were too text-dense	0	11	4
Unable to get a handy 'study' version of the ILM	0	2	0
Personal issues with the ILM electronic presentation eg. size of reference bubbles, typeface colours, screen size	0	1	5
Not enough examples	0	0	1
Disorganised/too layered; navigation difficult	0	0	3
No opportunity for face-to-face feedback/communication	1	1	3
It showed up what I didn't know or do!	0	0	1
Nothing	1	0	12
TOTAL n participant responses (%)	**6 (86%)**	**28 (77%)**	**40 (62%); 49 categories of response**

TABLE 26 – Post-course survey results for 'What did you like least about the interactive learning module (ILM)' for all study phases. Answers were reviewed and classified into categories of response as listed.

r20s response - 'It made basic assumptions that are not valid. It did not address the real reasons why dental records are not at the 'standard' that the Dental Board has guidelines on, but is really driven by litigation and what lawyers and judges believe is reality, in managing a public that does not want to take any responsibility for their own health.'

L. Do you have any suggestions for improvement?

Seventy one individual participants (65%) provided an answer to this open-ended question. Most results are collated in Table 27. Again, nine participants in phase three provided an answer in more than one tabulated category. One interesting response (from phase three participant r20s) is presented in its entirety and commentary is provided on this in the Discussion portion of this thesis.

Group (phase)	AuSFO members (1)	BDS3 student cohort (2)	Wider dental community (3)
Category of answer			
Remove quiz time limit and have 'view answer' button instead	0	4	4
Make multiple-choice quiz answers less limiting	1	0	0
Have an overall quiz to test knowledge at the end	0	1	3
Further explain quiz answers	0	1	2
Use more slides to divide up text/use more examples	0	2	0
Be able to enlarge photograph details	1	1	0
Cut down on words used	0	3	1
Include a voice-over	0	1	0
Make a handy study version or checklist that is pdf printable	0	4	2
Need more suggestions of how to practically apply the requirements	1	0	2
Add examples for mixed dentition to increase relevance for therapists	0	0	2
Require continuous progression of windows	0	2	3
Deliver as a face-to-face class meeting/lecture instead	0	1	0
Fix ILM freeze	0	1	0
Make a larger typeface and better contrasting colours for the ILM	0	0	1
Provide CPD recognition for completion of the ILM	0	0	3
No	3	3	18
TOTAL n participant responses (%)	**6 (86%)**	**24 (65%)**	**41 (63%)**

TABLE 27 – Post-course survey results for 'Do you have any suggestions for improvement?' for all study phases. Answers were reviewed and classified into categories of response as listed.

r20s response - 'In a word, 'reality'. It is not possible to achieve the records that we are told to do. You should also understand that the new standard is not just 'informed consent', it is 'understood consent'. Also, ALL options of treatment must be recorded, with ALL the complications and risks of ALL these treatment options fully understood. That is infinity times infinity. If you want the reference of this I can send it to you, or see DPL Changes Magazine. In fact, I

challenge any dentist to do record keeping at this level of detail for an average person in middle age with a restored mouth; it would take days to do. To explain this to you, as you are a dental student – it would be like your case presentation for your final exam…from hell. Can you imagine the time that would be needed to collate and accurately record this data on a patient, then explain to them and record again and again? Would you have the detail to satisfy a few specialists and a couple of experienced GP dentists, if they were as nit-picky as our supposed 'dental experts' and lawyers seem to be. I have never in my whole career seen the evidence that this detail in record keeping can actually be done. Now THAT is research that I would like to see; put these supposed 'dental experts' to the test. I can supply the patients and we, the coalface dental profession, can assess the total (all) extent of their detail. This is never done because they can't do it. It is legalised dreaming damaging our profession and actually discouraging record keeping, rather than encouraging. Academics live in the dream of what could be. Good coalface dentists live in the reality of what is and can be. I have not even started to mention that, per hour, examination is the lowest paid task any dentist does. A 531 takes no skill or time and pays over double. The good 011 takes ages and is paid half. While dentist use the examination and record keeping as a 'loss-leader', record keeping will always be time poor.'

6.4 Differences between pre- and post-course surveys for valid paired responses

There were 79 participants who completed both the pre- and post-course surveys: seven pairs in phase one; 26 pairs in phase two; and 46 pairs in phase three. Data from valid paired responses was examined for changes that *may* be attributed to the interactive learning module. Fisher's Exact test statistic (the chance that random sampling would result in an association between groups and outcomes that is as strong as observed in this experiment) and statistical significance were calculated using GraphPad (GraphPad Software, Inc.), where relevant.

A. I am aware of the importance of making complete and accurate oral health records

All paired AuSFO Inc participants rated this statement at the highest level (ie. strongly agree) at both pre- and post-course survey stages. There was no change between participants' view about the statement following interaction with the ILM. There was greater variability between pre- and post-course responses in the third year dental student (phase two) and wider dental community (phase three). All-phases combined change in participant perceptions to the statement 'I am aware of the importance of making complete and accurate oral health records' is presented as Table 28; changes by country of highest education are presented in Table 29; changes by current occupation are shown in Table 30; and changes by years of experience in current occupation are demonstrated in Table 31.

Question	Phase	n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Awareness	1 (AuSFO)	7 (100%)^#	0 (0%)	7 (100%)	0 (0%)	p=1.0000
	2 (dental students)	25 (100%)^#	10 (38%)	12 (50%)	3 (12%)	p=0.1482
	3 (wider dental community)	46 (100%)^#	10 (22%)	34 (74%)	2 (4%)	p=0.1209
TOTAL		78 (100%)	20 (26%)	53 (68%)	5 (6%)	p=0.0305*

TABLE 28 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I am aware of the importance of making complete and accurate oral health records' for all groups. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Country of highest level of education	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Awareness	Australia	59 (100%)^#	17 (29%)	40 (68%)	2 (3%)	p=0.0034*
	Other	18 (100%)^#	3 (17%)	12 (66%)	3 (17%)	p=1.0000
TOTAL		77 (100%)	20 (26%)	52 (68%)	5 (6%)	p=0.0305*

TABLE 29 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I am aware of the importance of making complete and accurate oral health records' by country of highest level of education. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Current occupation	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Awareness	Dental hygienist	9 (100%^#)	2 (22%)	7 (78%)	0 (0%)	p=0.5765
	Dental therapist	4 (100%^#)	1 (25%)	3 (75%)	0 (0%)	p=1.0000
	Dual qualified hygienist /therapist	8 (100%^#)	3 (38%)	5 (62%)	0 (0%)	p=0.2821
	Dentist	30 (100%^#)	4 (13%)	24 (80%)	2 (7%)	p=1.0000
	Dental specialist	2 (100%^#)	0 (0%)	2 (100%)	0 (0%)	p=1.0000
	Dental student	25 (100%^#)	10 (38%)	12 (50%)	3 (12%)	p=0.1482
TOTAL		78 (100%)	20 (26%)	53 (68%)	5 (6%)	p=0.0305*

TABLE 30 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I am aware of the importance of making complete and accurate oral health records' by current occupation. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Years of experience	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Awareness	Over 30 years	22 (100%^#)	3 (14%)	19 (86%)	0 (0%)	p=0.7205
	20-29 years	6 (100%^#)	2 (33%)	4 (67%)	0 (0%)	p=0.5455
	10-19 years	12 (100%^#)	2 (17%)	9 (75%)	1 (8%)	p=1.0000
	6-9 years	8 (100%^#)	2 (25%)	5 (63%)	1 (12%)	p=1.0000
	3-5 years	26 (100%^#)	10 (38%)	13 (50%)	3 (12%)	p=0.1534
	Less than 2 years	4 (100%^#)	1 (25%)	3 (75%)	0 (0%)	p=1.0000
TOTAL		78 (100%)	20 (26%)	53 (68%)	5 (6%)	p=0.0305*

TABLE 31 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I am aware of the importance of making complete and accurate oral health records' by years of experience in current occupation. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

B. I have the knowledge to make complete and accurate oral health records

Overall, students demonstrated the greatest improvement in self-reported knowledge on the subject matter following engagement with the ILM. All-phases combined change in participant perceptions presented as Table 32. Changes by country of highest education are presented in Table 33; changes by current occupation are shown in Table 34; and changes by years of experience in current occupation are demonstrated in Table 35.

Question	Phase	n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Knowledge	1 (AuSFO)	7 (100%^#)	1 (14%)	6 (86%)	0 (0%)	p=1.0000
	2 (dental students)	26 (81%^, 100%#)	19 (73%)	7 (27%)	0 (0%)	p=0.0004*
	3 (wider dental community)	46 (98%^#)	23 (50%)	22 (48%)	1 (2%)	p=1.0000
TOTAL		79 (96%)	43 (55%)	35 (44%)	1 (1%)	p=0.0046*

TABLE 32 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I have the knowledge to make complete and accurate oral health records' for all groups. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Country of highest level of education	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Knowledge	Australia	60 (95%^, 100%#)	33 (55%)	26 (43%)	1 (2%)	p=0.0714
	Other	19 (90%^, 100%#)	11 (58%)	8 (42%)	0 (0%)	p=0.2144
TOTAL		79 (96%)	44 (56%)	34 (43%)	1 (1%)	p=0.0046*

TABLE 33 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I have the knowledge to make complete and accurate oral health records' by country of highest level of education. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Current occupation	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Knowledge	Dental hygienist	9 (100%^#)	3 (33%)	5 (56%)	1 (1%)	p=1.0000
	Dental therapist	4 (100%^#)	2 (50%)	2 (50%)	0 (0%)	p=1.0000
	Dual qualified hygienist/ therapist	8 (100%^#)	6 (75%)	2 (25%)	0 (0%)	p=1.0000
	Dentist	30 (97%^#)	12 (40%)	18 ((60%)	0 (0%)	p=1.0000
	Dental specialist	2 (100%^#)	1 (50%)	1 (50%)	0 (0%)	p=1.0000
	Dental student	26 (81%^, 100%#)	19 (73%)	7 (27%)	0 (0%)	p=0.0004*
TOTAL		79 (98%)	43 (55%)	35 (44%)	1 (1%)	p=0.0046*

TABLE 34 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I have the knowledge to make complete and accurate oral health records' by current occupation. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Years of experience	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Knowledge	Over 30 years	22 (95%^#)	10 (45%)	12 (55%)	0 (0%)	p=1.0000
	20-29 years	6 (100%^#)	4 (67%)	3 (33%)	0 (0%)	p=1.0000
	10-19 years	12 (100%^#)	3 (25%)	9 (75%)	0 (0%)	p=1.0000
	6-9 years	8 (100%^#)	3 (38%)	4 (50%)	1 (12%)	p=1.0000
	3-5 years	27 (81%^, 100%#)	19 (70%)	8 (30%)	0 (0%)	p=0.0004*
	Less than 2 years	4 (100%^#)	3 (75%)	1 (25%)	0 (0%)	p=1.0000
TOTAL		79 (98%)	43 (55%)	35 (44%)	1 (1%)	p=0.0046*

TABLE 35 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I have the knowledge to make complete and accurate oral health records' by years of experience in current occupation. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

C. I have the confidence to make complete and accurate oral health records

There was no change between AuSFO participants' view about the statement following interaction with the ILM. Dental students demonstrated a significant increase in self-reported confidence to make complete and accurate oral health records after engaging with the ILM.

All-phases combined change in participant perception is presented as Table 36. Changes by country of highest education are presented in Table 37; changes by current occupation are shown in Table 38; and changes by years of experience in current occupation are demonstrated in Table 39.

Question	Phase	n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Confidence	1 (AuSFO)	7 (100%)^#	0 (0%)	7 (100%)	0 (0%)	p=1.0000
	2 (dental students)	25 (85%^, 96%#)	20 (77%)	5 (19%)	0 (0%)	p<0.0001*
	3 (wider dental community)	46 (98%^#)	24 (52%)	21 (46%)	1 (2%)	p=0.3155
TOTAL		78 (96%)	44 (57%)	33 (42%)	1 (1%)	P<0.0001*

TABLE 36 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I have the confidence to make complete and accurate oral health records' for all groups. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Country of highest level of education	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Confidence	Australia	59 (95%^, 97%#)	33 (56%)	25 (42%)	1 (2%)	p=0.0005*
	Other	19 (89%^, 100%#)	11 (58%)	8 (42%)	0 (0%)	p=0.0188*
TOTAL		78 (95%)	44 (57%)	32 (42%)	1 (1%)	P<0.0001*

TABLE 37 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I have the confidence to make complete and accurate oral health records' by country of highest level of education. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Current occupation	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Confidence	Dental hygienist	9 (100%^#)	3 (33%)	5 (56%)	1 (1%)	p=1.0000
	Dental therapist	4 (100%^#)	2 (50%)	2 (50%)	0 (0%)	p=1.0000
	Dual qualified hygienist/ therapist	8 (100%^#)	5 (63%)	3 (37%)	0 (0%)	p=0.4667
	Dentist	30 (97%^#)	13 (43%)	17 (57%)	0 (0%)	p=1.0000
	Dental specialist	2 (100%^#)	1 (50%)	1 (50%)	0 (0%)	p=1.0000
	Dental student	25 (84%^, 96%#)	20 (80%)	5 (20%)	0 (0%)	p<0.0001*
TOTAL		78 (98%)	44 (57%)	33 (42%)	1 (1%)	P<0.0001*

TABLE 38 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I have the confidence to make complete and accurate oral health records' by current occupation. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Years of experience	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Confidence	Over 30 years	22 (95%^#)	11 (50%)	11 (50%)	0 (0%)	p=1.0000
	20-29 years	6 (100%^#)	3 (50%)	3 (50%)	0 (0%)	p=1.0000
	10-19 years	12 (100%^#)	3 (25%)	9 (75%)	0 (0%)	p=1.0000
	6-9 years	8 (100%^#)	4 (50%)	3 (38%)	1 (12%)	p=1.0000
	3-5 years	26 (85%^, 96%#)	21 (81%)	5 (19%)	0 (0%)	p<0.0001*
	Less than 2 years	4 (100%^#)	2 (50%)	2 (50%)	0 (0%)	p=1.0000
TOTAL		78 (98%)	44 (57%)	33 (42%)	1 (1%)	p<0.0001*

TABLE 39 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I have the confidence to make complete and accurate oral health records' by years of experience in current occupation. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

D. I have the skill required to make complete and accurate oral health records

Students demonstrated a significant self-reported increase in skill level following engagement with the educational module. In particular, this was notable amongst students who had attained their highest level of education

within Australia. All-phases combined change in participant perception is presented as Table 40. Changes by country of highest education are presented in Table 41; changes by current occupation are shown in Table 42; and changes by years of experience in current occupation are demonstrated in Table 43.

Question	Phase	n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Skill	1 (AuSFO)	7 (100%)^#	0 (0%)	6 (86%)	1 (14%)	p=1.0000
	2 (dental students)	26 (85%^, 100%#)	19 (73%)	6 (23%)	1 (4%)	p<0.0001*
	3 (wider dental community)	46 (98%^#)	23 (50%)	22 (48%)	1 (2%)	p=0.7139
TOTAL		79 (97%)	42 (53%)	34 (43%)	3 (4%)	p=0.0008*

TABLE 40 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I have the skill required to make complete and accurate oral health records' for all groups. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Country of highest level of education	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Skill	Australia	60 (95%^, 98%#)	32 (53%)	25 (42%)	3 (5%)	p=0.0060*
	Other	19 (83%^, 100%#)	10 (53%)	9 (47%)	0 (0%)	p=0.1245
TOTAL		79 (94%)	42 (53%)	34 (43%)	3 (4%)	p=0.0008*

TABLE 41 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I have the skill to make complete and accurate oral health records' by country of highest level of education. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Current occupation	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Skill	Dental hygienist	9 (100%^#)	4 (44%)	4 (44%)	1 (2%)	p=1.0000
	Dental therapist	4 (100%^#)	2 (50%)	2 (50%)	0 (0%)	p=1.0000
	Dual qualified hygienist/ therapist	8 (100%^#)	4 (50%)	4 (50%)	0 (0%)	p=1.0000
	Dentist	30 (97%^#)	12 (40%)	17 (57%)	1 (3%)	p=1.0000
	Dental specialist	2 (100%^#)	1 (50%)	1 (50%)	0 (0%)	p=1.0000
	Dental student	26 (85%^, 92%#)	19 (73%)	6 (23%)	1 (4%)	p<0.0001*
TOTAL		79 (98%)	42 (53%)	34 (43%)	3 (4%)	p=0.0008*

TABLE 42 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I have the skill to make complete and accurate oral health records' by current occupation. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Years of experience	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Skill	Over 30 years	22 (100%^#)	10 (45%)	12 (55%)	0 (0%)	p=1.0000
	20-29 years	6 (100%^#)	3 (50%)	3 (50%)	0 (0%)	p=1.0000
	10-19 years	12 (100%^#)	3 (25%)	8 (67%)	1 (8%)	p=1.0000
	6-9 years	8 (100%^#)	4 (50%)	3 (38%)	1 (12%)	p=1.0000
	3-5 years	27 (85%^, 100%#)	20 (74%)	6 (22%)	1 (4%)	p<0.0001*
	Less than 2 years	4 (100%^#)	2 (50%)	2 (50%)	0 (0%)	p=1.0000
TOTAL		79 (99%)	42 (53%)	34 (43%)	3 (4%)	p=0.0008*

TABLE 43 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I have the skill to make complete and accurate oral health records' by years of experience in current occupation. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

E. I am motivated to learn more about how to make complete and accurate oral health records

There were no statistically significant changes (amongst any group) to self-reported motivation to learn more about making complete and accurate oral health records after completing the ILM. All-phases combined change in

participant perception is presented as Table 44. Changes by country of highest education are presented in Table 45; changes by current occupation are shown in Table 46; and changes by years of experience in current occupation are demonstrated in Table 47.

Question	Phase	n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Motivation	1 (AuSFO)	7 (100%^#)	0 (0%)	6 (86%)	1 (14%)	p=1.0000
	2 (dental students)	26 (92%^#)	5 (19%)	14 (54%)	7 (27%)	p=0.7761
	3 (wider dental community)	44 (96%^#)	11 (25%)	28 (64%)	5 (11%)	p=0.3554
TOTAL		77 (96%)	16 (21%)	48 (62%)	13 (17%)	p=0.8688

TABLE 44 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I am motivated to learn more about how to make complete and accurate oral health records' for all groups. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Country of highest level of education	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Motivation	Australia	58 (95%^, 97%#)	13 (22%)	37 (64%)	8 (14%)	p=0.3341
	Other	19 (95%^, 100%#)	3 (16%)	11 (58%)	5 (26%)	p=0.3300
TOTAL		77 (97%)	16 (21%)	48 (62%)	13 (17%)	p=0.8688

TABLE 45 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I am motivated to learn more about how to make complete and accurate oral health records' by country of highest level of education. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Current occupation	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Motivation	Dental hygienist	9 (100%^#)	1 (11%)	6 (67%)	2 (22%)	p=1.0000
	Dental therapist	4 (100%^#)	1 (25%)	3 (75%)	0 (0%)	p=1.0000
	Dual qualified hygienist/ therapist	8 (100%^#)	2 (25%)	6 (75%)	0 (0%)	p=0.5692
	Dentist	28 (93%^, 96%#)	7 (25%)	18 (64%)	3 (11%)	p=1.0000
	Dental specialist	2 (100%^#)	0 (0%)	2 (100%)	0 (0%)	p=1.0000
	Dental student	26 (92%^#)	5 (19%)	14 (54%)	7 (27%)	p=0.7761
TOTAL		77 (98%)	16 (21%)	49 (64%)	12 (15%)	p=0.8688

TABLE 46 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I am motivated to learn more about how to make complete and accurate oral health records' by current occupation. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Years of experience	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Motivation	Over 30 years	22 (91%^, 95%#)	4 (18%)	17 (77%)	1 (5%)	p=1.0000
	20-29 years	6 (100%^#)	2 (33%)	3 (50%)	1 (17%)	p=0.5455
	10-19 years	11 (100%^#)	1 (9%)	8 (73%)	2 (18%)	p=1.0000
	6-9 years	7 (100%^#)	4 (57%)	1 (14%)	2 (29%)	p=1.0000
	3-5 years	27 (93%^#)	5 (18%)	15 (56%)	7 (26%)	p=0.7822
	Less than 2 years	4 (100%^#)	0 (0%)	4 (100%)	0 (0%)	p=1.0000
TOTAL		77 (98%)	16 (21%)	48 (62%)	13 (17%)	p=0.8688

TABLE 47 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I am motivated to learn more about how to make complete and accurate oral health records' by years of experience in current occupation. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

F. I prefer learning in an online format using an interactive learning module (ILM)

There were also no statistically significant changes (amongst any group) to self-reported preference for online learning about making complete and accurate

oral health records after completing the ILM. All-phases combined change in participant perception is presented as Table 48. Changes by country of highest education are presented in Table 49; changes by current occupation are shown in Table 50; and changes by years of experience in current occupation are demonstrated in Table 51.

Question	Phase	n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Online preference to learn	1 (AuSFO)	7 (71%^, 100%#)	2 (29%)	5 (71%)	0 (0%)	p=0.4615
	2 (dental students)	26 (81%^, 69%#)	5 (19%)	11 (42%)	10 (39%)	p=0.5653
	3 (wider dental community)	45 (70%^, 87%#)	24 (53%)	21 (47%)	0 (0%)	p=0.0882
TOTAL		78 (80%)	31 (40%)	37 (47%)	10 (13%)	p=0.2492

TABLE 48 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I prefer learning in an online format using an interactive learning module (ILM)' for all groups. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Country of highest level of education	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Online preference to learn	Australia	59 (75%^, 85%#)	27 (46%)	26 (44%)	6 (10%)	p=0.0912
	Other	19 (79%^, 74%#)	5 (26%)	11 (58%)	3 (16%)	p=0.5077
TOTAL		78 (78%)	32 (41%)	37 (47%)	9 (12%)	p=0.2492

TABLE 49 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I prefer learning in an online format using an interactive learning module (ILM)' by country of highest level of education. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Current occupation	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Online preference to learn	Dental hygienist	9 (89%^, 100%#)	5 (56%)	4 (44%)	0 (0%)	p=1.0000
	Dental therapist	3 (33%^, 66%#)	2 (66%)	1 (33%)	0 (0%)	p=1.0000
	Dual qualified hygienist/ therapist	8 (88%^#)	3 (37%)	5 (63%)	0 (0%)	p=0.5692
	Dentist	30 (70%^, 87%#)	14 (47%)	16 (53%)	0 (0%)	p=0.1954
	Dental specialist	2 (0%^, 100%#)	2 (50%)	0 (50%)	0 (0%)	p=1.0000
	Dental student	26 (81%^, 69%#)	6 (23%)	11 (42%)	9 (35%)	p=0.5653
TOTAL		78 (73%)	32 (41%)	37 (47%)	9 (12%)	p=0.2492

TABLE 50 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I prefer learning in an online format using an interactive learning module (ILM)' by current occupation. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

Question	Years of experience	Paired n (BA)	Increased post-course Likert score n (%)	No change to Likert score n (%)	Decreased post-course Likert score n (%)	Fishers Exact test statistic
Online preference to learn	Over 30 years	21 (71%^, 81%#)	11 (52%)	10 (48%)	0 (0%)	p=0.0616
	20-29 years	6 (67%^, 83%#)	2 (33%)	4 (67%)	0 (0%)	p=1.0000
	10-19 years	12 (75%^, 92%#)	7 (58%)	5 (42%)	0 (0%)	p=1.0000
	6-9 years	8 (100%^#)	4 (50%)	4 (50%)	0 (0%)	p=1.0000
	3-5 years	27 (78%^, 70%#)	7 (26%)	11 (41%)	9 (33%)	p=0.4121
	Less than 2 years	4 (100%^#)	1 (25%)	3 (75%)	0 (0%)	p=1.0000
TOTAL		78 (73%)	32 (41%)	37 (47%)	9 (12%)	p=0.2492

TABLE 51 - Likert score differences between pre- and post-course survey responses for valid paired responses for 'I prefer learning in an online format using an interactive learning module (ILM)' by years of experience in current occupation. n=number of participants, % = percentage, BA = broad agreement, ^ denotes pre-course statistic, # denotes post-course statistic, * = statistically significant.

6.5 Individual paired responses

Graphical representation of all paired responses is presented as Appendix VIII of this thesis, demonstrating changes between pre- and post-course responses

for each individual that submitted both pre- and post-course surveys. There were seven paired responses in phase one of the research project (AuSFO Inc members); 26 paired responses during phase two (BDS3 dental students); and 46 paired responses in phase three (wider dental community). Within the appendix, single participant paired responses are presented in order of being received and paired.

This particular section contains graphical representations of eight paired responses (their 4-digit anonymous codes being LJ0S, NF1H, BJ0S and CA0G from the dental student cohort; Wm0T, r20s, nm1p and sa2r from the wider dental community cohort) that were deemed interesting and are considered in the Discussion section of this thesis.

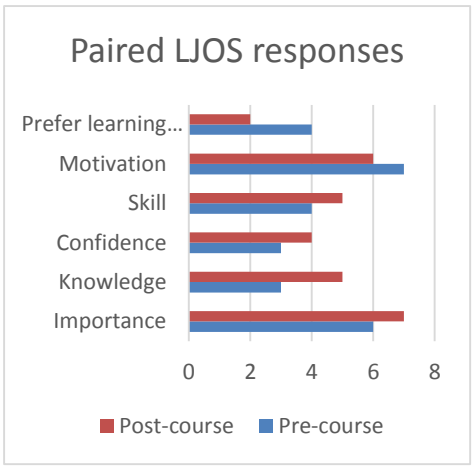


FIGURE 39 – Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from dental student participant LJOS.

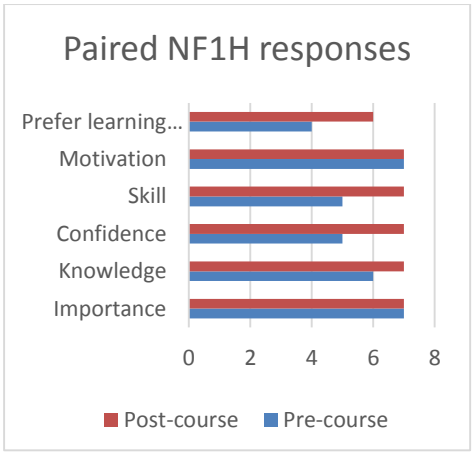


FIGURE 40 – Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from dental student participant NF1H.

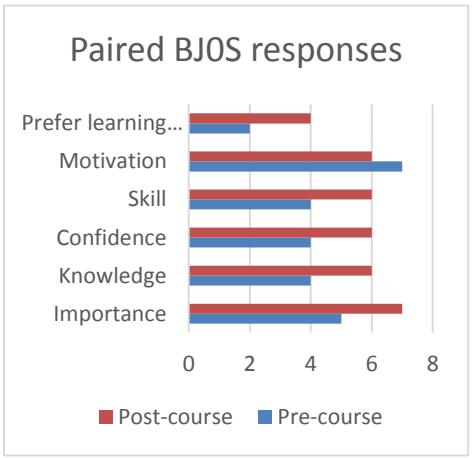


FIGURE 41 – Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from dental student participant BJ0S.

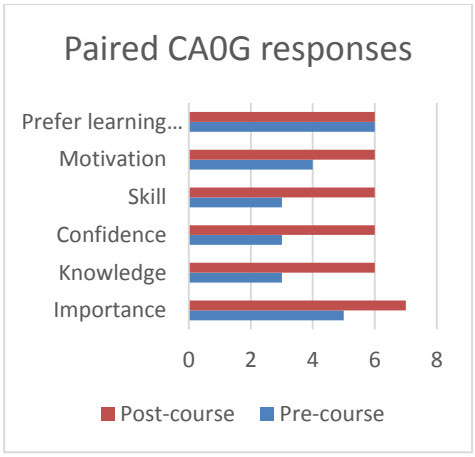


FIGURE 42 – Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from dental student participant CA0G.

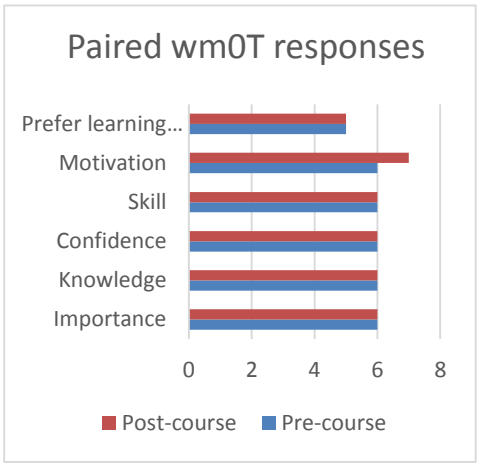


FIGURE 43 – Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participant wm0T.

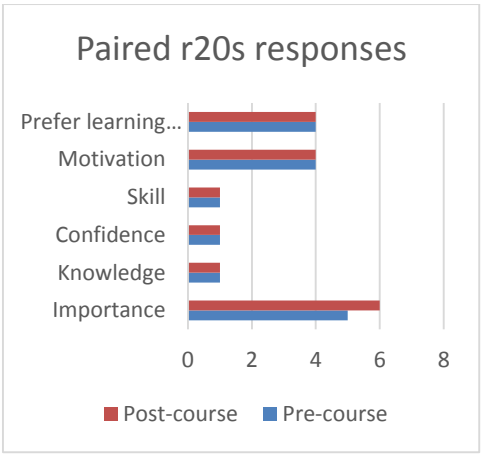


FIGURE 44 – Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participant r20s.

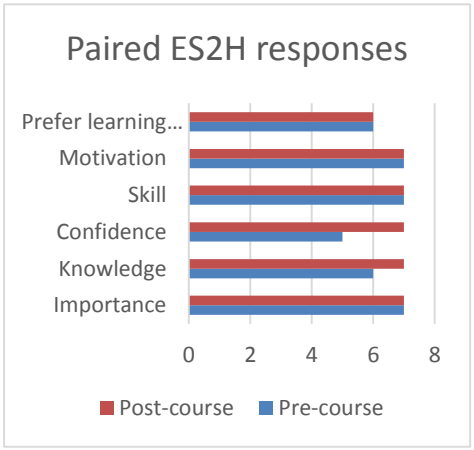


FIGURE 45 – Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participant ES2H.

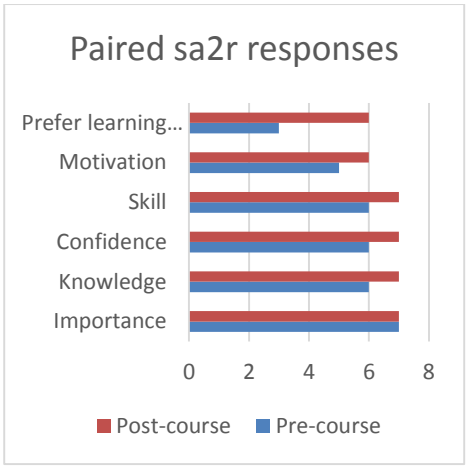


FIGURE 46 – Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participant sa2r.

CHAPTER 7

DISCUSSION

7. DISCUSSION

This research aimed to develop an electronic interactive learning module (ILM) to improve record keeping skills of oral health practitioners. It was developed with a specific focus on forensically-relevant recorded material and was seen as a continuing professional development tool. Information was also collected to allow an understanding of the awareness of the importance of record keeping amongst practitioners with varying levels of experience.

The learning module was targeted at three different groups of practitioners with varied levels of education and experience. Initially website access to the electronic learning module and access to pre- and post-course surveys was provided to members of the Australian Society of Forensic Odontology Inc. (AuSFO) in order to evaluate opinions and learning. Members of the society are Australian-registered dental practitioners with an interest or further training in the application of dental evidence to the law. They were considered by the research team to be expert in the field of the type of education relevant to the learning package and hence their advice was sought as priority. Minor modifications to the ILM were suggested by this group and were implemented prior to the subsequent release to third year Bachelor of Dental Surgery students at the University of Adelaide; a group considered to be at the other end of the experience spectrum. This particular year level of dental students was selected because the educational content contained within the ILM represented an extension of their current curriculum and linked with existing

learning outcomes for their academic year. Minor amendments with regards to appearance and accessibility were again made based on feedback prior to the ILM being released to the third focus group (members of the wider dental profession), whom it was felt would have a broader range of experience in record keeping. The self-reported opinions from all participants were used to determine the degree to which the ILM achieved its aim in providing continuing professional development related to case note recording standards for the targeted groups, with reference to Kirkpatrick's levels of learning effectiveness.

7.1 Participation

Participation (completion) rate is considered part of the reaction of participants to a training programme and is measured in level one of Kirkpatrick's Levels of Training effectiveness. Clearly, the first step in an educational programme being effective is to involve and engage the target audience.

For phase one, the interactive learning module and surveys were available exclusively to all AuSFO members for a period of seven weeks. The response rate to the pre- and post-course surveys was low. Overall, only 11% of the potential participant pool completed both pre- and post-course surveys. The low response rate may be attributed to several reasons. Potentially, the learning module and surveys were not available for a long enough period, or the timing was not ideal. It was a busy time of the year for AuSFO members,

with the AuSFO symposium being held during the survey period. Additionally, participation may have been discouraged by the length of time required to complete the interactive learning module and surveys, in a group who would most likely believe that they were already familiar with material that they anticipated would be in the module.

For dental students involved in phase two, the surveys were open for a period of three weeks. The response rate to the pre- and post-course surveys was moderate, with 36% of the potential participant pool completing both pre- and post-course surveys. A high rate of response in this group had been anticipated, as the content within the ILM was assessable in the pre-clinical written examination period, so students were driven to participate by assessment outcomes. Also, students were aware that the research was being undertaken by one of their year coordinators and so they likely felt obliged to participate. However, the response rate wasn't as high as it could have been possibly because the learning module and surveys were only open for a short period of time and because it was a busy time of the year for students new to BDS3; they may have elected to be selective in their learning. It is possible that a number of students completed the ILM (to aid their learning) but did not complete the surveys. This may have been because the predicted time for the completion of the ILM was already sufficiently long so that students did not feel they had time or inclination to additionally complete the feedback surveys.

For the general oral health population involved in phase three, the interactive learning module and surveys were available for a period of just over six months. The response rate to the pre- and post-course surveys that were linked to the interactive learning module was extremely low (1.3% pre-course, 1% post-course, 0.71% paired responses). The low response rate may be attributed to several reasons. Again, perhaps the predicted time requirement for completing the interactive learning module and surveys was too long and hence deterred people from participating. As the module was available for a lengthy period, participants may have originally delayed participation, with the intent to do so at a later date (and then forgot). There was also a potential lack of understanding amongst those invited to participate of the importance of the subject matter, or a lack of appreciation that although the subject matter might be deemed basic (or a simple skill that is easily mastered), it is something that requires review by even the most seasoned professional. Finally, the ease with which an email invitation for participation can be ignored, unless the participant has a genuine interest in the subject matter, should not be dismissed.

As the wider dental community cohort were not targeted as a specific professional group, I asked them the extra question 'How did you hear about this interactive learning module?' to gain an understanding how well the different avenues of invitation worked. A large number of participants indicated that they had received an invitation from the Australian Dental

Association (36%), making this the professional group that was most helpful in gaining study participants.

Participation rates reported in previous paper-based forensic odontology surveys have been moderate to high. In their 1999 study, Delattre and Stimson reported a 100% response and Baig et al. (2014) showed a response rate of 94%. In 2000, Osborn et al. reported 65% analysable returns whilst Alexander et al. (1998) received a lower 50% response. A little over a 41% response rate was also demonstrated in a 2014 forensic odontology survey by Sheddi and Al Asiri. It is interesting to note that many survey-based research topics have moved to online formats, assumedly in an attempt to increase survey access to participants and hence encourage an increased response. This may be assumed to be particularly relevant for younger cohorts of participants (such as students in the third year of the Bachelor of Dental Surgery programme, or the more recent graduates in the wider dental community cohort), as they are thought to be generally more agreeable to any type of electronic media. Certainly, it should be easier to gather a higher amount of data, at a minimal cost, via an online method, when compared to a paper-based (or telephone) method. However, web-based response rates generally appear either about the same (Hohwu et al., 2013), or lower than paper-based surveys. Dierickx et al. (2006) reported an 8% response rate in their online survey. Adelaide Dental School researchers reported only a 3.9% response rate via a link to an online survey software tool (with an option for hard copy provision that no participants

requested), despite employing measures to improve the participation in the survey (Al-Azri, James and Harford, 2016). In 2013, Cho, Johnson and VanGeest showed that mail survey mode was more effective than online methodologies in improving response rates. It is true that a paper-based task has few inherent distractions, whilst being online opens many opportunities to break concentration. Researchers have also shown hesitancy in deciding to use online-based data collection when the goal is to yield a truly representative sample, due to internet coverage issues (Chang and Krosnick, 2009). It is difficult to compare these results to the participation rate in this research, as this was not just a survey. Participants had to complete the ILM and submit the surveys, which demanded a much greater commitment of time and effort. Given this, the average paired response rate of 15.9% for all three phases of the current study is possibly quite reasonable.

It is clear that in order to improve results related to level one of Kirkpatrick's training effectiveness, measures need to be implemented to increase participation. This could be achieved by convincing major professional groups that the subject matter is important and that they must participate in the general interests of the profession. Such an achievement would greatly increase the reach of advertising.

7.2 Level of Experience

The pre-course surveys collected demographic information related to the level of experience of the participants.

Highest level of education/Current occupation – As expected, due to the differing target groups involved in the research project, the responses to this question were quite variable. All AuSFO participants had schooling beyond that of secondary school level. Most AuSFO participants had a Bachelor Degree or a Masters Degree. In comparison, the majority of the dental student participants indicated that their highest level of education was secondary schooling. Less than 20% of dental student participants had already completed a Bachelor Degree (with or without Honours) and one participant had an existing Masters Degree. For members of the wider dental community, the question posed was 'Which of the following best describes your current occupation?', rather than asking about their highest level of education. The question was modified for this phase of the study because it was important to understand the occupation-demographics of the participants; this was not important for the first two groups as their demographic was obvious. For the wider dental community cohort, participants could choose from nine categories of dental occupation. More than half of the participants were dentists. This slant is likely due to the fact that most of the invitations to participate were to dentists, via dentist membership groups, as these made up most of my contact list. Furthermore, the Australian Institute of Health and Welfare's report into the dental

workforce of 2012 (AIHW, 2014) indicates that whilst the total number of dental health care workers in Australia was 19462 persons, 75.5% of these were dentists, indicating a significantly higher proportion of practicing dentists in the community, compared with other oral health care workers.

No occupation group demonstrated a significant change in perception to any statement except for the dental student group. This group showed statistically significant results for the statements on knowledge, confidence and skill and a positive change to the statement 'I am aware of the importance of making complete and accurate oral health records'.

Year completed highest level of education/Years of experience on current occupation

The responses to this question reflected a range of experience. Most AuSFO members (46%) completed their highest level of education in the period 2001-2010, with 30% completing prior to 1980, demonstrating some educational time-period diversity amongst this group. For the dental student participants, the majority graduated from their highest degree in or after 2011. Students with a higher level of education had predominantly completed those degrees between 2001 and 2010. Effectively, the level of work experience related to dentistry and oral health amongst the participants in phase one was much greater than those in phase two. It could be inferred that their greater level of experience goes some way to explain the positive findings related to awareness

of importance, knowledge, confidence and skill related to preparing complete and accurate oral health records. For members of the wider dental community, the question posed was slightly re-phrased to 'How many years of experience do you have in your current occupation?' as the inferred correlation between experience (rather than the year they completed their highest level of education) and awareness had already been seen in the previous focus group. As with the AuSFO cohort, there was some educational time-period diversity amongst the wider dental community focus group. The category of 'over 30 years' of experience was the most highly represented, with the two categories pertaining to less than five years of experience combined showing the least representation. It is possible that those oral health providers in the older age brackets had more available time to complete the ILM, hence explaining the skew to a more-experienced participant in both the AuSFO and wider dental community cohorts. For the wider dental community group, answers to the repeated Likert-style questions in the pre- and post-course surveys appeared to be predictive of the level of experience that practitioners had in their current occupation.

Those participants with 3-5 years of experience in their current occupation (which included most of the dental student cohort) were identified as gaining more knowledge, confidence and skill from the ILM than any other. This group showed significant changes in perception to statements on knowledge, skill and confidence. While no other group showed any significant change, it was

interesting to note that those in the 'over 30 years' experience bracket showed an *almost* significant result with their improved perception of online learning; clearly they had a more positive educational interaction with the ILM than they expected!

Highest level of education completed in Australia? – The majority of participating AuSFO members completed their highest level of education in Australia. This can probably be attributed to the fact that Australia currently has a number of well-respected programmes in forensic odontology. Given these high quality learning opportunities, it may be that practitioners do not feel the need to look outside of this country for up-skilling. It is also probable that those who complete studies in forensic odontology within Australia are strongly encouraged to join AuSFO and hence were recipients of the participant request for this project. Over half of the BDS3 cohort in 2016 had completed their highest level of education in Australia. This statistic closely reflects the demographic seen amongst students in the current Bachelor of Dental Surgery programme, where the school is approaching a 50% intake of international students to year one of the academic course each calendar year. As seen in the AuSFO group, a large proportion of participants in the wider dental community cohort had also completed their education for their current occupation in Australia.

There was a statistically significant change between the pre- and post-course self-perceived survey results for 'I am aware of the importance of making accurate and complete oral health records' for participants whose highest degree had been attained within Australia but not for those educated elsewhere. This positive change for Australian-educated participants could be because they had little pre-course awareness of the subject matter and were significantly positively affected by engagement with the ILM or they did actually have moderate-high awareness of the subject matter before the ILM but were more suitably convinced of this once they had seen the ILM content (and so ranked their score higher). The lack of a statistically significant change for those whose highest degree came from outside Australia could be because they were actually more highly aware of the subject matter before embarking upon the ILM (ie. more educated) or they simply did not find the ILM educational (and so no change of opinion was seen).

For the statement pertaining to confidence, both Australian-educated and non-Australian educated groups showed a statistically significant improvement in opinion following engagement with the ILM. For skill, there was only a significant increase in Likert score for those whose highest degree was Australian. There was no statistical significance for change of opinion for the statements related to knowledge, motivation or preference to learn online when participants were categorised by country of highest educational degree.

Australian-educated participants, however, demonstrated a noteworthy result for improved knowledge and change in perception for online learning.

In summary, the ILM appeared to have a greater impact on self-perceived awareness, confidence and skill for those who had received their highest level of education from an Australian institution of learning.

7.3 Survey results

Aware of importance – At the pre-course survey stage, most participants were aware of the importance of making complete and accurate oral health records. This was not surprising as it is an area of learning that features heavily in most oral health curricula and practices, especially within Australia. At the post-course survey this level of awareness was seen to increase for most individuals or at least to stay consistent at the initial high level. For all three groups, there was 100% broad agreement with the statement with a large proportion of AuSFO and wider dental community participants strongly agreeing. A minor improvement in perceived awareness was demonstrated by AuSFO members, although the practical changes would likely be negligible due to their high pre-course awareness of the subject matter. Similar was true for the wider dental community; at the post-course stage, an additional 14% selected ‘strongly agree’ (compared with the pre-course stage) and no participants made a selection below the level of ‘agree’, with minimal dispersion of the response

values. This demonstrated that opinions regarding the statement had either stayed at the pre-course high level of agreement, or that opinions had increased for all members in the wider dental community cohort, to clump together at the highest end of the awareness scale. At the post-course survey stage, there was a marked increase in the number of BDS3 students in the 'strongly agree' category and all students who had previously selected the 'uncertain' category had moved to a higher level of agreement. This demonstrated a clear cohort improvement in the awareness of the importance of making accurate and complete oral health records.

Have the knowledge – There was a distinct difference in the responses to the statement regarding knowledge across the target groups. In general, participants with more experience in the profession self-reported greater knowledge with regard making complete and accurate oral health records than those with fewer years of exposure to dental health management. AuSFO members all agreed that they have the knowledge to create accurate and complete oral health records; this improved slightly after engagement with the ILM but the practical effect of this would be negligible for this group. Results were similar for the wider dental community; self-reported knowledge had improved but due to the high rate reported prior to the ILM, the improvement would not be practically noticeable. Interestingly, one wider dental community participant strongly disagreed with the statement at both the pre- and post-course stage and this notably went against results from every other participant

in the entire study. This particular participant (r20s) had interesting survey results across a number of categories and these are specifically discussed in section 7.4 of this thesis. For the participating dental undergraduates, results were mixed at the pre-course stage; most students agreed with the statement but some were undecided or disagreed. They consequently demonstrated significant combined improvement in their self-reported knowledge related to the subject matter. These results could be expected in a group that has not yet completed their undergraduate training in the profession; they may be unsure if they have received all required training about the subject, or if more is to come in the fourth and fifth year of the degree. The student cohort result may also be influenced by the high degree of importance that the University of Adelaide Bachelor of Dental Surgery programme places upon self-assessment and honest recognition of areas for improvement for students. It is clear, even from this current study with a low sample size, that the ILM was useful in improving the self-perceived knowledge of making complete and accurate oral health records of the least-experienced members of our dental professional community i.e. undergraduate students.

Have the confidence – AuSFO members all agreed with the proposed statement; the slight improvement following their engagement with the ILM would have no practical significance due to their existing high levels of confidence regarding the subject matter. Results were similar for the wider dental community group and unlikely to be of practical significance. Once

again, one participant was undecided; one participant (the same as in the previous statement category, r20s) strongly disagreed with the statement, feeling that the degree of expectation is too high for him/her to feel confident about making accurate and complete oral health records. Again, this is discussed specifically in section 7.4 of this thesis. Data for dental student response followed a similar distribution for that demonstrated for the preceding question. Overall, students demonstrated improved self-reported confidence to make complete and accurate oral health records after viewing the ILM and this was likely to be of some practical significance. It should be noted that there is a possible connection between knowledge and confidence within the student cohort. In my six years of experience with teaching undergraduate dental students, an improved level of knowledge is commonly linked with a more confident approach to task management in a clinical setting. This often then leads to an improved clinical outcome.

Have the skill – One hundred percent of AuSFO members broadly agreed that they had the skill to make complete and accurate oral health records at both the pre- and post-course stages. Overall, members were very slightly less convinced by their skill level following completion of the ILM but this would be practically insignificant. These was also little change in self-reported skill levels in the wider dental community group. Almost all of the participants in the wider dental community group broadly agreed with the statement; again, the one participant (r20s) strongly disagreed and is discussed specifically in section 7.4

of this thesis. It should be noted that there was a slightly wider range of opinions amongst the wider dental community cohort at the post-course stage and little positive (or negative) outcome can be extrapolated from these results. At the pre-course stage, most dental students only 'somewhat agreed' with the statement, with 15% rating themselves as 'undecided' or in some disagreement with the statement. Again, this would be seen as an honest reflection of their level of learning. Following ILM engagement, however, all students agreed that they had the required skill level and this group showed the greatest improvement in self-perceived skill related to engagement with the ILM.

Is motivated to learn more – Despite reporting high levels of awareness, knowledge, confidence and skill, AuSFO members still indicated a clear motivation to learn more about making complete and accurate oral health records throughout the research project. This response was indicative of a passionate professional group that remains keen to improve within their area of expertise, as well as to provide feedback in assisting with improvement across the wider dental profession. The participating BDS students were mostly motivated to improve before they commenced the ILM. Pleasingly, those who indicated a lower level of agreement with the awareness, knowledge, confidence and/or skill questions indicated a higher motivation to learn. Wider dental community participants were also mostly motivated to improve; two participants were undecided regarding their motivation. One might expect as

much at the beginning of an educational package that the participant has voluntarily started i.e. they must have some motivation/interest in the learning content to even bother looking at it! In short, the ILM did little to improve the motivation of participants from any group; it can only be said that it has been demonstrated to maintain their interest and motivation in the subject matter. Whilst not a strict rule, it has been observed that students are often motivated by their perception of examinable material, having 'extrinsic goal orientation' (Jacobsen, 2000); thus, having completed and understood the module, their motivation remained unchanged because they felt they knew enough to pass an examination on the subject. Effectively, the external motivators, such as grades and rewards, undermine intrinsic motivation to learn a task that would be beneficial for their professional careers (Deci, Koestner and Ryan, 1999).

Prefers learning in an online format – Before commencing the ILM, most AuSFO members broadly agreed with the statement that they preferred learning in an online format; the remaining quarter were undecided, possibly because they had either never learnt via an online format and were dubious regarding its merits, or had learnt via an online format in the past and felt that it did not suit their style of learning. AuSFO members demonstrated a clear positive change in opinion related to learning online during the post course survey stage, with almost a quarter upgrading their 'uncertain' response to an agreement category. There was also a 12% increase in the number of AuSFO participants who strongly agreed with the statement at the post-course stage.

Similar results were seen amongst the wider dental community participants. For those who indicated a preference to learn online at the pre-course stage, it is possible that they had either never learnt via an online format and were curious to do so in their own time, or had learnt via an online format in the past and felt that it suited their preferred learning method. With the wider dental community cohort, there was a 20% increase in the number of participants who strongly agreed with the statement at the post-course stage.

Participating pre-course BDS3 students also demonstrated similar overall broad agreement to the statement but there was a large deviation amongst their collated responses, with some students demonstrating very strong opinions on the topic. Interestingly, after completing the ILM, students in phase two of the project rated their preference for learning online slightly lower than they did before their ILM use. At both stages, there was a range of opinions related to the statement, from disagreement to strong agreement. Broad agreement dipped at the post-course stage. This remains an interesting finding given the large push to provide significantly more online learning opportunities both within this dental school and within the entire University of Adelaide, as part of the Beacon of Enlightenment initiative (Beacon of Enlightenment: The University of Adelaide Strategic Plan 2013-2023). It seems that whilst some students deem it an appropriate way to learn, many may prefer more traditional methods.

The post-course survey's final three Likert-style questions and three open-ended questions were used to assess the overall participant level of satisfaction with the learning programme. This is also measured as part of level one in Kirkpatrick's Levels of Training effectiveness.

Examples used aided understanding – All participants from phase one (AuSFO members) agreed or strongly agreed that the examples used in the ILM aided their understanding of the educational content. For students in phase two, whilst there was 100% broad agreement, a large proportion only agreed or somewhat agreed with the statement. It is possible that there was not enough 'background information' provided within the ILM to fully explain the examples, so whilst they were clear to the researcher and AuSFO members (who have more experience with the subject matter), they were not thoroughly clear to the undergraduate BDS3 students. For the wider dental community (which, as discussed, featured a high level of experienced practitioners), results were mostly predictable in their agreement. Whilst there was a high level of broad agreement, one individual (r20s) selected 'somewhat disagree' and this skewed results. Again, this individual is discussed in section 7.4 of this thesis.

ILM provided appropriate feedback – All AuSFO participants either agreed or strongly agreed that the ILM provided appropriate feedback for their learning. For the wider dental community, although the median response was 'agree',

there was a significant spread of responses. Two participants were uncertain, one selected 'somewhat disagree' and one selected 'disagree'. Clearly, the type and extent of feedback just did not suit the learning style of those particular wider dental community participants. There was also a significant deviation in responses regarding feedback from the participating phase two undergraduate students. Whilst the majority broadly agreed with the statement, 8% were undecided and 5% either disagreed or somewhat disagreed. It is worth noting that the Student Evaluation of Learning and Teaching (SELT) surveys that are annually completed for the Bachelor of Dental Surgery course often feature a lower broad agreement to statements regarding feedback (eg. timely, relevant, appropriate amount). This remains a significant area of disagreement between students and course coordinators. Whilst this fact may be irrelevant to the statistical findings of the current study, it is important to recognise that these dental students may be conditioned to rate feedback statements at a lower Likert score.

ILM was well organised – The vast majority of participants across all project phases felt that the ILM was suitably organised. Whilst all AuSFO member participants demonstrated broad agreement with the statement, 14% only somewhat agreed that the ILM was well organised; it was not clear as to why they felt this. The majority of the wider dental community members also broadly agreed that the ILM was well organised but 5% selected 'somewhat disagree'. Review of the individual responses would suggest that this was due

to the fact that they found the module difficult to navigate. In the BDS3 student group, there was overall broad agreement that the module was well organised.

What did you like the most about the ILM? Participants in all phases provided very similar feedback regarding what they liked most about the ILM. This included the ability to stop and start the ILM and work at their own pace, its portability, its clear order and referencing, the relevant information and examples, as well as the quizzes to test understanding.

What did you like least about the ILM? Again, participants in all phases provided similar feedback regarding their least favoured aspects of the ILM. They felt it was too 'wordy' or text dense, had too many branching pages and took too long. Issues with being able to enlarge the pictures and answer submission for quizzes were modified after feedback from phase one and two and hence were not prominent concerns for phase three. Some feedback was student specific; not being able to copy/paste notes for future reference and not being able to look back on information during the quizzes. Interestingly, at each phase of the project, feedback comments specified that face-to-face conversation was required to consolidate learning and allow question and answer time. This remains a standard practice within the School of Dentistry, despite the afore-mentioned push to move more aspects of learning online.

Do you have any suggestions for improvement? AuSFO members provided few suggestions for improvement and these could be summarised as being able to enlarge details and provide recommendations regarding practical application of the requirements for making accurate and complete case notes. Dental student responses were mainly aimed at improving access to the ILM content for future examination revision. They additionally commented on cutting down the word content, decreasing the number of branching tabs to click on and removing the twenty second timer limit for answer display. As expected, there was considerable overlap in the responses provided to the questions 'What did you like least about the ILM?' and 'Do you have any suggestions for improvement?' for both this group and those in phase three. Sixty-three percent of wider dental community participants responded to this question. Two notable, and thoroughly reasonable, suggestions were the request for a mixed dentition analysis example (to increase the relevance of the ILM for therapists, in particular) and provision of access to a downloadable checklist for keeping accurate and complete oral health records that could be installed in the dental practice, enabling all staff to reference at any time.

7.4 Differences between pre- and post-course surveys (valid paired responses)

Evaluation of the change in individual participants' perception across the six statements that appeared in both the pre- and post-course surveys allowed comment on level two (learning) of Kirkpatrick's Levels of Training

effectiveness. Combined paired participant responses demonstrated statistically significant improvements to perceived awareness, knowledge, confidence and skill in making complete and accurate oral health records. The statistical significance of the overall combined results was mostly driven by responses from the third year Bachelor of Dental surgery student cohort.

7.4.1 Australian Society of Forensic Odontology Inc. members

The general lack of change in opinions of participants from the phase one (AuSFO) group between the pre-course and post-course surveys would indicate that the ILM had minimal influence on the amount of learning (level two of Kirkpatrick's training effectiveness scale) for this group. Two participants recorded slightly improved perception regarding online learning. In this instance, it may have been that they were hesitant about the format prior to seeing it, due to previous experience (or lack there-of). One participant indicated a lower level of agreement with the statement regarding their current skill level after they had completed the course. Whilst this was an unexpected finding, perhaps the interactive learning module made the practitioner more aware of what they DIDN'T know about accurate and optimal dental case note recording, rather than specifically teaching them about how to improve! One participant indicated a decreased motivation to learn more about the topic (well…it was a long module!) and one reported increased knowledge following completion of the ILM.

7.4.2 Third year Bachelor of Dental Surgery students

For this cohort of participants, the ILM proved more effective in providing self-reported education regarding the subject matter and hence a more obvious positive outcome for Kirkpatrick's level two. Although they also started with a high self-reported baseline status regarding awareness, knowledge, confidence and skill related to the subject matter, there was greater difference between pre- and post-course survey paired responses for these participants.

An improvement in the level of awareness was noted for 38% of individuals in this group. However, half of participant's views remained unchanged. Three quarters of participants showed a significant improvement in their knowledge and a clear increase in confidence. These findings demonstrate a link between knowledge and confidence in the student cohort. Additionally, almost three quarters of paired responses demonstrated a very significant improvement in perceived skill. In contradiction, one participant indicated that their perceived level of skill had diminished. Again, perhaps this was an honest reflection of how much they thought they knew at the pre-course stage and how much they realised they did not know at the end. Paired student responses were mixed regarding the statement on motivation to learn more. Nineteen percent were motivated to learn more, while just over a quarter were less motivated. These outcomes were not statistically significant and do not allow any extrapolation in a practical sense. Paired responses showed a decrease in the preference for online learning. This may be due to the students realising they were unable to

clarify any questions they had with a real-life teacher. Individual responses from four participating BDS3 students were considered interesting and are discussed next.

Participant LJ0S was a direct school-leaver whose highest level of schooling was acquired in Australia. LJOS started with a baseline of low Likert scores (Figure 39) for knowledge, confidence, skill and online preference (selecting 'uncertain' or 'disagree' in all specified categories). For the pre-course survey, the participant scored themselves highly with regard to importance and motivation to learn more about making complete and accurate oral health records ('agree' to 'strongly agree'). Based on my own experience with BDS3 students, the particular traits demonstrated by LJ0S tend to represent the common student outlook when presented with new academic material.

LJOS demonstrated a slight improvement in the recognition of importance in making accurate and complete oral health records after viewing the ILM (from 'agree' to 'strongly agree'). Their response also improved regarding knowledge, from 'somewhat disagree' to 'somewhat agree' to the statement proposed. This may have been because the ILM provided the participant with validation that their existing knowledge base was better than they thought, or that there truly was an increase in their knowledge from completing the ILM. The participant's confidence changed from 'somewhat disagree' to 'uncertain',

with self-reported skill level improving from ‘uncertain’ to ‘somewhat agree’. Whilst both of these categories technically represented a positive opinion change, the result offers little reassurance that the ILM had any practical effect on the student’s confidence or skill related to the topic. Interestingly, LJ0S demonstrated a decrease in motivation to learn more about making accurate and complete oral health records after they had completed the ILM; this result may be a response to the participant’s self-reported improvement in knowledge, confidence and skill. Finally, participant LJ0S demonstrated a clear change of opinion regarding their preference to learn this particular topic online (from ‘uncertain’ before the ILM interaction to disagreement at the end). They commented that they liked that they could go at their own learning pace but felt there was too much text per slide. It is important to highlight that these particular results regarding online learning preferences cannot be extrapolated to assume that the participant would record the same decrease in online learning preference for other learning topics. Additionally, the participant only somewhat agreed that the examples used in the ILM aided their understanding of the educational content and somewhat disagreed that the ILM provided appropriate feedback and was well organised. These responses from LJ0S went against the majority of opinions from phase two participants.

Participant NF1H was also a 2015 school-leaver who had completed their highest level of schooling in Australia. Pre-course, they rated their awareness

of importance and motivation to learn more about how to make complete and accurate oral health records at the highest level (Figure 40); the participant's responses to these statements were unchanged after viewing the ILM. They felt their knowledge improved marginally (agreeing to the statement pre-course but strongly agreeing post-course). The largest opinion change was related to NF1H's skill and confidence (improved to the highest possible rating) and online learning preference (rated 'agree' post-course). The student mentioned that they particularly liked the examples and multiple choice questions that enabled them to test their understanding. They did, however, note that they found the 'Match each category with its example' quiz a little confusing (but no further explanation was provided for the confusion). NF1H indicated that they strongly agreed that the examples used in the ILM aided their understanding of the educational content, that appropriate feedback was provided and that the ILM was well organised. It was interesting to note that despite their indication that the ILM froze on 'several occasions' and needed to be turned off and re-opened, their response to the online learning preference statement increased considerably; freezing even once would have been enough to annoy the researcher!

Participant BJOS had completed a Bachelor Degree with Honours, Graduate Certificate or Graduate Diploma outside of Australia, in or after 2011. Figure 41 demonstrates that they were non-committal regarding their knowledge, confidence and skill regarding the research topic at the pre-course stage

('uncertain'). The participant mentioned that they were somewhat aware of the importance of making complete and accurate oral health records and, pleasingly, were optimally motivated to learn more. At the same pre-course stage, BJOS also somewhat disagreed with the statement 'I prefer learning in an online format using an interactive learning module'.

At the post-course stage, BJ0S's response to five out of the six statements were rated two Likert levels more positively; awareness of the importance was now at 'strongly agree', knowledge, confidence and skill were now classified as 'agree' and the preference to learn online was 'uncertain' rather than a definite dislike of the approach. It is possible that the student found that they learnt more (or more efficiently) than they expected, as they strongly agreed that the examples used in the ILM aided their understanding and that it was well organised. They also agreed that appropriate feedback for their learning was provided. Motivation to learn was the only area in which the participant rated their opinion lower ('agree') at the post-course stage; again, the decrease in motivation may be linked to the student thinking that the ILM had provided them with all the information they require. The participant did not provide any responses for the open-ended questions of the post course survey, so further explanation of the results is not possible. However, it was clear that the ILM provided a positive learning experience for participant BJ0S.

Participant CA0G – Figure 42 provides information regarding the responses of the final BDS3 participant to be discussed in this section. Participant CA0G had completed a Senior Secondary Certificate of Education in or after 2011 and had done this in Australia. In general, the participant's pre-course responses on the survey demonstrated that they had areas for improvement in being aware of the importance ('somewhat agree'), having the knowledge, confidence and skill ('somewhat disagree') and being motivated to learn more about how to make complete and accurate oral health records ('undecided'). At the post-course stage, all of the participant's responses had moved to the 'agree' category (except those related to recognition of importance, which had moved to 'strongly agree' and preference to learn online, which remained at its pre-course level of 'agree'). The participant noted that they agreed that the ILM's examples aided their understanding of the educational content, provided appropriate feedback for their learning and was well organised. CA0G particularly liked being able to stop and resume the ILM, plus the quiz tests but did not like that it was not possible to look back on the presented information during the test. However, it remained clear that the ILM was also a positive learning experience for CA0G.

7.4.3 Wider Dental Community

Change between pre- and post-course survey responses for the wider dental community participants was seen to sit somewhere between the levels noted in the AuSFO and dental student focus groups. In general, the wider dental

community similarly started with a high self-reported baseline status regarding awareness, knowledge, confidence and skill related to the subject matter. Still, the ILM proved effective in providing self-reported education regarding the subject matter and had an impact on learning with regard to Kirkpatrick's level two of Evaluation. While, the ILM caused minimal perceived OVERALL change in learning for the wider dental community cohort this does not mean that specific individuals gained little from their learning experience.

For over one fifth of paired responses, there was an improvement in the level of awareness (Table 28) following interaction with the ILM. However, just under three quarters of participants' views were unchanged. Half indicated that they had improved their knowledge (Table 32) and just over half of paired responses demonstrated increased confidence (Table 36). Additionally, 50% of paired responses demonstrated an improvement in perceived skill following ILM participation (Table 40). Wider dental community responses were mixed regarding the statement on motivation to learn more (Table 44) and thus did not allow any extrapolation in a practical sense. Just over half of paired participants ranked their preference for online learning higher at the post course stage, whilst just under half of opinions were unchanged (Table 48). While not statistically significant, these results indicate that many participants viewed the learning method (online) more favourably than they expected.

Individual responses from four participating wider dental community members were considered interesting and are discussed below.

Participant wm0T had over 30 years of experience as a qualified dental hygienist/therapist and had completed their highest level of schooling in Australia. wm0T started with a baseline of high Likert scores (Figure 43) for importance, knowledge, confidence, skill and motivation to learn more (selecting 'agree' in all specified categories). For the pre-course survey, the participant selected 'somewhat agree' for the statement 'I prefer learning in an online format using an interactive learning module (ILM)'.

Participant wm0T demonstrated no change in response to the statements on importance, knowledge, confidence and skill on the post-course survey stage (again selecting 'agree'). In itself, this made the responses interesting because it could be interpreted that the individual did not gain anything through their involvement with the educational package. In this instance, it is more likely that the participant's views about their solid understanding of the topic were validated, or revised and reinforced, as they worked through the ILM. The participant's response at the post-course stage was higher ranked regarding motivation to learn more about the topic, moving from 'agree' to 'strongly agree'. Whilst this might be seen as unusual, it is possible that their interest was piqued by reviewing some wider applications of dental records and being

reminded of the reason for the significant push by dental professional groups to take particular care in making accurate and specific records. Finally, participant wm0T demonstrated no change of opinion regarding their preference to learn this particular topic online ('somewhat agree' before the ILM interaction; 'somewhat agree' at the end). Participant wm0T commented that the ILM was mostly easy to follow but that a continuing professional development (CPD) certificate would be helpful to receive, in recognition of the time they spent on the module. Few other participants similarly commented regarding a CPD certificate during phase three of the study. It should be noted that this was, indeed, offered to the participants, as indicated in the Participant Information Sheet (PIS) that was included with all invitations to participate. The PIS advised that since the research was completely anonymous (beyond the participant-made code that allowed pairing of pre- and post-course results by me), participants would be required to email the researcher for certification to be electronically sent and, in doing so, the participant would be giving up their right to remain anonymous. This particular participant did not elect to ask for a CPD certificate via email; some other participants elected to personally contact the researcher and CPD certificates were sent.

Participant r20s was a dentist with over 30 years of experience, after receiving their highest degree from an Australian education institution. They indicated that they had heard about the ILM via the Australian Dental Association. Pre-course, they rated their awareness of importance of making complete and

accurate oral health records as ‘somewhat agree’ (Figure 44). In the pre-course survey, they went on to ‘strongly disagree’ that they had the knowledge, confidence and skill to make complete and accurate oral health records. They were ‘undecided’ about their level of motivation to learn more about it and had a similar perception about the online learning format that was presented. I was hopeful that they would significantly change their perceptions during the course of the online education package.

Unfortunately, the participant’s responses to these statements were largely unchanged after viewing the ILM. They felt their awareness of the importance improved marginally (somewhat agreeing to the statement pre-course but agreeing post-course). Their perceptions regarding knowledge, confidence, skills, motivation and online learning were unchanged from that at the pre-course survey stage. The participant noted that the examples used in the ILM did not aid their understanding of the educational package (selecting ‘somewhat disagree’); they were also unhappy with the amount of feedback that they received during the ILM (selecting ‘disagree’). They liked that the ILM provided ‘some additional information’ but effectively indicated that it did not address the ‘elephant in the room’ – that dental recording practices are ‘driven by litigation and what lawyers and judges believe is reality’. I have copied participant r20s’ lengthy suggestions for improvement and they appear in full on pages 95-97 of this thesis. I felt that the participant made some valid points regarding an (un)attainable ‘gold standard’ of record keeping in the fast-paced

world of clinical practice. The stated opinions of r20s may, indeed, be a reflection of many other members of the dental profession. However, the response at hand provided little that could be applied to the current research, where the 'gold standard' must still be something we aspire to, for all the reasons stated within the ILM.

Participant ES2H was a dual qualified dental hygienist/therapist, with less than two years of experience in their current professional position. They, too, had completed their degree within Australia and indicated that they had heard about the ILM's availability through Australian Dental and Oral Heath Therapists' Association (ADOHTA).

Overall, their responses (Figure 45) were typical of a newly-graduated practitioner and indeed had similarities with some paired responses from the undergraduate cohort in phase two. This was the main reason that they were highlighted as an interesting participant for this section of the study.

At the pre-course stage, the participant was 'strongly' aware of the importance of making complete and accurate oral health records and 'agreed' with the statement 'I have the knowledge to make complete and accurate oral health records'. They thought they had the skill to make such records ('strongly agree') but lacked confidence ('somewhat agree'). Like many undergraduate

responses, this particular participant from the wider dental community cohort was ‘strongly’ motivated to learn more about the process and ‘agreed’ that they preferred an online learning mode.

At the post-course stage, participant ES2H’s responses to the proposed statements showed a greater level of agreement with regard knowledge and confidence; in particular, confidence had moved from ‘somewhat agree’ at the pre-course stage to ‘strongly agree’ at the post-course stage. Responses to importance, skill and motivation remained unchanged, at the highest possible level of agreement with the proposed statements. The ILM was clearly ‘as expected’ by this participant, as their pre- and post-course response to preference for learning online was unchanged. They liked the quizzes and disliked that the ILM took a long time. Despite this, it remained clear that the ILM was a positive learning experience for ES2H. For me, it highlighted the need to reflect on the positive effect of actual clinical practice and that confidence to complete tasks (clinical or administrative) is gained through significant experience, not simply through completion of an undergraduate course. Since results for inexperienced and experienced practitioners in this phase of the study were quite different, the decision to ask participants for the amount of experience they had in their current professional position in the post-course surveys seemed valid.

Finally, **participant sa2r** was a dentist for over 30 years and had completed their highest level of schooling within Australia. This particular participant was chosen as an interesting one to highlight in this section of the Discussion because they submitted results (Figure 46) that were hoped might be 'the norm' when the ILM was being produced.

At both the pre-course and post-course stages, participant sa2r indicated the highest level of awareness regarding the importance of making complete and accurate oral health records. This reaction SHOULD be the case for most practicing oral health practitioners in Australia, given the heavy importance placed on it during undergraduate teaching, plus the guidelines highlighted by the Dental Board of Australia. With regard the statements concerning knowledge, confidence and skill, participant sa2r selected 'agree' at the pre-course stage; following interaction with the ILM, their perception about the statements had moved to the 'strongly agree' level. Similarly, sa2r was slightly more motivated to learn more about how to make complete and accurate oral health records AFTER working through the ILM (moving from 'somewhat agree' at pre-course to 'agree' at post-course). As mentioned, these results were generally as hoped might be achieved by the ILM; prompting reflection about the participant's own knowledge and skills, plus piquing interest in making improvements in participants' own practices.

It appeared that participant sa2r did not commence the ILM with a great deal of enthusiasm that their learning style would suit the online method presented for this subject matter, 'somewhat' disagreeing with the statement 'I prefer learning in an online format using an interactive learning module (ILM)'. As has been discussed previously, I had suspected that the learning mode might specifically suit participants of the newer generations (rather than someone with over 30 years of dental practice). However, participant sa2r's rating of the statement as 'agree' at the post-course stage indicated that they were perhaps pleasantly surprised about their learning experience. They additionally commented that the examples used aided their understanding ('strongly agree'), the ILM provided appropriate feedback for learning ('strongly agree') and that the ILM was well organised ('strongly agree'). Overall, the participant's statement 'It [the ILM] showed up what I didn't know or do' demonstrates that they had clearly reflected on the importance of the subject matter, as well as having a positive interaction with a learning mode that they wouldn't usually nominate as their preferred style.

7.5 Relating study findings to current odontology casework

During my studies and as a member of the staff of the Forensic Odontology Unit in Adelaide I have been involved in some 181 cases (to September 14, 2017) of identification of a deceased individuals using dental comparison. Although my experience is limited in terms of a career in Forensic Odontology, I have seen sufficient cases to draw comparisons between the present research

results and the practicalities of dental data reconciliation related to case work in South Australia.

Australian research (Stow, James and Richards, 2016) demonstrated that reviewed dental case notes were not ideal for forensic identification purposes and thus required some degree of interpretation by a specialist. To further investigate this, as part of this current study, I assessed the identification case outcomes for the Forensic Odontology Unit of South Australia over a five year period (2011-2015) to gain a better understanding of the practical influence of inadequate oral health case note recording on forensic identification. In brief, during this five year period a total of 262 identification cases presented to the unit for dental comparison. Identity was successfully established in 197 cases (75%). Although these cases commonly featured the phrase 'lack of antemortem data' in the final report sent to the Coroner, shortfalls in antemortem data did not hinder identification in these instances due to the interpretation that was possible by odontologists. However, some 20 cases (8%) were finalised as a 'probable' identification; 18 cases (7%) were reported as 'possible' identifications; and 14 cases (5%) featured insufficient evidence to be able to provide an opinion to the Coroner to assist identification. Of these combined cases listed as 'probable', 'possible' and 'insufficient evidence', all 52 lacked antemortem data and this was deemed to contribute to the inability to be more specific with the identification outcome. Some examples of where

antemortem data were not available in the case notes (but could reasonably be expected) included:

- No completed dental charting
- No clinical photographs and/or radiographs present in antemortem records, despite written documentation that they were taken
- No panoramic radiograph present despite impacted wisdom teeth removal being undertaken
- No labelling of removable dentures (11 cases over the five year period)

In other instances, details of interesting features were absent; these would have facilitated identification but would not necessarily be expected in routine record taking unless they posed a functional or aesthetic problem for the patient. Examples of this included:

- No record of accessory cusps on 36 and 46, despite their presence at postmortem examination
- No record of bilateral mandibular tori, despite their presence at postmortem examination
- No record of 2mm diastema between 11/21 in 19 year old man, despite presence at postmortem examination

Whilst the impact of lack of antemortem dental data on case outcome had long been a concern amongst staff at the Forensic Odontology Unit of South Australia, statistical analysis was able to actually demonstrate the need for

improvement in the following areas: detail recorded (including that related to relevant forensic guidelines recommended by the Dental Board of Australia); accuracy of antemortem records (e.g. correct description of surfaces of a dental restoration, correct identification of previously-extracted teeth); accessibility of dental records when required for forensic purposes; legibility (handwriting and use of abbreviations); and retention of records beyond the mandatory period of 7-10 years (as per the Health Practitioner Regulation National Law Act 2009 and the Dental Board of Australia).

7.6 Limitations of study

This research study had various limitations with regard to all phases. The sample size was small for phase one, as there was only a pool of 65 individuals available to contact. It was also a significant challenge to recruit professional groups (and then individuals from those professional groups) to be involved in the process. Effectively, professional groups seemed (understandably) protective about being seen to endorse material that might be seen as 'spam' by their members, or indeed be otherwise taken to be an abuse of members' personal email address. It was interesting to note that ADA NSW mentioned that they were in the process of developing their own record-keeping initiative.

This participation by certain groups (and not others) may have caused some bias of the results. Some professional groups were not approached to

participate (eg. Australian Society of Endodontology, Royal Australasian College of Dental Surgeons); there was no specific reason for this omission. Had AHPRA and the DBA agreed to participate in the research, the invitation to complete the ILM and surveys would have reached a greater number of potential participants, simply because their scope reaches more practitioners. Effectively, some potential participants were consequently excluded from participation simply due to the choice made by their professional group not to be involved. It is also possible that participants demonstrated some bias in responding to the surveys. For example, it might be suggested that ADA members are more likely to engage in the profession than non-members and hence may be more motivated to undertake the ILM and surveys. Their opinions could therefore be over-represented in the results. Members of AuSFO are already a group of practitioners with a vested interest in making detailed, accurate, legible case notes that are accessible and retained beyond the minimum required period. As such, their feedback regarding ILM modification may not have been optimally indicative of the needs of the general dental community in terms of education. Similarly, undergraduates have less knowledge and experience with the topic of research. It is therefore possible that their feedback was also not indicative of the needs of the general dental community in terms of education.

There are also inherent limitations of measuring how changes in perception through learning are actually applied to health care practices. As previously

stated, CPD in dentistry has been shown to be judged by participants to have a positive effect on learning and understanding (Bullock et al., 2010). It is quite reasonable to expect a study of this kind to be able to comment on the effectiveness of the learning programme with relevance to Kirkpatrick's Levels one (participation) and two (learning) of training criteria.

As part of the literature review for this thesis (section 2.7), issues regarding extrapolation of perception changes to actual changes were discussed (thus limiting any comment regarding Kirkpatrick's levels three - behaviour change - and four - health care outcomes). Issues such as an inability to undertake the preferred change in behaviour due to attitudes of other colleagues and time available etc. were explained at length. Additionally, the effects of education may not be evident for years after training. In such a situation, it would be impossible to determine whether the change in practice was in fact related to a training programme that was undertaken many years prior.

Consider the following: a dentist who participated in training and improved behaviours in direct relation to what had been learned, thus improving patient outcomes, would be seen at the optimal level of training effectiveness. However, in the case of this research, the definition of 'improving patient outcomes' would actually be whether or not the patient case notes were improved such that a forensic odontologist could reach an expedited

identification. To be able to accurately determine this, a researcher would need to demonstrate a difference between the usefulness of case notes recorded for a single individual by a single practitioner both before and after training (ie. it is simply not physically possible to do so). Instead, it may be possible to demonstrate some improvement in record keeping for a group of individuals over time. However, this would need a large group of non-anonymous dental practitioners to participate in a review of their case notes over a long period of time….and then to have a large number of their patients actually requiring identification by dental means following their death; a very unlikely scenario.

Whilst there is a lack of formalised studies regarding the number of deceased individuals who are visually identified in Australia, the percentage is said to be around 95%. An investigation by Cattaneo et al. (2010) of deceased individuals over the period 1995-2008 at the Institute of Legal Medicine in Milan found that 72% were identified visually, with some 24% identified via dental means. Individuals requiring identification by dental means in Australia make up part of the five percent of persons that cannot be visually recognised. At such a low rate of utilisation, it is simply implausible to expect data to be available for analysis of Kirkpatrick level four in a timely manner and this represents an inherent limitation with any study of this nature.

Whilst the ILM proved successful in influencing learning within the sample of participants, it is not possible to determine whether there has been an actual elimination of disparity between perceived and real value of dental case note recording with relevance to forensic identification.

7.7 Further research directions

Some further research areas can be recommended:

1. Implementing strategies to recruit more participation by professionals within the groups already targeted. These may include improving advertising to stress the importance of participation and making it clearer that CPD points are available for undertaking the continuing professional development module. If I were to break the ILM (currently a one hour module) into more 'bite-sized' stages (e.g. three 20 minute modules) that take less time to complete, this might also incentivise people to complete the module.

2. Expansion of the target groups to which the ILM CPD is made available i.e. increase exposure of the ILM. This would require a push to educate professional groups as to why they should come on-board i.e. it is in their members best interest.

3. Delivery of the ILM material as a traditional face-to-face short CPD course, with evaluation of outcomes and comparison of results to those of the current study.

4. Future assessment of dental records to see whether the education has actively changed recording practices for the better. As previously discussed, this has limitations if health outcomes are used as a measure of improvements. However, it might instead be possible to follow a specific group of identified practitioners over, say, a 10 year period, to determine specific changes in their individual recording practices.

CHAPTER 8

CONCLUSIONS

8. CONCLUSIONS

Without doubt, oral health recording practices are not currently optimal for forensic identification. A number of areas for improvement have been identified and, with this current research, an attempt to improve case note recording practices (with a view to improving forensic identification outcomes) in various focus groups has been undertaken.

Indeed, the research shows that a degree of learning occurred regarding the subject matter at hand when participants engaged with the online interactive learning module. In particular, the ILM has been successful in improving participants' personal perception in regard to importance of, knowledge of, confidence in and skill required for optimal oral health case note recording. Undergraduate dental students and practitioners with limited years of experience in their chosen dental field showed a greater change in perception following engagement with the ILM, compared with those with a considerable amount of case note recording experience. In other words, practitioners with fewer years of experience gained more from the ILM. Additionally, most participants throughout the entire study indicated that they were motivated to learn more and liked learning this particular topic online. Surprisingly, students were the least likely to indicate a preference for online learning. However, overall research results indicate clear effectiveness of this particular learning package for levels one and two of Kirkpatrick's Levels of Training criteria. For those who were willing to engage in the ILM, it remains difficult to comment

on whether positive changes in perception regarding importance, knowledge, confidence, skill and motivation will actually translate into change in a practical sense. The question also remains as to whether this learning is translated into long-term practice, thus improving record keeping processes during the life of the patient and in forensic investigation. It is additionally recognised that significant barriers (being time-poor, existing in a more and more litigious society) will need to be reduced before other oral health practitioners are willing to commit to a long-term change in their attitude to recording practices.

Regardless, our inability to measure outcomes in a practical sense should not deter the effort of trying. Being a true dental professional means a commitment to lifelong learning, as well as a commitment to recognising how to improve for the benefit of patients and society alike.

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APPENDICES

THE UNIVERSITY of ADELAIDE

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CRICOS Provider Number 00123M

5 May 2015

Professor L Richards
School of Dentistry

Dear Professor Richards

ETHICS APPROVAL No: **H-2015-086**

PROJECT TITLE: **Making oral health records more forensically relevant- development and evaluation of online education for the dental professional**

The ethics application for the above project has been reviewed by the Office of Research Ethics, Compliance and Integrity's Human Research Ethics Secretariat and is deemed to meet the requirements of the *National Statement on Ethical Conduct in Human Research (2007)* involving no more than low risk for research participants. It is noted this study will be conducted by Dr Lauren Stow, Masters student.

The ethics expiry date for this project is: 31 May 2018

Ethics approval is granted for three years and is subject to satisfactory annual reporting. The form titled *Annual Report on Project Status* is to be used when reporting annual progress and project completion and can be downloaded at http://www.adelaide.edu.au/ethics/human/guidelines/reporting. Prior to expiry, ethics approval may be extended for a further period.

Where possible, participants in the study are to be given a copy of the Information Sheet and the signed Consent Form to retain. It is also a condition of approval that you **immediately report** anything which might warrant review of ethical approval including:

- serious or unexpected adverse effects on participants,
- previously unforeseen events which might affect continued ethical acceptability of the project,
- proposed changes to the protocol; and
- the project is discontinued before the expected date of completion.

Yours sincerely

Michelle White
Manager
Office of Research Ethics, Compliance and Integrity

Dear AuSFO member,

You are invited to be the first to trial a brand new educational package available exclusively in the member-only area of your website.

As part of a University of Adelaide research project entitled 'Making oral health records more forensically relevant – development and evaluation of online education for the dental professional', we invite you to drop by, look around and submit feedback on a topic that should be close to your heart!

If you decide to work through the educational package in its entirety, it should take you around an hour. Note that you do not need to complete the package all in one go – it can be broken down to suit your schedule and you can 'resume where you left off'.

There are two short surveys linked to the package – pre-course and post-course. Please note that your feedback is important. Any feedback you provide will be used only for the research project and to help ensure the educational package is in top shape prior to its release to the general dental profession.

The educational package will be available to members of AuSFO exclusively until 9am on Monday November 16th. For access, log in to access the members only area and then select 'Making oral health records' in the User Menu.

For further information on your involvement in the project, please see the attached Participant Information Sheet and Complaints Procedure.

Enjoy!

Kind regards,

Lauren Stow

PARTICIPANT INFORMATION SHEET

PROJECT TITLE: Making oral health records more forensically relevant – development and evaluation of online education for the dental professional

SUPERVISORS: Prof Lindsay Richards, Dr Denice Higgins

STUDENT RESEARCHER: Dr Lauren Stow

STUDENT'S DEGREE: Master of Philosophy

Dear Participant,

You are invited to take part in the evaluation of an Interactive Learning Module (ILM) with regard to improving the forensic value of dental records, as developed by the University of Adelaide's Health Sciences (Dentistry) Faculty.

What is the project about?

In a recent study regarding the awareness of forensic odontology among dentists in Australia, over 80% of respondents believed that their oral health records would be of appropriate value, should they be called upon to assist in a forensic situation. Unfortunately, the results in the study confirmed that a high number of forensically important recording practices are currently inadequately understood by Australian dentists. In addition, a review of a randomised selection of Australian-produced dental records housed at the Forensic Odontology Unit of SA demonstrated that many of the records lacked detail from a forensic-specialist perspective, as well as sub-optimal recording related to the relevant Guidelines of Dental Records from the Dental Board of Australia.

This current project aims to design, develop, implement and test an online training package for educating dental health professionals on improving the detail, accuracy, legibility, accessibility and retention of dental records, with specific reference to forensic odontology.

In this way, this project hopes to eliminate the disparity between perceived and real forensic value of dental records.

Who is undertaking the project?

This project is being conducted by Dr Lauren Stow. This research will form the basis for the degree of Master of Philosophy at the University of Adelaide under the supervision of Prof Lindsay Richards and Dr Denice Higgins.

APPENDIX III – PARTICIPANT INFORMATION SHEET (AuSFO Inc and wider dental community)

A $950 grant from The Australian Society of Forensic Odontology (AuSFO) has been awarded for partial financial assistance with this project. Additional funding may be received from the Forensic Odontology Unit (FOU) of South Australia's research funds, as required.

Why am I being invited to participate?
You are invited to participate in your capacity as a member of ASO.

What will I be asked to do?
The Interactive Learning Module (ILM) has been developed to aid continuing education into best practice oral health recording for forensic purposes. The series, designed to take around 60 minutes to complete, covers the following topics that have been identified as requiring improvement in application of knowledge:
Introduction
Detail
Accuracy
Legibility
Accessibility
Retention

To determine the effectiveness of this initiative, we would additionally ask you to complete two online
surveys (pre- and post-course) via surveymonkey. You will be asked to create a 4-digit 'unique identifier code' (by answering 4 simple questions) that will allow your pre-and post-course survey responses to be matched for the purposes of the research project. The survey responses will remain entirely anonymous.

Before you commence the ILM, you will be asked to complete a short online pre-course survey. From drop-down boxes, you will be asked to indicate your occupation, level (years) of experience in your occupation, as well as where you completed your highest level of training for your current occupation. You will then be asked to rate your perceived awareness, knowledge, confidence, skills and motivation to record forensically valuable information in oral health records. This survey is expected to take 2 minutes.

The second (post-course) survey will be done online after you have completed learning via the ILM. The post-course survey includes perception questions as per the pre-course survey, with additional queries regarding your opinions and preferences of the content and format of the Interactive Learning Module (ILM). The post-course survey is expected to take 5 minutes, dependent on feedback provided.
Completion and return of these surveys indicates your consent to being involved in the project.

The analysis and interpretation of these data will focus on improving the ILM, particularly with regard to enhancing the relevance and educational experience for future users.
Are there any risks associated with participating in this project?
There are no foreseeable risks in being involved with this project. As your responses are collected with a code that is known only to the participant, no responses can be

linked to any individual by any means. Only collective results from the study will be reported.

NOTE – if you would like a 1 hour CPD certificate following your completion of the ILM and surveys, you will need to email lauren.stow@adelaide.edu.au to request that it is sent to you. In doing so, you will have provided your own email address to researchers. Although your email will not be used for any purpose beyond providing you with the personalised CPD certificate, please consider whether you are agreeable to this.

What are the benefits of the research project?
As a gap in both knowledge and application of knowledge has been identified with relation to recording forensically relevant dental features of patients, this project hopes to increase the amount of available Continuing Professional Development (CPD) resources in the dental community. In this way, it hopes to eliminate the disparity between perceived and real forensic value of dental records being produced in Australia.

Can I withdraw from the project?
Participation in this project is completely voluntary. If you agree to participate, you can withdraw from the study at any time.

Who do I contact if I have questions about the project?
If you require any more details about the project before, during or after the educational course or evaluation, have any problems arising from your involvement in this project or if you simply require further details about any of aspects, please contact:

Dr Lauren Stow) or Dr Denice Higgins

What if I have a complaint or any concerns?
The study has been approved by the Human Research Ethics Committee at the University of Adelaide (approval number H-2015-086). Should you have any queries or complaints regarding the ethical conduct of this study, please consult the Independent Complaint Procedure attachment accompanying this Information Sheet for advice. If you are not satisfied that your concerns have been resolved, please contact the HREC Secretariat on (08) 83136028 or via email at hrec@adelaide.edu.au.

Yours sincerely,

Dr Lauren Stow

The University of Adelaide Human Research Ethics Committee (HREC)
This document is for people who are participants in a research project.

CONTACTS FOR INFORMATION ON PROJECT AND INDEPENDENT COMPLAINTS PROCEDURE

The following study has been reviewed and approved by the University of Adelaide Human Research Ethics Committee:

Project Title:	**Making oral health records more forensically relevant – development and evaluation of online education for the dental professional**
Approval Number:	**H – 2015 -086**

The Human Research Ethics Committee monitors all the research projects which it has approved. The committee considers it important that people participating in approved projects have an independent and confidential reporting mechanism which they can use if they have any worries or complaints about that research.

This research project will be conducted according to the NHMRC National Statement on Ethical Conduct in Human Research (see http://www.nhmrc.gov.au/publications/synopses/e72syn.htm)

If you have questions or problems associated with the practical aspects of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult the project co-ordinator:

Name:	**Dr Denice Higgins, Director, Forensic Odontology Unit of South Australia**
Phone:	
Name:	**Dr Lauren Stow, principal researcher**
Phone:	

If you wish to discuss with an independent person matters related to:

- making a complaint, or
- raising concerns on the conduct of the project, or
- the University policy on research involving human participants, or
- your rights as a participant,

contact the Human Research Ethics Committee's Secretariat on phone (08) 8313 6028 or by email to hrec@adelaide.edu.au

APPENDIX IV – HUMAN ETHICAL APPROVAL (Bachelor of Dental Surgery 3 student cohort)

RESEARCH BRANCH
OFFICE OF RESEARCH ETHICS, COMPLIANCE AND INTEGRITY

LEVEL 7, 115 GRENFELL STREET
THE UNIVERSITY OF ADELAIDE
SA 5005 AUSTRALIA

TELEPHONE +61 8 8313 5137
FACSIMILE +61 8 8313 3700
EMAIL hrec@adelaide.edu.au

CRICOS Provider Number 00123M

6 January 2016

Professor L Richards
School of Dentistry

Dear Professor Richards

ETHICS APPROVAL No: **H-2015-086**

PROJECT TITLE: **Making oral health records more forensically relevant- development and evaluation of online education for the dental professional**

Thank you for the information dated 26.10.2015, 30.11.2015 and 04.01.2016 submitted by Masters' student Lauren Stow requesting amendment to the above project. The request to include an additional participant group of 3rd year dental students has been reviewed by the Office of Research Ethics, Compliance and Integrity's Human Research Ethics Secretariat and is deemed to meet the requirements of the *National Statement on Ethical Conduct in Human Research (2007)* involving no more than low risk for research participants.

The ethics expiry date for this project is: 31 May 2018

Ethics approval is granted for three years and is subject to satisfactory annual reporting. The form titled *Annual Report on Project Status* is to be used when reporting annual progress and project completion and can be downloaded at http://www.adelaide.edu.au/ethics/human/guidelines/reporting. Prior to expiry, ethics approval may be extended for a further period.

Where possible, participants in the study are to be given a copy of the Information Sheet and the signed Consent Form to retain. It is also a condition of approval that you **immediately report** anything which might warrant review of ethical approval including:

- serious or unexpected adverse effects on participants,
- previously unforeseen events which might affect continued ethical acceptability of the project,
- proposed changes to the protocol; and
- the project is discontinued before the expected date of completion.

Yours sincerely

Amy Weckert
Human Research Ethics Officer
Office of Research Ethics, Compliance and Integrity

APPENDIX V – EMAIL INVITATION (Bachelor of Dental Surgery 3 student cohort)

Dear BDS3 student,

Recent research has indicated that, as a dental community, our patient records are not as detailed, accurate or legible as the Dental Board of Australia's guidelines (2010) on record keeping would prefer. Some practitioners have indicated that this might be due to a lack of education regarding the requirements and use of dental records beyond that for clinical practice. As such, this has been identified as an issue that we could tackle at undergraduate level.

As part of a University of Adelaide research project entitled 'How to make oral health records more forensically relevant – development and evaluation of online education for the dental professional', an interactive online educational module (60 minutes) has been developed. The content represents an existing examinable component of the BDS3 curriculum…but it's just delivered a little differently to third year students in 2016. Completion of the module is a key part of the Preparation for Comprehensive Patient-centred Care (PCPC) block, so following your interaction with the online class meeting, you should be able to identify and discuss the requirements for optimal clinical and forensic dental case notes.

You are additionally invited to provide (voluntary) simple feedback to the researchers via pre- and post-course surveys. These surveymonkey surveys are embedded in the educational module - the first is on the 'Introduction' tab, the second on the 'Finish' tab. All feedback you provide will be anonymous and used only for the research project.

For further information on your involvement in the project, please see the Participant Information Sheet, available below.

Please note that the content will work best on a device running Windows (or a Mac running Parallels Desktop or similar).

The class meeting – interactive learning module, or ILM - and associated survey material is available Friday January 29 - Monday February 22.

Enjoy!

Kind regards

Dr Stow

APPENDIX VI – PARTICIPANT INFORMATION SHEET (Bachelor of Dental Surgery 3 student cohort)

PARTICIPANT INFORMATION SHEET

PROJECT TITLE: Making oral health records more forensically relevant – development and evaluation of online education for the dental professional

SUPERVISORS: Prof Lindsay Richards, Dr Denice Higgins

STUDENT RESEARCHER: Dr Lauren Stow

STUDENT'S DEGREE: Master of Philosophy

Dear Participant,

You are invited to take part in the evaluation of an Interactive Learning Module (ILM) regarding improving the forensic value of dental records, as developed by the University of Adelaide's Health Sciences (Dentistry) Faculty.

What is the project about?

In a recent study regarding the awareness of forensic odontology among dentists in Australia, over 80% of respondents believed that their oral health records would be of appropriate value, should they be called upon to assist in a forensic situation. Unfortunately, the results in the study confirmed that a high number of forensically important recording practices are currently inadequately understood by Australian dentists. In addition, a review of a randomised selection of Australian-produced dental records housed at the Forensic Odontology Unit of SA demonstrated that many of the records lacked detail from a forensic-specialist perspective, as well as sub-optimal recording related to the relevant Guidelines of Dental Records from the Dental Board of Australia.

This current project aims to design, develop, implement and test an online training package for educating dental health professionals on improving the detail, accuracy, legibility, accessibility and retention of dental records, with specific reference to forensic odontology.

In this way, this project hopes to eliminate the disparity between perceived and real forensic value of dental records.

Who is undertaking the project?

This project is being conducted by Dr Lauren Stow. This research will form the basis for the degree of Master of Philosophy at the University of Adelaide under the supervision of Prof Lindsay Richards and Dr Denice Higgins.

APPENDIX VI – PARTICIPANT INFORMATION SHEET (Bachelor of Dental Surgery 3 student cohort)

A $950 grant from The Australian Society of Forensic Odontology (AuSFO) has been awarded for partial financial assistance with this project. Additional funding may be received from the Forensic Odontology Unit (FOU) of South Australia's research funds, as required.

Why am I being invited to participate?
You are invited to participate in your capacity as a BDS3 student, as the content builds on material already presented in your curriculum.

What will I be asked to do?

The online Interactive Learning Module (ILM) has been developed to aid continuing education into best practice oral health recording for forensic purposes. Designed to take around 50 minutes to complete (ie. the same amount of time as a routine, face-to-face class meeting), it covers the following topics that have been identified as requiring improvement in application of knowledge:

- Introduction
- Detail
- Accuracy
- Legibility
- Accessibility
- Retention

The basic content included in the ILM may be examined in written assessments during the course of the BDS3 academic year and is seen as a core part of your curriculum.

To determine the effectiveness of this online initiative, we would additionally ask you to complete two online surveys (pre- and post-course) via surveymonkey. You will be asked to create a 4-digit 'unique identifier code' (by answering 4 simple questions) that will allow your pre-and post-course survey responses to be matched for the purposes of the research project. The survey responses will remain entirely anonymous.

Before you commence the ILM, you will be asked to complete a 6-question online pre-course survey regarding your awareness, knowledge, confidence, skills and motivation to record forensically valuable information in oral health records. This pre-course survey is expected to take 1 minute.

The second (post-course) survey will be completed online after you have completed learning via the ILM. The post-course survey includes questions as per the pre-course survey, with additional queries regarding your opinions and preferences regarding the content and format of the Interactive Learning Module (ILM). The post-course survey is expected to take 3 minutes, dependent on feedback you decide to provide.

Completion of these surveys indicates your consent to being involved in the project. The surveys are voluntary and you may elect to complete the ILM without providing survey feedback.

APPENDIX VI – PARTICIPANT INFORMATION SHEET (Bachelor of Dental Surgery 3 student cohort)

The analysis and interpretation of these data from the survey responses will focus on improving the ILMs, particularly with regard to enhancing the relevance and educational experience for users when they are released to the wider dental community.

Are there any risks associated with participating in this project?

There are no foreseeable risks in being involved with this project. At no point will personal details be collected. Only collective results from the study will be reported. There will be no impact on your relationship with the university, nor your academic results, should you elect to take part in the research component (pre- and post-course surveys) of the learning module. The same is also true should you decline participation in the research component (pre- and post-course surveys) of the learning module.

What are the benefits of the research project?

As a gap in both knowledge and application of knowledge has been identified with relation to recording forensically relevant dental features of patients, this project hopes to increase the amount of available Continuing Professional Development (CPD) resources in the dental community. The 3rd year dental student population has also been identified as an appropriate target audience for this project, such that you are able to start and (hopefully) maintain optimal practices very early in your career. In this way, the project hopes to eliminate the disparity between perceived and real forensic value of dental records being produced in Australia.

Can I withdraw from the project?

Participation in this project is completely voluntary. If you agree to participate, you can withdraw from the study at any time.

Who do I contact if I have questions about the project?

If you require any more details about the project before, during or after the educational course or evaluation, have any problems arising from your involvement in this project or if you simply require further details about any of aspects, please contact:

Dr Lauren Stow or Dr Denice Higgins

What if I have a complaint or any concerns?

The study has been approved by the Human Research Ethics Committee at the University of Adelaide (approval number H-2015-086). Should you have any queries or complaints regarding the ethical conduct of this study, please consult the Independent Complaint Procedure attachment accompanying this Information Sheet for advice. If you are not satisfied that your concerns have been resolved, please contact the HREC Secretariat on (08) 83136028 or via email at hrec@adelaide.edu.au.

Yours sincerely,

Dr Lauren Stow

APPENDIX VI – PARTICIPANT INFORMATION SHEET (Bachelor of Dental Surgery 3 student cohort)

The University of Adelaide Human Research Ethics Committee (HREC)

This document is for people who are participants in a research project.

CONTACTS FOR INFORMATION ON PROJECT AND INDEPENDENT COMPLAINTS PROCEDURE

The following study has been reviewed and approved by the University of Adelaide Human Research Ethics Committee:

Project Title:	**Making oral health records more forensically relevant – development and evaluation of online education for the dental professional**
Approval Number:	**H – 2015 -086**

The Human Research Ethics Committee monitors all the research projects which it has approved. The committee considers it important that people participating in approved projects have an independent and confidential reporting mechanism which they can use if they have any worries or complaints about that research.

This research project will be conducted according to the NHMRC National Statement on Ethical Conduct in Human Research (see http://www.nhmrc.gov.au/publications/synopses/e72syn.htm)

If you have questions or problems associated with the practical aspects of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult the project co-ordinator:

Name:	**Dr Denice Higgins, Director, Forensic Odontology Unit of South Australia**
Phone:	
Name:	**Dr Lauren Stow, principal researcher**
Phone:	

If you wish to discuss with an independent person matters related to:

- making a complaint, or
- raising concerns on the conduct of the project, or
- the University policy on research involving human participants, or
- your rights as a participant,

contact the Human Research Ethics Committee's Secretariat on phone (08) 8313 6028 or by email to hrec@adelaide.edu.au

APPENDIX VII- EMAIL INVITATION (ADASA version, wider dental community)

Dear dental professional,

Recent research has indicated that, as a community, our dental records are not as detailed, accurate and legible as the Dental Board of Australia's guidelines (2010) on record keeping would prefer. Some practitioners have indicated that this might be due to a lack of education regarding the requirements and use of dental records beyond that for clinical practice.

As part of a University of Adelaide research project entitled 'How to make oral health records more forensically relevant – development and evaluation of online education for the dental professional', an interactive online educational module has been developed. As a valued Australian Dental Association South Australia member, you are invited to take part in the project by extending your knowledge and providing some simple feedback evaluation to the researchers.

Pre-course and post-course surveymonkey links are embedded on the 'Introduction' and 'Finish' pages of the package. All feedback you provide will be anonymous and used only for the research project.

There is no cost for you to participate in the project, other than that of your time. Focus groups that have already participated in the project have indicated that a thorough viewing of the educational package will take around an hour. There is no need to complete the package in one sitting; you are able to stop and start again where you left off.

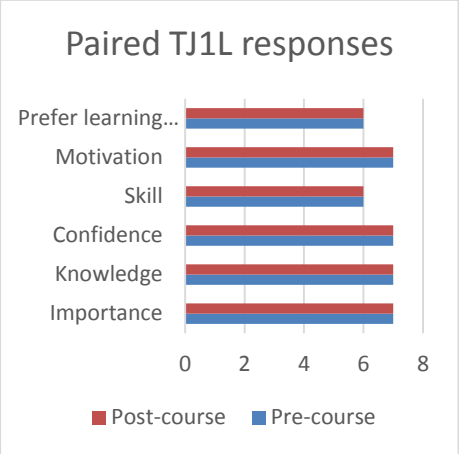
Please note that the content will work best on a device running Windows (or a Mac running Parallels Desktop or similar).

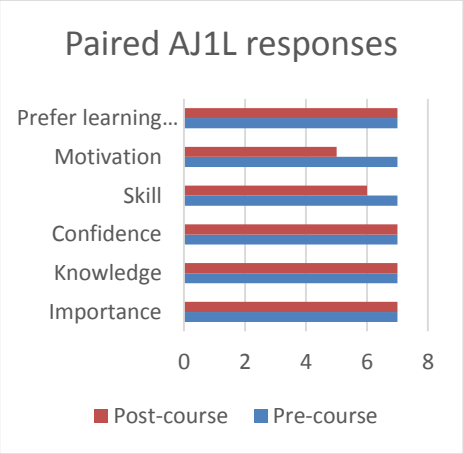
For further information on your involvement in the project, please see the attached Participant Information Sheet.

Enjoy by clicking on the following link:
http://www.ausfo.org.au/making-oral-health-records-more-clinically-and-forensically-relevant/

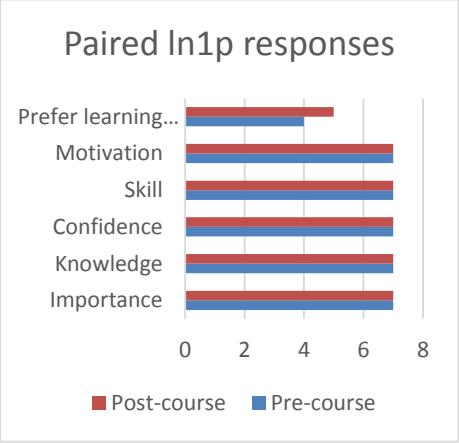
Kind regards
Lauren Stow

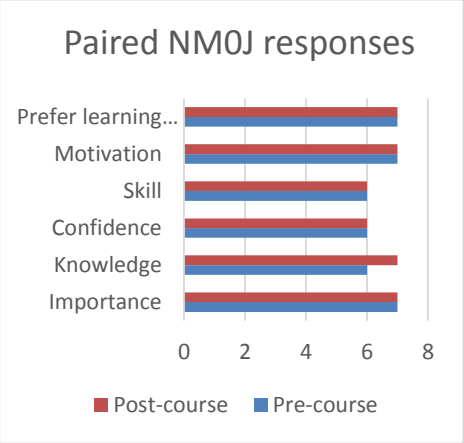
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





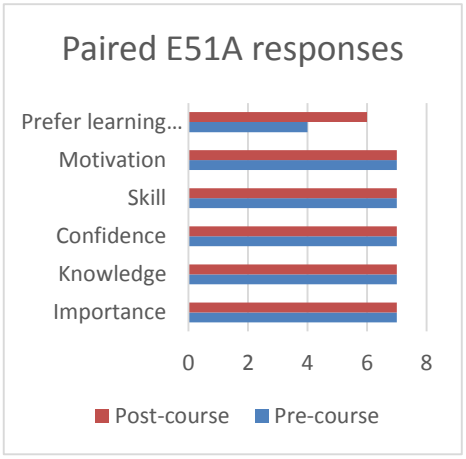
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from AuSFO participants TJ1L and AJ1L.

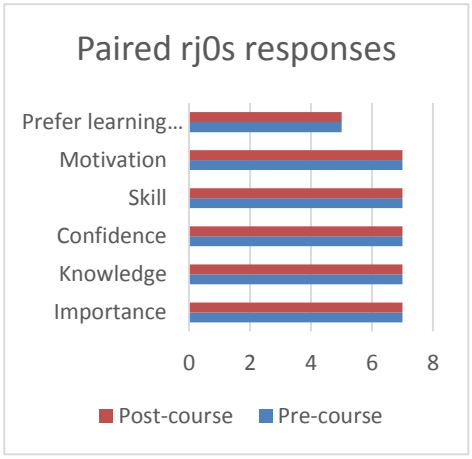




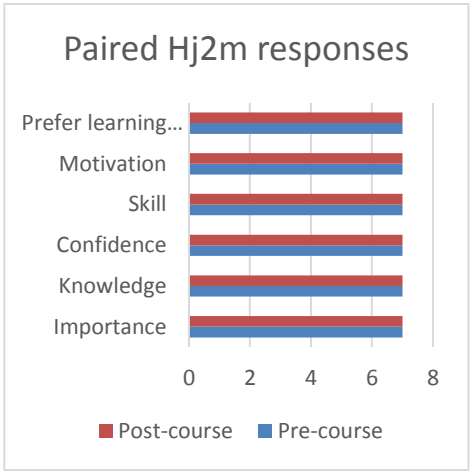
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from AuSFO participants ln1p and NM0J.

APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS



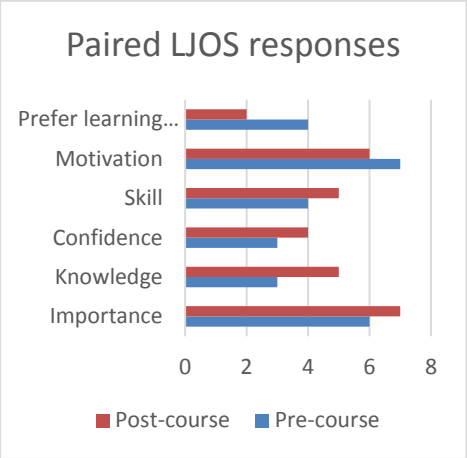


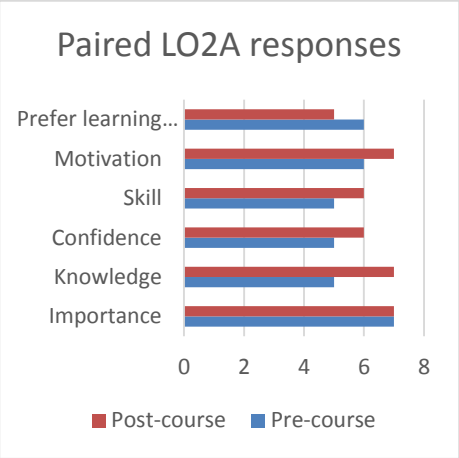
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from AuSFO participants E51A and rj0s.



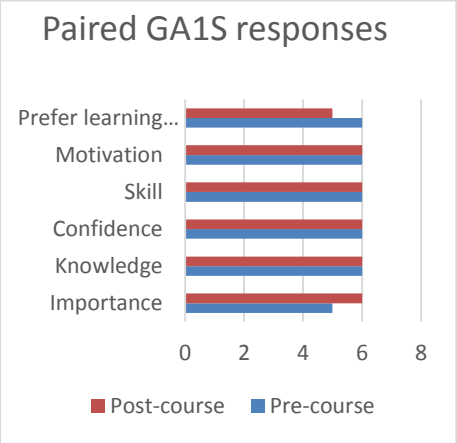
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from AuSFO participant Hj2m.

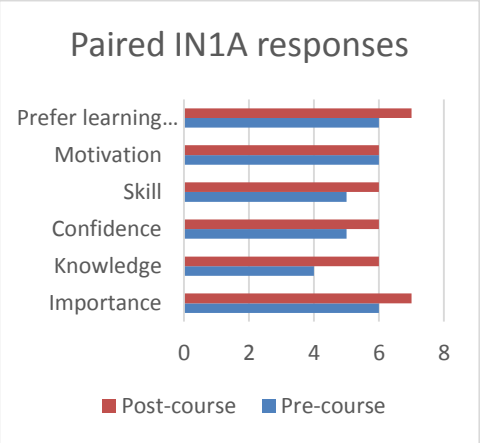
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





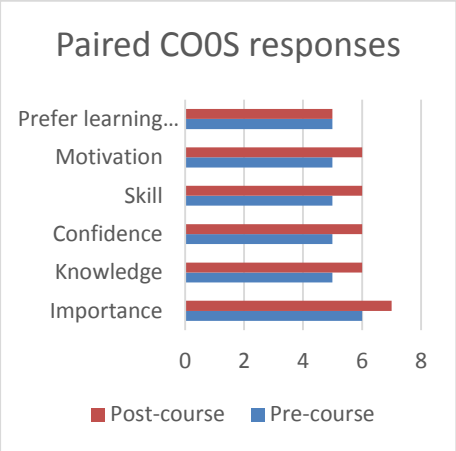
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from dental student participants LJ0S and LO2A.

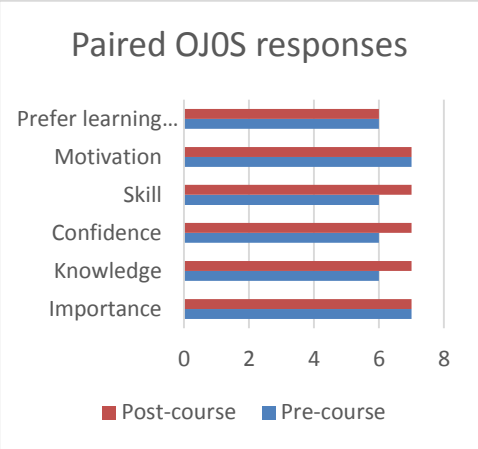




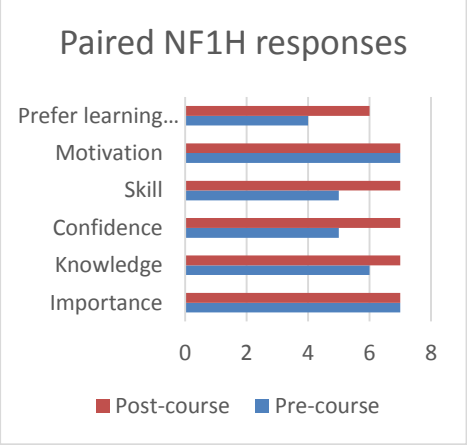
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from dental student participants GA1S and IN1A.

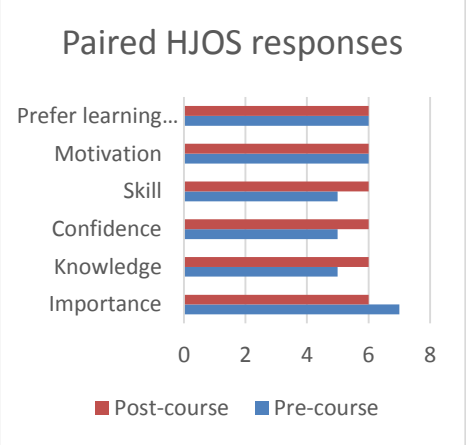
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





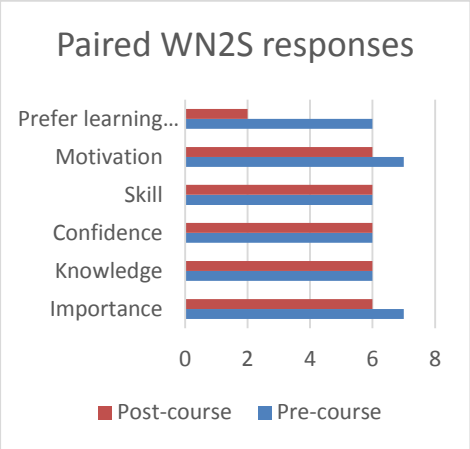
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from dental student participants CO0S and OJ0S.

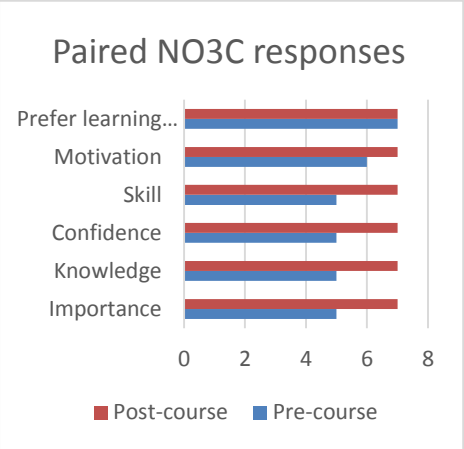




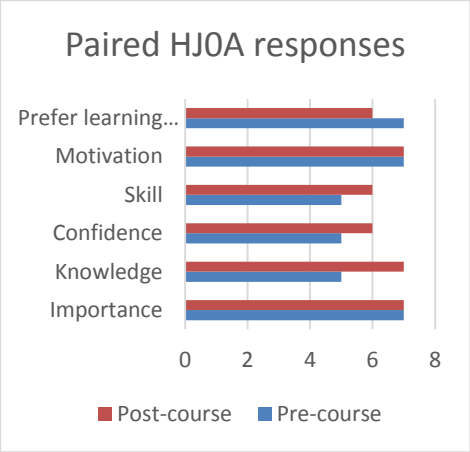
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from dental student participants NF1H and HJ0S.

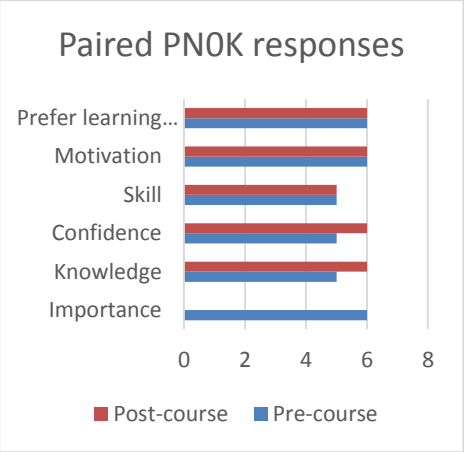
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





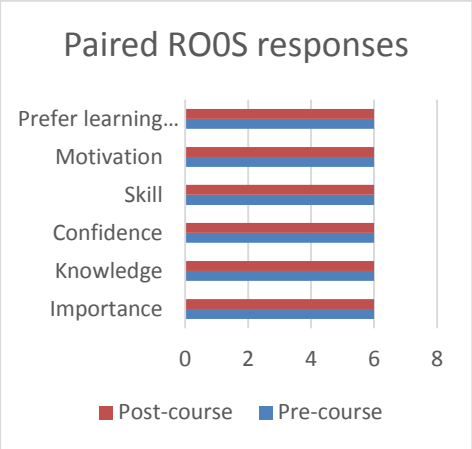
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from dental student participants WN2S and NO3C.

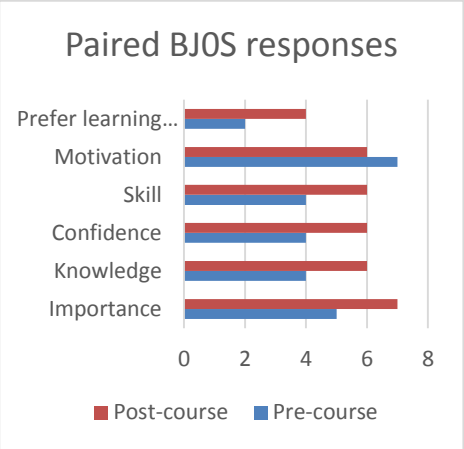




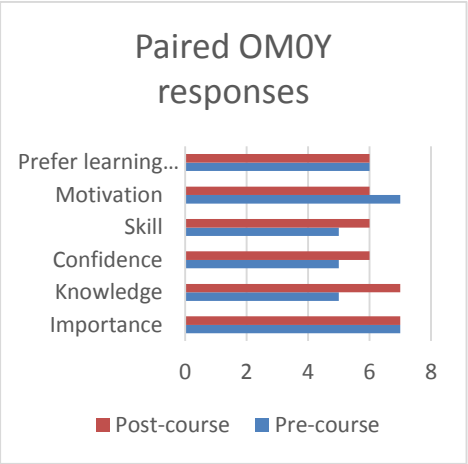
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from dental student participants HJ0A and PN0K.

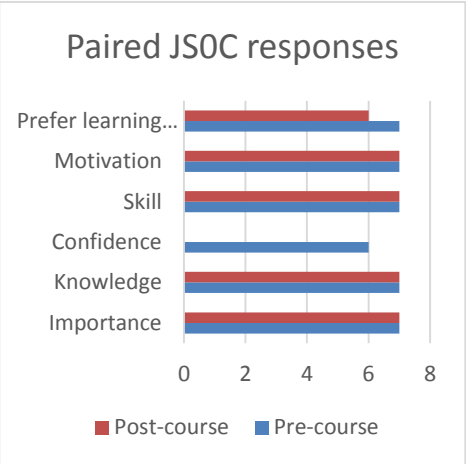
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





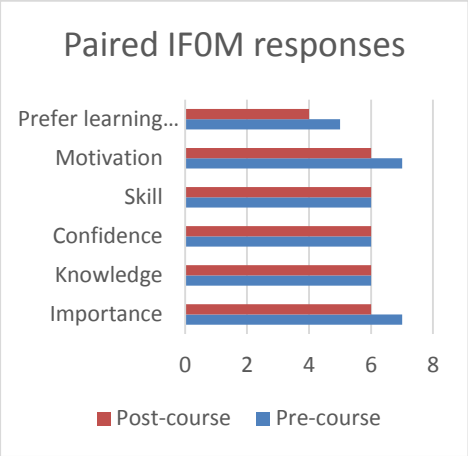
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from dental student participants RO0S and BJ0S.

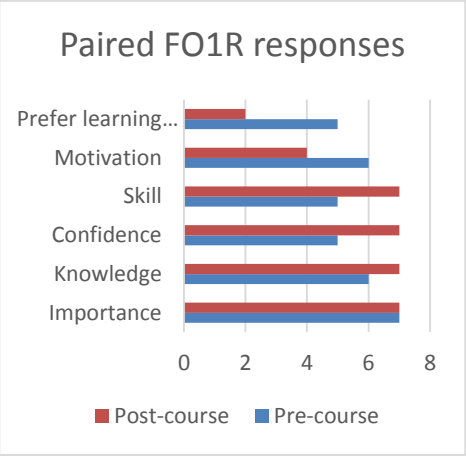




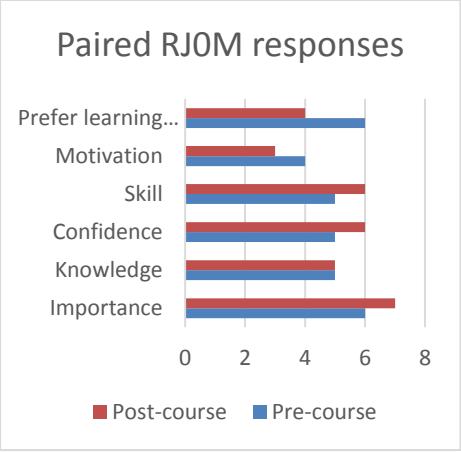
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from dental student participants OM0Y and JS0C.

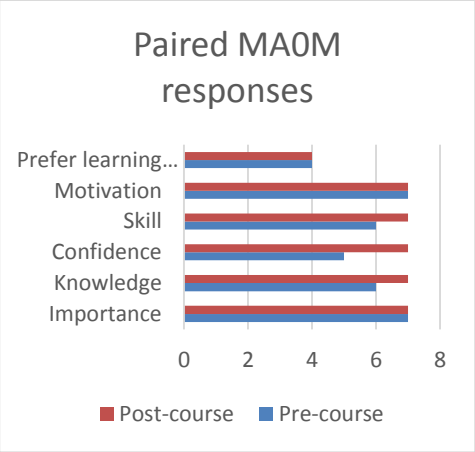
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





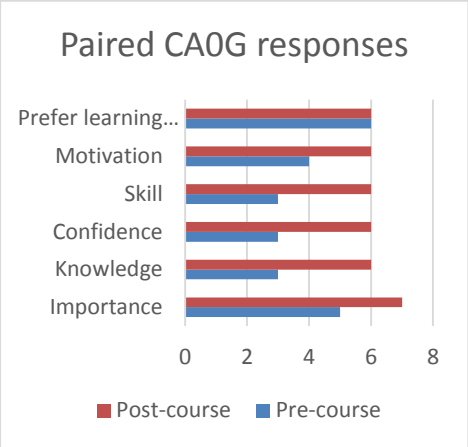
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from dental student participants IF0M and FO1R.

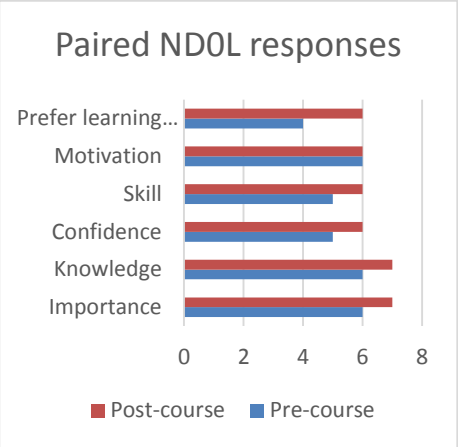




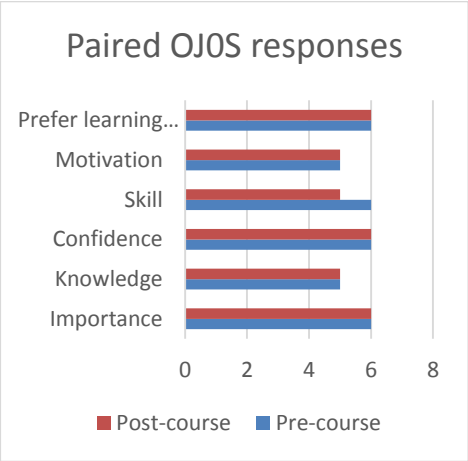
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from dental student participants RJ0M and MA0M.

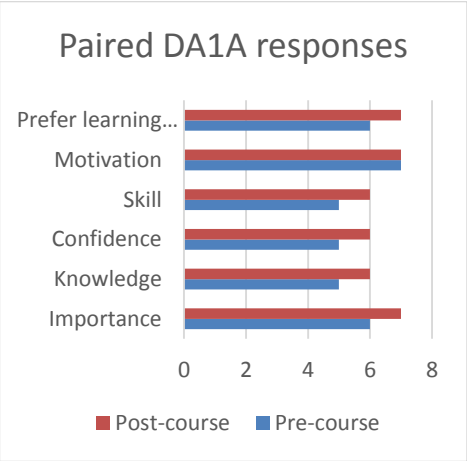
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





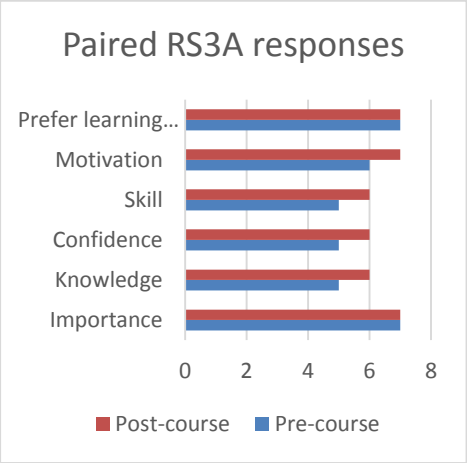
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from dental student participants CA0G and ND0L.

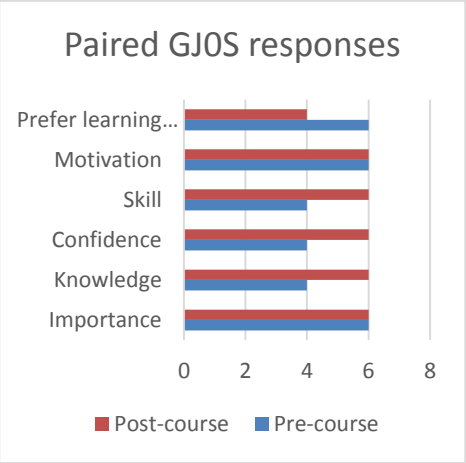




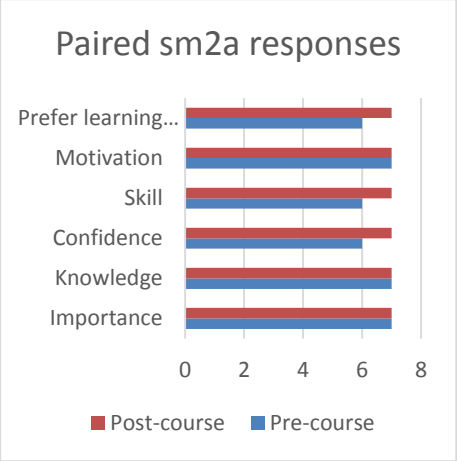
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from dental student participant OJ0S and DA1A.

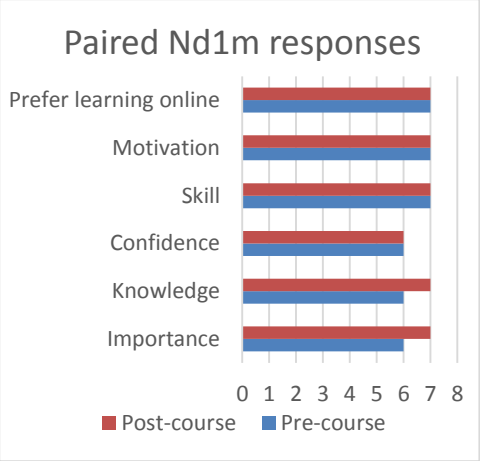
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





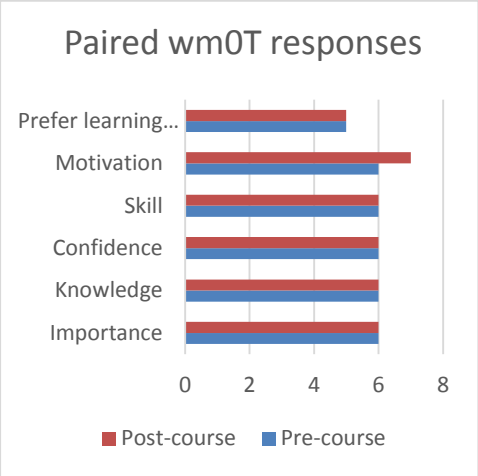
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from dental student participants RS3A and GJ0S.

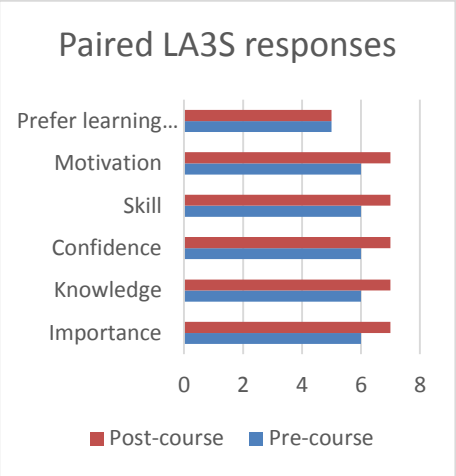




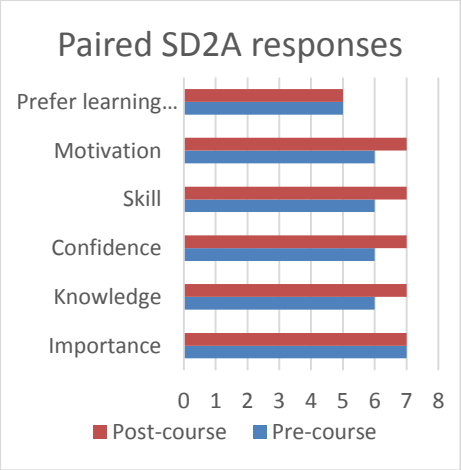
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants sm2a and Nd1m.

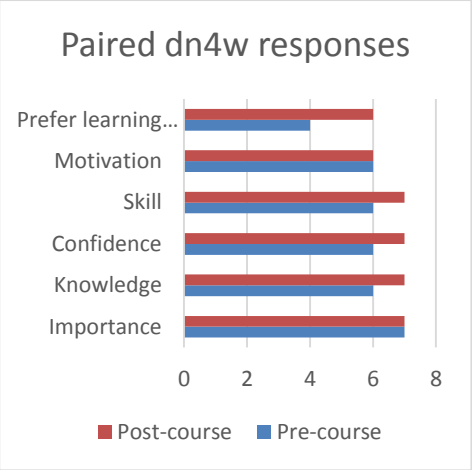
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





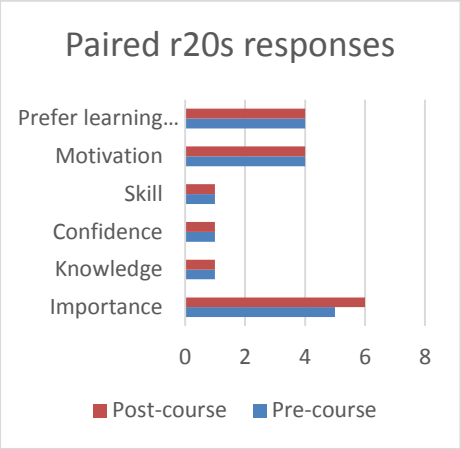
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants wm0T and LA3S.

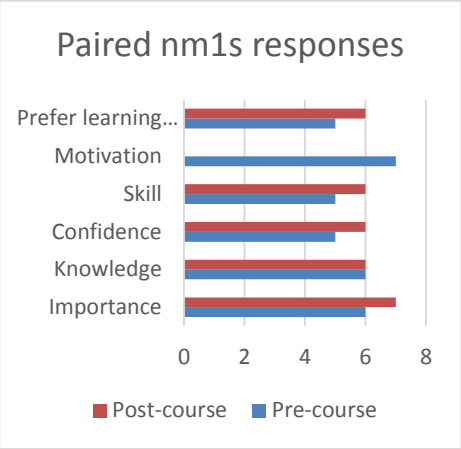




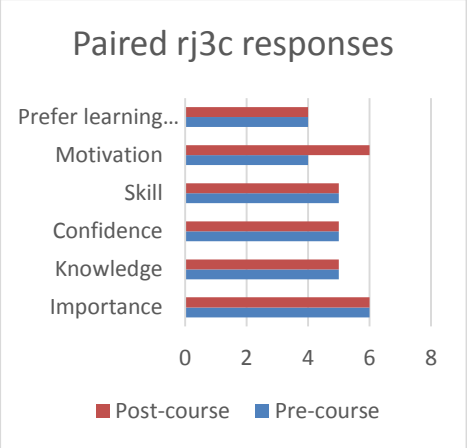
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants SD2A and dn4w.

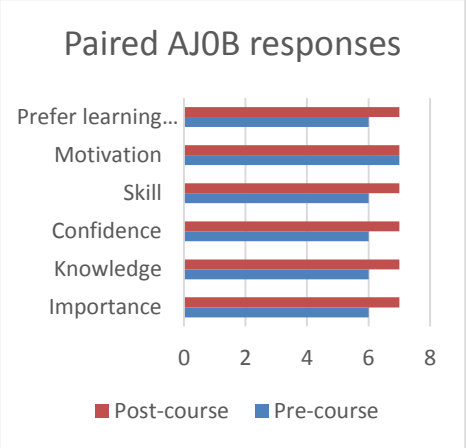
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





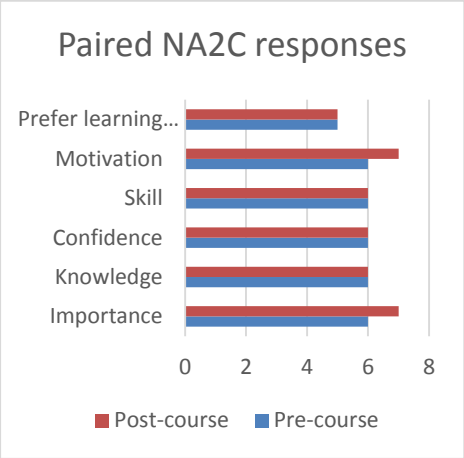
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants r20s and nm1s.

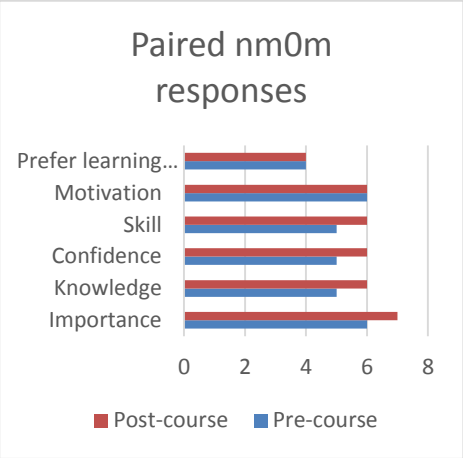




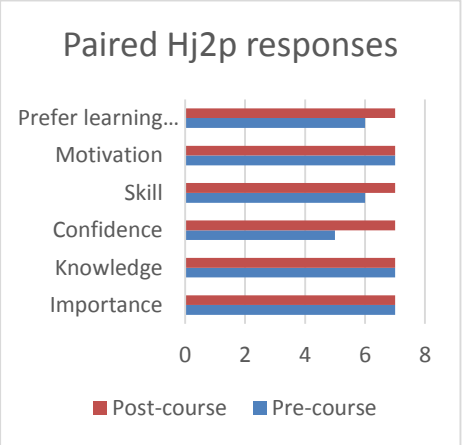
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participant rj3c and AJ0B.

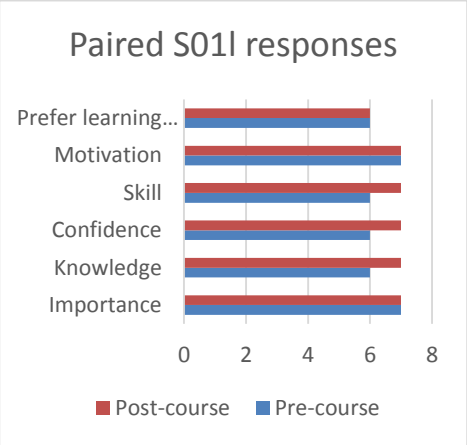
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





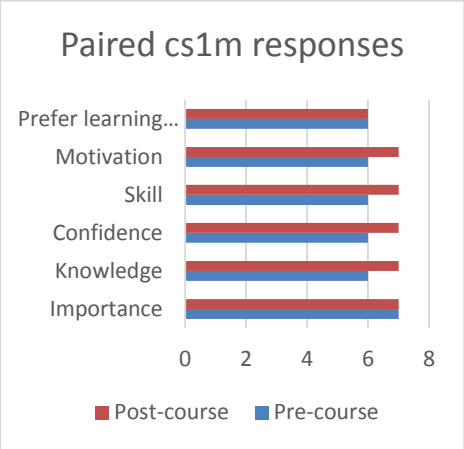
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants NA2C and nm0m.

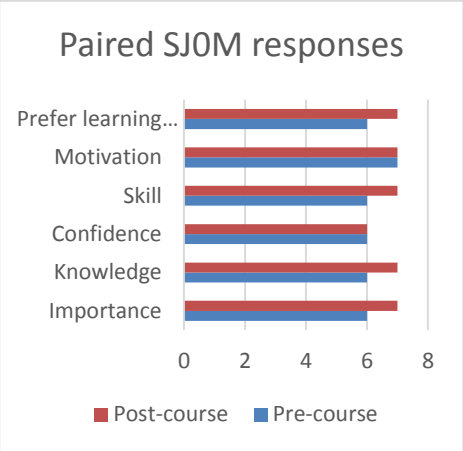




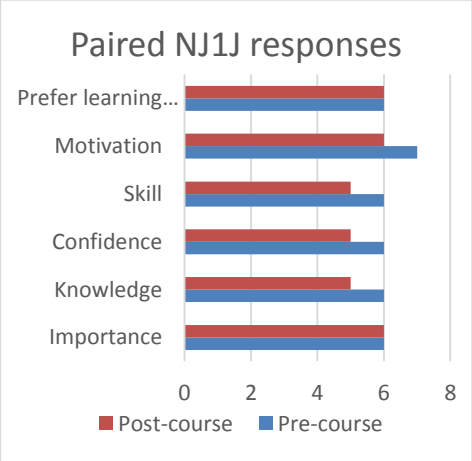
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants Hj2p and SO1l.

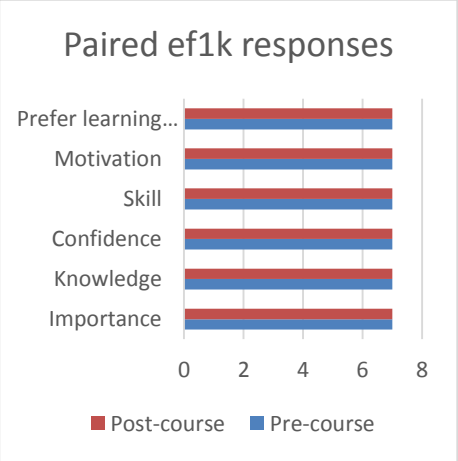
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





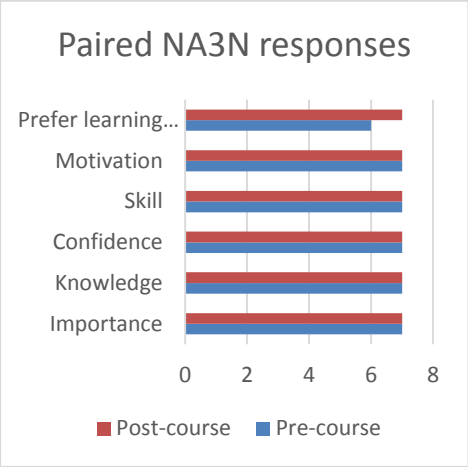
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants cs1m and SJ0M.

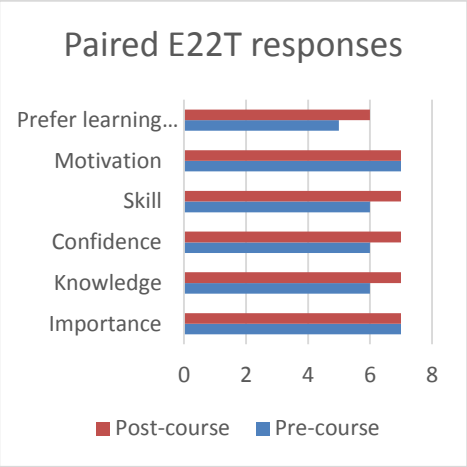




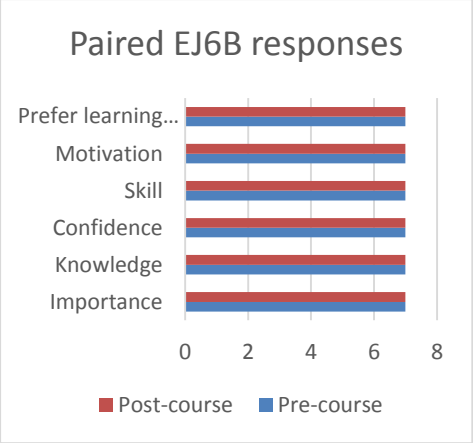
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants NJ1J and ef1k.

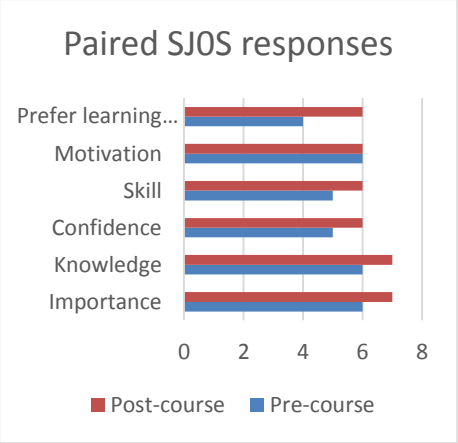
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





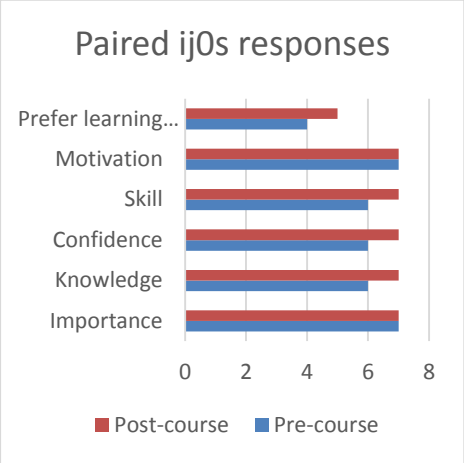
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants NA3N and E22T.

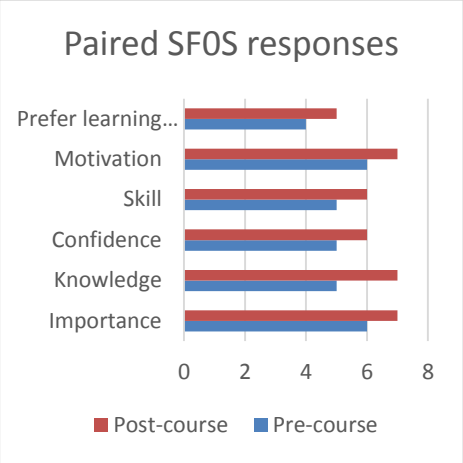




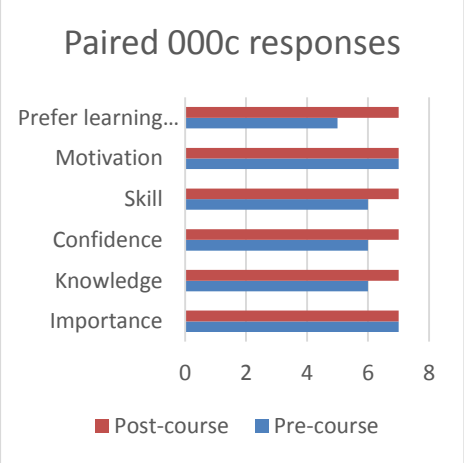
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants EJ6B and SJ0S.

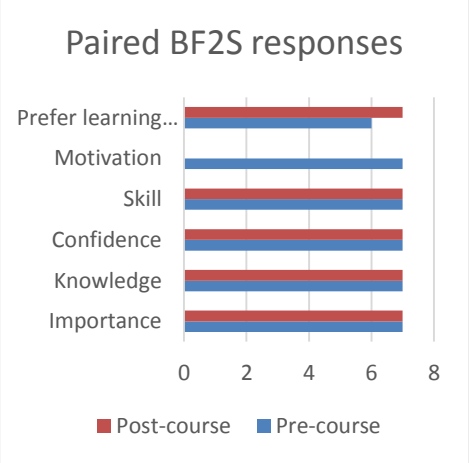
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





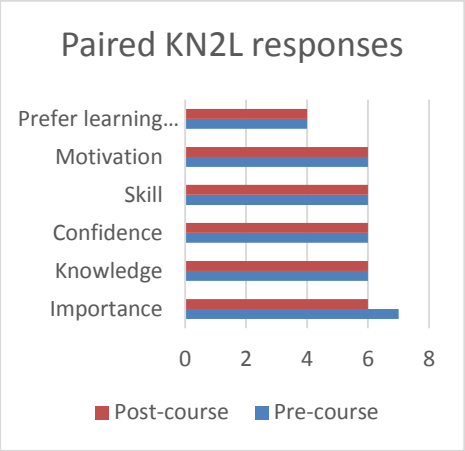
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants ij0s and SF0S.

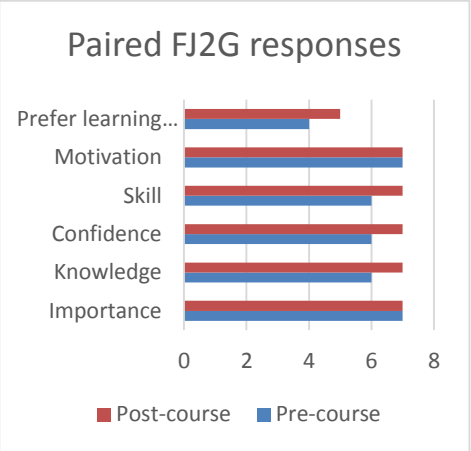




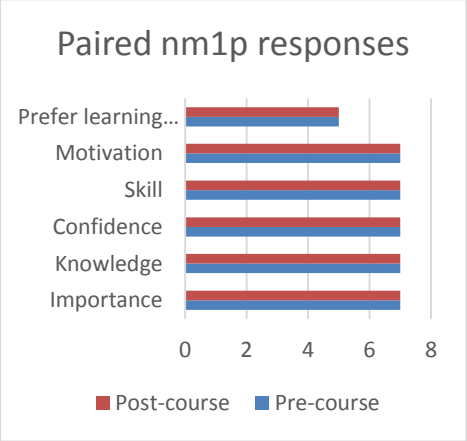
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants 000c and BF2S.

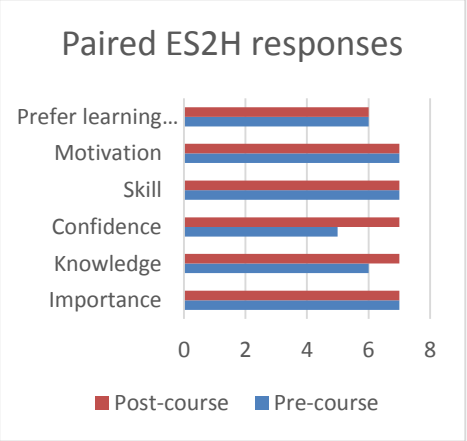
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





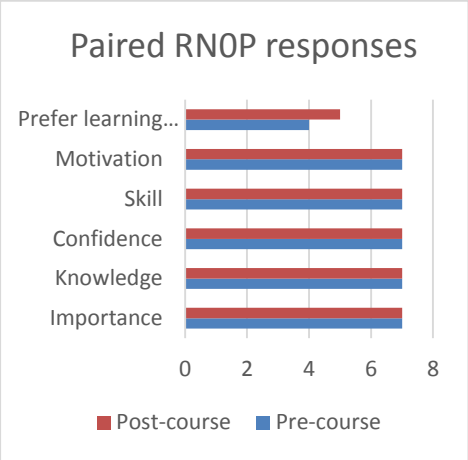
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants KN2L and FJ2G.

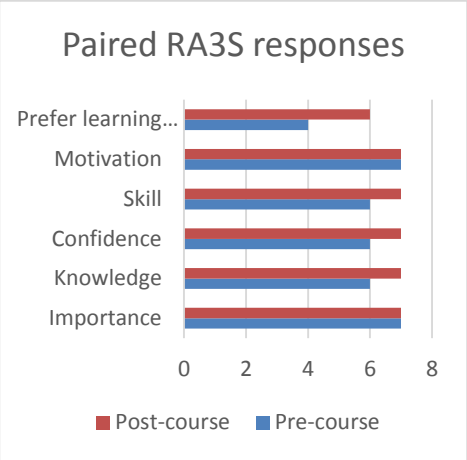




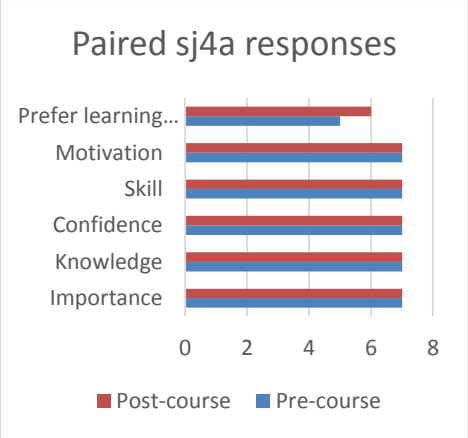
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants nm1p and ES2H.

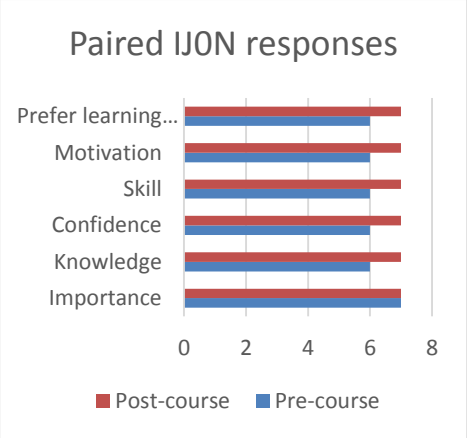
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





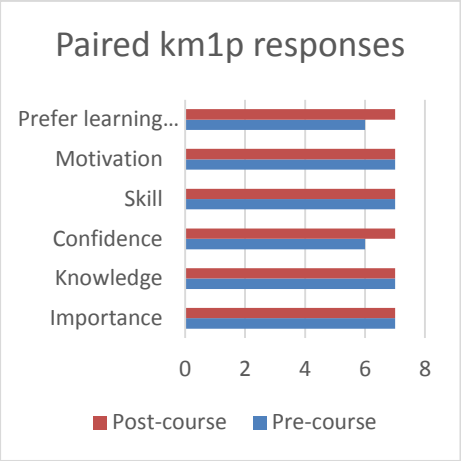
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants RN0P and RA3S.

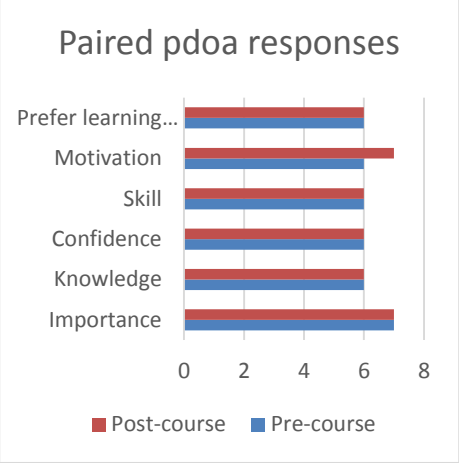




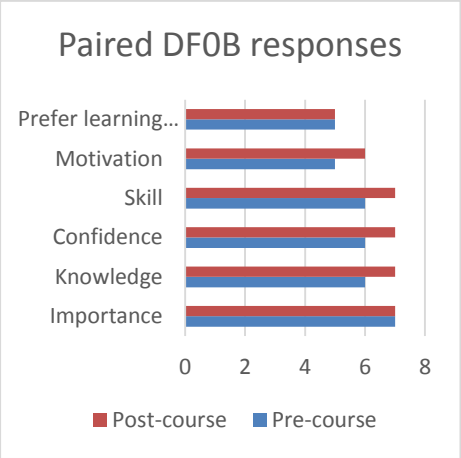
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants sj4a and IJ0N.

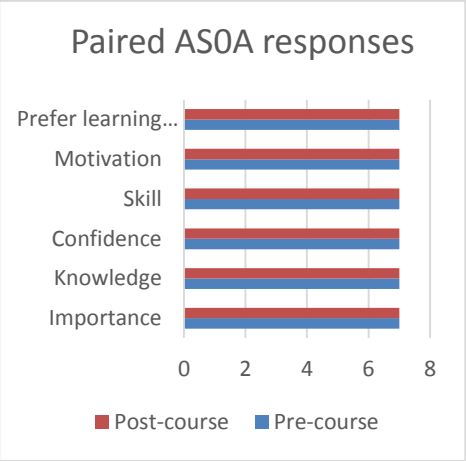
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





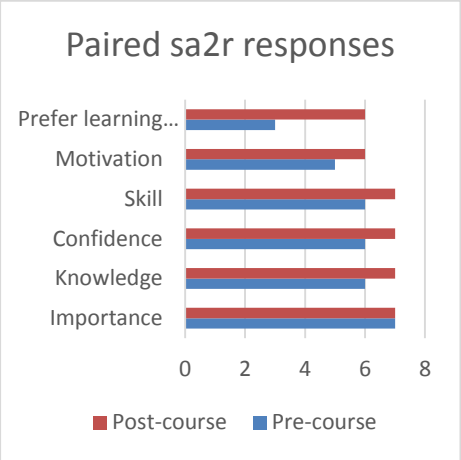
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants km1p and pdoa.

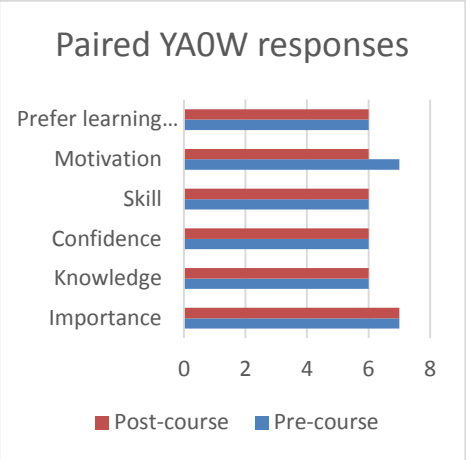




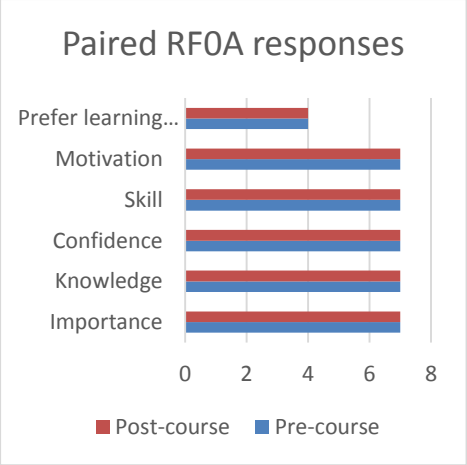
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants DF0B and AS0A.

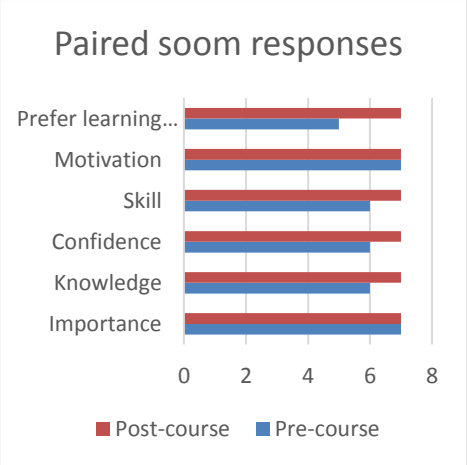
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





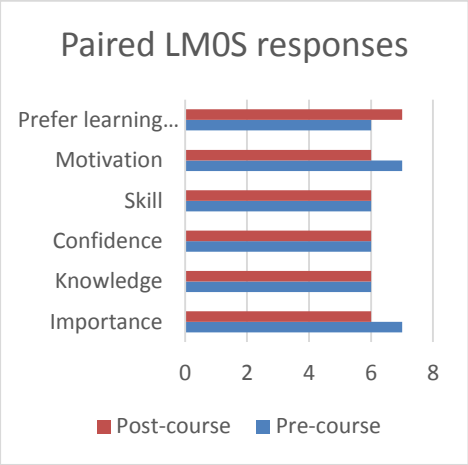
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants sa2r and YA0W.

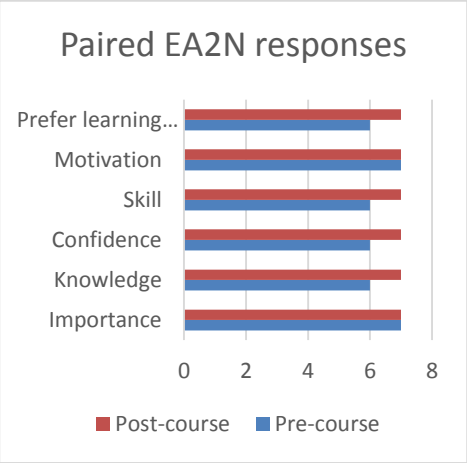




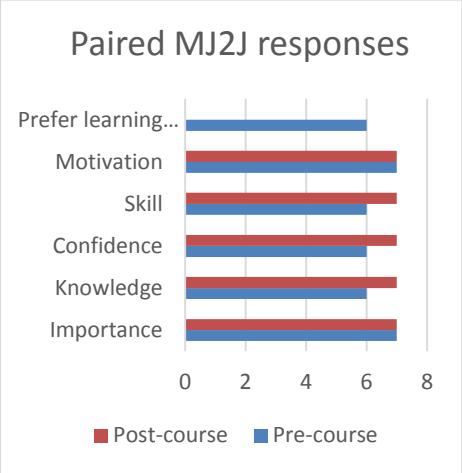
Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants RF0A and soom.

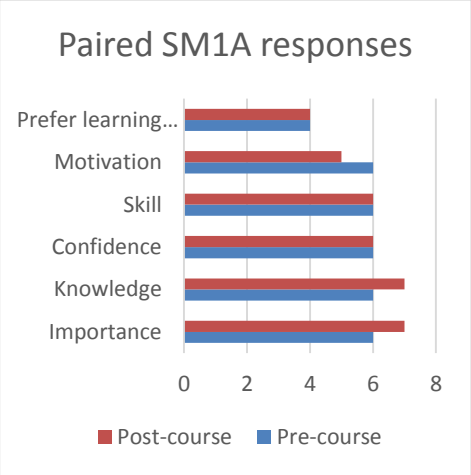
APPENDIX VIII – INDIVIDUAL PAIRED RESPONSES FOR PRE- AND POST-COURSE SURVEYS





Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants LM0S and EA2N.





Graphical representation of Likert score differences between pre- and post-course survey responses for six statements from wider dental community participants MJ2J and SM1A.

APPENDIX IX - MANUSCRIPTS

This published article contains information briefly discussed within section 7.5 of this thesis.

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Principal Author

Name of Principal Author (Candidate)	Lauren Stow
Contribution to the Paper	Performed analysis of results, interpreted data, wrote manuscript, acted as corresponding author
Overall percentage (%)	90%
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.
Signature	Date 12/9/17

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);
ii. permission is granted for the candidate in include the publication in the thesis; and
iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Denice Higgins
Contribution to the Paper	Supervised development of work, helped in data interpretation and manuscript evaluation/editing
Signature	Date 12/09/17

Name of Co-Author	—
Contribution to the Paper	
Signature	Date

Please cut and paste additional co-author panels here as required.

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The importance of increasing the forensic relevance of oral health records for improved human identification outcomes

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ABSTRACT

Dental comparison can confirm human identity to a high degree of certainty. Research examining Australian-made records demonstrated suboptimal recording of dental traits important for forensic dental identification and compliance with Dental Board of Australia (DBA) record keeping guidelines. This is a significant issue for human identification by dental comparison; lack of adequate antemortem information can hinder or obstruct outcomes. Reported identification opinions from the Forensic Odontology Unit of South Australia (FOU-SA) during 2011–2015 were assessed to determine whether the quantitative and qualitative value of antemortem records affected the ultimate identification outcome. Identity was established in 79% (n=197) of the 249 cases presented to the FOU-SA; odontology was unable to categorically confirm an individual's identity for the remaining 21%. Dental records of almost all cases demonstrated a lack of antemortem data for comparison. Inadequate antemortem information within dental records may preclude identity determination; at minimum, an outcome is hindered by a greater number of issues requiring reconciliation. Given previous results regarding adherence to DBA guidelines, practitioners should reasonably be expected to make small recording changes to improve the continuity of clinical patient care. This antemortem recording improvement will potentially improve the rate at which a forensic identification is reconciled.

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Forensic; dental; identification; outcomes; records

Introduction

According to the Dental Board of Australia's 2010 guidelines on dental record keeping, case notes are made 'to serve the best interest of patients … and contribute to the safety and continuity of their dental care'[1].

A dental record or case note should provide comprehensive evidence of the history of illness, examination, clinical diagnoses, treatment and management of a patient by an oral health practitioner. Case notes often consist of a written or electronic account made by the treating health provider about patient visits and the treatment that occurred, along with important patient details, diagnostic aids such as radiographs, dental casts, extra-oral and intra-oral photographs, laboratory forms and referrals.

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Table 1. Deceased individual identification categories utilized in South Australia, as per the Interpol Disaster Victim Identification Guide, 2009.

Identification category	
Established	Absolute certainty that the antemortem and postmortem records are from the same person
Probable	Specific characteristics correspond between the records but either antemortem data or postmortem data or both are minimal
Possible	There is nothing to exclude identity but either the antemortem data or postmortem data or both are minimal
Insufficient	No comparison can be made with the data available
Excluded	Antemortem and postmortem records are from different persons

These very same dental records made during an individual's lifetime of dental care can be an excellent source of information comparable to an unknown deceased. In fact, the use of dental records in forensic identification situations has long been documented[2,3].

As teeth are composed of extremely resilient tissues, they are often the last remaining indication of a person's identity after death. By compiling all available antemortem dental information about an individual and comparing it to a postmortem data set, a conclusion can be drawn as to a matching (or mismatching) of two identities[4].

However, the ability to form any such conclusion rests with the availability of adequate and accurate information regarding the antemortem status of an individual's orofacial features. Forensic dental identification requires that *any* discrepancy between consolidated antemortem records and the available postmortem data be reconciled, even if the detail is minor and unlikely to affect the conclusion. As such, detailed and up-to-date records will provide the most timely dental identification in the majority of circumstances.

Unfortunately, research examining Australian-made records has previously demonstrated suboptimal recording of dental traits that are important for both forensic dental identification and compliance with Dental Board of Australia record keeping guidelines[5].

Different classification criteria are used worldwide to describe the certainty in the reconciliation and consequent identification process relating to antemortem and postmortem dental records[6–8]. In South Australia, the identification categories currently used when reporting a dental identification opinion to the coroner are those specified by Interpol[9] (Table 1).

This study aimed to highlight cases within the period 2011–2015 where a lack of adequate antemortem information in dental records hindered or entirely obstructed forensic identification outcomes reported to the coroner by the Forensic Odontology Unit of South Australia (FOU-SA).

Methods

Reported outcomes for dental identification requests made to the FOU-SA during the period 2011–2015 were assessed via annual case log records and review of individual case files.

While identification outcomes were mainly classified as per the Interpol Disaster Victim Identification Guide, 2009 (Table 1), an additional category of 'Not progressed' was also required to demonstrate cases where the FOU-SA was originally recruited for opinion but was then directed to withdraw from the case because the individual had been identified using alternate methods, such as fingerprints.

For each case within the period 2011–2015, departmental reports issued to the coroner were reviewed for their terminology related to the quality and quantity of existing antemortem records of the individual. In particular, the incidence of the use of the phrase 'lack of antemortem data' was determined. A lack of antemortem data could include any of the following:

(1) Absence of records for treatment that was observed at the postmortem examination, including a lack of comprehensive and/or current charting
(2) Absence of (or inadequate) radiographs or photographs of the orofacial region
(3) Lack of detailed descriptions of individualizing features, e.g. diastemata, accessory cusps, tori, occlusion
(4) Lack of distinguishing orofacial features, e.g. complete absence of natural teeth, minimal restorative intervention and/or no distinctive morphology/abnormalities

The percentage of cases where the lack of existing antemortem dental data actually inhibited the individual's identity from being established was determined. The type of antemortem data deemed missing from cases that were not identified to a level of 'established' was determined; percentages of these were classified as per their Interpol identification category.

Results

In the five-year period 2011–2015, the FOU-SA received 262 requests for identification via comparison of antemortem and postmortem dental data. Thirteen of these cases (5%) were commenced but not completed, as the individual was identified by other means (e.g. fingerprints, DNA).

In 197 cases (79%), the available data for comparison allowed the identity of the individual to be established. In a forensic dental identification, this is the best possible outcome for the deceased individual and their family, as it provides the coroner with definitive information with which to finalize the case and release the body for burial.

Twenty cases (8%) were deemed 'probable' identifications; 18 cases (7%) were determined to be 'possible' identifications; 14 cases (6%) had 'insufficient' evidence to provide an opinion; and no cases (0%) were 'excluded' from identification. These outcomes are summarized in Table 2.

All 52 of the cases that were not identified to a level of 'established' were reported to the coroner as featuring a 'lack of antemortem data' for comparison to postmortem examination results. This meant that dental comparison was not able to identify the individual with absolute certainty to the coroner. The classifications of antemortem data deemed missing in

Table 2. Identification case outcomes for the FOU-SA in the five-year period 2011–2015.

		Identification outcome					
Year	Total cases	Established	Probable	Possible	Insufficient evidence	Excluded	Not progressed
2011–2012	73	52 (71%)	8 (11%)	2 (3%)	7 (10%)	0 (0%)	4 (6%)
2013	76	57 (75%)	6 (8%)	7 (9%)	3 (4%)	0 (0%)	3 (4%)
2014	62	47 (76%)	6 (10%)	2 (3%)	2 (3%)	0 (0%)	5 (8%)
2015	51	41 (80%)	0 (0%)	7 (14%)	2 (4%)	0 (0%)	1 (2%)

Table 3. Classification of lack of antemortem data within the study sample, per Interpol identification category.

	Absence of records for treatment observed at post-mortem examination *n* (%)	Absence of images (radiographs or photographs) *n* (%)	Lack of detailed description of individualizing features *n* (%)	Lack of distinguishing features *n* (%)
Probable	7 (13%)	7 (13%)	3 (6%)	6 (12%)
Possible	9 (17%)	5 (10%)	0 (0%)	8 (15%)
Insufficient evidence	6 (12%)	2 (4%)	0 (0%)	11 (21%)
TOTAL (52 cases)	22 (42%)	14 (27%)	3 (6%)	25 (48%)

Note: that nine cases featured more than one classification of lack of antemortem data.

these 52 cases are summarized per Interpol identification category in Table 3. Nine of these cases lacked more than one type of required antemortem data for optimal identification. Eleven (21%) of these cases were edentulous and had limited or no radiographic data available. All of these 11 cases fell into the classification 'lack of distinguishing orofacial features'. There was no correlation between the type of missing antemortem data and the Interpol identification category that was reported to the coroner.

Discussion

Dental records are created expressly to assist with the continuity of clinical dental care for an individual during their lifetime. In fact, maintaining accurate and complete dental case notes is an oral health practitioner's ethical and legal obligation[10]. In Australia, all oral health care workers must produce and manage patient case notes in line with professional guidelines and laws[11–14].

As an approved registration standard for a health profession and a code approved by a National Board, record keeping guidelines are admissible in proceedings under the Health Practitioner Regulation National Law (South Australia) Act 2010; they can be used against a health practitioner registered by the Board as evidence of what constitutes appropriate professional conduct[14].

Failure to comply with professional record keeping guidelines may not only lead to suboptimal continuity of patient care, but can also leave practitioners open to indefensible litigation actions.

While the Australian Health Practitioner Regulation Agency and the Board regulate practices related to *clinical use* of dental records at a national level, practitioners should also be aware of the influence of their relevant state's Coroner's Act, as well as the Commonwealth Privacy Act (Commonwealth of Australia, 1988), on compliance to requirements[15,16]. It is of particular relevance in the Privacy Act that authorities can request the use and release, by dentists and other oral health workers, of personal information (including dental records) for *forensic* services, even though this was not their original intended use.

This research hence assessed the value of dental records, originally prepared for clinical practice, in assisting an optimal and timely outcome for forensic identification.

A large proportion (79%) of cases that were brought to the attention of the FOU-SA in the five-year period of assessment were finalized at the highest degree of forensic identification, i.e. 'established'. It should, however, be noted that even though the identity of each

individual was established, the case reports written to the coroner commonly featured the phrase 'lack of antemortem data' with regard to the dental records. In these cases, odontologists clearly perceived a decreased quality or quantity of dental records related to the individual. While this lack of data did not inhibit an optimal outcome, it is likely that the reduced quality or quantity of the records complicated or slowed the rate of finalization of these cases, simply because a greater number of issues needed to be reconciled.

For the 52 cases (21%) that were reported to the coroner at an identification level below that of 'established', the lack of antemortem data contained within the records for the individual was inadequate for an optimal dental identification. In these cases, the lack of antemortem information meant that a dental identification could not definitively be made. As a professional group, it is for these individuals that we particularly need to improve dental record keeping processes.

The following three cases highlight real instances where dental records failed to provide reasonable information that could have established the identity of an individual.

Case 1

This case was a routine identification for which the postmortem dental examination progressed unremarkably. Following the postmortem examination, all available antemortem dental information was compiled for reconciliation of the two data sets.

A review of the available antemortem data highlighted that the records did not contain any dental charting (complete or incomplete) and despite written documentation that the deceased's impacted third molars had been removed, no panoramic radiograph was present. Odontologists deemed it reasonable to expect that these sources of information should have been available in the antemortem dental records.

Additionally, at the postmortem examination, odontologists documented that the deceased presented with symmetrical 'accessory cusps' on both lower first molars. No information regarding the accessory cusps had been documented in the antemortem records. While odontologists did not deem it reasonable to expect that such anatomical variant information be present in dental records that were constructed for clinical purposes, it would have been particularly useful for the forensic identification. Such a situation highlighted how useful dental casts (perhaps taken for orthodontic purposes or mouthguard construction) may prove in a forensic identification.

Given the lack of antemortem data contained within the dental records for the individual, the FOU-SA documented a conclusion of 'probable' in the report to the coroner, i.e. specific characteristics corresponded between the records but the antemortem data were minimal. In this case, the coroner needed to seek evidence beyond the dental opinion to irrefutably determine the individual's identity.

Case 2

This case was another routine identification for which odontologists from the unit performed a postmortem dental examination. Again, this progressed unremarkably. Following the postmortem examination, all available antemortem dental information was compiled for reconciliation of the two data sets.

The available antemortem records contained only one radiograph – a periapical view of the lower right second premolar – despite documentation that most of the patient's teeth had been extracted. Written antemortem dental records also indicated that a panoramic radiograph had been taken of the patient, but this radiographic view was not provided in the information that was received by the FOU-SA. In these instances, odontologists deemed

it reasonable to expect that the radiographs should have been available in the antemortem dental records. A dental panoramic radiograph contains a record of orofacial features beyond dental hard tissues; anything of interest on the radiograph may be compared to postmortem details. It is possible, in this case, that the missing antemortem radiograph displayed individualizing orofacial features (e.g. sinus lobulation, retained root fragments, residual amalgam following extraction) that could have been compared to postmortem findings in order to facilitate identification.

Interestingly, the deceased also had upper and lower removable dentures situated in the mouth at the postmortem examination phase. These were not labeled with a personal identifier, such as the deceased's name or an individualized barcode. While this is not antemortem information, patients and clinical professionals remain divided as to whether denture labeling is an appropriate use of time and money; among forensic odontology circles, it remains an important identifier[17–19]. The antemortem record did not contain any information about the dentures. Information that could be expected to be available includes material of construction and extension of denture base, as well as the number, shade and mold of teeth used.

It is noteworthy that 11 of the individuals classified as having a lack of distinguishing orofacial features available for comparison in this study were edentulous, in addition to having no labeled dentures. In Case 2, it can categorically be stated that should both the compiled antemortem and postmortem records have contained information that the dentures were labeled with an identifier, the forensic identification outcome would have been different. Here, the 'possible' outcome that was provided to the coroner may easily have been elevated to an established identification.

Case 3

Again, the case was routine and the postmortem examination progressed unremarkably. The deceased victim was a very young adult, with limited obvious dental treatment. Following the postmortem examination, all available antemortem dental information was compiled for reconciliation of the two data sets.

Predictably, because the deceased had sound dental health, there was limited antemortem information available for reconciliation. However, he had a notable dental trait in his upper anterior region at the postmortem examination – a 1.5 mm diastema between 11 and 21. Given the prominence of the trait, odontologists deemed it reasonable to expect that the information should have been available in the antemortem dental records. In fact, school-based dental records noted that the diastema was present in the deciduous dentition for the individual but there was no mention of it in the permanent dentition. Additionally, no antemortem photographs were available to the FOU-SA for comparison. Consequently, the identification advised to the coroner for this case was 'probable', with some specific characteristics existing between the records but with limited antemortem data available for reconciliation. Had antemortem records actually documented the presence of this diastema, it is possible that a more definitive identification outcome could have been provided to the coroner.

In addition to highlighting obvious areas for improvement in record keeping in relation to forensic identification, the current review has also highlighted that some consideration should be given to changes to the reporting phrase 'lack of antemortem data' in our forensic odontology reports. Clearer reporting would make it more obvious as to the true impact of

dental case note recording on identification outcomes. In particular, it might be prudent to distinguish the following:

(a) 'Lack of antemortem information' being that where limited or no antemortem information is available to the forensic odontologist. Such instances might include the inability of relevant authorities to source dental records: cannot locate where the individual went to the dentist; the person never actually went to a dentist; or the dental records have been shredded/disposed of by the dentist.
(b) 'Inadequate antemortem information' being that which comprises incorrect or incomplete information. Information that is not present but that a sensible clinical dentist or forensic odontologist would reasonably expect to be available within dental records would fall into this category. One example of this would be a case note saying that a radiograph was taken on a particular date that is not contained in the dental records at the time of examination. Another example would be an expectation that a completed odontogram be present in the dental case notes if the patient has been charged for a comprehensive examination.

If these changes to the reporting phrase were made, by far the most commonly used one throughout the 2011–2015 period at the FOU of South Australia would have been 'inadequate antemortem information', highlighting that clear improvement is needed in case note recording in order to expedite forensic dental identification.

Conclusion

It has been shown that optimal forensic dental identification outcomes *can* be achieved despite a lack of antemortem case note detail for comparison to a postmortem examination. However, this is not always the case.

Professional education is suggested in order to improve the dental recording practices of oral health care workers. In particular, this education should highlight the need for simple but adequate detail and accuracy in record keeping, with consideration to the realistic time restraints of busy practice. While this will be with the aim to improve the outcome of those few individuals whose dental records are not sufficient to definitively identify them after death, it will also assist in a more timely and valid (easily explainable) dental identification outcome for all those requiring it.

Disclosure statement

No potential conflict of interest was reported by the authors.

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APPENDIX IX - MANUSCRIPTS

This published article is a summary of key findings of this complete research project. It does not add more to the information already presented in this thesis; it is included here only for completeness.

Statement of Authorship

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Contribution to the Paper	Performed analysis on data, interpreted data, wrote manuscript, acted as corresponding author
Overall percentage (%)	90 %
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.
Signature	Date 12/9/17

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Denice Higgins
Contribution to the Paper	Supervised development of work, helped in data interpretation and manuscript evaluation/editing
Signature	Date 12/09/17

Name of Co-Author	—
Contribution to the Paper	
Signature	Date

Please cut and paste additional co-author panels here as required.

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Development and evaluation of online education to increase the forensic relevance of oral health records

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ABSTRACT

Background: : Human identification can be reliably established by dental comparison; success is significantly impacted by inadequate ante-mortem information. Previous Australian research revealed suboptimal recording of features important for forensic dental identification and compliance with Dental Board of Australia guidelines. We hence created and evaluated an online education programme aimed at improving oral health practitioner recording.
Methods: : An interactive learning module (ILM) was constructed and released to three focus groups representing practitioners with varying experience levels: Australian Society of Forensic Odontology members, third year dental students and the wider dental community. Pre- and post-participation perceptions were recorded, with percentage, mean, broad agreement, standard deviation and statistical significance between responses determined.
Results: : Improved recognition of importance of record keeping, knowledge, confidence, skill and motivation to learn was seen following ILM interaction. This was particularly significant for students, participants with 3–5 years of experience in their current occupation and those whose highest level of education was achieved in Australia.
Conclusions: : The ILM increased self-reported awareness, understanding and attitude of participants with different levels of case note recording experience; this can improve recording practises and aid forensic dental identification if utilized in undergraduate teaching and as a continuing professional development tool for dental practitioners.

Keywords: Case notes, dental, education, forensic, identification.

Abbreviations: AHPRA = Australian Health Practitioner Regulation Agency; AuSFO = Australian Society of Forensic Odontology; CPD = continuing professional development; ILM = interactive learning module; SD = standard deviation.

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INTRODUCTION

The use of dental records in human identification has long been documented.[1,2] As teeth are highly individual, resist destruction and have generally been documented in some form during the life of a person, detailed information depicting the dentition can be compared between ante-mortem and post-mortem situations.[3,4] Identification by dental means can be quick, inexpensive and highly accurate, with dental data frequently being more readily available than fingerprint or DNA records.[5] Forensic Odontology continues to play a significant role in identifying severely disfigured and visually non-recognizable deceased individuals and in mass disaster situations. Of note, dental investigation assisted the identification of 76% of the victims of the 2001 World Trade Centre disaster in New York;[6] approximately 60% of victims of the 2002 Bali bombings;[7] and following the Boxing Day 2004 tsunami in Thailand, early reports suggested that some 70–79% of the deceased were identified by dental comparison.[8,9] More recently in Australia, identification of the majority of the 173 severely incinerated victims of the 2009 Black Saturday Victorian bushfires was facilitated by odontology.[10,11] In 2014, international collaboration allowed identification of the victims of the Malaysia Airlines MH-17 disaster through various forensic investigations, including dental comparison.[12] It is anticipated that a similar recovery and identification effort will be required for passengers of the presumed-submerged Malaysia Airlines flight MH-370, which disappeared on 8 March 2014, should it eventually be located. The process of identification relating to an underwater disaster presents specific problems not encountered during land investigations.[13] However, the ability to perform an odontological assessment and interpretation remains the same and, having been submerged

and at the mercy of the deep sea environment for a number of years, there would remain scant other information available for victim identification.

The success of human identification by dental means relies on both the condition of the unknown deceased's dental remains and the quality of the available recorded ante-mortem dental information. To be optimally useful for forensic identification, dental case notes need to precisely document the entire oral status. As such, the case notes should be legible, up-to-date, detailed, accurate and accessible. Previous research examining Australian-made case notes demonstrated suboptimal recording of dental traits important for both forensic dental identification and clinical practise.[14] Additionally, 60% of respondents to a survey regarding oral health recording recognized that shortcomings exist, noting that lack of information and continuing professional development (CPD) may be a barrier to developing and maintaining good record-keeping practises.[15] This lack of available CPD resources pertaining to record keeping should be viewed as a serious problem, especially given that the Dental Practice Board of Victoria, the Australian Health Practitioners Registration Authority and the Australasian Legal Information Institute had, following proceedings related to dental complaints in the period 2011–2014, all determined that the practitioners involved needed to undertake further education in record keeping.[16]

Many dental registration authorities throughout the world mandate CPD as a requirement for ongoing registration. In Australia, dental professionals are required to complete a minimum of 60 h of CPD over a 3-year period.[17,18] Research has shown that training can enhance a practitioner's accuracy and consistency in clinical diagnostic tasks.[19] Effective education needs to be engaging and targeted, balancing stimulating academic content with examples of practical application. Recently, there has been an increased availability of teaching and learning content online in all facets of education, thus ensuring that today's busy trainees can digest information at a time suitable to their personal schedule.[20–22] It is reassuring to note that computer-aided, self-instructional programs have been shown to be effective in dental education.[23,24] Whilst it may be that those who work in a more hands-on profession (such as clinical dental practise) prefer a kinaesthetic style of learning, there remains a place for online learning and evaluation in oral health professions for more basic concepts.[25,26]

Inherently, effectiveness of health care education is difficult to measure. For one, some of the effects of education may not be apparent for years after the programme has been completed.[27] Additionally, practitioners may actually learn from an educational intervention but not have resources available (e.g. time, attitudes of colleagues, finances) to implement a change in practise. Hence, the learning intervention may be judged ineffective, as its goals were not met.[28] Despite the limitations and difficulties of measuring true effectiveness, evaluation models have been proposed to offer some standardization of outcome measures. The most well-known and currently popular approach to education evaluation was first proposed by Kirkpatrick in 1976.[29] He described effectiveness based on four evaluation levels: participant reaction or satisfaction (level one); change in learning or knowledge (level two); change in behaviour (level three); and results or health care outcomes (level four).

This research aimed to construct an electronic interactive learning module (ILM) to facilitate improvement in oral health record-keeping practises, with a specific focus on forensically relevant material. The ILM was released to three specific focus groups with varying levels of existing dental case note experience and awareness. To determine the degree to which the ILM achieved its aim, feedback from participants was statistically analysed, with reference to Kirkpatrick's levels one and two of learning effectiveness.

METHODS

This research was approved by the Research Ethics and Compliance Committee of the University of Adelaide (H-2015-086).

The online ILM was constructed using Articulate Storyline 2 software (Articulate, New York, NY, USA). The start page has six categories ('buttons') of learning: Introduction (to the ILM), Detail, Accuracy, Legibility, Accessibility and Retention. Each learning area contains basic background information and published references to justify to the participant the need to improve record-keeping practises, as well as one to four clinical and real-life scenarios (Figs. 1 and 2). Each learning area additionally contains interactive feedback for the participant in the form of one to four short answer or multiple choice quiz questions. Types of scenarios and quiz questions varied between sections but were usually of the short answer or multiple choice variety (Fig. 3). As one example of a learning area in the ILM, the Accuracy button provided background information on basic ante-mortem–post-mortem reconciliation processes using dental records, as used when a forensic odontologist provides a dental identification opinion (i.e. the justification for required learning). Three scenarios were given of de-identified case reconciliations where ante-mortem and post-mortem records are erroneously mismatched due to inaccurate record keeping (e.g. a tooth was recorded as missing ante-mortem but present at the post-mortem phase, despite being of the same individual). To check

APPENDIX IX - MANUSCRIPTS

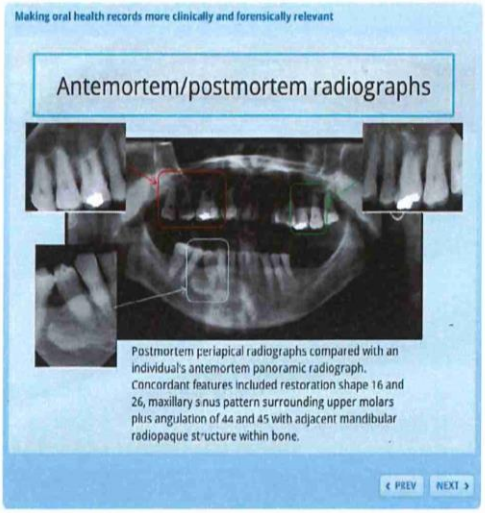

Fig. 1 Further exploration of the 'Radiographs' button in the 'Detail' section of the interactive learning module demonstrates a real-life example of ante-mortem orthopantomogram/post-mortem periapical radiograph comparison.

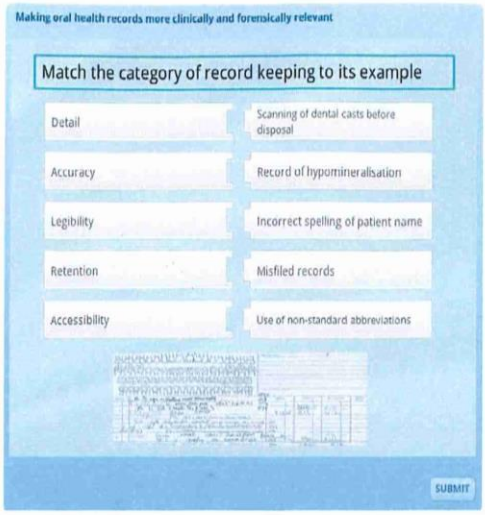

Fig. 3 Screen cap of 'drag and drop'-type question to ensure participants had grasped key aspects of the 'Introduction' section of the interactive learning module.

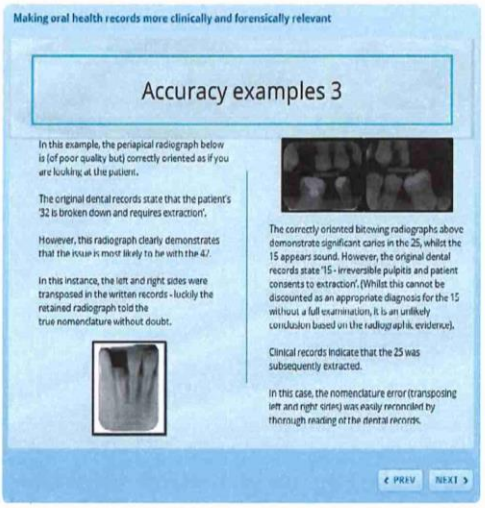

Fig. 2 Further examples of forensic dental reconciliation demonstrating that ante-mortem and post-mortem dental records did not entirely match in the 'Accuracy' section of the interactive learning module.

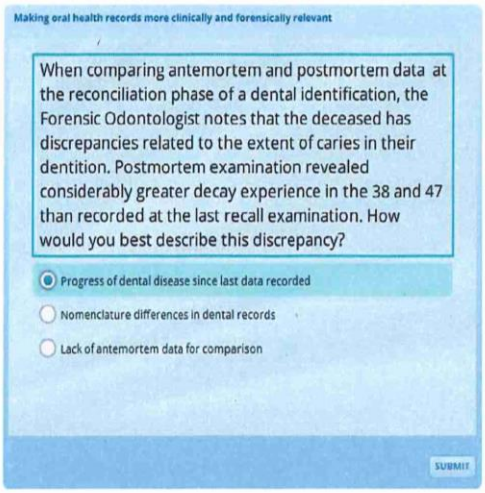

Fig. 4 An example of one of the multiple choice quiz questions in the 'Accuracy' section of the interactive learning module.

their understanding of the importance of taking time to accurately assess and document findings for each patient, participants were then asked to select a multiple choice response to four direct questions regarding a clinical situation or photograph (Figs. 4 and 5). If the participant selected the wrong option, further attempts were allowed. The complete ILM was designed to take the participant 60 min to work through in its entirety, although it did not need to be completed all in one sitting.

Data were collected over three separate study phases. In the first instance, members of the Australian Society of Forensic Odontology (AuSFO) Inc. (N = 65) were invited to participate via an email link from their professional staff, with the ILM being available in the members-only area of their website for a period of 7 weeks. In the second instance, third year students enrolled in the Bachelor of Dental Surgery programme at the University of Adelaide in 2016 (N = 73) were invited to participate, as the educational content formed an existing part of their accredited curriculum. The content was available on the

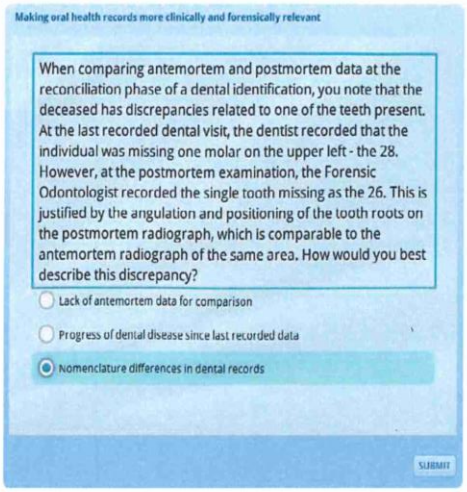

Fig. 5 A further example of one of the multiple choice quiz questions in the 'Accuracy' section of the interactive learning module.

dental students' learning management system for a 4-week period coinciding with their preclinical programme. In the third and final instance, the ILM was made available to the wider dental community for a period of 6 months, with email invites being sent via professional group staff asking members to access the ILM on the open-access area of the AuSFO Inc website.

Short pre- and post-course SurveyMonkey (San Mateo, CA, USA) surveys were embedded within the ILM at each study phase. Brief demographic and/or educational history was collected from participants, via drop-down selection. Additionally, participants were asked to assign a level of agreement to six short Likert-style statements (Table 1). These six statements were the same for both the pre- and post-course surveys, enabling overall perception changes of participants within each study phase to be determined. Percentage responses, mean, median, standard deviation and broad agreement were calculated.

Table 1. Selections available for participants choosing Likert-style level of agreement to the questions posed on both pre- and post-course surveys

Likert score	Level of agreement
1	Strongly disagree
2	Disagree
3	Somewhat disagree
4	Undecided
5	Somewhat agree
6	Agree
7	Strongly agree

A unique and anonymous identifier, created by the participant, also allowed individual pre- and post-course surveys to be linked for analysis. Fisher's exact test was used to assess the statistical significance of changes in perceptions, from the pre-course to post-course stages of engagement with the ILM, to the six repeated Likert-style statements for each individual. This was determined for each study group, by occupation, by years of experience and by country of highest level of education.

As part of the post-course survey, participants were also asked to provide responses to three Likert-style statements regarding the quality of the feedback provided by, the examples used in and the organization of the ILM.

RESULTS

Phase 1

Twenty percent (N = 13) of AuSFO members completed pre-course surveys and 11% (N = 7) completed post-course surveys. Of these participants, the majority reported that they have a Bachelor Degree (54%, N = 7), were educated between the years 2001 and 2010 (46%, N = 6) and had completed their highest level of education in Australia (83%, N = 10). Their awareness, knowledge, confidence, skill and motivation to produce complete and accurate oral health records was high at both the pre- and post-course survey stages (Table 2). An improvement in the preference to learn online following participation with the ILM was observed but was not statistically significant. All participants broadly agreed that the ILM used appropriate examples for the educational content, provided appropriate feedback for learning and was well organized.

Phase 2

Forty-four percent of students (N = 32) completed valid pre-course surveys; 51% (N = 37) completed post-course surveys; and 36% (N = 26) completed both pre- and post-course surveys that could be assessed for paired responses.

Most of the dental student participants indicated that their highest level of completed education was secondary school (78%, N = 25), completed after 2010 (84%, N = 27) and within Australia (53%, N = 17). The surveyed dental students demonstrated statistically significant changes to their self-perceptions about knowledge, confidence and skill after they had completed the ILM (Table 3). No statistically significant changes with regard to the students' awareness and motivation to learn more about making complete and accurate oral health records were noted. Students

Table 2. Results from phase one of research study, with participants from the Australian Society of Forensic Odontology Inc. (AuSFO)

Question/statement posed to AuSFO members	Pre-course survey (20% participation, N = 13)				Post-course survey (11% participation, N = 7)			
What is the highest level of education you have completed?	Bachelor Degree (54%, N = 7); Masters (24%, N = 3); Bachelor Degree with Honours, Graduate Certificate or Graduate Diploma (8%, N = 1); Diploma or Advanced Diploma (8%, N = 1); Doctor of Philosophy (8%, N = 1)				–			
In what year did you complete your highest level of education?	Between 2001–2010 (46%, N = 6); prior to 1980 (31%, N = 4); between 1991–2000 (15%, N = 2); between 1981–1990 (8%, N = 1)				–			
Did you complete your highest level of education in Australia?	Yes (83%, N = 10); No (17%, N = 2)				–			
I am aware of the importance of making complete and accurate oral health records	Mean Likert	Median Likert	SD	BA	Mean Likert	Median Likert	SD	BA
	6.92	7.00	0.28	100%	7.00	7.00	0.00	100%
I have the knowledge to make complete and accurate oral health records	6.77	7.00	0.44	100%	7.00	7.00	0.00	100%
I have the confidence to make complete and accurate oral health records	6.69	7.00	0.63	100%	6.86	7.00	0.38	100%
I have the skill ro make complete and accurate oral health records	6.62	7.00	0.65	100%	6.57	7.00	0.53	100%
I am motivated to learn more about how to make complete and accurate oral health records	6.77	7.00	0.60	100%	6.71	7.00	0.76	100%
I prefer learning in an online format using an ILM	5.54	5.00	1.19	77%	6.14	6.00	0.91	100%
The examples used in the ILM aided my understanding of the educational content	–				6.57	7.00	0.53	100%
The ILM provided appropriate feedback for my learning	–				6.43	6.00	0.53	100%
The ILM was well organized	–				6.71	7.00	0.76	100%

Due to the low numbers of participants completing both pre- and post-course surveys in this phase, Fisher's exact test for statistical significance was not applied to the overall results.
BA = broad agreement, ILM = interactive learning module, N = number of participants, SD = standard deviation.

Table 3. Results from phase two of research study, with participants from the third year of the Bachelor of Dental Surgery (BDS) programme at The University of Adelaide

Question/statement posed to BDS3 students	Pre-course survey (44% participation, N = 32)				Post-course survey (51% participation, N = 37)				Statistical significance of difference between pre- and post-course (Fisher's exact) for the 26 (36% participation) valid paired responses
What is the highest level of education you have completed?	Secondary school (78%, N = 25); Bachelor Degree (9.38%, N = 3); Bachelor Degree with Honours, Graduate Certificate or Graduate Diploma (9.38%, N = 3); Masters (3.13%, N = 1)				–				–
In what year did you complete your highest level of education?	Between 2001–2010 (16%, N = 5); 2011 or after (84%, N = 27)				–				–
Did you complete your highest level of education in Australia?	Yes (53%, N = 17); No (47%, N = 15)				–				–
I am aware of the importance of making complete and accurate oral health records	Mean Likert	Median Likert	SD	BA	Mean Likert	Median Likert	SD	BA	Two-tailed $P = 0.1599$ (not significant)
	6.31	6.00	0.69	100%	6.69	7.00	0.48	100%	
I have the knowledge to make complete and accurate oral health records	5.19	5.00	0.84	82%	6.30	6.00	0.62	100%	Two-tailed $P = 0.0004$*
I have the confidence to make complete and accurate oral health records	5.09	5.00	0.82	84%	6.14	6.00	0.64	97%	Two-tailed $P < 0.0001$*
I have the skill to make complete and accurate oral health records	5.22	5.00	0.83	84%	6.08	6.00	0.65	100%	Two-tailed $P < 0.0008$*
I am motivated to learn more about how to make complete and accurate oral health records	6.13	6.00	0.87	94%	6.22	6.00	0.89	95%	Two-tailed $P = 1.0000$
I prefer learning in an online format using an ILM	5.50	6.00	1.22	78%	5.41	6.00	1.28	73%	Two-tailed $P = 0.5230$
The examples used in the ILM aided my understanding of the educational content	–				6.27	6.00	0.65	100%	–
The ILM provided appropriate feedback for my learning	–				5.78	6.00	1.11	86%	–
The ILM was well organized	–				6.14	6.00	0.83	94%	–

* Statistically significant.
BA = broad agreement, ILM = interactive learning module, N = number of participants, SD = standard deviation.

appeared less inclined to view online learning of this particular topic favourably after using the ILM but did indicate that they thought the examples used aided understanding of the educational content (100% broad agreement). Only 86% broadly agreed that appropriate feedback was provided via the ILM; 94% broadly agreed that it was well organized.

Phase 3

Email invitations were sent to 6464 potential participants: 1.3% (N = 86) completed a valid pre-course survey; 1% (N = 65) completed a valid post-course survey; and 0.71% (N = 46) completed both, allowing for paired analysis.

Most responses were received from Australian Dental Association (36%, N = 31) members or from areas listed as 'other' (30%, N = 26), which included 16 participants from the Dental Hygienists Association of Australia. Most participants identified as a dentist (51%, N = 44), had practised for over 30 years (40%, N = 34) and had gained their highest level of education for their current occupation within Australia (80%, N = 69). In general, participants' awareness, knowledge, confidence, skill and motivation to produce complete and accurate oral health records was high at both the pre- and post-course survey stages (Table 4) and did not demonstrate statistically significant changes via engagement with the ILM. Participants indicated a more positive perception regarding online learning at the post-course survey stage, when compared with their pre-course survey responses. Participants broadly agreed that the examples used in the ILM aided understanding of the educational content (98%), the ILM provided appropriate feedback for learning (94%) and was well organized (95%).

Combined valid paired responses

When data from all phases was combined, statistical significance was demonstrated for changes to participant perception with regard to statements on awareness ($P = 0.0305$), knowledge ($P = 0.0046$), confidence ($P < 0.0001$) and skill ($P < 0.0008$) in making complete and accurate oral health records (Table 5). Participants with their highest degree of education from an Australian institution of learning also demonstrated a statistically significant change to the statements on awareness ($P = 0.0034$) and skill ($P = 0.0060$); both Australian educated ($P = 0.0005$) and non-Australian educated ($P = 0.0188$) participants showed statistically significant change to the statement on confidence (Table 6). No occupations (other than dental student) showed any statistically significant results (Table 7), while participants with 3–5 years of experience in their current profession showed significant perception changes with regard to knowledge ($P = 0.0004$), confidence ($P < 0.0001$) and skill ($P < 0.0001$) following viewing of the ILM (Table 8).

DISCUSSION

The availability of accurate and detailed ante-mortem dental records is imperative for successful and expedient identification of unknown human remains by dental comparison. Record keeping in Australian oral health practices is often suboptimal for this very important function,[30] as well as by legal and ethical standards. It is plausible that this is due to a lack of education and training in this area. In an effort to address this shortfall we have developed and trialled an online ILM.

Surveyed participants reported satisfaction with the ILM, as considered by Kirkpatrick's Levels of Training Criteria.[29] Additionally, improvements in awareness of the importance, knowledge, confidence, skill and motivation to learn regarding the subject matter were seen following participant interaction with the ILM; this was regardless of their graduated occupation. The vast majority of participants demonstrated an improvement in their level of agreement to statements posed about making complete and accurate oral health records, namely a change in learning, as demonstrated by Kirkpatrick's level two of training effectiveness, was seen. It is our opinion that this demonstrates an increased understanding of what is both appropriate and legal for dental record keeping. Undergraduate dental students and practitioners with limited years of experience in their chosen dental field showed a greater increase in appreciation of optimal record-keeping practises following engagement with the ILM, compared with those with a considerable amount of case note recording experience. Additionally, those whose highest level of education was earned from an Australian learning institution were overall more positively affected by the ILM compared with those who had gained their highest level of education from another country.

The undergraduate student cohort indicated a statistically significant positive change in their agreement to the statements related to knowledge/confidence/skill to make complete and accurate oral health records following interaction with the ILM. Previously published data for online e-learning for undergraduates in health professions mirrors these current findings.[31,32] The current pre-course survey results recorded could be expected in a group that has not yet completed their undergraduate training in the profession; they may be unsure if they have received all required training about the subject, or if more is to come in the fourth and fifth year of their degree. The student-cohort

Table 4. Results from phase three of research study, with participants from the wider dental community

Question/statement posed to the wider dental community cohort	Pre-course survey (1.3% participation, N = 86)				Post-course survey (1% participation, N = 65)				Statistical significance of difference between pre- and post-course (Fisher's exact) for 46 (0.71% participation) valid paired responses
Which of the following best describes your current occupation?	Dentist (51%, N = 44); dental hygienist (20%, N = 17); dual qualified dental hygienist/therapist (13%, N = 11); dental therapist (8%, N = 7); registered dental specialist (8%, N = 7)				–				–
How many years of experience do you have in your current occupation?	Over 30 years (40%, N = 34); 10–19 years (20%, N = 17); 6–9 years (16%, N = 14); 20–29 years (10%, N = 9); 3–5 years (7%, N = 6); <2 years (7%, N = 6)				–				–
Did you complete your highest level of education for your current occupation in Australia?	Yes (80%, N = 69); no (20%, N = 17)				–				–
I am aware of the importance of making complete and accurate oral health records	Mean Likert	Median Likert	SD	BA	Mean Likert	Median Likert	SD	BA	Two-tailed $P = 0.1209$
	6.69	7.00	0.72	100%	6.86	7.00	0.35	100%	
I have the knowledge to make complete and accurate oral health records	6.05	6.00	0.85	98%	6.54	7.00	0.92	98%	Two-tailed $P = 1.0000$
I have the confidence to make complete and accurate oral health records	6.05	6.00	0.84	98%	6.48	7.00	0.90	98%	Two-tailed $P = 0.3155$
I have the skill to make complete and accurate oral health records	6.10	6.00	0.84	99%	6.52	7.00	0.89	98%	Two-tailed $P = 0.7139$
I am motivated to learn more about how to make complete and accurate oral health records	6.50	7.00	0.72	98%	6.59	7.00	0.66	98%	Two-tailed $P = 0.6771$
I prefer learning in an online format using an ILM	5.40	6.00	1.17	78%	5.91	6.00	1.00	89%	Two-tailed $P = 0.1198$
How did you hear about this ILM?	Australian Dental Association (36%, N = 31); Other (30%, N = 26); CPDent Adelaide (22%, N = 19); Adelaide Dental School (6%, N = 5); AHPRA or Dental Board of Australia (2%, N = 2); Bite Magazine (2%, N = 2)				–				–
The examples used in the ILM aided my understanding of the educational content	–				6.43	7.00	0.75	98%	–
The ILM provided appropriate feedback for my learning	–				6.22	6.00	0.99	94%	–
The ILM was well organized	–				6.38	7.00	0.93	95%	–

AHPRA = Australian Health Practitioner Regulation Agency, BA = broad agreement, ILM = interactive learning module, N = number of participants, SD = standard deviation.

Table 5. Likert score differences between pre- and post-course survey responses for valid paired responses for statements related to awareness, knowledge, confidence, skill, motivation and online preference to learn for all groups

Question	Phase	N (BA)	Increased post-course Likert score n (%)	No change to Likert score, N (%)	Decreased post-course Likert score, N (%)	Fisher's exact test statistic (*P*)
Awareness	1 (AuSFO)	7 (100%)†‡	0 (0%)	7 (100%)	0 (0%)	1.0000
	2 (dental students)	25 (100%)†‡	10 (38%)	12 (50%)	3 (12%)	0.1482
	3 (wider dental community)	46 (100%)†‡	10 (22%)	34 (74%)	2 (4%)	0.1209
	Total	78 (100%)	20 (26%)	53 (68%)	5 (6%)	0.0305*
Knowledge	1 (AuSFO)	7 (100%†‡)	1 (14%)	6 (86%)	0 (0%)	1.0000
	2 (dental students)	26 (81%†, 100%‡)	19 (73%)	7 (27%)	0 (0%)	0.0004*
	3 (wider dental community)	46 (98%†‡)	23 (50%)	22 (48%)	1 (2%)	1.0000
	Total	79 (96%)	43 (55%)	35 (44%)	1 (1%)	0.0046*
Confidence	1 (AuSFO)	7 (100%)†‡	0 (0%)	7 (100%)	0 (0%)	1.0000
	2 (dental students)	25 (85%†, 96%‡)	20 (77%)	5 (19%)	0 (0%)	0.0001*
	3 (wider dental community)	46 (98%†‡)	24 (52%)	21 (46%)	1 (2%)	0.3155
	Total	78 (96%)	44 (57%)	33 (42%)	1 (1%)	0.0001*
Skill	1 (AuSFO)	7 (100%)†‡	0 (0%)	6 (86%)	1 (14%)	1.0000
	2 (dental students)	26 (85%†, 100%‡)	19 (73%)	6 (23%)	1 (4%)	0.0001*
	3 (wider dental community)	46 (98%†‡)	23 (50%)	22 (48%)	1 (2%)	0.7139
	Total	79 (97%)	42 (53%)	34 (43%)	3 (4%)	0.0008*
Motivation	1 (AuSFO)	7 (100%†‡)	0 (0%)	6 (86%)	1 (14%)	1.0000
	2 (dental students)	26 (92%†‡)	5 (19%)	14 (54%)	7 (27%)	0.7761
	3 (wider dental community)	44 (96%†‡)	11 (25%)	28 (64%)	5 (11%)	0.3554
	Total	77 (96%)	16 (21%)	48 (62%)	13 (17%)	0.8688
Online preference to learn	1 (AuSFO)	7 (71%†, 100%‡)	2 (29%)	5 (71%)	0 (0%)	0.4615
	2 (dental students)	26 (81%†, 69%‡)	5 (19%)	11 (42%)	10 (39%)	0.5653
	3 (wider dental community)	45 (70%†, 87%‡)	24 (53%)	21 (47%)	0 (0%)	0.0882
	Total	78 (80%)	31 (40%)	37 (47%)	10 (13%)	0.2492

* statistically significant.
† pre-course statistic.
‡ post-course statistic.
AusFo = Australian Society of Forensic Odontology Inc., BA = broad agreement, N = number of participants.

Table 6. Likert score differences between pre- and post-course survey responses for valid paired responses for statements related to awareness, knowledge, confidence, skill, motivation and online preference to learn by country of highest level of education

Question	Country of highest level of education	Paired, N (BA)	Increased post-course Likert score, N (%)	No change to Likert score, N (%)	Decreased post-course Likert score, N (%)	Fisher's exact test statistic (*P* value)
Awareness	Australia	59 (100%)†‡	17 (29)	40 (68)	2 (3)	0.0034*
	Other	18 (100%)†‡	3 (17)	12 (66)	3 (17)	1.0000
	Total	77 (100%)	20 (26)	52 (68)	5 (6)	0.0305*
Knowledge	Australia	60 (95%†, 100%‡)	33 (55)	26 (43)	1 (2)	0.0714
	Other	19 (90%†, 100%‡)	11 (58)	8 (42)	0 (0)	0.2144
	Total	79 (96%)	44 (56)	34 (43)	1 (1)	0.0046*
Confidence	Australia	59 (95%†, 97%‡)	33 (56)	25 (42)	1 (2)	0.0005*
	Other	19 (89%†, 100%‡)	11 (58)	8 (42)	0 (0)	0.0188*
	Total	78 (95%)	44 (57)	32 (42)	1 (1)	<0.0001*
Skill	Australia	60 (95%†, 98%‡)	32 (53)	25 (42)	3 (5)	0.0060*
	Other	19 (83%†, 100%‡)	10 (53)	9 (47)	0 (0)	0.1245
	Total	79 (94%)	42 (53)	34 (43)	3 (4)	0.0008*
Motivation	Australia	58 (95%†, 97%‡)	13 (22)	37 (64)	8 (14)	0.3341
	Other	19 (95%†, 100%‡)	3 (16)	11 (58)	5 (26)	0.3300
	Total	77 (97%)	16 (21)	48 (62)	13 (17)	0.8688
Online preference to learn	Australia	59 (75%†, 85%‡)	27 (46)	26 (44)	6 (10)	0.0912
	Other	19 (79%†, 74%‡)	5 (26)	11 (58)	3 (16)	0.5077
	Total	78 (78%)	32 (41)	37 (47)	9 (12)	0.2492

* statistically significant.
† pre-course statistic.
‡ post-course statistic.
BA = broad agreement, N = number of participants.

Table 7. Likert score differences between pre- and post-course survey responses for valid paired responses for statements related to awareness, knowledge, confidence, skill, motivation and online preference to learn by current occupation

Question	Current occupation	Paired n (BA)	Increased post-course Likert score, N (%)	No change to Likert score, N (%)	Decreased post-course Likert score, N (%)	Fisher's exact test statistic (*P*)
Awareness	Dental hygienist	9 (100%†‡)	2 (22)	7 (78)	0 (0)	0.5765
	Dental therapist	4 (100%†‡)	1 (25)	3 (75)	0 (0)	1.0000
	Dual qualified hygienist/therapist	8 (100%†‡)	3 (38)	5 (62)	0 (0)	0.2821
	Dentist	30 (100%†‡)	4 (13)	24 (80)	2 (7)	1.0000
	Dental specialist	2 (100%†‡)	0 (0)	2 (100)	0 (0)	1.0000
	Dental student	25 (100%†‡)	10 (38)	12 (50)	3 (12)	0.1482
	Total	78 (100%)	20 (26)	53 (68)	5 (6)	0.0305*
Knowledge	Dental hygienist	9 (100%†‡)	3 (33)	5 (56)	1 (1)	1.0000
	Dental therapist	4 (100%†‡)	2 (50)	2 (50)	0 (0)	1.0000
	Dual qualified hygienist/therapist	8 (100%†‡)	6 (75)	2 (25)	0 (0)	1.0000
	Dentist	30 (97%†‡)	12 (40)	18 ((60)	0 (0)	1.0000
	Dental specialist	2 (100%†‡)	1 (50)	1 (50)	0 (0)	1.0000
	Dental student	26 (81%†, 100%‡)	19 (73)	7 (27)	0 (0	0.0004*
	Total	79 (98%)	43 (55)	35 (44)	1 (1)	0.0046*
Confidence	Dental hygienist	9 (100%†‡)	3 (33)	5 (56)	1 (1)	1.0000
	Dental therapist	4 (100%†‡)	2 (50)	2 (50)	0 (0)	1.0000
	Dual qualified hygienist/therapist	8 (100%†‡)	5 (63)	3 (37)	0 (0)	0.4667
	Dentist	30 (97%†‡)	13 (43)	17 (57)	0 (0)	1.0000
	Dental specialist	2 (100%†‡)	1 (50)	1 (50)	0 (0)	1.0000
	Dental student	25 (84%†, 96%‡)	20 (80)	5 (20)	0 (0)	$P < 0.0001$*
	Total	78 (98%)	44 (57)	33 (42)	1 (1)	$P < 0.0001$*
Skill	Dental hygienist	9 (100%†‡)	4 (44)	4 (44)	1 (2)	1.0000
	Dental therapist	4 (100%†‡)	2 (50)	2 (50)	0 (0)	1.0000
	Dual qualified hygienist/therapist	8 (100%†‡)	4 (50%)	4 (50%)	0 (0%)	1.0000
	Dentist	30 (97%†‡)	12 (40)	17 (57)	1 (3)	1.0000
	Dental specialist	2 (100%†‡)	1 (50)	1 (50)	0 (0)	1.0000
	Dental student	26 (85%†, 92%‡)	19 (73)	6 (23)	1 (4)	$P < 0.0001$*
	Total	79 (98%)	42 (53)	34 (43)	3 (4)	0.0008*
Motivation	Dental hygienist	9 (100%†‡)	1 (11)	6 (67)	2 (22)	1.0000
	Dental therapist	4 (100%†‡)	1 (25)	3 (75)	0 (0)	1.0000
	Dual qualified hygienist/ therapist	8 (100%†‡)	2 (25)	6 (75)	0 (0)	0.5692
	Dentist	28 (93%†, 96%‡)	7 (25)	18 (64)	3 (11)	1.0000
	Dental specialist	2 (100%†‡)	0 (0)	2 (100)	0 (0)	1.0000
	Dental student	26 (92%†‡)	5 (19)	14 (54)	7 (27)	0.7761
	Total	77 (98%)	16 (21)	49 (64)	12 (15)	0.8688
Online preference to learn	Dental hygienist	9 (89%†, 100%‡)	5 (56)	4 (44)	0 (0)	1.0000
	Dental therapist	3 (33%†, 66%‡)	2 (66)	1 (33)	0 (0)	1.0000
	Dual qualified hygienist/therapist	8 (88%†‡)	3 (37)	5 (63)	0 (0)	0.5692
	Dentist	30 (70%†, 87%‡)	14 (47)	16 (53)	0 (0)	0.1954
	Dental specialist	2 (0%†, 100%‡)	2 (50)	0 (50)	0 (0)	1.0000
	Dental student	26 (81%†, 69%‡)	6 (23)	11 (42)	9 (35)	0.5653
	Total	78 (73%)	32 (41)	37 (47)	9 (12)	0.2492

* statistically significant.
† pre-course statistic.
‡ post-course statistic.
BA = broad agreement, N = number of participants.

result may also be influenced by the high degree of importance that the University of Adelaide Bachelor of Dental Surgery programme places upon self-assessment and honest recognition of areas for improvement for students. It should also be noted that there is a possible connection between knowledge, confidence and skill within the student cohort. An improved level of knowledge is commonly linked with a more confident approach to task management in a clinical setting in the third year of the Bachelor of Dental Surgery course at the University of Adelaide.

The current study revealed no statistically significant preference to learn online amongst any participants. Previous research has demonstrated that the success of education is dependent on the users having a positive attitude towards it;[28] this is particularly true for online

Table 8. Likert score differences between pre- and post-course survey responses for valid paired responses for statements related to awareness, knowledge, confidence, skill, motivation and online preference to learn by years of experience in current occupation

Question	Years of experience	Paired n (BA)	Increased post-course Likert score, N (%)	No change to Likert score, N (%)	Decreased post-course Likert score, N (%)	Fisher's exact test statistic (*P*)
Awareness	Over 30 years	22 (100%†‡)	3 (14)	19 (86)	0 (0)	0.7205
	20–29 years	6 (100%†‡)	2 (33)	4 (67)	0 (0)	0.5455
	10–19 years	12 (100%†‡)	2 (17)	9 (75)	1 (8)	1.0000
	6–9 years	8 (100%†‡)	2 (25)	5 (63)	1 (12)	1.0000
	3–5 years	26 (100%†‡)	10 (38)	13 (50)	3 (12)	0.1534
	< 2 years	4 (100%†‡)	1 (25)	3 (75)	0 (0)	1.0000
	Total	78 (100%)	20 (26)	53 (68)	5 (6)	0.0305*
Knowledge	Over 30 years	22 (95%†‡)	10 (45)	12 (55)	0 (0)	1.0000
	20–29 years	6 (100%†‡)	4 (67)	3 (33)	0 (0)	1.0000
	10–19 years	12 (100%†‡)	3 (25)	9 (75)	0 (0)	1.0000
	6–9 years	8 (100%†‡)	3 (38)	4 (50)	1 (12)	1.0000
	3–5 years	27 (81%†, 100%‡)	19 (70)	8 (30)	0 (0)	0.0004*
	<2 years	4 (100%†‡)	3 (75)	1 (25)	0 (0)	1.0000
	Total	79 (98%)	43 (55)	35 (44)	1 (1)	0.0046*
Confidence	Over 30 years	22 (95%†‡)	11 (50)	11 (50)	0 (0)	1.0000
	20–29 years	6 (100%†‡)	3 (50)	3 (50)	0 (0)	1.0000
	10–19 years	12 (100%†‡)	3 (25)	9 (75)	0 (0)	1.0000
	6–9 years	8 (100%†‡)	4 (50)	3 (38)	1 (12)	1.0000
	3–5 years	26 (85%†, 96%‡)	21 (81)	5 (19)	0 (0)	< 0.0001*
	< 2 years	4 (100%†‡)	2 (50)	2 (50)	0 (0)	1.0000
	Total	78 (98%)	44 (57)	33 (42)	1 (1)	< 0.0001*
Skill	Over 30 years	22 (100%†‡)	10 (45)	12 (55)	0 (0)	1.0000
	20–29 years	6 (100%†‡)	3 (50)	3 (50)	0 (0)	1.0000
	10–19 years	12 (100%†‡)	3 (25)	8 (67)	1 (8)	1.0000
	6–9 years	8 (100%†‡)	4 (50)	3 (38)	1 (12)	1.0000
	3–5 years	27 (85%†, 100%‡)	20 (74)	6 (22)	1 (4)	<0.0001*
	< 2 years	4 (100%†‡)	2 (50)	2 (50)	0 (0)	1.0000
	Total	79 (99%)	42 (53)	34 (43)	3 (4)	0.0008*
Motivation	Over 30 years	22 (91%†, 95%‡)	4 (18)	17 (77)	1 (5)	1.0000
	20–29 years	6 (100%†‡)	2 (33)	3 (50)	1 (17)	0.5455
	10–19 years	11 (100%†‡)	1 (9)	8 (73)	2 (18)	1.0000
	6–9 years	7 (100%†‡)	4 (57)	1 (14)	2 (29)	1.0000
	3–5 years	27 (93%†‡)	5 (18)	15 (56)	7 (26)	0.7822
	< 2 years	4 (100%†‡)	0 (0)	4 (100)	0 (0)	1.0000
	Total	77 (98%)	16 (21)	48 (62)	13 (17)	0.8688
Online preference to learn	Over 30 years	21 (71%†, 81%‡)	11 (52)	10 (48)	0 (0)	0.0616
	20–29 years	6 (67%†, 83%‡)	2 (33)	4 (67)	0 (0)	1.0000
	10–19 years	12 (75%†, 92%‡)	7 (58)	5 (42)	0 (0)	1.0000
	6–9 years	8 (100%†‡)	4 (50)	4 (50)	0 (0)	1.0000
	3–5 years	27 (78%†, 70%‡)	7 (26)	11 (41)	9 (33)	0.4121
	< 2 years	4 (100%†‡)	1 (25)	3 (75)	0 (0)	1.0000
	Total	78 (73%)	32 (41)	37 (47)	9 (12)	0.2492

* statistically significant.
† pre-course statistic.
‡ post-course statistic.
BA = broad agreement, N = number of participants.

learning.[33] There is little available published data for dental professionals that can be compared with the current data. Brumini *et al.* demonstrated that the preference for dental students to learn online is influenced by many factors: environment, motivation, personal attitudes towards alternate methods of learning, level of computer skills and perceived usefulness; more positive attitudes are related to previous positive e-learning experiences.[34] They also found that a higher age bracket of participants is associated with a more positive attitude towards online learning. In this current study, most dental students were young (~20 years of age) and our results demonstrated that participants were more likely to favour this style of learning if they were an Australian-educated dentist with 30 years or more of experience; they might have had greater previous experience with online learning and viewed the potential educational value more favourably than younger participants before they even commenced the ILM. It is interesting to note that other available literature regarding dental student online preference to learn shows mixed results;[35–37] most agree that students who are enrolled in courses that are more 'hands-on' or clinical seem to prefer an integrated learning approach, namely face-to-face and e-learning in combination. It is possible that a combined approach with the current learning package might have improved participant outcomes.

APPENDIX IX - MANUSCRIPTS

The average paired survey response rate of 15.9% for all three phases of the current study was lower than we would have liked but given previously published data this might have been expected. In 2006, researchers in Belgium reported an 8% response rate to their online survey.[38] In 2013, researchers showed that mail survey mode was more effective than online methodologies in improving response rates.[39] More recently in 2016, Adelaide School of Dentistry researchers reported a 3.9% response rate via a link to an online survey software tool (with an option for hard copy provision that no participants requested), despite employing measures to improve the participation in the survey.[15] Despite this, many survey-based research projects have moved to online formats in the recent past, partly in an attempt to increase survey access to participants.[40–42] This online format could be seen as particularly palatable to younger cohorts of participants (such as students in the third year of the Bachelor of Dental Surgery programme, or the more recent graduates in the wider dental community cohort), as they are generally more favourable to any type of electronic media. The moderate levels of participation from this group was also likely the result of the ILM content being assessable in their pre-clinical written examination, namely students were driven by assessment outcomes to participate with the ILM and surveys. Overall, dissemination of the ILM was problematic due to the lack of available group forums. It was particularly difficult to get professional groups to agree to use their mailing lists to publicize the ILM, even though some specifically indicated that the subject matter was likely to be relevant to their members. Effectively, professional groups seemed (understandably) protective about being seen to endorse material that might be seen as 'spam' by their members, or indeed be otherwise taken to be an abuse of members' personal information. As such, whilst we eventually made the ILM available, our target audience was not as large as we would have liked.

As previously stated, CPD in dentistry has been judged by participants to have a positive effect on learning and understanding.[41] However, issues regarding extrapolation of perception changes to actual changes (Kirkpatrick's level three, practitioner behaviour; and Kirkpatrick's level four, health care outcomes) remain real. Consider the following: a dentist who participated in training and improved behaviours in direct relation to what had been learned, thus improving patient outcomes, would be seen at the optimal level of training effectiveness. However, in the case of this research, the definition of 'improving patient outcomes' would actually be whether or not the patient case notes were improved such that a forensic odontologist could reach an expedited identification. To be able to accurately determine this, a researcher would need to demonstrate a difference between the usefulness of case notes recorded for a singular individual by a single practitioner both before and after training (i.e. it is simply not physically possible to do so). It may be more reasonable to expect to demonstrate some improvement in record keeping for a group of individuals over time. However, this would need a large group of non-anonymous dental practitioners to participate in a review of their case notes over a long period of time and then to have a large number of their patients actually require identification by dental means following their death; a very unlikely scenario. The situation does, however, warrant further improvement in record-keeping practises and evaluation of improvements in this direction.

CONCLUSIONS

Without doubt, Australian oral health recording practises are not currently optimal, especially for use in forensic identification. A number of areas for improvement in these practises have been previously statistically identified. This study has produced a learning module with the potential for use as a CPD tool to improve case note recording practises (with a view to improving forensic identification outcomes).

We have demonstrated that the online ILM was well received by our focus groups (Kirkpatrick level one). Additionally, a significant degree of perceived learning (Kirkpatrick level two) occurred regarding the subject matter for participants with fewer years of work experience. This most likely equates to an improved appreciation of clinical and legal record-keeping requirements. Whilst it is difficult to measure the outcomes of continued practitioner education in this area, an improved understanding of requirements can in no way be a poor outcome for patients and society alike.

DISCLOSURE

The authors have no conflict of interest to declare.

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