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Harmonization & Standardization of European Dental Schools' Programs of Continuing Professional Development for Graduate Dentists

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Workpackage 3.2b Literature/Internet Search

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Finding and selecting sources for the review

A literature (papers and reports) and internet search was carried out on the topic of CPD activity for dentists in Europe.

The Literature Search

Search strategy

As well as searching for papers in the science, medical and nursing databases (1-5), further databases were searched in order to capture educational aspects (6-7), any potentially relevant social sciences and psychology papers (8-10) and an academic literature search engine (11).

1. Web of Science
2. OVID Medline
3. EMBASE
4. CINAHL
5. SCOPUS (Life Sciences, Health Sciences, Physical Sciences and Social Sciences & Humanities)
6. ERIC (post 1996)
7. British Education Index (BEI)
8. ISI Web of Knowledge
9. ASSIA (post 1987)
10. PsychInfo
11. Google Scholar

All of these databases (1-11) were searched using the “keywords”:

- Dentists/dentistry/dental/dent* AND CPD
- Dentists/dentistry/dental AND CPD AND Europe
- Dental AND education
- Continuing AND dental AND education
- Dental AND education AND Europe
- Continuing AND dental AND education AND Europe

This search was complemented by one conducted by colleagues in Finland who searched using the following databases of academic papers (2) and systematic reviews (12-14):

2. OVID Medline
12. EBM Reviews - ACP Journal Club (1991 to December 2010)

13. EBM Reviews – Cochrane Database of Systematic Reviews (2005 to December 2010)
14. EBM Reviews - Database of Abstracts of Reviews of Effects (1st Quarter 2011)

Using the search terms:

- Education, Dental, Continuing/Legislation & Jurisprudence, Standards (8)
- Dentist* AND continuing education (12-14)

From these searches, the UK team initially identified 4,140 references and the Finland team found 195. Reference lists of relevant papers (see Inclusion Criteria below) were read and further potentially relevant papers were noted. Additional papers known to the DentCPD research team were also included.

The Internet search

In order to expand our results and ensure access to the most up-to-date CPD regulations and guidelines, an internet search was also carried out. Although Google is a popular search engine, different engines work in slightly different ways potentially retrieving different WebPages so a wider search was needed (1-5).

1. Google
2. Yahoo
3. Alta Vista
4. Bing
5. Dogpile

The same search terms as used by the UK team were employed, as well as additional searches substituting specific European country names instead of “Europe”.

A search of these five search engines highlighted 68 relevant European country specific sites, seven sites providing an overview of European information and one site listing worldwide dental organisations. The information was collated in a table which provides detail on CPD requirements by country. (Appendix 1)

Inclusion criteria

Of the total 4335 references (from the searches in the UK and in Finland), 2546 were duplicates leaving a total of 1789 potentially relevant papers. The references were exported to EndNote X3 (a software tool for managing bibliographies) where the titles and abstracts, if available, of each reference were scanned for relevance or further investigation.

Papers addressing specialties or focused on CPD for dental care professionals (DCPs) rather than general dentistry were excluded together with those centred on undergraduate education, vocational training or assessment rather than continuing education. Papers published before 1990 and those advertising courses or events were also excluded. References selected for review included:

1. general papers on dental CPD (16)
2. opinion papers on dental CPD (3)
3. papers on dental CPD in Europe (13)
4. papers on attitudes and perceived CPD needs (14)
5. comparisons of different state/countries' CPD requirements for dentists (2)
6. papers of CPD participation by dentists (23)
7. papers on effect of CPD on dental practice (13)
8. papers on dental CPD delivery methods (28)

Papers were categorised by EB (UK) and TKS (FL). The total number of references judged to be relevant was 118 (minus duplicates). A further twenty six papers were gathered from citations and from personal collections. Of these 103 were read in full, abstracts only were available for 9 and 32 could not be accessed either online or through an interlibrary loan (see figure in Appendix 2). Of the papers read, 80 were empirical containing original data, eight were reports, seven were literature reviews, five were opinion pieces and twelve were topic summaries (see table in Appendix 3 for a full breakdown).

During the internet search, WebPages included for review were any European Dental organisation websites or pages that outlined national CPD guidelines for provision for any European country. WebPages were excluded if they were solely promoting available CPD courses, dental practices or for cosmetic dentistry only.

Review of the literature

The review begins by setting out definitions of CPD and providing a justification for its importance and by implication, the value of this review. In the context of the wider purpose of the DentCPD project, the next section focuses on the importance of harmonisation. This is followed by a consideration of factors associated with CPD uptake and barriers. The range of CPD modes or delivery methods is then reviewed. We follow this by presenting an overview of what is known about CPD effectiveness in dentistry and its relationship to impact-on-practice. The section on topics reviews the limited literature currently available on common CPD content. The report ends with a summary of main points.

Introduction

What is CPD?

Education for dentists now extends throughout everyday clinical practice as continuing professional development (CPD) (Scott 2003). The Continuing Education Recognition Program (CERP) of the American Dental Association (2010a, p. 28), for example, define CPD as:

“educational activities designed to review existing concepts and techniques, to convey information beyond basic dental education and to update knowledge on advances in dental and medical sciences”.

The United Kingdom Department of Health states that CPD is:

‘lifelong learning for all individuals and teams which meets the needs of patients and delivers the health outcomes and healthcare priorities ... and which enables professionals to expand and fulfil their potential’

(Department of Health 1998, p43)

The European Commission defined it as:

‘a career-long process required by dentists to maintain, update, and broaden their attitudes, knowledge, and skills in a way that will bring the greatest benefit to their patients’

(European Commission 1996, as cited in Tseveenjav et al 2003, p130)

These definitions draw attention to the career long importance of CPD and its primary value for patient care. Best et al (2005b) argue that attitudes towards lifelong learning should be developed during undergraduate dental training along with the ability to identify and

pursue one's own educational needs (Polyzois et al. 2010). Bottenberg (2004) also points to the importance of reflection and suggests that, in addition to clinical skills, CPD should contain components of "personal reflection". Grace (2001) argues that CPD should meet individual needs, include an evaluation component, and result in positive changes in the individual taking part. Bullock et al (2010) note that not only is the need to update clinical skills and integrate new developments into patient care accepted as part of professional practice but it is also increasingly related to perceived fitness to practice and continued registration.

CPD has been classified into two categories (Buck and Newton 2002; Tredwin et al. 2005): "verifiable" and "general" (non-verifiable) CPD. "Verifiable" CPD has concise educational aims and objectives, clear anticipated outcomes, and identified quality control mechanisms. "General" or "non-verifiable" CPD includes activities such as independent study of professional literature, multimedia learning, staff training, and background research.

Why CPD is important

Patients' oral health needs are becoming more complex and dentists have to manage an increasingly wide range of health issues (Low and Kalkwarf 1996). Patterns in oral health are changing (Office for National Statistics 1998), along with higher patient expectations and increased dental awareness of the public (Eaton et al. 2000; Burke et al. 2005) and social priorities (Sanz et al. 2008). Dental practitioners must keep up to date with these changes as well as advances in knowledge resulting from dental research (Kittipibul and Godfrey 1997; Schleyer et al. 2002; Chan et al. 2006). As a consequence, practitioners need to develop a wider knowledge base than that which can be provided in undergraduate training alone (Mossey 2004; Christensen 2007; Sanz et al. 2008).

The possibility that practitioners who are providing care for the public may deskill if they do not maintain and update the skills, knowledge and understanding could be a very powerful motivation for governments to promote mandatory CPD requirements for dentists (Best et al. 2005b). As the public gain increasing access to oral healthcare information through the internet, the need for evidence of CPD may become more pressing (Schleyer et al. 2002). Writers contend that lifelong learning as a defined continuum of education should be verified through an ethos of 'cradle-to-grave quality assurance' of dentists' CPD activity, a professional responsibility of the practitioner and an on-going commitment necessary for them to continue to be registered to practice (Svec 1993; Wilson 2000; Mathewson and Rudkin 2008).

The benefits of CPD are not only those related to practice; there may be reduced costs to the healthcare system through research and development into improved techniques and more effective preventive treatment (Belfield et al. 2001). An enhanced sense of professionalism and improved job satisfaction for the dentist may also arise from the mastery of new techniques and responsibilities (Firmstone et al. 2010) which may help to attract and retain skilled dentists within the profession (Belfield et al. 2001).

Europe and Harmonisation

The shortage of skills within Europe is being addressed by the mobilisation of workers, facilitated by a series of European Directives, not least in relation to governance of the professions, including dentistry which needed to address the lack of uniformity in training (Scott 1999). The movement of dentists within Europe has contributed to the globalisation of oral health care systems (Schleyer et al. 2002). This globalisation is forcing a review of dental education systems in Europe (Hobson 2009).

All European Member States must recognise the profession of the dental practitioner and practitioners must hold a specific qualification (Advisory Committee on the Training of Dental Practitioners to the European Commission 1997). However, owing to differences in dental education provision, patients are likely to be subject to different standards of oral health care, depending on where they live, or travel to, within the EU (Shanley et al. 2002). For example, the VT/Foundation program where graduates spend a year in a supervised vocational programme is specific to the UK (Scott 1999). Therefore it is important to review the training of dentists to ensure they graduate with comparable levels of skill/knowledge (van den Heuvel and Plasschaert 2005) but without seeking to limit it to one curricular and educational approach.

The ADEE have, through the DentEd projects, been very active in this arena (Plasschaert et al. 2006; Jones et al. 2007; Plasschaert et al. 2007; Cowpe et al. 2010). Seven key domains, within an overarching profile, underpinned by major and supporting competences have been identified (See Figure 1) (Cowpe et al. 2010) and a system of visitations by multinational teams has been encouraged to provide a more European perspective to the quality assurance of undergraduate education (Scott 1999).

Figure 1: The seven key domains for undergraduate education

Seven domains that may apply in differing ways to patients of all ages, including children, adolescents, adults and the elderly within a given population –

- I. Professionalism*
- II. Interpersonal, Communication and Social Skills*
- III. Knowledge Base, Information and Information Literacy*
- IV. Clinical Information Gathering*
- V. Diagnosis and Treatment Planning*
- VI. Therapy: Establishing and Maintaining Oral Health*
- VII. Prevention and Health Promotion*

CPD harmonization

CPD systems in Europe vary between countries, with each member state being responsible for its own dental educational content and CPD requirements. Different histories and cultures of dental education have led to varying CPD rules and requirements (Allen 1994; Bottenberg 2004; Best et al. 2005b). Best et al (2005b) reviewed CPD activity in six countries- England, Latvia, Netherlands, Denmark, Norway, Sweden- and confirmed such variation. They argue for knowledge exchange and sharing of ideas (to which this DentCPD project is an obvious contribution).

The movement of dentists around Europe would be facilitated by a recognised core education available to all European dentists although as (Blinkhorn et al. 2005) highlight, allowing for cultural diversity at the same time. Harmonization of CPD, just as with undergraduate training, should also allow diversity and innovation (Blinkhorn et al. 2005). Promoting consistency in approach to training programmes argues Scott (2003) should ultimately lead to a convergence of high standards of the delivery of patient care.

Mandatory CPD creates challenges, not least for the quality assurance of courses and programmes (Blinkhorn et al. 2005; Hopcraft et al. 2010) as well as the need for international recognition of activities (Best et al. 2005b). Prior to any Europe-wide agreement on CPD, targeted CPD for migrating dentists, rather than a system based on free choice, may be a useful interim mechanism for achieving harmonisation (Bullock et al. 2002; Best et al. 2005a).

Who decides?

There is a general worldwide trend towards mandatory CPD (Eaton et al. 2000; Schleyer et al. 2002; Best and Messer 2003), which is deemed desirable and reasonable (Blinkhorn et al. 2005; Mersel 2007; Hopcraft et al. 2010), for dentists (and other members of the dental team). The trend is for mandatory CPD to be associated with relicensure.

In some countries there is currently a great deal of freedom for dentists to choose their own CPD topics with the choice being left to their own judgement. In many countries there is no official control of the topics studied or in the way in which they are regulated. Mersel (2007) states that in countries where private dentistry is strong practitioners have a moral and ethical duty to fulfil their CPD requirements but free scope to choose which topics to cover. Other European countries have some obligatory control over CPD with certification or accreditation a necessary part of the system. Often, these CPD programmes are administered by law but according to Mersel (2007), who looked at responses from 31 European countries, in only 3 countries was CPD administered by the Government.

Amount of CPD

Table 1: Studies reporting amount of CPD undertaken by dental practitioners

Authors, date	Country	Main method, numbers	Context, subjects	Key findings
Walmsley and Frame (1990)	UK	Audit, 1700 GDPs	Data collected from records held by West Midlands Regional Postgraduate Dental Education Committee on attendance at courses	41% attended at least one course during previous academic year. Age variation, reduced uptake among older practitioners.
Buckley and Crowley (1993)	Ireland	Audit, 146 dentists	Sample of dentists participating in CDE in the South and Mid-West regions of Ireland	Low level of involvement in some modes of CPD.
Allen et al (1994)	Worldwide	Questionnaire 24 returns	26 selected national dental associations	10 countries reported hands-on courses were taken by <10% of dentists, 4 countries reported 20-40%.
Johnson, Johnson et al (1996)	UK	Questionnaire 200 returns	Practitioners attending day courses	74% attended at least 5 courses over the preceding 2 years.
Kuthy, Bean et al (1996)	USA	Audit 507 returns	Dentists on Ohio register	Mean of 10 courses (56 CPD hours), mode 6, max 37. This related to a mean of 56 CPD hours over the previous two years.
Vlitos et al (1996)	USA	Audit of 507 GDPs	Dentists on Ohio register and data from American Dental Directory	At least 25% took at least one home study course. Slightly more than 5% took all required CPD hours via home study courses.
Baldwin et al (1998)	UK	Questionnaire 183 responses	2 cohorts – 1 qualified just before mandatory DVT and 1 qualifying	98% attended a mean of 5.6 sessions in the previous year. 15% attended none. No differences by

			just after its introduction from the Scottish Dental School in 1991 and 1994	year of graduation or gender.
Buckley and Gloster (1998)	Ireland	Questionnaire, 90 responses	Sample of dentists on the Irish Dental Council register in the South West region	92% attended at least one course and more than 65% had attended more than three courses.
Mercer, Long et al (1998)	UK	Questionnaire 307 returns	GDPs taking part in clinical audit in Yorkshire	In previous year: 82% attended ≥ 1 State funded course; 50% ≥ 1 private course. 13% attended zero. 20% involved in study groups.
Ireland et al (1999)	UK	Questionnaire 514 returns	Dentists on Health Authority lists in two regions	In the previous year: 99% attended one postgraduate session, 89% attended ≥ 2 , 53% attended ≥ 4 .
Kuthy et al (1999)	USA	Audit 507 returns	Dentists on Ohio register	Mean of 10 courses taken over the previous two years. 42% took at least one course provided by a dental school and 67% took at least one from a local dental society.
Al Fouzan (2000)	Saudi Arabia	Questionnaire 298 returns	GDPs in eight urban cities within Kingdom of Saudi Arabia	Within the previous two years 46% attended only one or two courses.
McGimpsey et al (2000)	Northern Ireland	Questionnaire, no n given	Sample of Northern Ireland GDPs	90% of respondents fulfilled contractual requirement by attending at least two courses annually. 60% attend 5+ events a year.
Wiskott, Borgis et al (2000)	Switzerland	Audit of records, questionnaire (unclear - 40-60% of 1300)	Geneva	Only 20% of the required course hours were undertaken.
Best and Messer (2001)	Australia	Questionnaire 396 returns. Review of records	Dental practitioners in Victoria	52% belonged to a study group; 67% subscribed to \geq journal; 89% regularly discussed work with colleagues; 99% assessed their own work but 13% did not attend CPD courses and 18% did not complete any courses within the previous year.
Buck and Newton (2002)	Ireland	Questionnaire 379 returns	Dentists on GDC register	~50% attended 5+ days in the previous year. 87% read journals once per month.
Tseveenjav, Vehkalahti et al (2003)	Mongolia	Questionnaire 245 returns	Dentists in the capital city	In last 2 years 38% undertook some form of CPD.
Firmstone, Bullock et al (2004)	UK	Questionnaire 2082 returns	GDPs in 3 English Deaneries	97% \geq one 2½ hour course; 43% 15+ hours in the previous year.
Burke, Wilson et al (2005)	UK	Questionnaire 701 returns	GDPs in Scotland and North West England	In previous year: 41% 5+ courses; 27% 3-4; 27% 1-2; 5% zero.
Chang, Ng et al (2006)	Hong Kong	Questionnaire 514 returns	Dentists attending 26th Asia Pacific Dental Congress	96% intended to attend CPD courses within next 5 years.
Kossioni, Tzoutzas et al (2007b)	Greece	Questionnaire 21 returns	Greek Dental Associations (DAs)	18 DAs had organised CPD courses in previous 3 years. Attendance was 21-50% (11 DAs), 70% (3 DAs).
Nieri and Mauro (2008)	Italy	123 telephone interviews	Dental practitioners in Prato	In previous year: mean 2 courses, consulted 31 books, 53 journal papers (mainly national), accessed internet information 16 times, 44 consultations with colleagues.

Hopcraft et al (2010)	Australia	Questionnaire 552 returns	Dentists on register	During 2007 more than half of respondents attended 20+ hours of CPD. 93% attended a course, 85% read journals, 68% discussed practice with colleagues and 68% attended a conference. Only 5% took part in distance learning, 8% clinical audit and self-assessment (16%).
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A number of studies have been conducted which have looked at the amount of CPD undertaken by dental practitioners (Table 1). In the UK, Johnson et al (1996) issued questionnaires to practitioners who attended day courses delivered by the Department of Conservative Dentistry. They found that 74% of the respondents had attended at least 5 courses over the preceding 2 years. Opinions were divided on the question of making CPD compulsory (should be compulsory 30%; remain voluntary 41%).

Kuthy et al (1996) carried out an audit of dentists in Ohio, USA. They found that dentists took a mean number of ten courses, with a mode of six and a high of thirty seven. This related to a mean of 56 CPD hours over the previous two years.

Walmsley and Frame (1990) carried out an audit of course attendance and found that out of 1700 on records held by West Midlands Regional Postgraduate Dental Education Committee (WMRPDEC) GDPs, 41% of dentists attended at least one course during the previous academic year.

Mercer et al (1998) surveyed general dental practitioners in Yorkshire, UK, who were taking part in clinical audit activity. Sixty seven percent were members of a national or local professional association and twenty percent were actively involved in study groups. Eighty two percent had attended at least one State funded course and 50% at least one private course in the previous academic year. Only 13% had not attended any courses.

Ireland et al (1999) sent questionnaire to randomly selected dentists on the Health Authority lists in two regions of the UK. They found that within the previous year 99% of respondents reported attending a postgraduate session, 89% attended two or more and 53% attended four or more.

Kuthy and Mitchell (1999) audited the records of 507 dentists on the Ohio, USA state dental register and found that a mean of 10 courses, with a mean total of 56 CPD hours, were taken over the previous two years. Forty two percent took one or more course provided by a local dental school and 67% took at least one from a local dental society.

Al Fouzan (2000) analysed 298 questionnaires from general dental practitioners in eight urban cities within the Kingdom of Saudi Arabia and found that 46% of respondents reported attending only one or two courses within the previous two years.

Best and Messer (2001) issued a questionnaire and reviewed the records of dental practitioners in Victoria, Australia. They found that 52% of respondents were actively involved in a study group, 67% subscribed to one or more journals, 89% regularly discussed with colleagues, 99% assessed their own work. However, 13% did not attend any CPD courses and 18% did not complete any courses within the previous year.

Tseveenjav et al (2003) sent a questionnaire to all Mongolian dentists practising in the capital city, Mongolia, with the aim of exploring attendance and the self-perceived need for CPD, which was at that time not compulsory. They found that 38% of the dentists reported undertaking some form of CPD within the previous two years. Chang et al (2006) surveyed dentists attending the 26th Asia Pacific Dental Congress held in Hong Kong. Ninety six percent of respondents indicated that they intended to take CPD courses within the next five years.

Two studies explored CPD activity in Ireland. Buckley and Crowley (1993) found a general low level of involvement in courses and scientific conferences, while 41% of respondents belonged to one or more dental association and 55% subscribed to more than one journal. While Buckley and Gloster's (1998) survey found that 92% of respondents reported attending at least one course and 65% had attended three or more.

Firmstone et al (2004) surveyed three English Deaneries and found that 97% of respondents reported attending at least one 2½ hour study session, while 43% had attended more than 15 hours in the previous year. Burke, Wilson et al (2005) received 701 questionnaires from dentists in Scotland and North West England. Five percent of respondents said they had not attended any courses in the previous calendar year, while 27% attended one or two courses, 27% attended three or four courses, and 41% attended five or more courses. Buck and Newton (2002) surveyed dentists registered on the Dentist's Register in the UK and found that around half had attended 5 days or more CPD activities in the previous year. Eighty seven percent reported reading professional journals at least once a month.

Kossioni et al (2007b) sent questionnaires to the 52 Greek Dental Associations and received responses from 21. They found that, of the 18 Associations that had organised CPD courses within the previous three years, the attendance rate ranged from <30% (one association) to >70% (three associations).

Hopcraft et al (2008) surveyed dentists in Victoria, Australia and found that during 2004 90% attended at least one CPD course, with 17% completing 6-10 hours and 16% completing 16-20 hours of CPD.

Nieri and Mauro (2008) conducted telephone interviews with dentists who were members of the Order of Dental Practitioners of the Province of Prato, Italy. They found that within the previous year, the members had attended a mean of two courses, consulted thirty one books, accessed the internet for information sixteen times and had forty four consultations with colleagues. They also consulted forty one Italian journal articles but only twelve international articles. They concluded that most dentists sought CPD in a fairly passive way and favoured national journals over international ones, potentially limiting access to up to date information.

Even in countries with structured CPD systems uptake may still fall short of the recommended requirements. In Geneva, it was found that only 20% of the required course hours were undertaken (Wiskott et al. 2000). However, when McGimpsey et al (2000) surveyed Northern Ireland GDPs they found that 90% of respondents reported fulfilling their requirement by attending at least two courses each year, with 60% attending at least five a year.

This brief review of studies looking at the amount of CPD undertaken by dentists shows that uptake varies considerably. To understand more about the reasons for such variation we turn to consider work that has been done on the factors facilitating and impeding CPD uptake.

Factors Associated with CPD Uptake

Table 2: Studies reporting factors relating to CPD uptake

Authors, date	Country	Main method, numbers	Context, subjects	Key findings
Bean (1995)	USA	Audit of 507 GDPs and data from American Dental	Dentists on Ohio register	Mean age of those undertaking CPD was 46.9 years, graduating 20.2 years ago. 73% claimed to work more than 30

		Directory		hours a week.
Mouatt et al (1991)	UK	Questionnaire 1670 returns	Dentists on English register	Least likely to attend courses: age < 30 and > 50.
Young and Rudney (1991)	USA	Questionnaire 357 returns	Sample of practising dentists within a six state regions of the upper Midwest	Cost and distance were less important factors than the quality of the courses.
Buckley and Crowley (1993)	Ireland	Audit 146 dentists	Sample of dentists participating in CDE in the South and Mid-West regions of Ireland	Dentists belonging to a number of organisations and subscribing to various journals also tended to be the most frequent attendees at relevant courses, conferences and meetings. With some exceptions, specialists and hospital-based dentists were more likely to be involved in CPD activities.
Kuthy et al (1996)	USA	Audit 507 returns	Dentists on Ohio register	Curvilinear relationship between age and CPD.
Baldwin et al (1998)	UK	Questionnaire 183 responses	2 cohorts – 1 qualified just before mandatory DVT and 1 qualifying just after its introduction from the Scottish Dental School in 1991 and 1994	The number of sessions attended was significantly associated with feelings of competence.
Ireland et al (1999)	UK	Questionnaire 514 returns	Dentists on Health Authority lists in two regions	Travelling up to 30 miles for a one off session was acceptable to 27%.
Newton et al (2000)	UK	Questionnaire 1798 returns	Dentists on GDC register	Least likely to attend courses: female.
Ralph et al (2001)	UK	Questionnaires 154 returns	Dental graduates of University of Leeds	Completing a postgraduate vocational year had little impact on later amount of CPD activity.
Best and Messer (2001)	Australia	Questionnaire 396 returns, review of records	Dental practitioners in Victoria	Most likely to attend courses: Association members and mid-career dentists.
Belfield et al (2001)	UK	Discussion paper	n/a	Two main types of costs of CPD: (a) provision costs and (b) opportunity cost of professionals' time.
Buck and Newton (2002)	Ireland	Questionnaire 1550 returns	Dentists on GDC register	Reading journals: those qualified longest were least likely to read professional journals.
Leggate and Russell (2002)	UK	Questionnaire	General dental practices in Scotland	Views on CPD benefits: skill enhancement (those with further qualification); career prospects (those <30 years of age).
Bullock, Firmstone et al (2003)	UK	Questionnaire 2082 returns	GDPs in 3 English Deaneries	More likely to complete recommended amount of CPD: postgraduate qualification; part-time related work (e.g. tutor). Least likely: longer in practice; single-handed.
Tseveenjav, Vehkalahti et al (2003)	Mongolia	Questionnaire 245 returns	Dentists practising in the capital city	Perceived need for CPD: less clinical experience, working in general practice, having a postgraduate degree and other CPD attendance during the time period.
Firmstone, Bullock et al	UK	Questionnaire 2082 returns	All GDPs in 3 English Deaneries	Four main constraints on participation: cost; personal and staff issues; time and restraints

(2004)				owing to regulating body.
Christensen (2004)	USA	Opinion article	Effectiveness of different forms of CPD	Dentists tend not to attend CPD courses for the first few years after education.
Best et al 2005a (2005a)	Australia	Questionnaire, n undisclosed	Members of key dental organisations in 17 countries.	Costs of CPD involve not only the direct cost of courses and other activities but also indirect costs such as travelling and accommodation expenses and loss of earnings.
John and Parashos (2007)	Australia	Questionnaire 108 responses	Practitioners attending day courses	Only dentists without a postgraduate qualification tend not to attend CPD courses for the first few years after education.
Kossioni, Tzoutzas et al (2007b)	Greece	Questionnaire 21 returns	Greek Dental Associations (DAs)	More likely to attend courses: <40 year of age.
Abbot, Burgess et al (2010)	Australia	Audit	Data collected from University Continuing Dental Education Committee (UCDEC)	Curvilinear relationship between age and CPD.
Polyzois, Claffey et al (2010)	Ireland	Questionnaire 235 returns	12 cohorts of dentists who had qualified in Dublin	Less CPD undertaken by those with child(ren). More CPD: working full-time. General practitioners less likely to attend conferences than specialists. Those in rural areas found accessing CPD harder.

With regard to those participating in CPD, female dentists (Newton et al. 2000) and those under the age of 30 and over 50 (Mouatt et al. 1991) have been found to be those least likely to attend courses while the length of time since qualification was relative to a dentists' likelihood of reading professional journals (Buck and Newton 2002). Buckley and Crowley found that (1993) dentists who belonged to more than one dental organisation and who subscribed to a variety of journals were more likely to attend courses, conferences and meetings.

Bullock et al (2003) from their survey of three English Deaneries observed that 43% of their sample did not undertake their recommended amount of CPD per year. Those with a postgraduate qualification and those who carried out part-time related work (e.g. part-time tutor) were twice as likely to have completed the recommended hours while those who had been in practice longer or were a single-handed practitioners were the least likely.

Leggate and Russell (2002) issued a postal questionnaire to all general dental practices in Scotland. They found that CPD was undertaken by almost 95% of practising dentists over the age of thirty. In the <30 age-group, 11% reported undertaking no CPD but this was explained by their participation in a vocational training year during which they

received at least 180 verifiable CPD hours. Amongst the cohort with further qualifications, most saw the benefits in terms of skill enhancement, while the majority of those less than 30 years of age stated career prospects as a benefit.

Christensen (2004) stated that new dentists tend not to attend CPD courses for the first few years after education. John and Parashos (2007) found that this was only true for practitioners without a postgraduate qualification. Recent graduates felt that their undergraduate education dictated their practice: they tended to use the internet more frequently for information and relied on the guidance of colleagues on new materials or techniques whereas dentists with a postgraduate qualification tended to wait for independent evaluations of new materials and techniques and attended CPD to update their clinical skills. Mouatt et al (1991) found that general dental practitioners under 30 years of age and over 50 took part in the least amount of courses in the preceding year (75% and 73% respectively). Eighty two percent of 30-39 age group and 85% of the 40-49 year olds had taken courses. Bean et al (1995) found that the average age of those undertaking regular CPD in Ohio was 46.9 years of age. Kuthy et al (1996) also found a curvilinear relationship between age and CPD and suggested that more recent graduates may not participate beyond what is required owing to the recency of their education, the costs involved in building a clinical practice while managing educational debts and home costs. Older dentists may only seek out activities which fulfil a perceived clinical need, such as new techniques or materials, or one that provides an opportunity for an increased income. A similar age effect was noted by Walmsley and Frame in the UK (1990) and by Best and Messer (2001) and Abbot, Burgess et al (2010) in Australia.

In contrast, a study by Kossioni et al (2007b) found that among Greek dentists, those under 40 years of age participated in more CPD than those older. Tseveenjav et al (2003) also found that shorter period of clinical experience was a factor relating to perceived need for CPD as well as working in general practice, having a postgraduate degree and other CPD attendance during the time period. Ireland et al (1999) found no significant relationship between the age and number of sessions attended but they did note that dentists under 45 were more likely to attend a programme leading to a certificate whereas younger dentists were more likely to want to undertake a postgraduate degree.

Best et al (2005b) suggested that attitudes to practice and CPD needs are formed during a dentist's undergraduate training. However, Polyzois et al (2010) studying 12 cohorts of dentists who had qualified from Dublin Dental School and Hospital over an eleven year period, during which time three different types of curriculum had been in use, found that the

undergraduate curriculum type had little or no effect on their attitude to CPD. Baldwin et al (1998) and Ralph et al (2001) surveyed dentists in the UK and found little difference in the patterns of CPD activity undertaken by dentists who had completed a postgraduate vocational training year and similarly aged local dentists who had not. Professional and demographic variables appeared to have more effect. For example, having a child negatively affected the amount of time dedicated to CPD and those working full-time dedicated more time (a finding supported by Bean et al (1995)). General practitioners were less likely to attend conferences than specialists and those working in rural areas experienced a general disadvantage in accessing CPD.

Some studies have looked at reasons for attending courses or engaging in other forms of CPD (Table 3).

Table 3: Studies reporting reasons for choosing CPD activity

Authors, date	Country	Main method, numbers	Context, subjects	Key findings
Patterson and Thompson (1990)	Canada	Questionnaire 650 returns	Dentists practising in Alberta and Atlantic Canada	Most important factors in decision making: course content (91%), identity of the speaker (72%) and location/travel time of venue (39%).
Johnson, Johnson et al (1996)	UK	Questionnaire 200 returns	Practitioners attending day courses	Influenced by, title and content of the courses as advertised, personal recommendation of a colleague, geographic location.
Vlitos et al (1996)	UK	Questionnaire 16 returns	Pre, post and six months post-programme assessment of dentists attending a yearlong restorative techniques course.	Choice influenced by desire to improve skills (100%), to learn new skills (94%), build confidence (100%) and work under expert supervision (88%). Also break from routine (63%) and contact with other GPs (75%) were important.
Renehan (1998)	Ireland	Questionnaire 657 returns	Dentists on Irish register	Choice related to improving skills and knowledge associated with work.
Ireland et al (1999)	UK	Questionnaire 514 returns	Dentists on Health Authority lists in two regions	The cost was not as important a factor as the quality of the course.
Johnson (2000)	USA	Questionnaire 8 returns	Practitioners attending alumni day	Delivery method least important factor in decision making.
Best and Messer (2001)	Australia	Questionnaire 396 returns, review of records	Dental practitioners in Victoria	Topics of the course and the identity of the tutor were most important factors.
Leggate and Russell (2002)	UK	Questionnaire	General dental practices in Scotland	Views on CPD benefits: skill enhancement (those with further qualification); career prospects (those <30 years of age)
Firmstone, Bullock et al (2004)	UK	Questionnaire 2082 returns	GDPs in 3 English Deaneries	Selection of CPD on basis of a review of learning need was rare. More commonly choice was convenience-led plus consideration of other factors (e.g. new developments, colleagues'

				suggestions, and views on quality).
Sutton et al (2005)	UK	Questionnaire 75 returns	GDPs working in Merseyside area,	99% attended CPD courses out of interest in a particular dental discipline and only one because of a personal learning need.
John and Parashos (2007)	Australia	Questionnaire 108 returns	Practitioners attending day courses	Choice influenced by course presenters.
Hopcraft, Marks et al (2008)	Australia	Questionnaire 451 returns	Dentists on Victoria, Australia register	54% chose courses to improve knowledge; 27% to fulfil CPD requirements; 11% to learn new skills; 3% for personal satisfaction; 2% to mix with colleagues; 1% to increase patient numbers.
Hopcraft et al (2010)	Australia	Questionnaire 552 returns	Dentists on Victoria, Australia Register	Selection factors included: the topic (94%), the identity of the speaker (66%), the day of the week it was held (57%) and travel time (54%).
Redwood, Winning et al (2010)	Australia	Summary paper	The role of self-assessment in CPD	Choice influenced by who are course presenters.

Newton (1993, p. 9) suggested that the essential elements of the CPD process include:

- *“An objective analysis of the professional development needs of individual practitioners.*
- *The considered selection of activities likely to meet these needs*
- *The undertaking of the selected activities*
- *An objective assessment of the outcomes of the activities in terms of improved professional competence.”*

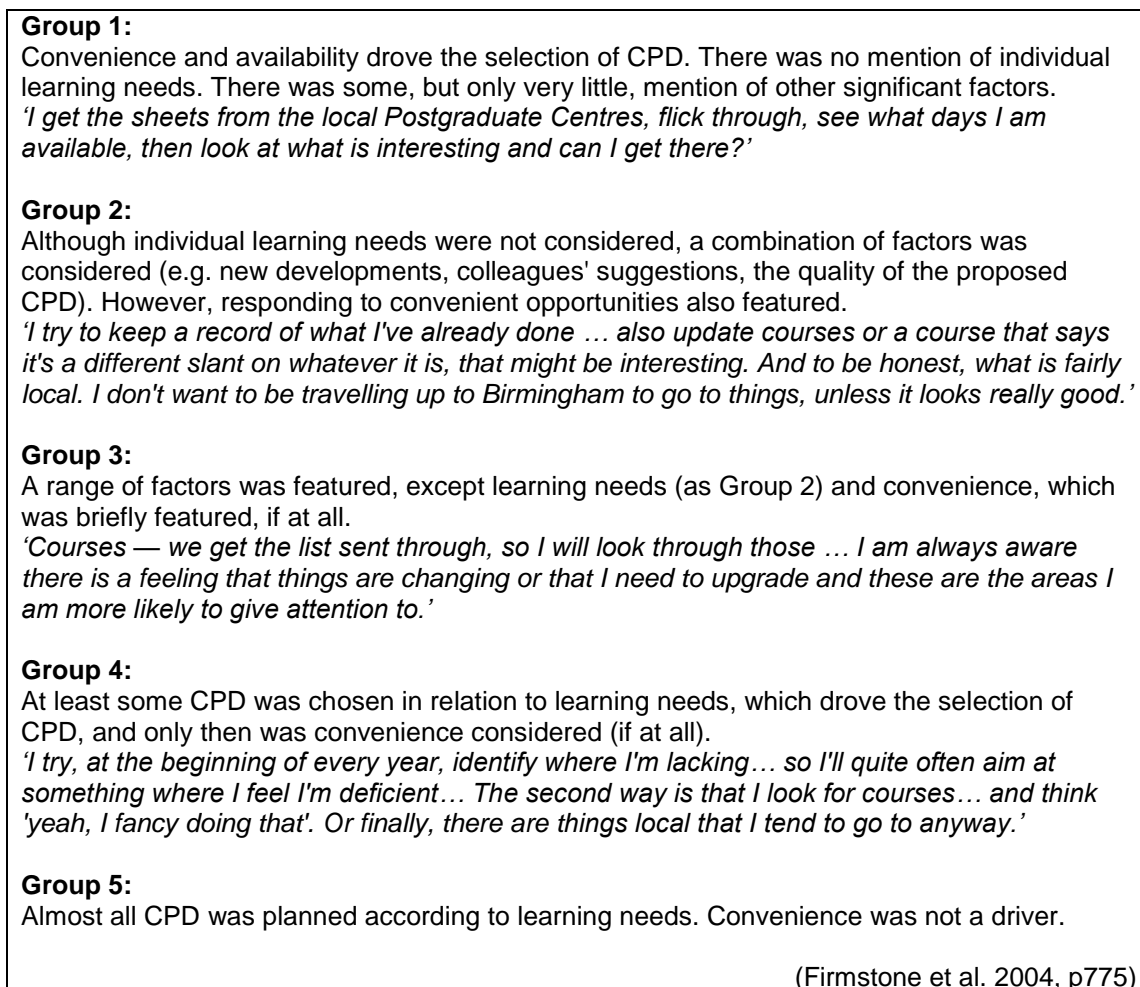
The decision to attend or not attend a CPD course can be based on several factors. Vlitos et al (1996) found that participants reported the desire to improve current skills (100%), to learn new skills (94%), to build confidence (100%) and the chance to work under expert supervision (88%) as reasons for choosing courses. Hopcraft et al. (2010) found that 58% of their participants chose their courses to improve their knowledge, 21% to fulfil CPD requirements, 10% to learn new skills, 5% for personal satisfaction and 4% for the opportunity to mix with colleagues. Renehan (1998) surveyed dentists in Ireland and found that the dentists’ choice of topic was related to the type of work that was carried out in practice in order to improve their skills and knowledge. In China, where CPD is a relatively new concept, participation is mainly considered as a means towards promotion or achieving a higher professional title (Wu et al. 2010).

The literature suggests that generally participants are likely to attend courses in areas in which they are interested (Patterson and Thompson 1990; Best and Messer 2001), are already competent or like and less likely to attend courses in areas in which they were

weak, if in fact they were aware of any weakness in their practice or clinical knowledge (John and Parashos 2007; Hopcraft et al. 2008; Hopcraft et al. 2010; Redwood et al. 2010).

Two key selection criteria were suggested by Firmstone et al. (2004) namely, convenience and learning needs, although the authors found that selecting CPD on the basis of a review of learning need was rarely used (Figure 2). The background of the course presenters had also been found to be a factor in course attendance decision making (Patterson and Thompson 1990; Best and Messer 2001; John and Parashos 2007; Hopcraft et al. 2008; Redwood et al. 2010), the location of the venue and the practicality of work or home commitments are also considered (Patterson and Thompson 1990; Mouatt et al. 1991; Johnson et al. 1996; Johnson 2000; Best and Messer 2001; Hopcraft et al. 2008). Johnson (2000) found that the delivery methods of the activity was the least important factor in decision making.

Figure 2: A framework for categorising CPD selection



As well as a perceived lack of relevance of the topic (Hopcraft et al. 2008), other suggested barriers to CPD activity are heavy clinical commitments and reluctance to pay the cost of CPD for little perceived benefit (Leggate and Russell 2002). According to Belfield et al (2001) if the costs outweigh the benefits of taking part then practitioners will not, and should not take part in CPD activities. Provision costs and the professional's time may restrict the practitioners' willingness to participate in CPD (Mouatt et al. 1991; Belfield et al. 2001; Firmstone et al. 2004; Best et al. 2005a; Hopcraft et al. 2008). When CPD is a mandatory requirement, registration costs or fees become a more important factor in decisions (Patterson and Thompson 1990). Costs may not be solely financial, such as travel expenses and loss of earning, but issues such as resistance from other staff may present a barrier to CPD engagement (Firmstone et al. 2004) or domestic commitments (Mouatt et al. 1991). Other studies have found that for some CPD is perceived as something that should be an 'entitlement' rather than an 'investment' that needs to be accommodated or an encroachment on everyday practice (Parboosingh 2000). Conversely, some studies have found that costs and distance were less important factors than the quality of the courses (Young and Rudney 1991; Ireland et al. 1999)

A number of empirical studies have explored factors related to CPD uptake; the factors that recur include: the age of the practitioner and time since graduation, the costs of taking part, work and home commitments, whether the practitioner holds any postgraduate qualifications and the practitioner's perceived learning needs. A key dimension related to the selection of CPD is whether choice of CPD activity is needs-driven or convenience- and/or interest-led. Mandatory systems with obligatory core topics will, of course, place limits on freedom of choice.

Delivery Methods

Several papers focused on how CPD should be delivered. In general, six major methods of learning were reported to be commonly used (Wiskott et al. 2000; Best et al. 2005a; Christensen 2007):

- Hands-on courses;
- Organised seminars;
- Lecture courses;
- Reading journals or books;
- E-learning/internet usage
- Distance learning;

- Peer review/clinical audit.

A GDC report surveyed dentists' opinions shortly after the introduction of mandatory CPD in the UK and found respondents considered reading journals (93%), lectures (89%), and hands-on courses (88%) to be effective methods of verifiable CPD. Less commonly engaged in were peer review (62%), audit (54%) and websites offering dental education (39%) (Anonymous 2001). Ireland et al (1999) found that respondents identified a combination of part lecture/part hands-on learning as their preferred method of learning (63%), followed by lectures (43%) and hands-on courses (37%). Vaughan (1992) found that respondents wanted courses to focus on, in order, theory, clinical demonstration, practical work and the laboratory work. Kossioni et al (2010), in Greece found that respondents preferred hands-on courses (73%), followed by lectures (53%) and seminars (53%) and few preferred internet courses (1%) (Kossioni et al. 2010). Chan et al (2006) in Hong Kong found that respondents preferred formal lectures (82%), with self-learning approaches such as distance learning (29%) and Internet courses (29%) also mentioned. Bullock et al (2003) found that the most frequently undertaken forms of CPD within their UK sample were journal reading (98%) and attending courses (97%) while the least frequently undertaken were clinical audit (11%) and distance learning (9%). Regular discussion with colleagues was also reported as a common form of learning. In their Irish sample, Buckley and Gloster (1998) reported that CPD was typically delivered via lectures/seminars (85%) and practical hands-on courses (15%). Johnson, Johnson et al (1996) in the UK reported that their respondents favoured courses that couple didactic teaching methods with a hands-on practical element. This was supported by Abbott et al's (2010) finding that half of the courses taken by their participants in Western Australia were presented as lecture courses or seminars with the remainder incorporating practical and clinical components. However, when Woolfolk et al (1991) presented participants with a choice of CPD formats 42% selected distance learning methods while only 17% chose traditional formal lecture courses.

Lectures and seminars

Lectures refer to the delivery method where the presenter makes a presentation, oral, visual or both, to a group of students and the audience merely observes it. They are acknowledged as a useful method for disseminating information as well as providing an opportunity to meet up with colleagues (Johnson et al. 1996; Leggate and Russell 2002). Firmstone et al (2004) found that 73% of respondents rated the impact of course attendance (which may also have included hands-on courses) at least 4 out of 5, higher than any of the other 14 activities listed in their survey.

Lectures are a relatively inexpensive and efficient way of delivering education to large numbers of students but it has been questioned whether simply attending a lecture will help advance the dentist's knowledge (Leggate and Russell 2002; Bottenberg 2004). When they sought feedback about a lecture series, Wiskott et al (2000) found that the style of teaching or presenting information was important. They believed that a lecture should not be presented like a conference presentation but neither should it be taught in a style similar to that used with undergraduate students.

Seminars are group sessions which may involve question and answer sessions, group discussion and breakout groups. Seminars require the dentist to take a more active part in the session, the interaction between tutors and the audience, and among the group itself, can aid learning but relies somewhat on the skills of the facilitator, otherwise sessions can seem time-consuming, ineffective and frustrating (Christensen 2004).

Hands-on courses

It has been stated that the best learning environment for practical skills is the environment in which that skill will be practised (Mossey 2004). Hands-on learning introduces skills that the student can put into practice immediately after the session and allows the dental team to specialise in different areas thereby supporting colleagues who are specialised in other areas (Belfield et al. 2001; Christensen 2004). Allen et al (1994) highlighted the fact that dentistry is a clinical science and the skilled completion of procedures is essential to practice. This may explain Young and Rudney's (1991) finding that dentists with less practice experience favoured in-depth participatory methods such as hands-on learning.

While the opportunity for learning is high, so may the costs incurred be also high. Practicing procedures on 'live' patients means recruiting volunteers and possibly payment of transport costs as well as time lost from 'no-show' patients. Simulated clinical environments minimise this problem but working on simulators loses some of the benefits of working on real patients such as the loss of the observable outcomes of making mistakes on real patients versus mistakes on simulators. The small group sizes, necessary for this delivery method, also means a higher number of instructors per-student than in other modalities (Christensen 2004). Bullock et al (2000) found that hands-on courses that included practical tips and information were well received by dentists, with one participant commenting 'dentists are practical people who want practical courses'.

Journals

Professional dental journals are a source of information with high potential value to practitioners (Christensen 2004). The array of journals available, the range of topics covered within them, the frequent repetition of subjects or papers by the same authors in different journals and a lack of interest in, or relevance to, their practice, of some topics means that their impact can be lessened without careful review of the available materials (Christensen 2004). It is not surprising then that, as Tredwin et al (2005) observed, this is rarely dentists' only form of CPD. For example, in their study they found that 88% of respondents also reported attending postgraduate courses.

Peer review/clinical audit

Self-assessment and clinical audit relate to both knowledge acquisition, maintaining that knowledge and ensuring the practitioner is meeting the standards required by any professional bodies. These methods are not just ways of identifying gaps in knowledge but should involve monitoring and reflection on clinical practice (Redwood et al. 2010). Whereas peer review may end with the identification of educational need or the implementation of change, clinical audit is a continual process where the practitioner revisits the areas of need to ensure an improvement in practice (Bullock et al. 2000).

E-Learning

As quickly as dental technology has changed in recent years, so has information communication technology. Such advances in technology have brought flexibility to educational delivery while retaining the personal touch missing in some other distance-learning techniques. Distance learning is often interchangeable now with terms such as online learning, e-learning and flexible learning (Reynolds et al. 2008).

The internet is now a well accepted source of information for both practitioners and patients (Alexander et al. 2008; Eaton and Reynolds 2008) and e-learning is now a common method of distance learning (Eaton and Hammick 2003). In studies, participants have requested greater access to IT based courses (Bullock et al. 2003), particularly younger dentists (Leggate and Russell 2002). In 2000 Kuthy et al found that at least 25% of the dentists they audited had taken part in distance learning courses and just over 5% achieved all their required CPD hours via this method (Kuthy et al. 2000) .

E-learning avoids the limitations incurred by the time spent out of the practice or home travelling to and attending courses, instead allowing geographically diverse professionals the opportunity to learn in an interactive environment (Anneroth 1994; Johnson 2000; Clark 2003; Reynolds et al. 2008). The ability to search and research information via

the internet overcomes one of the major limitations of traditional distance learning (Reynolds et al. 2008). Such ease of access was thought to encourage a 'democratisation' of knowledge by Schonwetter et al (2010). However, a noted potential limitation of both distance and E-learning is their limited potential for teaching clinical skills (Anneroth 1994).

Schleyer et al (1999) examined 157 online dental CPD courses and found that four distinct types of presentation were typically used. Many used a book or brochure style which included a combination of text and images. Other courses consisted of a slide show of information, sometimes with text annotations. Another type was the case report which would outline a chief complaint or preliminary findings, diagnostic documentation, treatment plan and treatment. The final type outlined was that of a newsletter or report which consisted of a number of short articles on different topics.

Schleyer and Pham (1999), detected 157 dental CPD courses available online. These were provided by 32 providers, of which 31% were provided by universities and 37.5% provided by companies. At that time courses could be hard to search for as there was no consistency in the terms used by the sites and most web pages did not state which dental boards would accept the accreditation. A traditional method of searching for CPD courses is through provider or association directories and some may not list online courses (Johnson 2002). Websites can also remain online, unchanged, for many years until the information is out of date and if it doesn't clearly declare when it was created or last updated, students may be relying on inaccurate information (Schleyer and Pham 1999; Christensen 2004). In 2003, Clark found more than 300 courses for dentists available online and concluded that there was no reason to believe that there would not be a continued rise in the use of e-learning (Clark 2003), particularly with the popularity of emerging mobile technologies such as tablets and smartphones (Reynolds et al. 2008).

Eaton and Hammick outlined a series of best practice guidelines for distance learning materials (Figure 3). Johnson (2002) highlighted some pedagogical issues around e-learning such as appropriate use of the computer, appropriateness of the methodology, lesson length and mastery levels, ensuring that best use is made of the technology and not simply recreating what is already available in books on a computer screen. For example, taking this to its most basic level, out of the 157 courses Schleyer et al (1999) examined, 84% reinforced text with relevant images but only three courses (2%) used video clips. Johnson emphasises the interactional possibilities of e-learning, where ideally software should adapt

to the learner's skills and knowledge level, allowing the user to control the pace, which would aid learning and increase motivation.

Figure 3: Recommendations for distance learning programmes

In general, the content should:	Specifically, good learning materials will have:	High quality materials will have:	Activities, assignments and assessment should:
<ul style="list-style-type: none"> • Be coherent, clear and consistent, i.e. easy to follow • Fit in with any wider programme it may be a part of • Develop thinking and learning skills, taking into account prior skills, and knowledge • Enable participants to reflect on new knowledge and skills in terms of their own professional experience. • Encourage participants to implement what they have learnt, i.e. improve practice 	<ul style="list-style-type: none"> • A statement about their target audience, e.g. post-graduate general dentists • A short introduction with an overview of the content and an estimated overall time that should be spent on the learning • Well-structured content matched to the learning outcomes (or aims and objectives), including activities and reference to further readings and other sources • Plans for updating the learning materials to ensure they remain relevant 	<ul style="list-style-type: none"> • Be written simply and clearly, with definitions of new terminology • Be presented in short, manageable chunks • Have content (text) interspersed with activities • Include suggestions for further reading and opportunities for reflection • Avoid sexist or other discriminatory language, and unnecessary jargon 	<ul style="list-style-type: none"> • Be achievable and realistic, without using too many resources • Generate interest and enthusiasm • Relate to the learning outcomes (or aims and objectives) • Support reflection on new knowledge and skills provide an indication of how long they will take • Be followed by some commentary • Present different types of problems or questions and require various modes of response • Be clearly linked to any award given on completion of the programme

(Eaton and Hammick 2003, p. 254)

Francis et al (2000), developed two online dental CPD courses which were piloted by dental professionals from four North Carolina Area Health Education Centres in the United States. Each module incorporated interactive components, including a pre and post-module test. Most participants felt that their knowledge of the topic had increased as a result of completing the modules and this was supported by a significant increase in post-test scores. Most participants felt that completing the course online was acceptable and convenient but technical and formatting issues were experienced by some participants. The authors concluded that e-learning offered providers a flexible and effective method of CPD delivery with participants' interest and their ability to use the internet being the only potential limitation. The increased reliance on the self-discipline of the student with this delivery method was also noted by Eaton and Reynolds (2008).

Three separate studies have evaluated videoconferencing as a method of e-learning. The studies each delivered a CPD course through a series of videoconferences held in London, UK (Odell et al. 2001), throughout the south east of England (Eaton et al. 2001) and

Kentucky, USA (Smith et al. 1998). The sessions were evaluated by post-session questionnaires. Of Odell et al's (2001) forty one sessions only one was thought to have 'failed', for technical reasons and overall feedback was positive. Both students and teachers rated the sessions as convenient due to the lack of travel necessary for some face-to-face sessions (Smith et al. 1998; Eaton et al. 2001). The teachers felt that preparation time was similar to that of face-to-face sessions (Odell et al. 2001) and students reported that the experience was sometimes not that different from traditional classroom sessions (Smith et al. 1998) and allowed interaction with experts in their field (Smith et al. 1998; Eaton et al. 2001). However, the lack of human contact with students was a negative factor for some teachers and lead some to note that it was sometimes hard to 'read' the audience (Smith et al. 1998) and that they sometimes appeared passive in the sessions (Odell et al. 2001) and reluctant to ask questions (Eaton et al. 2001).

"In general, evidence shows that no approach for transferring evidence to practice is superior to all changes in all situations." (Best et al. 2005a)

CPD Effectiveness and Impact-on-Practice

As well as maintaining regular CPD activities, it is important, perhaps more so in mandatory systems, that CPD is effective (Tredwin et al. 2005; Best et al. 2005a; Firmstone et al. 2010). Effective CPD is that which enables the participants to gain new knowledge and/or skills. CPD can be said to have had impact where an improvement in practice can be seen to have resulted from the new knowledge or skills – i.e. that the effective CPD has been applied by the practitioner to their work (Hopcraft et al. 2010). Baldwin et al (1998) found that feelings of competence were significantly positively associated with the number of CPD sessions their participants attended. We note that CPD may be effective but not impact-on-practice in the case where new learning is acquired but not applied to practice.

The effectiveness and impact of CPD is difficult to evaluate. Many CPD programmes do not assess learning gain, for example through pre and post-testing (Low and Kalkwarf 1996) and changes may not occur immediately post-learning but emerge some time after participation, after reflection, or emerge in a way that is difficult to quantify (Best and Messer 2003). Therefore it is unsurprising that there is relatively little literature on CPD effectiveness or the impact of CPD on practice.

Absi et al (2006; Absi et al. 2009) published two studies exploring the pre and post-course scores achieved over a series of one-day radiation protection courses. Multiple

choice questionnaires were issued before and immediately post-course and the studies found that participants showed a mean improvement of 30% (2006) and 29% (2009). The percentage of participants who achieved the minimum standard pass mark improved by 55% and 54%. The authors noted that this improvement in scores does not however measure competency and clinical performance.

O'Flynn et al (1998) asked attendants of courses 'Will you apply what you learned to your practice?' and found that 44% would apply what they learned, 41% would apply it a little and 12% would apply what they had learned later on. Cohen et al (1996) measured changes in clinical performance immediately and six months after taking part in a one-day AIDS awareness course in the USA. At six months they found that the rates of dentists using gloves with all patients had increased from a baseline of 98.1% to 100%, using masks with all patients from 84.6% to 92.4% and using protective eyewear with all patients from 87.5% to 94.3%. There was also an increase in the number of practitioners planning to be immunized against hepatitis b and an increase in perceptions of patients at risk for AIDS.

Mercer et al (1998) asked general dental practitioners to identify what activities or courses that they had taken part in within the previous three years had impacted on the way that they practiced. Over three quarters of respondents reported a change in techniques, materials and or methods of treatment. Eighty percent claimed that participation in courses had caused the change, followed by journals (9%) and peer review activity (7%).

Bullock et al (1999) sent out questionnaires to participants attending three short courses at UK Dental Schools, one large lecture course, one small hands-on course and one medium sized course. Ninety-three percent of respondents felt that the small hands-on course and the large lecture course had improved their understanding. When asked whether it had changed their practice, 64% of the large lecture course attendees indicated that it had, compared with the small hands-on course and the medium sized course (25% and 29% respectively). Courses were also found to be effective in changing knowledge by Maidment (2006), when he surveyed dentists in Scotland. Courses and reading journals were both seen as better for changing knowledge whilst other methods of CPD delivery were considered better at changing practice. In their study Woolfolk et al (1991) found that while respondents who selected lectures as their chosen delivery method for a CPD course on fissures and sealants showed the greatest increase in follow-up measures they also had the lowest baseline scores compared to those who chose distance learning or no CPD (highest baseline scores).

Paterson et al (1991) trialled 'Trends', an illustrated guidebook on the diagnosis and management of fissure caries, and found that between 28 and 44% of respondents reported changes in various aspects of their practice of treating the condition. Tredwin et al (2005) observed that as well as increasing knowledge, more than two-thirds of their respondents felt that an element of their clinical practice had changed as a result of taking part in a British Dental Journal CPD initiative.

John and Parashos (2007), surveyed the effectiveness of CPD programs in endodontics and implant dentistry, using questionnaires on three occasions, pre-, post - course and delayed – three months later. Significant numbers of participants felt that their practice had changed. However, this could have been related to the fact that the participants were motivated to undertake the CPD activities as they were not mandatory courses, were topics of interest to them and were perceived to be opportunities for them to improve their clinical skills.

As previously discussed, dentists frequently select CPD on an ad hoc basis (Bullock et al. 2007) and are more likely to attend courses on topics that they are already interested in (Hopcraft et al. 2010) but it has been observed that the impact on practice is greater when CPD targets a dentist's learning needs (Bullock et al. 2003). Bullock et al (2007) investigated the use of personal development plans (PDPs) with UK dentists and found that those who used the process had a clearer view of their CPD needs with regard to current practice needs and future career direction. Best and Messer (2003) also found quality improvement interventions (comprising of a self-assessment manual alongside relevant references and individual performance scores) showed significantly higher scores when compared to controls. However, authors also note even if little or no new learning occurs, then CPD activity can still perform a valuable role in reinforcing current practice, although a balance between reassurance and updating practice needs to be maintained (Firmstone et al. 2004).

Even when practitioners attend CPD and learn new clinical skills there can be additional barriers to implementing the changes in everyday practice. Issues such as the availability of materials and resources or support of colleagues in their practice can affect implementation (Bullock et al. 2010). Additionally, not all CPD may be relevant to the dentists' daily practice. Vlitos et al (1996) evaluated participants pre, immediately post and 6 months after completing a course. They found that the topics that were rated to have the least impact on practice were also those which were seen to have the lowest relevance to their practice. Facilitators of change included perceived financial benefit, regular patient attendance, particularly a compliant core patient group, staff loyalty, open communication and access to peer support (Watt et al. 2004).

Many more dentists are undertaking CPD activities than there are students in undergraduate dental education and yet little if any research, relating to CPD for graduate dentists has been undertaken (Best et al. 2005b). In addition, there is little evidence, within the literature of the value of CPD, let alone exploring the educational cost-benefits of dental CPD (Belfield et al. 2001). It should be remembered that the costs of CPD activities include not only direct costs of the course and related issues but the indirect costs of the participants in terms of travel, subsistence, accommodation and loss of earnings (Best et al. 2005a). Harden and Laidlaw (1992) developed the CRISIS system as a proposed method to aid evaluation of CPD programmes (see Figure 4).

Figure 4: CRISIS system developed at the University of Dundee

Crisis C: convenience. In theory, a CE programme should be designed so as to make participation as easy as possible. Location and time are major criteria under this heading.

cRisis R: relevance. University staff and practising dentists usually differ in their views as to the relevance of a topic. The natural tendency of academics is to construct courses by first discussing basic science issues, to then draw clinical implications and finally (if time permits) to present some technical aspects. The order of priority of practising dentists is exactly the opposite in that practical skills come first since those are the ones that are perceived as having the most direct implication on generating income.

crisis I: Stimulating potential participant *interest* is the ideal motivator. In this respect, we may have to change our approach in that CE may not be the mere extension of a university knowledge base to the practicing community, but a business-type of interaction which would be defined in terms of benefit to customers rather than adding teaching structures to academic institutions.

criSis S: Self- and course-evaluation. Course evaluation and feed-back from the audience has been stressed throughout. The purpose here was two-fold: (i) seek ways to improve future courses and (ii) (when the comment was really aggressive) defuse the participant's animosity towards the CE programme as a whole.

crisis I: stands for Individualisation. In this respect, our performance is poor and probably will stay scanty since no plans exist to cater to the individual needs of each participant. The dentists will still have to adapt to the programme and not the opposite.

crisiS S: Systematic. This is probably our greatest asset. Participants are encouraged to follow the courses in a logical sequence, since most build on previous knowledge and the courses offered give each practitioner the opportunity to update her/his knowledge over a period of approximately 5 years.

Harden and Laidlaw (1992) as cited in Wiskott et al (2000)

Core Topics

Comfort and Hobdell (2007) point out that topics for CPD activities should be planned with the both the current professional needs and interests of the expected audience in mind. Patterson and Thompson (1990) suggest that frequent needs assessments would assist programme planners in providing courses which would be of interest to practitioners and lessen the emphasis of other factors in decision making such as cost, location or loss of income. Absi et al (2006) point out that while some topics may not be attractive to practitioners, course content should contain what the profession *needs* rather than what is popular. However, Bullock and Firmstone (2010) as cited in Firmstone et al (2010) urged caution against being over prescriptive beyond the inclusion of core topics to avoid undermining their professionalism and de-motivating practitioners.

Wiskott et al (2000), point out that unlike undergraduate students, CPD course attendees come with a wide variety of clinical backgrounds, experience and subjective learning needs. They found that dentists wanted courses that either updated or reinforced existing knowledge and ones that introduced information on new materials and techniques. They suggested that certain core topics, such as diagnostic sciences, oral medicine and surgery should be taken before other modules in order to enhance learning across the cohort.

There is a relative dearth of information on the essential subject areas for dentists' CPD (for a summary of recommended topics see Table 4). Mouatt et al (1991) found that their participants wanted more information on practice management, hands-on training, computer use, restorative techniques, preventative treatment and oral surgery. Wiskott et al (2000) reported that their participants requested more courses on risk assessment in medically compromised patients, communication with attending physicians, medical emergencies and formal courses on topics such as otolaryngology, pharmacology, haemostasis and antibiotics. Chan et al (2006) found that participants requested CPD in oral Implantology, cosmetic dentistry and root canal therapy.

In a survey of Australian dentists CPD attendance, Hopcraft et al (2008) found that the most commonly attended courses were in restorative dentistry (54.5%), implants (45.8%) and aesthetic/cosmetic dentistry (45.3%) while less than 10% attended courses in dental public health, cariology, radiology and less than 5% attended behavioural management, oral health promotion, anaesthesia or dental traumatology courses. When practitioners were

asked what areas they required more CPD they identified implantology (38.9%), endodontics (38.9%) and aesthetic/cosmetic dentistry (36.6%).

Shanley et al. (2002), claimed that most dental mistakes are made because of inadequate cross-infection control, incorrect use of ionising radiation, failure to recognise the early signs of serious diseases such as cancer and incorrect management of a medically compromised patient for whom dental treatment has serious systemic implications. Therefore, they suggested CPD should focus on reinforcing these specific issues. When Wright and Franklin (2007) carried out a Significant Event Analysis workshop to explore the events that practitioners recalled as ones where they felt that they were not adequately equipped to cope with they found that the events tended to fall into three main themes: incidents involving clinical treatment, incidents involving the running of the practice and those related to the relationships between members of the team, and members of the team and patients. Walker et al (2003) found their respondents identified gaps in their specialised clinical skill knowledge but relatively few reported gaps in general clinical skills, communicating with patients, acute care of dental patients or continuing care of dental patients.

In a paper cited in Mersel (2007), Mersel (2005) stated that the most important disciplines for CPD are Periodontics, Prosthodontics, Conservative dentistry, Implants and Endodontics. Christensen (2007) discussed how, in his experience, practice management, practical occlusion concepts, aesthetic dentistry, implant prosthodontics and implant surgery, orthodontics, diagnosis and treatment planning should be core topics, as he felt that they were not covered in enough detail during undergraduate training. Oral and maxillofacial radiology and surgery were also considered important, but prosthodontics, endodontics, operative dentistry, paediatric dentistry and periodontics were considered to be of less importance.

Ireland et al (1999) found that the most frequently requested topics included restorative dentistry (46%), endodontics and orthodontics (18%), oral surgery (13%) and Periodontology (10%). Additional subject such as practice managements, dental implants, prosthetics, sedation and oral medicine were also requested.

Young and Rudney's (1991) respondents indicated that they would like to receive training in orthodontics (18%), periodontics (15%), new areas of dentistry such as implants (15%) and new restorative materials (12%) and practice administration (12%). The top three learning needs that Al Fouzan's (2000) sample of Saudi Arabian dentists reported were

dental and medical emergencies (77%), implants (76%) and early mixed dentition treatment (74%). The least attractive continuing education learning needs were related to amalgam restorations and tooth preparation (40%), impression procedures (40%), and periodontal instrumentation (40%).

Three studies have explored CPD needs in the UK. In a survey of Scottish GDPs Davis and Pitts (1994) found that the top three most requested topics were conservative dentistry (42%), Periodontology (18%) and orthodontics (8%). A Merseyside, England survey found that respondents felt that they had a good knowledge of restorative techniques, periodontics, endodontics, paediatric dentistry and dental radiography but wanted more training in implant dentistry, oral surgery, orthodontics, dental sedation techniques, endodontics and periodontics(Sutton et al. 2005). In a Northern Ireland based survey McGimpsey et al (2000) found dentists wanted knowledge of new techniques, to improve their oral cancer diagnosis skills and cross infection control.

Table 4: Summary of requested CPD topics

Topic identified	Studies
Oral Implantology	Young and Rudney 1991; Ireland et al 1991; Al Fouzan 2000; Sutton et al 2005; Chan et al 2006; Christensen 2007; Mersel 2007; Hopcraft et al 2008.
Practice management	Mouatt et al 1991; Young and Rudney 1991; Ireland et al 1999; Christensen 2007; Wright and Franklin 2007.
Orthodontics	Young and Rudney 1991; Davis and Pitts 1994; Ireland et al 1999; Christensen 2007; Mersel 2007
Periodontics	Young and Rudney 1991; Davis and Pitts 1994; Ireland et al 1999; Sutton et al 2005; Mersel 2007
Endodontics	Ireland et al 1999; Sutton et al 2005; Mersel 2007; Hopcraft et al 2008
Cosmetic/aesthetic dentistry	Chan et al 2006; Christensen 2007; Hopcraft et al 2008
Diagnosis/illness detection	McGimpsey et al 2000; Shanley et al 2002; Christensen 2007
Oral surgery	Mouatt et al 1991; Ireland et al 1999; Sutton et al 2005
Radiology	Shanley et al 2002; Christensen 2007; Mersel 2007
Restorative techniques	Mouatt et al 1991; Ireland et al 1999; Hopcraft et al 2008
Conservative techniques	Davis and Pitts 1994; Mersel 2007
Cross infection	McGimpsey et al 2000; Shanley et al 2002

Medically compromised patients	Wiskott et al 2000; Shanley et al 2002
Medical emergencies	Al Fouzan 2000, Wiskott et al 2000
Prosthodontics	Ireland et al 1999; Mersel 2007
Sedation	Ireland et al 1999; Sutton et al 2005
Communication with attending physicians	Wiskott et al 2000
Computer use	Mouatt et al 1991
Early mixed dentition treatment	Al Fouzan 2000
Hands-on training	Mouatt et al 1991
New materials	Young and Rudney 1991
Occlusion	Christensen 2007
Preventative treatment	Mouatt et al 1991
Root canal therapy	Chan et al 2006

Summary

Key competences required of the new dental graduate and a European perspective on the quality assurance of undergraduate education has been established (Cowpe et al. 2010). In the context of changing patterns of oral health needs (Office for National Statistics 1998), an increasingly wide range of health issues (Low and Kalkwarf 1996) and higher patient expectations (Eaton et al. 2000; Burke et al. 2005; Sanz et al. 2008), practitioners need to develop a wider knowledge base than that which can be provided in undergraduate training alone (Schleyer et al. 2002; Mossey 2004; Chan et al. 2006; Christensen 2007; Sanz et al. 2008). Continuing Personal Development (CPD) is the mechanism by which practitioners develop their skills and knowledge and maintain up-to-date practice. Definitions of CPD (1996, p. 43; Tseveenjav et al. 2003; American Dental Association Continuing Education Recognition Program 2010b) draw attention to the career-long importance of CPD and its primary value for patient care.

CPD systems in Europe vary between countries and different histories and cultures have led to varying rules about the amount and content of CPD (Bottenberg 2004; Best et al. 2005b). There is evidence of a worldwide trend towards mandatory CPD (Eaton et al. 2000; Schleyer

et al. 2002; Best and Messer 2003; Blinkhorn et al. 2005; Mersel 2007; Hopcraft et al. 2008). Not only is the need to update clinical skills and integrate new developments into patient care an accepted part of professional practice, it is also increasingly related to continued registration (Wilson 2000; Mathewson and Rudkin 2008). However differences in CPD requirements mean that patients are likely to be subject to different standards of oral health care depending on where they live, or travel to, within the EU (Shanley et al. 2002)

Uptake

The studies showed that uptake varies considerably although comparisons are difficult because even if courses alone are considered, type (e.g. lecture, hands-on) and duration (e.g. half-day, full-day) differ (or are not specified) as does the time period: although the majority of these studies looked at courses undertaken in the previous year, some looked over a two year period and one considered intentions. A number of these studies report a small proportion of dentists who do not participate in any courses.

Reasons facilitating/barring uptake

A number of these studies report a curvilinear relationship between age/experience and CPD: less CPD seems to be undertaken by both younger or more recently qualified practitioners as well as older or more experienced practitioners. Leggate and Russell (2002) suggest that more recent graduates may not participate beyond minimum requirements because they have recently qualified and may be reluctant to pay for CPD because of the financial demands of building a clinical practice while managing educational debts. Provision costs and the professional's time may restrict the practitioners' willingness to participate in CPD (Mouatt et al. 1991; Belfield et al. 2001; Firmstone et al. 2004; Best et al. 2005a). Older dentists may only seek out activities which fulfil a perceived clinical need, such as new techniques or materials, or ones that provide an opportunity for an increased income (Kuthy et al. 1996). Other factors affecting uptake include domestic commitments, gender and whether the practitioner holds a postgraduate qualification.

A key dimension is whether choice of CPD activity is needs-driven or convenience- and/or interest-led. Mandatory systems with obligatory core topics will, of course, place limits on freedom of choice.

Delivery methods

Lectures are cost-efficient, acceptable and effective but their passive nature may hinder learning. Hands-on work is good for learning skills but can increase costs for both tutor and

learner. Journals can be an interesting adjunct if the reader knows how to filter and focus on the information. Peer review and self-assessment is a recommended component for CPD (Bottenberg 2004; Redwood et al. 2010), not just for identifying gaps in knowledge but also reflecting on own practice. E-learning has potential and is becoming more common on blended learning techniques.

Impact and effectiveness

The effectiveness and impact of CPD is difficult to evaluate. Many CPD programmes do not assess learning gain, for example through pre and post-testing (Low and Kalkwarf 1996) and changes may not occur immediately post-learning but emerge some time after participation, after reflection, or emerge in a way that is difficult to quantify (Best and Messer 2003). Therefore it is unsurprising that there is relatively little literature on CPD effectiveness or the impact of CPD on practice. It has also been noted that improvement in scores does not necessarily lead to improved clinical performance (2006; Absi et al. 2009).

It was found that dentists frequently select CPD on an *ad hoc* or convenience-led basis and are more likely to attend courses on topics in which they are already interested (Hopcraft et al. 2008) but it has been observed that the impact-on-practice is greater when CPD targets a dentist's learning needs (Bullock et al. 2003). Self-report studies suggest that courses in particular have led to widespread new learning and in some cases considerable changes in practice have been claimed. However, significant barriers to implementing change in everyday practice have also been noted and include issues such as the availability of materials and resources or support from colleagues in their practice (Bullock et al. 2010). As for the value of particular CPD delivery modes, Best et al. (Best et al. 2005a: 71) comment that "in general, evidence shows that no approach for transferring evidence to practice is superior to all changes in all situations."

Core topics

Many countries have no regulation about the content of CPD and currently allow their dentists the freedom to make their own choice of CPD topics: selection of CPD activity is left to individual's professional judgement. Other European countries mandate that certain core topics are studied. The top five topics as highlighted in the papers reviewed include oral implantology, practice management, orthodontics, periodontics and endodontics.

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Appendix 1 - Summary of European CPD regulations by country

*Reference to Kravitz and Treasure, 2009

Country	Compulsory (since)	Requirements	Core topics	Providers & payment	Accreditation
Austria	No*	<ul style="list-style-type: none"> An obligation to participate in continuing education, but it is not proscribed as mandatory The dentist is free to choose the activity he wants to join in. (Kravitz and Treasure 2009) Since 1995, the Austrian dentists must be able to prove that they regularly attend continuing education activities. But so far no sanctions have been imposed. (Bottenberg 2004) 		<ul style="list-style-type: none"> universities, scientific societies, medical or pharmaceutical companies, national and international medical congresses (Kravitz and Treasure 2009) 	Can apply for a diploma of education from the Austrian Dental Chamber, by submitting the approvals of the different types of training he/she has completed during this period. (Kravitz and Treasure 2009)
Belgium	Yes (2002)*	<ul style="list-style-type: none"> Since June 2002 the requirement is 60 hours over 6 years. (Kravitz and Treasure 2009) <p>OR</p> <ul style="list-style-type: none"> Includes a minimum of 60 hours spread over six years, with a minimum of 20 hours per two-year period. Each cycle begins July 1 of the calendar year following the award of specific professional title of dentist or of the calendar year following the decision to maintain the professional special general dentist. burden of proof to the DG (without further precision) (http://www.cod.be/) <p>Belgium - College of Dental general practice</p> <p>"Regarding training (requirement I), we must particularly remember the following requirements:</p> <ul style="list-style-type: none"> 500 or more units on a 5-year cycle 10 units or more in each domain on a 5-year 	General medicine, radiology, prevention, practice management, conservative dentistry, orthodontics, prosthodontics (Kravitz and Treasure 2009)		<ul style="list-style-type: none"> in Belgium by the Belgian system abroad by the foreign system (Kravitz and Treasure 2009)

		<p>cycle, except the field 2 (50 units minimum), domain 3 (20 units minimum, for cycles beginning in 2010 and subsequent years), and the field 0 (no minimum)</p> <ul style="list-style-type: none"> • Minimum 60 units per year • 160 units maximum per year taken into account (surplus units are allowed for requirements domains) • maintain an average of 100 units or more per year over 5 year cycle" <p>www.cod.be</p>			
Bulgaria	Yes (unknown)*	<p>A minimum of 30 points is to be covered in 3 years. (Kravitz and Treasure 2009)</p> <p>Bulgarian government website: "All doctors [and dentists] are required to pursue continuing education in a minimum volume. Annually, by the end of March, doctors and dentists in regional colleges provide a statement of the previous year continuing education, accompanied by copies of documents in evidence of it.</p> <p>Doctors and dentists who do not meet the required volume of continuing education for a specified period of time may be withdrawn from listing on the subject by the MB"</p> <p>http://www.parliament.bg/bills/39/454-01-134.rtf</p>		The CE is delivered by BgDA, or by other institutions, accredited by BgDA. (Kravitz and Treasure 2009)	A credit system has been introduced and administered by BgDA. (Kravitz and Treasure 2009)
Croatia	Yes (unknown)*	<p>The requirement is 7 hours of formal training each year. (Kravitz and Treasure 2009)</p> <p>Croatian dental chamber: During a period of six years, the dentist is obliged to undergo professional training and acquire a sufficient number of points in the manner prescribed by the regulations of the Chamber (10 points per year - a total of 60 points). (Croatia Dental Chamber, "What should I know after graduation", 2008</p> <p>http://www.hkdm.hr/?page=akti-kodeks)</p>		Courses are given by dental school staff and private organisers. (Kravitz and Treasure 2009)	Organised by the Chamber (the number of courses and standards). (Kravitz and Treasure 2009)
Cyprus	No*	None (Kravitz and Treasure 2009)		The Dental Services of the Ministry of Health, with the collaboration of the Cyprus	The Dental Services of the Ministry of Health, with the collaboration of the Cyprus Dental Association (Kravitz and

				Dental Association, organises seminars and workshops on contemporary dental topics in Cyprus, with instructors from EU countries (mainly from Greek Universities). (Kravitz and Treasure 2009)	Treasure 2009)
Czech Republic	Yes (2004)*	<ul style="list-style-type: none"> Can receive the Certificate if the required amount of credits and the prescribed spectrum of educational actions, during two years, is fulfilled. The Certificate is valid usually for 3 to 5 years – it can be then repeated, if the conditions of postgraduate education are fulfilled. The holder of a Certificate has higher settlements for some dental care issues (about 10% higher) from the system of health insurance - the patient does not pay more. (Kravitz and Treasure 2009) 	Recommended but not compulsory (Kravitz and Treasure 2009)	<ul style="list-style-type: none"> Delivered mainly by CSK, but also other providers can take part in the system. (Kravitz and Treasure 2009) 	<ul style="list-style-type: none"> The attendance of dentists on recommended practice-oriented courses or theoretical lectures is evaluated by credits. Gain The Certificate of Proficiency. (Kravitz and Treasure 2009)
Denmark	?	<ul style="list-style-type: none"> CE is not compulsory in Denmark. From January 2009 members of the DDA have to register 25 hours of CE annually (Kravitz and Treasure 2009) 		<ul style="list-style-type: none"> Dental associations, Dental schools Private companies. (Kravitz and Treasure 2009) 	
Estonia	No*	A general requirement to keep skills updated. (Kravitz and Treasure 2009)		<ul style="list-style-type: none"> Tartu University Postgraduate Training Centre Estonian Dental Association (Kravitz and Treasure 2009) 	
Finland	No*	A general requirement to keep skills updated. (Kravitz and Treasure 2009)		<ul style="list-style-type: none"> Finnish Dental Society Apollonia. (Kravitz and Treasure 2009) 	
Former Yugoslav republic of Macedonia					
France	Yes (2004)*	Points to be acquired: 800 in 5 years with at least 150 per year. (Kravitz and Treasure 2009)		<ul style="list-style-type: none"> 16 dental Schools (Schleyer et al. 2002) 	<ul style="list-style-type: none"> A body, composed of colleges (Ordre, Unions, University) sets the

		<p>www.cod.be states that in France, dental practitioners must complete CPD amounting to 800 credits over a 5 year period, including a minimum of 150 credits per year to ensure the continuing education "follows a pattern of regular and sustained training".</p>		<ul style="list-style-type: none"> The practitioner may also attend courses and conferences abroad. Sponsorship and advertising are not allowed. (Bottenberg 2004) 	<p>subjects of the training, the content of the proposed training sessions as well as the credits (Kravitz and Treasure 2009)</p> <ul style="list-style-type: none"> State professional societies (Schleyer et al. 2002) "National Council for Continuing Education which oversees the organisation - approves the course beforehand and controls the quality. (Bottenberg 2004)
Germany	Yes (2004)	<ul style="list-style-type: none"> New legislation on health care Gesundheitssystem-Modernisierungsgesetz, GMG 2003) introduced, from January 2004, compulsory CE and regular monitoring in the form of recertification, after a 5 years period. (Kravitz and Treasure 2009) From 30 June 2009 practitioners who cannot provide proof that they were trained continuously can expect a loss of revenue and even lose their license. (Bottenberg 2004) <p>In 2004, it was decided that dentists in Germany must undertake compulsory CPD. Every 5 years, they are required to submit evidence to prove that they have met requirements during that time period. It is specified that any CPD activity should last for at least 45 minutes and not more than 8 hours per day. http://www.bzaek.de/fileadmin/PDFs/bfortb/leits_06.pdf</p>		<ul style="list-style-type: none"> The costs for courses are deductible from income tax as a practice expense (Kravitz and Treasure 2009) 30 institutes from professional and scientific organizations, 32 dental schools, 10 industry-based institutes. (Schleyer et al. 2002) DGZMK (Deutsche Gesellschaft für Zahn-Mund- und Kieferheilkunde) with the Practice and Science Academy "Akademie Praxis und Wissenschaft" in partnership with universities offer courses for postgraduate education. (Bottenberg 2004) 	<p>The content and amount of the compulsory CE was defined by the KZBV, in agreement with BZAK, in June 2004. [The KZBV is the association of KZVs on a national level].(Kravitz and Treasure 2009)</p> <ul style="list-style-type: none"> regionally by a dental association "Kassenzahnärztliche Vereinigung" (Bottenberg 2004)
Greece	Yes*	<ul style="list-style-type: none"> For dentists practicing within the NHS, continuing education is required by law. However, since there is no structured continuing education programme available, there are no sanctions connected with non-compliance. (Kravitz and Treasure 2009) 		<p>The Board of the Hellenic Dental Association has already asked the members of its Scientific Committee to submit their proposals on the above referred subject, and the Oral Health Committee of the Ministry of</p>	<ul style="list-style-type: none"> No continuing education system exists, in a mode of mandatory and points-earning attendance of lectures, seminars, symposia and conventions. (Kravitz and Treasure 2009)

				Health and Social Solidarity has opened a debate to finalise it within 2011(Kravitz and Treasure 2009)	
Hungary	Yes (1999)*	<ul style="list-style-type: none"> • A scoring system, with accredited continuing education courses. • A dentist must achieve 250 points in 5 years. This represents 250 hours, and some reading is allowed to be counted. • The ultimate sanction for noncompliance is suspension from practice and the first audit of compliance took place in 2004. (Kravitz and Treasure 2009) 		The system is delivered mainly by the Dental Section of the Hungarian Medical Chamber, which is responsible for the supervision. (Kravitz and Treasure 2009)	
Iceland	No*	There is no post-qualification vocational training. (Kravitz and Treasure 2009)			
Republic of Ireland	Yes (2010)?	<p>CPD is becoming mandatory for all dentists from January 2010. (Kravitz and Treasure 2009)</p> <p>“From 1 January 2010, it is expected that the Dental Council of Ireland will require every registered dentist to complete 250 hours of CPD (continuing professional development) over the following five years and then over each ensuing a five-year cycle. This CPD is to be divided into 75 hours of verifiable CPD and 175 of CPD undertaken personally.</p> <p>This, in effect, means that each year 15 hours of verifiable CPD must be accumulated and certificates kept for scrutiny by the Council if required. The IDA-run scientific meetings, the annual IDA conference, hands-on courses, training in CPR and overseas courses or conferences can all count towards your total.</p> <p>The remainder of the 175 hours (this works out to approximately 45 minutes a week or 2.5 hours a month) are to be covered by journal reading, personal study, forming a local study group devoted to a particular topic (for example, I know</p>		<ul style="list-style-type: none"> • Postgraduate Medical and Dental Board, the Dental Schools • The Royal College of Surgeons • The Irish Dental Association • Various societies.(Kravitz and Treasure 2009) 	Course organisers apply for credit points for their courses and these are then allocated to course participants. A dentist who has accumulated a target number of points in a calendar year is entitled to a CDE Certificate. (Kravitz and Treasure 2009)

		<p>of some who studied orthodontics with Skip Truitt who now hold regular study groups and annual study days), DVD or CD-ROM presentations or online information. (Dentaltown.com hosts many varied presentations that can be viewed.)”</p> <p>http://www.irishdentist.ie/articles/articles_detail.php?id=522&authorid=61</p> <p>A pdf document from Dental Council of Ireland outlining requirements can be found here: http://www.dentalcouncil.ie/files/CPD%20-%20Scheme%20-%2020100401.pdf</p>			
Italy	Yes (2002)*	150 units of CPE within a 3-year period (2008-10), including a minimum of 30 and a maximum of 70 each year. (Kravitz and Treasure 2009)			Italian Ministry of Health (Kravitz and Treasure 2009)
Latvia	Yes (2001)*	<ul style="list-style-type: none"> • 250 hours of CPE every 5 years, whilst they practice. • Auxiliary personnel have the same requirements only the number of credit hours may be different. (Kravitz and Treasure 2009) • The 5-year recertifications required by all dentists since 2001 are achieved by attending lectures, seminars, practical courses and congresses. Forty per cent of the credit points must be gained by attending academic lectures, organised by the LDA and the staff of the Faculty and Institute of Stomatology.(Best et al. 2005b) • 	lectures and courses cover all areas of clinical dentistry	The Latvian Dental Association, working in collaboration with the Faculty and Institute of Stomatology at Riga Stradiņš University, the State Dental Centre, the Latvian Physicians’ Society and the Latvian Dental Hygienists’ Association and representatives from industry organise professional education for all the dental team members. (Kravitz and Treasure 2009)	certification and re-certification is performed by the Latvian Dental Association (LDA) in collaboration with the Faculty and Institute of Stomatology, Riga Stradins University, the State Dental Centre, the Latvian Physicians Society and representatives from industry. (Best et al. 2005b)
Lithuania	Yes*	In order to remain registered a dentist needs to attend the courses and obtain a certain number of professional training hours, which are 120 hours in 5 years for dentists and dental specialists. (Kravitz and Treasure 2009)		The Lithuanian Dental Chamber coordinates the continuing education of dentists and oral care specialists. This function is performed by the Commission on Informal Education. It sets up main principles of the qualifying courses and the basic requirements for organisers. (Kravitz and Treasure 2009)	

Luxembourg	Yes*	<p>Currently, a minimum amount of continuing education is required by law, but each dentist decides how much is needed for proper practise.(Kravitz and Treasure 2009)</p> <p><i>Continuing professional development for graduate dentists in Luxembourg.</i></p> <p>The "Institut Luxembourgeois for continuing medical education" (ILFMC) is an independent NGO of the medical and dental professions in Luxembourg. They are responsible for quality assurance of continuing education for both professions. All CE providers must be accredited by the ILFMC before they can provide certified CE events. Very detailed information about accreditation rules is provided on the website. http://www.institutfmc.lu/mmp/online/website/content/about_us/partners/214/index_FR.html</p> <p>They are responsible for several aspects of CE including accrediting and evaluating continuing education events. They co-ordinate and publish a list of CE events, and are involved in establishing training needs and organising training cycles. The ILFMC co-ordinates continuing education for members of the medical and medico-dental professions. The ILFMC and the Department of Health finance the costs of these activities. http://www.institutfmc.lu/mmp/online/website/content/about_us/partners/214/index_FR.html</p>	None (Kravitz and Treasure 2009)	Historically, dentists either undertook their continuing education in Luxembourg (where AMMD organises continuing education) or they return to the dental school where they have been trained previously. They also can choose another dental school or courses.(Kravitz and Treasure 2009)	
Malta	No?	Continuing education is not mandatory under Maltese legislation, but Proposals for legislation to make CPE compulsory for renewal of a licence to work as a dentist had not come to fruition by 2008. (Kravitz and Treasure 2009)		<ul style="list-style-type: none"> • The Dental Association of Malta • Faculty of Dental Surgery (Kravitz and Treasure 2009) 	
The Netherlands	No*	<ul style="list-style-type: none"> • No absolute obligation for CPD, but is a requirement for anyone practising a profession in healthcare. • Voluntary system of peer review (Bottenberg 2004) 		Normally provided by universities and private organisations. (Kravitz and Treasure 2009)	<ul style="list-style-type: none"> • NMT (Nederlandse Maatschappij terbevordering tandheelkunde van) and as the general scientific society NVT(Nederlandse Vereniging van tandartsen).

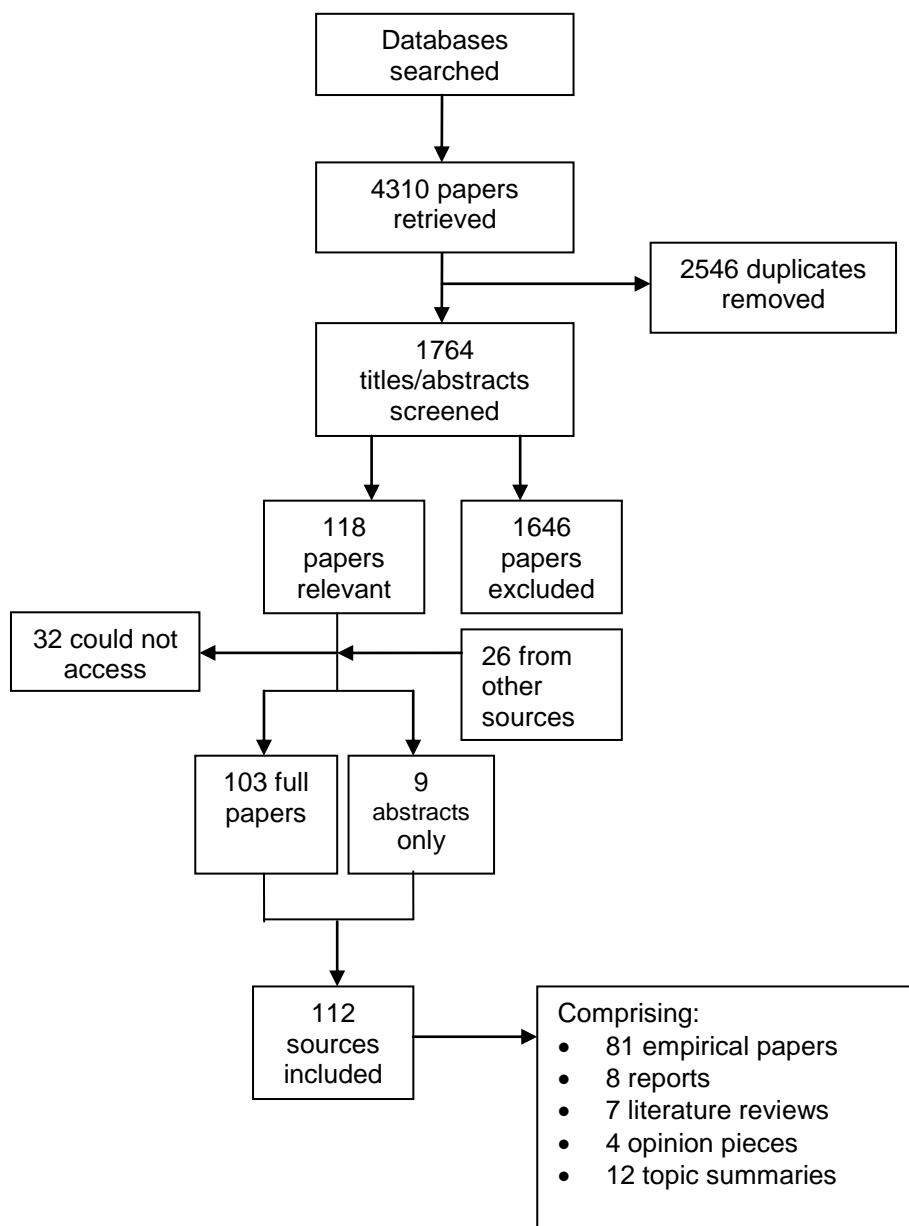
					<ul style="list-style-type: none"> NVT 'quality assesses' CPD courses to some extent (Bottenberg 2004) 'Q-system' which is owned by the Society of Dutch Dentists. The protocol for accreditation has been set as follows: an organisation or course provider applies for accreditation to the Accreditation Committee that in its turn takes action. The provider applies for one test-year to implement quality criteria of the accreditation system.(Best et al. 2005b)
Norway	No*	<p>Dentists have an obligation to treat the patients in accordance with the professional standard (based on the current knowledge and common accepted procedures at the time). This requires that the dentist adopts new knowledge. However there are no specific requirements concerning how. Should the dentist give treatment with outdated methods it may result in a number of consequences - private lawsuits, as well as investigations and possible actions by the supervising authorities and the dental association. (Kravitz and Treasure 2009)</p> <p>CPD courses are not mandatory but the Norwegian Dental Authority encourages dentists to take courses (Komabayashi and Åstrom 2007)</p>		The Norwegian Dental Association (NDA) offers postgraduate courses as "brush up" lessons for dentists in practice. (Kravitz and Treasure 2009)	
Poland	Yes*	A credit-point system is applied, 200 credit points have to be collected in a 4-year period. (Kravitz and Treasure 2009)	Determined by the Law on the Professions of Physician and Dental Practitioner. (Kravitz and Treasure 2009)	The Chambers in accordance with the regulation of the Minister of Health. Many kinds of courses and training sessions, as well as routine monthly training are organised by the Polish Dental Association (PDA). (Kravitz and Treasure 2009)	Continuing education is conducted in various forms and in accordance with a grading scale.(Kravitz and Treasure 2009)
Portugal	Yes (2009)?	<ul style="list-style-type: none"> Continuing education is and is expected to be mandatory by January 2009. (Kravitz and 		<ul style="list-style-type: none"> The OMD arranges an annual continuing education 	<ul style="list-style-type: none"> Regulated by the OMD Dentists who attend pay a

	*	<p>Treasure 2009)</p> <p>Regulamento n.º 57/2009: Regulatory standards are imposed relating to accreditation of individual dentists from 2009. <i>Diário da República</i>, http://dre.pt/util/getpdf.asp?s=udrd&serie=2&idrr=19.2009&iddip=2009008061</p>		<p>programme; there is one annual multidisciplinary scientific congress (3 days) and another scientific congress each two years. There are also several courses such as: thematic courses, usually one-day in length; mini-courses (half-a-day courses) and practical courses. (Kravitz and Treasure 2009)</p>	<p>registration fee and receive a Certificate of Attendance.(Kravitz and Treasure 2009)</p>
Slovakia	Yes	<ul style="list-style-type: none"> Dental surgeons are under a statutory obligation to take part in continuing education under Law 219/2002. Must undertake 5 days a year, in a mixture of theoretical and practical training. A dentist who does not complete the continuing education requirement breaks the rules and the duties of a member of the Slovak Chamber of Dentists, which will lead to disciplinary processes. <p>http://www.skzl.sk/en/read/Slovakia/Slovakia5.html</p>		<ul style="list-style-type: none"> Slovak Chamber of dentists, which supervises and provides the Quality Assurance. Universities, the Slovak Chamber of Dentists and the dental industry provide the schemes.(Kravitz and Treasure 2009) 	
Slovenia	Yes*	<ul style="list-style-type: none"> 75 points (about 10 courses) of continuing education in every 7-year period, provided by the Chamber. If the dentist does not fulfil this 75 points obligation, then he must undertake an examination. Failure to pass the examination leads to a loss of licence to practice. (Kravitz and Treasure 2009) 			<ul style="list-style-type: none"> The responsibility for the supervision of this lies with the Chamber. Courses taken overseas are estimated by the Medical Chamber and are allowable.(Kravitz and Treasure 2009)
Spain	?	<ul style="list-style-type: none"> An extended system of evaluation of the continuing education systems is being developed, but it is not compulsory in 2008.(Kravitz and Treasure 2009) 		<ul style="list-style-type: none"> Consejo General and local Colegios de Odontólogos y Estomatólogos. Some companies and particular initiatives offer programmes on continuing 	

				education, of different degrees of quality and control.(Kravitz and Treasure 2009)	
Sweden	No*	<ul style="list-style-type: none"> Continuing education is optional.(Kravitz and Treasure 2009) 		<ul style="list-style-type: none"> The Swedish Dental Association has a continuing education programme (printed and sent to all members twice a year), but almost all county councils (public dental health) do as well; the dental industry gives courses and also there are private initiatives.(Kravitz and Treasure 2009) 	
Turkey	?				
UK	Yes*	<ul style="list-style-type: none"> 250 hours in five years. This requirement is subdivided into 75 hours verifiable postgraduate education and 175 hours of general (informal) postgraduate education. Verifiable activity would include participation in courses, interactive distance learning, clinical audit, peer review – all of which must have defined learning objectives and outcomes. Dentists must keep a record of their activity and certify compliance annually. NHS dentists participate in regular peer review and clinical audit as part of the mandatory continuing education. (Kravitz and Treasure 2009) During a cycle of 5 years, 250 hours must be devoted to retraining including 75 verifiable hours 'verifiable'. (Bottenberg 2004) 	<ul style="list-style-type: none"> Since 2007 certain core subjects must be included in the verifiable activity – including radiation and infection control.(Kravitz and Treasure 2009) 	<ul style="list-style-type: none"> There are two schools of postgraduate dentistry (London and Edinburgh) and also postgraduate institutes attached to many undergraduate schools. In Scotland NHS GDPs may claim allowances for loss of practice income, for attending courses.(Kravitz and Treasure 2009) 14 Postgraduate Dental Deans/Directors, four Faculties of Dental Surgery and some 20 divisions of the Faculty of General Dental Practitioners (UK). (Schleyer et al. 2002) 	<ul style="list-style-type: none"> Administered by the GDC.(Kravitz and Treasure 2009) The list of verifiable courses must be accompanied by all supporting documents and forwarded to the General Dental Council (GDC). (Bottenberg 2004) By the Dental Faculties of the Surgical Royal Colleges as their Members and Fellows are required to complete quotas of annual CPD and prior to taking some Faculty Diploma examinations. All forms of CPD are accredited by these bodies. By the Postgraduate Dental Deans, who manage the local delivery of government-funded CPD attendance courses and may

					accredit privately funded courses to enable those attending to claim attendance fees. The competent authority (body which maintains dentists' registration and licences the right to practice) for the UK is the General Dental Council. It does not accredit courses. (Best et al. 2005b)
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Appendix 2 - Literature search process diagram



Appendix 3 - Breakdown of papers reviewed by type

	Empirical	Reports	Literature reviews	Opinion	Summary	total
1.general papers on dental CPD	4	4	3	0	5	16
2.opinion papers on dental CPD	0	0	0	3	0	3
3.papers on dental CPD in Europe	5	3	2	0	3	13
4.papers on attitudes and perceived CPD needs	13	1	0	0	0	14
5.comparisons of different state/countries' CPD requirements for dentists	2	0	0	0	0	2
6.papers of CPD participation by dentists	22	0	0	0	0	22
7.papers on effect of CPD on dental practice	12	0	0	1	0	13
8.papers on dental CPD delivery methods	22	0	2	1	4	28
total	80	8	7	5	12	112