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[Intervention Review]

The effect of different methods of remuneration on the behaviour of primary care dentists

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ABSTRACT

Background

Methods of remuneration have been linked with the professional behaviour of primary care physicians. In dentistry, this can be exacerbated as clinicians operate their practices as businesses and take the full financial risk of the provision of services. The main methods for remunerating primary care dentists include fee-for-service, fixed salary and capitation payments. The aim of this review was to determine the impact that these remuneration mechanisms have upon primary care dentists' behaviour.

Objectives

To evaluate the effects of different methods of remuneration on the level and mix of activities provided by primary care dentists and the impact this has on patient outcomes.

Search methods

We searched the Cochrane Effective Practice and Organisation of Care (EPOC) Group Specialised Register; the Cochrane Central Register of Controlled Trials (CENTRAL, *The Cochrane Library*, Issue 7, 2013); MEDLINE (Ovid) (1947 to 11 June 2013); EMBASE (Ovid) (1947 to 11 June 2013); EconLit (1969 to 11 June 2013); the NHS Economic Evaluation Database (EED) (11 June 2013); and the Health Economic Evaluations Database (HEED) (11 June 2013). We conducted cited reference searches for the included studies in ISI Web of Knowledge; searched grey literature sources; handsearched selected journals; and contacted authors of relevant studies.

Selection criteria

Primary care dentists were defined as clinicians that deliver routine or mainstream dental care in a primary care environment. We included randomised controlled trials (RCTs), non-randomised controlled clinical trials (NRCTs), controlled before-after (CBA) studies and interrupted time series (ITS) studies. The methods of remuneration that we considered were: fee-for-service, fixed salary and capitation payments. Primary outcome measures were: measures of clinical activity; volume of clinical activity undertaken; time taken and clinical session length, or both; clinician type utilised; measures of health service utilisation; access and attendance as a proportion of the population; re-attendance rates; recall frequency; levels of oral health inequalities; non-attendance rates; healthcare costs; measures of

patient outcomes; disease reduction; health maintenance; and patient satisfaction. We also considered measures of practice profitability/income and any reported unintended effects of the included methods of remuneration.

Data collection and analysis

Three of the review authors (PRB, JP, AMG) independently reviewed titles and abstracts and resolved disagreements by discussion. The same three review authors undertook data extraction and assessed the quality of the evidence from all the studies that met the selection criteria, according to Cochrane Collaboration procedures.

Main results

Two cluster-RCTs, with data from 503 dental practices, representing 821 dentists and 4771 patients, met the selection criteria. We judged the risk of bias to be high for both studies and the overall quality of the evidence was low/very low for all outcomes, as assessed using the GRADE approach.

One study used a factorial design to investigate the impact of fee-for-service and an educational intervention on the placement of fissure sealants in permanent molar teeth. The authors reported a statistically significant increase in clinical activity in the arm that was incentivised with a fee-for-service payment. However, the study was conducted in the four most deprived areas of Scotland, so the applicability of the findings to other settings may be limited. The study did not report data on measures of health service utilisation or measures of patient outcomes.

The second study used a parallel group design undertaken over a three-year period to compare the impact of capitation payments with fee-for-service payments on primary care dentists' clinical activity. The study reported on measures of clinical activity (mean percentage of children receiving active preventive advice, health service utilisation (mean number of visits), patient outcomes (mean number of filled teeth, mean percentage of children having one or more teeth extracted and the mean number of decayed teeth) and healthcare costs (mean expenditure). Teeth were restored at a later stage in the disease process in the capitation system and the clinicians tended to see their patients less frequently and tended to carry out fewer fillings and extractions, but also tended to give more preventive advice.

There was insufficient information regarding the cost-effectiveness of the different remuneration methods.

Authors' conclusions

Financial incentives within remuneration systems may produce changes to clinical activity undertaken by primary care dentists. However, the number of included studies is limited and the quality of the evidence from the two included studies was low/very low for all outcomes. Further experimental research in this area is highly recommended given the potential impact of financial incentives on clinical activity, and particular attention should be paid to the impact this has on patient outcomes.

PLAIN LANGUAGE SUMMARY

The effect of different methods of remuneration on the behaviour of primary care dentists

Financial incentives within remuneration systems (methods of payment) can influence the behaviour of clinicians working in primary care environments. Systematic reviews in medicine have found that changing the way that doctors are paid can produce substantial changes in the types of activities that are undertaken. For example, paying a fee for specific services can increase the quantity of services delivered, although this may not produce an improvement in patient outcomes.

The main methods for remunerating primary care dentists include:

1. fee-for-service payment (a payment made to a dentist for every item of service or unit of care that they provide);
2. fixed salary payment (a lump sum payment made to a dentist for a set number of working hours or sessions per week);
3. capitation payment (a payment based on the number and types of patients whose care the dentist takes responsibility for); and
4. blended payment (combination of above).

Our review identified two studies examining the effects of different methods of remuneration on the behaviour of 821 dentists from 503 dental practices, involving 4771 patients. Both were conducted in the United Kingdom. One study investigated the impact of a fee-for-service payment and an educational intervention on the placement of fissure sealants in permanent molar teeth. The second

study compared the impact of capitation payments and fee-for-service payments on primary care dentists' clinical activity and the levels of dental decay that were experienced across the two payment systems.

The first study found an increase in clinical activity related to fee-for-service payments. In the second study, dentists working under capitation arrangements restored carious teeth at a later stage in the disease process than fee-for-service controls. In the capitation arm, the dentists tended to see their patients less frequently and tended to carry out fewer fillings and extractions, but tended to give more preventive advice.

There was insufficient information regarding cost-effectiveness of the different remuneration methods.

Financial incentives within remuneration systems may produce changes to clinical activity undertaken by primary care dentists. However, the number of included studies is limited and the quality of the evidence is low/very low for all outcomes.

SUMMARY OF FINDINGS FOR THE MAIN COMPARISON *[Explanation]*

Population: Dentists seeing children with erupted second permanent molars Settings: Scotland, in areas representing the four most deprived categories (out of seven) in the Scottish post code based system defining deprivation Intervention: Fee-for-service remuneration Control: No specific intervention					
Outcomes	Illustrative comparative risks (95% CI)		Relative effect (95% CI)	No. of Participants (studies)	Quality of the evidence (GRADE)
	Assumed risk	Corresponding risk			
	Control	Fee-for-service remuneration			
Measures of clinical activity: mean percentage of 12- to 14-year-olds receiving fissure sealants for second permanent molars per dentist (weighted by number of children seen) - adjusted¹ Follow-up: 18 months	-	RD 9.8% higher (1.8% higher to 17.8% higher) ³	-	133 dentists (1 study)	⊕○○○ very low ⁴
Measures of clinical activity: mean percentage of 12- to 14-year-olds receiving fissure sealants for second permanent molars per dentist (weighted by number of children seen) - unadjusted² Follow-up: 18 months	26.3% (CI NR)	RD 7.1% higher (1.9% lower to 16.1% higher)	RR 0.27 (CI NR)	133 dentists (1 study)	⊕○○○ very low ⁴

Healthcare costs: cost-effectiveness of fee-for-service vs. control (reported as the “% change in outcome <i>per</i> £[GBP]” - currency year NR)⁵ Follow-up: 18 months	-	-	0.10 (CI NR)	68 dentists (1 study)	⊕○○○ very low⁴
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CI: Confidence interval; GBP: Pound Sterling; NR: Not reported; RD: Risk difference; RR: Risk ratio

GRADE Working Group grades of evidence

High quality: Further research is very unlikely to change our confidence in the estimate of effect.

Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low quality: We are very uncertain about the estimate.

¹The model adjusted for the baseline dental practice-level covariates (deprivation category for the area of dental practice, number of partners in practice, throughput of 11- to 13-year-olds and the number of restorative fissure sealants placed on first permanent molars at baseline).

²The basis for the assumed risk is the risk in the control group (i.e. the probability of a dentist in the control group fissure sealing a second permanent molar of a 12- to 14-year-old). The corresponding risk (the risk difference) is based on the assumed risk in the control group and the relative effect of the fee-for-service remuneration (the risk ratio).

³Statistically significant at the 5% level.

⁴Quality of the evidence

- **Risk of bias:** high
- **Inconsistency:** undetected (single study)
- **Indirectness:** yes

- The dentists only received the fee-for-service remuneration in the first six months of the study but the data were collected 18 months after the start of the trial. The effects of the fee-for-service remuneration would have been attenuated if 18-month data were analysed

- The fee-for-service remuneration did not affect National Health Service capitation payments which were GBP 2.76 per month to age 12 and GBP 4.01 thereafter, so it is not possible to show the effect of fee-for-service remuneration compared to capitation (only fee-for-service and capitation compared to capitation)

- The authors suggested that the dentists may have found it too inconvenient to claim a fee from the research team, rather than via the routine National Health Service channel, which would normally be the route for claiming fee-for-service remuneration

- The average age at baseline was from 13.2 years in the education arm to 13.3 years in the both fee-for-service and education arm, and the data on fissure sealant placement was collected up to 18 months after this baseline so some of the children may have already started to experience decay if their second permanent molars erupted at around 12 years old. Attempting to place fissure sealants soon after the eruption of second permanent molars is considered preferable to waiting a fairly long time after eruption, so the percentage of children with fissure sealants at the end of the study may have been attenuated (this could apply across all of the study arms). Records of any caries already present or any restorations placed would be useful as this could impact on the proportion of fissure sealants placed i.e. dentists in the study may have placed restorations instead of sealant. The authors noted that only two-thirds of eligible dentists claimed a fee, perhaps due to the fact that the child already had caries in their second permanent molars
 - The dentists were working in deprived areas of Scotland, which would have different levels of need compared to Scotland as a whole
 - The economic evaluation does not take into account the payments from the state (i.e. the fee-for-service remuneration in one arm and the capitation payments in both arms, which would be difficult to include as they are paid for dental care as a whole) so the only costs taken into account are the costs to the dental practices (in terms of staff time and consumables) and the costs to parents. An alternative perspective would be to investigate the cost-effectiveness from the point of view of the state which pays the fee-for-service (in place of the dental practices) and parents
 - **Imprecision:** potentially - the total sample size is lower than the required sample size calculated by the authors
 - **Publication bias:** undetected (single study)
 - **Large effect:** not relevant (applies to studies with no threats to validity)
 - **Plausible confounding would change the effect:** not relevant (applies to studies with no threats to validity)
 - **Dose response gradient:** not relevant (applies to studies with no threats to validity)

⁵Outcome in the incremental cost-effectiveness ratio (ICER) is not specified and can only be assumed to relate to sealant placement

BACKGROUND

In medicine, methods of remuneration that form the provider payment have been linked with the clinical and professional behaviour of primary care physicians (Donaldson 1989).

In a Cochrane Effective Practice and Organisation of Care (EPOC) Group review of the effects of the method of remuneration on the behaviour of primary care physicians, fee-for-service payments were associated with an increase in the quantity of primary care services, but changes to patient outcomes were equivocal (Gosden 2000).

A more recent EPOC Group review examined the effect of financial incentives on the quality of health care provided by primary care physicians (Scott 2011). Again, there was insufficient evidence to determine the impact of financial incentives on the quality of primary health care. Six of the seven included studies demonstrated positive but modest effects on a minority of the measures of quality of care, and the remaining study found no effect. Most of the studies had a substantial risk of bias due to factors such as selection bias (due to non-randomisation and, in randomised studies, due to analysis at the level of the medical group combined with lack of reporting on changes in the composition of these medical groups between baseline and follow-up, or between the intervention and control groups).

An EPOC Group overview of reviews was carried out to evaluate the effects of financial incentives on the behaviour of health-care professionals and patient outcomes (Flodgren 2011). This overview included four reviews, two of which were judged to be of moderate quality and the remaining two were judged to be of high quality. The 32 studies that these four reviews reported on were found to be of low to moderate quality. Fee-for-service and capitation payments were generally effective (improving 7/10 outcomes and 48/69 outcomes, respectively), while fixed salary payments were generally ineffective (improving 3/11 outcomes). The review also considered payments for providing a prespecified level of activity or providing a change in activity or quality of care, and found that this was generally effective (improving 17/20 outcomes). In addition, the review considered the effect of financial incentives in general across categories of outcomes and found that they were generally effective at improving processes of care, referrals and admissions, and prescribing costs. However, financial incentives were ineffective in improving compliance with guidelines' outcomes, and had mixed effectiveness on consultation rates. No evidence was found for the effect of financial incentives on patient outcomes. Vote counting was used to summarise the direction of the effect, rather than a meta-analysis. Many studies utilised a controlled before-after design, and adjusting for these reduced the overall impact on effectiveness. There were also concerns about the completeness and generalisability of the evidence.

Description of the condition

This review considered all aspects of dental care undertaken by primary care dentists (defined as clinicians that deliver routine or mainstream dental care in a primary care environment), excluding the provision of specialist services or the management of adult or child patients with special needs.

Description of the intervention

The main mechanisms for remunerating primary care dentists include fee-for-service, fixed salary and capitation payments (Grytten 2005) i.e. service throughput-based (fee-for-service), time-based (fixed salary) and patient-based (capitation). These vary considerably across different countries and are heavily influenced by the prevailing political and professional culture (Grytten 2005). Capitation payments tend to secure effectiveness at the cost of patient selection and under treatment, while fee-for-service payments secure quality but often suffer from cost containment problems (Gosden 2000; Grytten 2005). For example, Birch 1988 found that where primary care dentists have a substantial influence over demand for care, there are strong incentives to over treat. Chalkley 2006 also found that treatment for patients exempt from payment was more intensive when provided by self employed primary care dentists compared to their salaried counterparts. In a natural experiment where public dental officers in one county were given the opportunity to renegotiate their contract from a fixed salary contract to a combined capitation and fixed salary contract, "the transition to an incentive-based remuneration system led to an increase in the number of individuals under supervision, without either a fall in quality or a patient selection effect" (Grytten 2009). Salary remuneration removes the link between income and the level and type of services delivered, or patients served, leading to high costs per patient (Grytten 2005). A recent review of the impact of introducing a new National Health Service contract on the behaviour of primary care dentists in the United Kingdom found that clinicians were very sensitive to changes to remuneration (SDO 2011). This reduced job satisfaction and morale (Harris 2009), adversely affected patient access and changed the service and mix of activity, or led to a shift of primary care dentists from a national contract to the private sector (Steele 2009).

How the intervention might work

Financial incentives within health care remuneration systems have the potential to align the provision of health services with the aims of the health system, e.g. making the services more effective, more equitable or more patient-centred. Financial incentives involve transferring money from 'buyers' (patients or third-party payers such as governments or insurers) to 'sellers' (individuals or groups of clinicians, or their employers) on the condition that the sellers

behave in a certain way, e.g. by providing a particular health service, sometimes at a specified level of quality (Scott 2011).

The economic theory explains that if the size of the payment is greater than the marginal (i.e. additional) costs of the behaviour change, then the cost-benefit ratio of the behaviour change can be lowered and this can make the behaviour change more likely to happen (Scott 2011). There may be heterogeneity in the marginal costs of changing behaviour among the providers, e.g. due to differences in administrative costs of practices of different sizes, as larger practices may have lower unit costs (Scott 2011). The theory highlights that, in addition to the method of remuneration, other factors such as the level of payment (particularly in terms of the proportion of total revenue from the remuneration system) are likely to have an impact, due to the economic concepts of substitution and income effects. How payments are utilised by a practice is also significant, particularly regarding how the payments are distributed between groups of providers and whether any of the payments are invested into service provision to reduce the marginal costs (which reduces the cost-benefit ratio), rather than being used to pay the providers (Scott 2011). The relative impact of other sources of motivation (such as professional autonomy) has a bearing on the effect of financial incentives, and these may vary for different providers and in different settings (Scott 2010; Scott 2011). It is important to note that financial incentives may also influence the quality and cost of health service provision by influencing recruitment and retention and thereby influencing the mix of providers. If poorly designed, financial incentives can have unintended effects such as incentivising providers to prioritise one disease area at the expense of other disease areas, such that the overall net impact on health service provision is detrimental. Primary care dentists operate their practices as businesses (Grytten 2005; Tickle 2011) so they differ from many other healthcare professionals in that they take all the financial risk for service provision, receiving little or no support to cover initial start-up costs or for the development of their capital infrastructure. As a result, they are potentially more sensitive to financial incentives within the remuneration system, which represents their principal source of income; changes in the clinical activity of primary care dentists in the United Kingdom have been documented following the introduction of new methods of payment in the National Health Service (McDonald 2012; Tickle 2011). In addition, unlike primary care physicians, whose predominant function is the management of symptomatic patients or those with chronic conditions, the bulk of service delivery in dentistry in most industrialised countries, in terms of volume of activity, is based on the regular attendance of asymptomatic patients. This can produce distortions in both the demand and supply side of provision (Wright 2001). Demand can be influenced by health literacy and patient expectations of care (Gregory 2007; Milsom 2009; Steele 2009), while supply can be influenced by the financial incentives inherent within the remuneration system, leading to supplier-induced demand (Birch 1988; Tickle 2011). Despite this, remuneration systems in pri-

mary care dentistry have received relatively little attention from a health economics perspective (Grytten 2009).

Why it is important to do this review

In dentistry, there is some evidence from observational study designs that methods of remuneration can impact on the behaviour of clinicians in primary care environments (Chalkley 2006; Grytten 2005; Tickle 2011). In medicine, fee-for-service payments are associated with an increase in the quantity of primary care services, but changes to patient outcomes are equivocal (Gosden 2000). As a result, it is important to understand the effects that different remuneration systems have on the pattern of service activity in dentistry and the patient outcomes generated (Grytten 2005). Evidence from experimental designs would also help to determine the most appropriate method of service delivery for the needs of a given population in order to inform future workforce planning (Grytten 2009).

OBJECTIVES

To evaluate the effects of different methods of remuneration on the level and mix of activities provided by primary care dentists and the impact this has on patient outcomes.

METHODS

Criteria for considering studies for this review

Types of studies

We included the following study designs that met the Cochrane EPOC Group criteria (EPOC 2013).

- Randomised controlled trials (RCTs)
- Non-randomised clinical trials (NRCTs)
- Controlled before-after (CBA) studies (at least two sites in each group)
- Interrupted time series (ITS) studies

We reported numerical data on an individual study basis and outcome data for the multiple publications of one trial (Coventry 1989) were reported as one.

Types of participants

We examined studies involving primary care dentists providing routine dental care in primary care environments.

Types of interventions

We defined the method of remuneration as the payment that directly determines or influences the personal income of the primary care dentist. We included the following remuneration systems.

- Fee-for-service payments
- Fixed salary payments
- Capitation payments
- Blended payments (combinations of above)

Fee-for-service remuneration was defined as a payment made to a primary care dentist for every item of service or unit of care that they provide. Salaried remuneration was defined as a lump sum payment made to a primary care dentist for a set number of working hours or sessions per week. Capitation remuneration was defined as a payment based on the number and types of patients whose care the provider takes responsibility for.

Types of outcome measures

We only reported objective outcome measures and subjective outcome measures that used standardised validated instruments.

Primary outcomes

We considered the following as primary outcome measures.

- Measures of clinical activity
 - Number of activities undertaken in a specified time period including examinations, oral hygiene instruction, scaling and polishing, periodontal treatment, restorations, root canal treatments, extractions and prostheses
 - Number of sessions over which treatment activity is distributed
 - Time taken and session length, or both, for treatment activities
 - Clinician type utilised
- Measures of health service utilisation
 - Proportion of a population receiving care
 - Re-attendance rates
 - Recall frequency
 - Levels of oral health inequalities by socio-economic status, education or income
 - Proportion of population not receiving care (non-attendance rates)
- Healthcare costs
- Patient outcomes
 - Disease reduction, including the number of new carious teeth, the proportion of patients with a basic periodontal examination greater than a score of two, and the proportion of patients with sites that bled on probing
 - Health maintenance, including the proportion of patients that did not require any operative treatment
 - Patient satisfaction, including the proportion satisfied with the dental care they received, the proportion satisfied with

the waiting time for an appointment, and the proportion reporting that they felt involved in decisions about their care

Secondary outcomes

We considered the following as secondary outcome measures.

- Measures of non-clinical behaviour of primary care dentists including the rates of performing specified non-clinical behaviours (e.g. education and training), when specified as a secondary outcome.
 - Measures of dental practice profitability/income.
 - Any unintended effects of the remuneration systems, including supplier-induced demand when the service provided is not based on need (Birch 1988), changes to the types of treatment offered, and limitations to access (see Tickle 2011 for a conceptual framework).

Search methods for identification of studies

Michelle Fiander, Trials Search Co-ordinator (TSC) for the Cochrane EPOC Group, wrote the search strategies. The TSC searched the Cochrane Database of Systematic Reviews and the Database of Abstracts of Reviews of Effects (DARE) for related systematic reviews, and the databases listed below for primary studies. Searches were conducted in June 2013; exact search dates for each database are included with the search strategies in Appendix 1.

Electronic searches

Databases

- Cochrane Central Register of Controlled Trials (CENTRAL), Issue 7, 2013, Wiley
- MEDLINE, 1946 - June 2013, In-Process and other non-indexed citations, Ovid
- EMBASE, 1947 - June 2013, Ovid
- EPOC Group, Specialised Register, June 2013, Reference Manager
- EconLit, Dissertations & Theses, 1969 - June 2013, ProQuest
- PAIS International, Political Science, Worldwide Political Science Abstracts, June 2013, Proquest
- CINAHL (Cumulative Index to Nursing and Allied Health Literature), 1980- June 2013, EbscoHost
- NHS Economic Evaluation Database (EED), Issue 7, 2013, Wiley
- Health Economic Evaluations Database (HEED), Issue 7, 2013, Wiley

We used search strategies that were comprised of keywords and, when available, controlled vocabulary such as MeSH (Medical

Subject Headings). The TSC finalised search strategies using an iterative development process in which citations identified by various search terms were screened for relevance, either by review authors or the TSC. In this manner, individual terms and combinations of terms were assessed as relevant or irrelevant and were included or omitted from the final search strategies. We did not place any restrictions on either the date or language used. We searched all the databases from their start date forward.

We used two methodological search filters to limit retrieval to appropriate study designs: the Cochrane Highly Sensitive Search Strategy (sensitivity- and precision-maximising version, 2008 revision) to identify randomised trials (Higgins 2011); and an EPOC methodology filter to identify non-RCT designs. We have provided all the search strategies and specific run dates in Appendix 1.

Grey literature sources

We scanned publication titles on the following grey literature websites.

- University of York (<http://www.york.ac.uk/che/publications/>)
- University of Aberdeen, HERU (<http://www.abdn.ac.uk/heru/publications/>)
- University of Sheffield (<http://www.shef.ac.uk/scharr/sections/heds/discussion>)
- University of Bristol (<http://www.bris.ac.uk/populationhealth/methodology/economics/>)
- Brunel University, HERG (<http://www.brunel.ac.uk/about/acad/herg>)
- Swedish Institute of Health Economics (<http://www.ihe.se/publiceringar-1.aspx>)
- RAND Corporation (http://www.rand.org/pubs/research_briefs.html)

We examined websites for grey literature manually without using search interfaces as they do not usually support complex Boolean or other operators. We conducted the latest search in August 2013.

Searching other resources

We also undertook the following.

- Reviewed reference lists of all included studies.
- Conducted cited reference searches for all included studies in ISI Citation Indexes via Web of Knowledge.
- Contacted authors of relevant studies/reviews to clarify reported published information and to seek unpublished results/data.
 - Screened the following individual journals from January 2010 to December 2012: *Health Economics*; *Journal of Political Economy*; *Journal of Health Services Research and Policy*; *European Journal of Health Economics*; and *Journal of Applied Economics*.

Data collection and analysis

We managed the whole review process using Review Manager 5 (RevMan 2012).

Selection of studies

After we had identified the titles and abstracts from the electronic searches, we downloaded them to a reference management database and removed the duplicates. Three of the review authors (PRB, JCP and AMG) independently examined the remaining references. We excluded studies that did not meet the inclusion criteria and obtained full-text copies of the references that appeared to meet the inclusion criteria to assess for inclusion. We resolved differences by discussion and recorded the excluded studies in the [Characteristics of excluded studies](#) table.

Data extraction and management

Three of the review authors (PRB, JCP and AMG) independently extracted data from the included studies and resolved any differences by discussion.

We extracted the following data into the [Characteristics of included studies](#) tables.

- Methods (study type and duration of study)
- Participants (setting, unit of randomisation, unit of assessment/analysis, method of recruitment, inclusion criteria and exclusion criteria)
- Interventions (details of interventions and control group)
- Outcomes (primary and secondary (as specified in the protocol for this review) and adverse outcomes)
- Source of funding

We extracted the following into the [Appendices](#).

- Number of participants (number randomised, number analysed and number not analysed with reasons, each by study arm)
- Baseline characteristics and outcomes

Assessment of risk of bias in included studies

Three review authors (PRB, JCP and AMG) independently assessed the risk of bias of the included studies and considered other factors that affect the quality of evidence, including inconsistency, indirectness, imprecision and publication bias. We resolved disagreements by discussion.

We assessed the risk of bias for studies with a control group (RCTs, NRCTs and CBAs) using the following criteria (EPOC 2011; Higgins 2011).

- Random sequence generation
- Allocation concealment
- Blinding of participants and personnel
- Blinding of outcome assessment
- Incomplete outcome data

- Other bias (including baseline characteristics and outcomes, and protection against contamination)

We assessed ITS studies using the following criteria (EPOC 2011).

- The intervention was independent of other changes
- The shape of the intervention effect was prespecified
- The intervention was unlikely to affect data collection
- Incomplete outcome data were adequately addressed
- The study was free from selective outcome reporting

We tabulated the description of the domains for each included study, along with a judgement on the risk of bias (low, high or unclear) for each domain, based on the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011). We planned to undertake a summary assessment of the risk of bias for the primary outcome across the studies (Higgins 2011). For each study, we provided the following summary assessment of the risk of bias.

- Low risk when there is a low risk of bias across all domains.
- Unclear risk of bias when there is an unclear risk of bias in one or more of the domains.
- High risk of bias when there is a high risk of bias in one or more of the domains.

Measures of treatment effect

We reported outcomes for each included study in natural units. For RCTs, NRCTs and CBAs, we reported pre-intervention and post-intervention means or proportions for all data points for both intervention and control groups where baseline results were available. Had data allowed, we had planned to calculate the unadjusted and adjusted (for any baseline imbalance) absolute change from baseline with 95% confidence intervals (CIs). For continuous variables, we reported mean differences (MDs). Dichotomous variables would have been reported as risk ratios (RRs) together with 95% CIs.

Had eligible ITS studies been identified, we would have extracted the difference in slope and the difference in pre- to post-intervention levels. We had planned to analyse the post- versus pre-intervention difference (adjusted for trends) at specific time points (three months, six months and six-monthly thereafter). If the differences were not available in the primary reports, we would have reanalysed the results using data from graphs or tables.

We have presented the findings of the main comparisons from the included studies in the [Summary of main results](#) in order to interpret the results and draw conclusions about the effects of different interventions along with the quality of the evidence.

Unit of analysis issues

For cluster-RCTs, we undertook analysis at the same level as the randomisation or at the individual level, accounting for the clustering. For cluster-RCTs with unit of analysis error we did not report the P values or 95% CIs, as analyses not accounting for the design effect have the potential to inflate the type 1 error rate and

result in artificially narrow CIs (Ukoumunne 1999). The point estimate is not affected by unit of analysis errors.

Dealing with missing data

We explicitly stated where studies had missing data.

Assessment of heterogeneity

We had planned to assess heterogeneity using The Cochrane Collaboration's test for heterogeneity, where $P < 0.1$ was to be considered significant (Higgins 2011). However, due to variations in comparisons made, plus methodological heterogeneity, it was felt inappropriate to pool data.

Assessment of reporting biases

If more than 10 studies had been identified for meta-analysis, we had planned to assess publication bias according to the recommendations on testing for funnel plot asymmetry (Higgins 2011).

Data synthesis

We had planned to undertake meta-analyses for clinically homogeneous RCTs that reported the same outcome measures: RRs for dichotomous data and MDs for continuous data, using random-effects models (or fixed-effect models if fewer than four studies were included). Given the lack of relevant studies, we undertook a qualitative synthesis.

Subgroup analysis and investigation of heterogeneity

If data had allowed, we had planned to group the results according to the type of remuneration system. However, we were unable to undertake subgroup analyses due to the lack of eligible studies.

Sensitivity analysis

In order to determine the robustness and consistency of the results, we had planned to compare RCTs (when at low risk of bias) to other studies, had we identified sufficient studies.

RESULTS

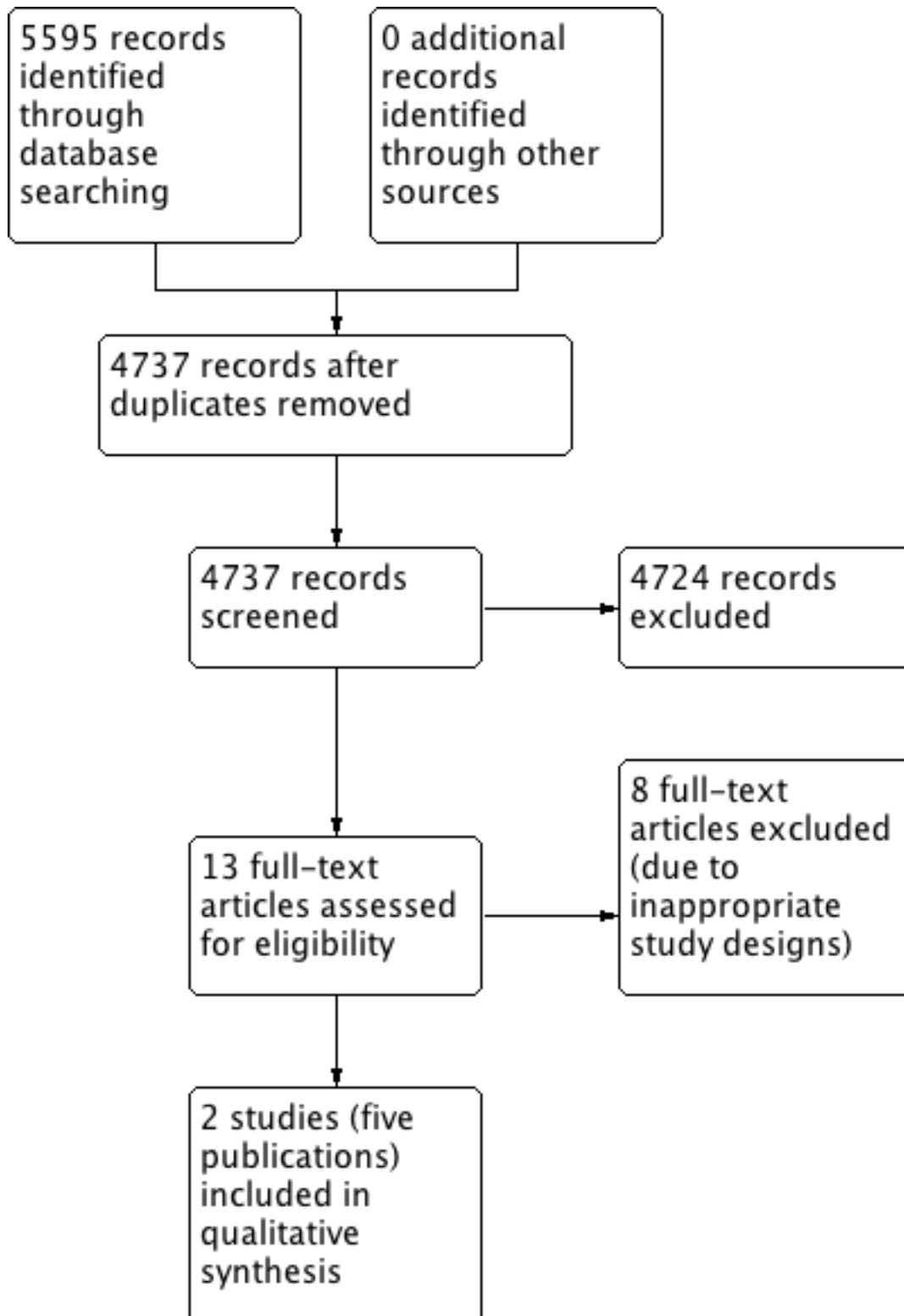
Description of studies

Characteristics of the included studies are presented in detail in [Appendix 2](#) and summarised in the [Characteristics of included studies](#) tables.

Results of the search

We identified 4737 studies from the literature search. Following two rounds of screening, we assessed 13 publications in detail ([Figure 1](#)).

Figure 1. Study flow diagram.



Included studies

Two studies (from five publications) met the inclusion criteria (Clarkson 2008; Coventry 1989), with data from 503 dental practices, representing 821 dentists and 4771 patients. Both were RCTs and were undertaken in the United Kingdom.

after a change to the remuneration system. We excluded one ITS study on the basis of an inadequate number of time points between changes in the remuneration rate offered to primary care dentists. In addition, we excluded a cohort and an observational extension of the included Coventry 1989 study (See Characteristics of excluded studies tables).

Excluded studies

We excluded eight studies (Blinkhorn 1996; Chalkley 2008; Fiset 2000; Holloway 1997; Mayer 2000; Mellor 1994; Mellor 1997; Rosen 1977); five on the basis that they were uncontrolled before-after studies examining the impact on clinical activity before and

Risk of bias in included studies

Details of the risk of bias assessment are provided in the Characteristics of included studies and summarised in Figure 2. We assessed both studies as being at an overall high risk of bias.

Figure 2. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Clarkson 2008	+	+	-	?	?	?
Coventry 1989	+	+	-	?	?	-

Allocation

We considered both the [Clarkson 2008](#) and the [Coventry 1989](#) trial to be of low risk with respect to the random sequence generation and allocation concealment. In the former trial, sampling, randomisation and analysis were conducted at arm's length from the study base by a remote Health Services Research Unit at the University of Aberdeen. Randomisation was carried out using minimisation, involving four practice-based variables: the deprivation category for the area of practice; the number of partners in the practice; the throughput of 11- to 13-year-olds; and the number of restorative sealant claims in 2002. As the dentists were recruited before randomisation occurred, this would reduce selection bias. In the latter trial, a senior officer of the British Dental Association spun a coin to decide which one of each pair of areas should transfer to capitation and which should remain under fee-for-service. Again, the primary care dentists were recruited before randomisation.

Blinding

We judged the blinding of outcome assessors to represent a high potential for bias in both trials. In the [Clarkson 2008](#) study, the primary care dentists acted as the outcome assessors after the patients had received the intervention.

In the [Coventry 1989](#) trial, outcome assessors varied for different outcomes and for many, their measurement was undertaken by unblinded non-participant dentists.

Incomplete outcome data

We judged both trials to be unclear with respect to incomplete outcome data. Although there does not appear to be an imbalance of missing data across the fee-for-service and control arms in the [Clarkson 2008](#) trial, the authors did not provide any analysis, although the data was stated to be analysed using the intention-to-treat principle.

In the [Coventry 1989](#) trial, only nine capitation practices and two fee-for-service practices withdrew. The number of dental practices which dropped out was therefore very low (4.9%) in the capitation areas and 1.2% in the fee-for-service areas. However, it is not clear how many children were examined, or if there was an imbalance across the two arms.

Selective reporting

We were not able to judge whether all the prespecified primary outcomes were reported for either trial; we assessed both trials as unclear risk of bias for this domain.

Other potential sources of bias

The [Clarkson 2008](#) trial was judged to be unclear with respect to other potential sources of bias. The baseline characteristics and baseline outcomes of the arms were not statistically different at the practice level, probably due to the minimisation process. However, there was a statistically significant lower proportion of children having at least one sealant treatment in their second permanent molars at baseline in the fee-for-service only arm and the fee-for-service and education arms compared to the education only and the control arms. Even so, the primary analysis adjusted for a number of variables including the number of sealants placed in first permanent molars pre-intervention, and found a statistically significant difference in favour of the dentists receiving fee-for-service remuneration. When baseline differences were not adjusted for, this did not reach statistical significance.

The [Coventry 1989](#) trial was judged to represent a high risk of bias due to a lack of stratification at baseline. The baseline characteristics and baseline outcomes in a number of paired areas were unbalanced and a statistically significant difference was found in the level of reported dental caries. An analysis conducted after the trial had commenced found that the mean number of decayed missing and filled teeth in five- to six-year-olds and eight- to nine-year-olds was significantly greater in Salford compared to Doncaster and in Bromley compared to Wycombe; Salford and Bromley were both remunerated by capitation.

Effects of interventions

See: [Summary of findings for the main comparison Fee-for-service remuneration for encouraging fissure sealant placement for second permanent molars in 12- to 14-year-olds](#); [Summary of findings 2 Capitation remuneration compared to fee-for-service remuneration for encouraging routine continuing dental care of children](#)

The two included studies were heterogenous and so we considered pooling of the data to be inappropriate. The results are presented separately in [Summary of findings table 1](#) and [Summary of findings table 2](#).

The primary outcomes of this review are measures of clinical activity, measures of health service utilisation, healthcare costs, and patient outcomes; the secondary outcomes are measures of non-clinical behaviour of primary care dentists, measures of dental practice profitability/income, and measures of unintended consequences. The [Clarkson 2008](#) study reported that there was a statistically significant increase in clinical activity among those incentivised with a fee-for-service payment compared with the control arm, when the model was adjusted for the deprivation category for

the area of practice, the number of partners in the practice, the throughput of 11- to 13-year-olds, and the number of restorative fissure sealants placed on first permanent molars at baseline. Using this model, the mean percentage of 12- to 14-year-olds receiving fissure sealants for second permanent molars was 9.8% higher (95% CI 1.8% to 17.8%) in the fee-for-service arm compared to the control arm. When left unadjusted, the difference in the mean percentage was 7.1%, which was not statistically significant (95% CI -1.9% to 16.1%). No further measures of health service utilisation or patient outcomes were reported.

The incremental cost-effectiveness of the fee-for-service arm compared to the control arm was reported to be 0.10 i.e. for every extra GBP 1 spent there was a 0.1% increase in activity. Units were reported as “% change in outcome per £[GBP]”, but no price year was provided, and the detail of the outcome measure was not specified, and can only be inferred to be sealant placement. This lack of precision represents a major flaw in the reporting of the study. Furthermore, the economic evaluation did not undertake any discounting, nor did it take into account the payments from the state (i.e. the fee-for-service payment), rather, it investigated the cost to practices (in terms of staff time and consumables) to avoid double-counting, and the costs to parents.

In terms of clinical activity, the [Coventry 1989](#) study reported that, in each of the pairs of areas, the mean number of filled teeth per 0- to 15-year-olds and the mean percentage of 0- to 15-year-olds having one or more teeth extracted tended to be lower in capitation areas while the mean percentage of 0- to 15-year-olds receiving active preventive advice tended to be higher.

Regarding health service utilisation, in each of the pairs of areas, the mean number of visits per 0- to 15-year-old tended to be lower in capitation areas compared to fee-for-service areas.

Regarding healthcare costs, in each of the pairs of areas, the mean expenditure in GBP per 0- to 15-year-old tended to be higher in capitation areas compared to fee-for-service areas. However, the authors reported that the mean expenditures should only be considered as approximations, and there is bias that places the capitation arm at a disadvantage. In addition, participating dentists in capitation areas referred significantly more children to the Community Dental Service compared to dentists in fee-for-service ar-

reas, and the cost of treating the children in the Community Dental Service would not have been taken into account in the economic analysis.

In terms of patient outcomes, in each of the pairs of areas, the mean number of decayed teeth per 14- to 15-year-old tended to be higher in capitation areas compared to fee-for-service areas, although this was only statistically significant in one of the pairs of areas. The authors reported that dentists working under capitation arrangements restored carious teeth at a later stage in the disease process than those working under fee-for-service arrangements, but this delay did not appear to compromise dental health.

It is important to note that not all of these comparisons between the pairs of areas were reported as statistically significant and the unit of analysis (e.g. dentists, patients, parents and administrators) was often not the same as the unit of randomisation, leading to unit-of-analysis error, where P values are artificially small. In addition, the baseline mean decayed/missing/filled permanent teeth (DMFT) and DMFT in the pairs of areas were unbalanced in two of the four pairs, with all the significant differences favouring the fee-for-service areas i.e. dental health tended to be better in the fee-for-service areas.

In terms of the secondary outcomes of this review, the [Clarkson 2008](#) study did not report any relevant outcomes. However, the [Coventry 1989](#) study reported several. Dentists under the fee-for-service system were more likely to introduce innovations into their dental practices compared to dentists under the capitation system (69% versus 56%, $P \leq 0.01$), and reported a greater temptation to over-prescribe using a 0 - 100 visual analogue scale (31.0 versus 16.1, $P \leq 0.01$), although, conversely, dentists under the capitation system felt a greater temptation to under-prescribe (58.3 versus 37.7, $P \leq 0.01$). These latter outcomes were self reported using a visual analogue scale that was not validated and they cannot be substantiated with an objective measure. Moreover, these pooled results from the four pairs of areas are problematic because the matched pairs of areas were very different from each other. Therefore, indicating where there were consistent trends in all pairs is more appropriate than testing the statistical significance of overall differences between capitation areas and fee-for-service areas.

ADDITIONAL SUMMARY OF FINDINGS *[Explanation]*

Population: Children undergoing routine continuing dental care at 354 dental practices (the number of dentists varied over time as dentists joined and left dental practices, so the number of dental practices was the stable and primary parameter; the total number of 0- to 15-year-old children was not reported accurately) Settings: Matched pairs of Health Service administrative areas in England (representing northern urban, commuter suburb and rural communities) and Scotland Intervention: Capitation remuneration Comparison: Fee-for-service remuneration					
Outcomes	Illustrative comparative risks (95% CI)		Relative effect (95% CI)	No. of participants (studies)	Quality of the evidence (GRADE)
	Assumed risk	Corresponding risk			
	Fee-for-service remuneration	Capitation remuneration			
Measures of health service utilisation: mean number of visits per 0- to 15-year-old Follow-up: 3 years	Northern urban community: 2.8	MD 0.4 lower ¹	-	~ 2250 (1 study ⁴)	⊕⊕○○ low ⁶
	Commuter suburb community: 2.3	MD 0.4 lower ¹			
	Rural community: 2.5	MD 0.3 lower			
	Scottish community: 2.8	MD 0.5 lower ¹			
Patient outcomes: mean number of filled teeth per 0- to 15-year-old Follow-up: 3 years	Northern urban community: 0.78	MD 0.18 lower ¹	-	~ 2250 (1 study ⁴)	⊕⊕○○ low ⁶
	Commuter suburb community: 0.34	MD 0.03 lower			
	Rural community: 0.44	MD 0.21 lower			
	Scottish community: 0.91	MD 0.28 lower ¹			

Patient outcomes: mean percentage of 0- to 15-year-olds having one or more teeth extracted³ Follow-up: 3 years	Northern urban community: RD 5% lower ¹ 18%	RR 28% lower ¹	~ 2250 (1 study ⁴)	⊕⊕○○ low⁶
	Commuter suburb community: 7% RD 0%	RR 0%		
	Rural community: 10% RD 3% lower ¹	RR 30% lower ¹		
	Scottish community: 15% RD 1% lower	RR 7% lower		
Patient outcomes: mean number of decayed teeth per 14- to 15-year-old (data for 0- to 15-year-olds NR) Follow-up: 3 years	Northern urban community: MD 0.16 higher 0.16	-	1919 (1 study ⁴)	⊕⊕○○ low⁶
	Commuter suburb community: 0.24 MD 0.07 higher			
	Rural community: 0.58 MD 0.75 higher ²			
	Scottish community: 0.65 MD 0.15 higher			
Measures of clinical activity: mean percentage of 0- to 15-year-olds receiving active preventive advice³ Follow-up: 3 years	Northern urban community: RD 27% higher ¹ 19%	RR 142% higher ¹	~ 2250 (1 study ⁴)	⊕⊕○○ low⁶
	Commuter suburb community: 18% RD 15% higher	RR 83% higher		
	Rural community: 34% RD 5% lower	RR 15% lower		
	Scottish community: 28% RD 9% higher	RR 32% higher		
Healthcare costs: mean expenditure in GBP (currency year NR) per 0- to 15-year-old⁵ Follow-up: 1 year	Northern urban community: MD 4.22 higher 20.55	21% higher	276,414 ⁵ (1 study ⁴)	⊕⊕○○ low⁶

	Commuter suburb commu- nity: 16.67	MD 6.18 higher	37% higher
	Rural community: 17.29	MD 6.90 higher	40% higher
	Scottish community: 17.68	MD 1.52 higher	9% higher

CI: Confidence interval; **GBP:** Pound Sterling; **MD:** Mean difference; **NR:** Not reported; **RD:** Risk difference; **RR:** Risk ratio

GRADE Working Group grades of evidence

High quality: Further research is very unlikely to change our confidence in the estimate of effect.

Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low quality: We are very uncertain about the estimate.

¹Statistically significant at the 5% level. However, the unit of analysis (e.g. dentists, patients, parents and administrators) was often not the same as the unit of randomisation. This leads to unit-of-analysis error, where P values are artificially small (though the estimates of effect are unbiased), leading to false positive conclusions that the intervention had an effect.

²Statistically significant at the 1% level. However, the unit of analysis (e.g. dentists, patients, parents and administrators) was often not the same as the unit of randomisation. This leads to unit-of-analysis error, where P values are artificially small (though the estimates of effect are unbiased), leading to false positive conclusions that the intervention had an effect.

³The basis for the assumed risk is the risk in the control group (i.e. the probability of a dentist in the control group giving preventive advice to or extracting a tooth for a 0- to 15-year-old). The corresponding risk (the risk difference) is based on the assumed risk in the control group and the relative effect of the capitation remuneration (the risk ratio).

⁴There were four matched pair of Health Service administrative areas. These randomised pairs were treated as separate, thus the overall study contained four replicates under contrasting socioeconomic and environmental circumstances. There were only two Health Service administrative areas randomised in each replicate, therefore each arm of each replicate only contained one Health Service administrative area.

⁵ All payments made to study dentists for the treatment of 0- to 5-year-olds during 1988 were divided by the estimated numbers of children treated. However, the estimated number is only an approximation as it was impossible to eliminate double-counting, particularly in the fee-for-service system. This means that the mean expenditure per 0- to 15-year-old should only be considered as close approximations, and there is bias that places the capitation arm at a disadvantage. In addition, participating dentists in capitation areas referred significantly more children to the Community Dental Service compared to dentists in fee-for-service areas; this is despite the fact that non-participating dentists in the capitation areas tended to refer significantly fewer children compared to non-participating dentists in fee-for-service areas. The cost of treating the children in the Community Dental Service would not have been taken into account in the economic analysis.

⁶ Quality of the evidence

- **Risk of bias:** high
- **Inconsistency:** undetected (single study)
- **Indirectness:** no
- **Imprecision:** undetected (95% CIs were not reported)
- **Publication bias:** undetected (single study)
- **Large effect:** not relevant (applies to studies with no threats to validity)
- **Plausible confounding would change the effect:** not relevant (applies to studies with no threats to validity)
- **Dose response gradient:** not relevant (applies to studies with no threats to validity)

DISCUSSION

Summary of main results

In the [Clarkson 2008](#) trial, there was a statistically significant increase in clinical activity (placement of sealants) among those incentivised with a fee-for-service payment compared with the control arm, when the model was adjusted.

In the [Coventry 1989](#) trial, dentists working under capitation arrangements restored carious teeth at a later stage in the disease process than fee-for-service controls, and visits, fillings and extractions tended to be lower in capitation areas compared to fee-for-service areas, while preventive advice tended to be given more frequently.

Overall completeness and applicability of evidence

The results of the [Clarkson 2008](#) study need to be interpreted in the context of a high risk of bias and indirectness; the primary care dentists received the fee-for-service remuneration in the first six months of the study, whilst the data was collected for a further twelve months after the start of the trial. It is possible that the effects of the fee-for-service remuneration could have been attenuated if the data had been collected at the limit of this 18-month data period.

The clinical relevance of placing fissure sealants on thirteen-year-olds may also have had an impact on the decision to treat. It is good practice to place sealants on teeth as soon as it is possible to provide moisture control for the erupting tooth. Second molars erupt at twelve years of age, yet the average age at baseline was 13.2 years in the education arm and 13.3 years in both the fee-for-service and education arm. The data was also collected for 18 months. Again, the percentage of children with fissure sealants at the end of the study may have been attenuated by this and in high risk children, restorations may have already been indicated rather than sealants. Finally, there was imprecision as the sample size was lower than the required sample size calculated by the authors. While the adjusted mean percentage difference for 12- to 14-year-olds receiving fissure sealants for second permanent molars was 9.8% higher in the fee-only group, the 95% CIs intervals were wide, with the lower boundary showing an increase of 1.8%. The clinical significance and cost-effectiveness of a financial payment that results in an increase of 1.8% in the number of children receiving fissure sealants is difficult to determine. In addition, given that the study was conducted in the four most deprived areas of Scotland the applicability of the findings to other settings may be limited.

In the [Coventry 1989](#) trial, the researchers did not stratify the participants, based on disease experience at baseline and there were significantly different disease levels across a number of the paired

arms, in addition to unit of analysis error. This means that it was not possible to determine the impact that the remuneration systems had on the health of the children, nor determine the cost-effectiveness of either arm, given the unknown impact on patient outcomes.

Another limitation of the review is the inclusion criteria regarding study design. Major advances in econometrics have been made, which make it possible to draw causal inferences from non-random assignments of patients and dentists, for example, as demonstrated by [Chalkley 2008](#). These studies could be considered and triangulated with experimental evidence to fully inform the evidence base. Future updates of this review may also consider broadening the inclusion criteria to consider data from non-experimental sources.

Quality of the evidence

The number of studies using an experimental design was very low. Both included studies had a high risk of bias and the quality of the evidence from the two included studies was low/very low for all outcomes, as assessed by GRADE.

Potential biases in the review process

Bias in the review process was kept to a minimum. Three authors (PRB, AMG and JP) screened the titles and determined inclusion, assessed for bias and extracted the data. Any differences were resolved by discussion. No post hoc changes were made to the review methods described in the protocol.

One area which may introduce bias is the choice of grey literature sources. The identified sources do not represent a comprehensive list of international health economics centres and is unclear as to whether this would have introduced some form of reporting bias within the review. Future updates of the review will aim to identify further relevant sources of both published and unpublished papers.

Agreements and disagreements with other studies or reviews

An examination of the health economic literature would suggest that a retrospective cost-based system like fee-for-service shifts the cost of care to the third party payer and creates an incentive for over-provision of services, as activity generates revenue. In contrast, prospective payment systems are said to cut the link between the revenue per case and create an incentive for under-provision, with a restriction of services largely to those with low needs (cream-skimming), the “dumping” of high cost patients and the “skimping” or under-provision for those with high needs ([Ellis 1997](#); [Krasnik 1990](#)).

In Gosden et al's review, fee-for-service payments were associated with an increase in the quantity of primary care services, but

changes to patient outcomes were equivocal and there was considerable variation in the study setting and the range of outcome measures utilised (Gosden 2000). In Scott et al's review, there was insufficient evidence to determine the impact of financial incentives on the quality of primary health care and the quality of the included studies was considered poor (Scott 2011). Flodgren et al's overview of reviews concluded that financial incentives may be effective in changing healthcare professional practice, but the included studies were of low to moderate quality and there were no studies evaluating patient outcomes (Flodgren 2011).

AUTHORS' CONCLUSIONS

Implications for practice

There is limited evidence that retrospective payment systems (fee-for-service) increase the clinical activity of primary care dentists, but it was not possible to determine whether this impacted on patient outcomes. The quality of the evidence from the two included studies was low/very low for all outcomes and the studies focused on levels of activity and throughput, rather than its distribution.

Implications for research

Further experimental research in this area is highly recommended

given the paucity of evidence, and particular attention should be paid to patient outcomes. Future studies need to consider the level of payment, as well as the methods of remuneration. Investigating the effect of changing the remuneration method from one form to another is as important as studying different payment mechanisms in isolation. In addition, future studies should take the clinical context into account, with careful alignment of the incentives with patients' care needs.

The use of CBA and ITS studies as part of a natural experiment is warranted. In addition, major advances in econometrics have been made, which make it possible to draw causal inferences from non-random assignments of patients and dentists; these should be considered alongside and triangulated with experimental evidence to fully inform the evidence base.

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REFERENCES

References to studies included in this review

Clarkson 2008 {published and unpublished data}

Clarkson JE, Turner S, Grimshaw JM, Ramsay CR, Johnston M, Scott A, et al. Changing clinicians' behavior: a randomized controlled trial of fees and education. *Journal of Dental Research* 2008;**87**(7):640–4.

Coventry 1989 {published data only (unpublished sought but not used)}

* Coventry P, Holloway PJ, Lennon MA, Mellor A, Worthington HV. A trial of a capitation system of payment for the treatment of children in the General Dental Service: final report. *Community Dental Health* 1989;**6**(Suppl 1): 1–63.

Holloway PJ, Lennon MA, Mellor AC, Coventry P, Worthington HV. The capitation study. 1. Does capitation encourage "supervised neglect?". *British Dental Journal* 1990;**168**(3):119–21.

Lennon MA, Worthington HV, Coventry P, Mellor AC, Holloway PJ. The capitation study. 2. Does capitation encourage more prevention?. *British Dental Journal* 1990; **168**(5):213–5.

Mellor AC, Coventry P, Worthington HV, Holloway PJ, Lennon MA. The capitation study. 3. The views of

participating dentists and the profession. *British Dental Journal* 1990;**168**(7):303–5.

References to studies excluded from this review

Blinkhorn 1996 {published data only}

Blinkhorn AS, Hassall DC, Holloway PJ, Mellor AC, Worthington HV. An assessment of capitation in the new General Dental Service contract. *Community Dental Health* 1996;**6**(Suppl 1):3–20.

Chalkley 2008 {published data only}

Chalkley M, Tilley T, Young L, Bonnetti D, Clarkson J. The effect of activity-based payment on dentists' activity: evidence from a natural experiment in the UK National Health Service. www.discovery.dundee.ac.uk/portal/files/105619/DDPE_217.pdf (accessed 3 April 2013).

Fiset 2000 {published data only}

Fiset L, Grembowski D, Del Aguila M. Third-party reimbursement and use of fluoride varnish in adults among general dentists in Washington State. *Journal of the American Dental Association* 2000;**131**(7):961–8.

Holloway 1997 {published data only}

Holloway PJ, Blinkhorn AS, Hassall DC, Mellor AC, Worthington HV. An assessment of capitation in the

General Dental Service Contract. 1. The level of caries and its treatment in regularly attending children and adolescents. *British Dental Journal* 1997;**182**(11):418–23.

Mayer 2000 {published data only}

Mayer ML, Stearns SC, Norton EC, Rozier RG. The effects of Medicaid expansions and reimbursement increases on dentists' participation. *Inquiry* 2000;**37**(1):33–44.

Mellor 1994 {published data only}

Mellor AC. Resource costs of capitation maintenance care in Britain. *Community Dental Health* 1994;**11**(4):188–91.

Mellor 1997 {published data only}

Mellor AC, Blinkhorn AS, Hassall DC, Holloway PJ, Worthington HV. An assessment of capitation in the General Dental Service contract 2. Patterns of treatment provided to regularly attending patients. *British Dental Journal* 1997;**182**(12):460–4.

Rosen 1977 {published data only}

Rosen HM, Sussman RA, Sussman EJ. Capitation in dentistry: a quasi-experimental evaluation. *Medical Care* 1977;**15**(3):228–40.

Additional references

Birch 1988

Birch S. The identification of supplier-inducement in a fixed price system of health care provision. The case of dentistry in the United Kingdom. *Journal of Health Economics* 1988; **7**(2):129–50.

Chalkley 2006

Chalkley M, Tilley C. Treatment intensity and provider remuneration: dentists in the British National Health Service. *Health Economics* 2006;**15**(9):933–46.

Donaldson 1989

Donaldson C, Gerard K. Paying general practitioners: shedding light on the review of health services. *Journal of the Royal College of General Practitioners* 1989;**39**(320):114–7.

Ellis 1997

Ellis R, McGuire T. Supply-side and demand-side cost sharing in health care. *Journal of Economic Perspectives* 1993; **7**(4):135–51.

EPOC 2011

Cochrane Effective Practice and Organisation of Care Group. Suggested risk of bias criteria for EPOC reviews. www.epoc.cochrane.org/sites/epoc.cochrane.org/files/uploads/Suggested%20risk%20of%20bias%20criteria%20for%20EPOC%20reviews.pdf (accessed 3 April 2013).

EPOC 2013

Effective Practice and Organisation of Care (EPOC) Group. What study designs should be included in an EPOC review and what should they be called?. www.epocoslo.cochrane.org/sites/epocoslo.cochrane.org/files/uploads/05%20What%20study%20designs%20should%20be%20included%20in%20an%20EPOC%20review%202013%2008%2012.pdf (accessed 10 August 2013).

Flodgren 2011

Flodgren G, Eccles MP, Shepperd S, Scott A, Parmelli E, Beyer FR. An overview of reviews evaluating the effectiveness of financial incentives in changing healthcare professional behaviours and patient outcomes. *Cochrane Database of Systematic Reviews* 2011, Issue 7. DOI: 10.1002/14651858.CD009255

Foy 2003

Foy R, Parry J, Duggan A, Delaney B, Wilson S, Lewin-Van Den Broek NT, et al. How evidence based are recruitment strategies to randomized controlled trials in primary care? Experience from seven studies. *Family Practice* 2003;**20**(1): 83–92.

Gosden 2000

Gosden T, Forland F, Kristiansen I, Sutton M, Leese B, Giuffrida A, et al. Capitation, salary, fee-for-service and mixed systems of payment: effects on the behaviour of primary care physicians. *Cochrane Database of Systematic Reviews* 2000, Issue 3. DOI: 10.1002/14651858.CD002215

Gregory 2007

Gregory J, Gibson B, Robinson PG. The relevance of oral health for attenders and non-attenders: a qualitative study. *British Dental Journal* 2007;**202**(7):E18.

Grytten 2005

Grytten J. Models for financing dental services. A review. *Community Dental Health* 2005;**22**(2):75–85.

Grytten 2009

Grytten J, Holst D, Skau I. Incentives and remuneration systems in dental services. *International Journal of Health Care Finance and Economics* 2009;**9**(3):259–78.

Harris 2009

Harris R, Burnside G, Ashcroft A, Grieson B. Job satisfaction of dental practitioners before and after a change in incentives and governance: a longitudinal study. *British Dental Journal* 2009;**207**(2):E4.

Higgins 2011

Higgins JPT, Green S (editors). *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, 2011. Available from www.cochrane-handbook.org.

Krasnik 1990

Krasnik A, Groenewegen PP, Pedersen PA, von Scholten P, Mooney G, Gottschau A, et al. Changing remuneration systems: effects on activity in general practice. *BMJ* 1990; **300**(6741):1698–1701.

McDonald 2012

McDonald R, Sudeh C-S, Tickle M. Changes to financial incentives in English dentistry 2006 to 2009: a qualitative study. *Community Dentistry and Oral Epidemiology* 2012; Vol. 40, issue 5:468–73.

Milsom 2009

Milsom KM, Jones C, Kearney-Mitchell P, Tickle M. A comparative needs assessment of the dental health of adults attending dental access centres and general dental practices

in Halton & St Helens and Warrington PCTs 2007. *British Dental Journal* 2009;**206**(5):257–61.

RevMan 2012 [Computer program]

The Nordic Cochrane Centre, The Cochrane Collaboration. RevMan (Review Manager). Version 5.2. Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2012.

Scott 2010

Scott A, Nacarella L, Furler J, Young D, Sivey P, Ait Ouakrim D, et al. *Using Financial Incentives to Improve the Quality of Primary care in Australia. Final Report.* Canberra: Australian Primary Health Care Research Institute, Australian National University, January 2010.

Scott 2011

Scott A, Sivey P, Ait Ouakrim D, Willenberg L, Naccarella L, Furler J, et al. The effect of financial incentives on the quality of health care provided by primary care physicians. *Cochrane Database of Systematic Reviews* 2011, Issue 9. DOI: 10.1002/14651858.CD008451

SDO 2011

Service Delivery and Organisation programme. The impact of incentives on the behaviour and performance of primary care professionals. www.sdo.nihr.ac.uk/files/project/SDO_FR_08-1618-158_V06.pdf (accessed 3 April 2013).

Southwick 1999

Southwick C, Evans D, Davies HTO. Improving child dental health in Scotland: an audit in primary care. In: Davies HTO, Tavakoli M, Malek M, Neilson AR editor(s). *Managing Quality: strategic issues in health care management.* Aldershot: Ashgate Publishing Ltd, 1999:195–205.

Steele 2009

Steele J, Clarke J, Wilson T, Rooney E. NHS dental services in England: an independent review. www.webarchive.nationalarchives.gov.uk/+/dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_101137?IdcService=GET_FILE&dID=198219&Rendition=Web (accessed 3 April 2013).

Tickle 2011

Tickle M, McDonald R, Franklin J, Aggarwal VR, Milsom K, Reeves D. Paying for the wrong kind of performance? Financial incentives and behaviour changes in National Health Service dentistry 1992–2009. *Community Dentistry Oral Epidemiology* 2011;**39**(5):465–73.

Wright 2001

Wright D, Batchelor PA. General dental practitioners beliefs on the perceived effects of and their preferences for remuneration mechanisms. *British Dental Journal* 2001;**192**(1):46–9.

* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Clarkson 2008

Methods	<p>Study type: Cluster-randomised control trial (with 2 x 2 factorial design)</p> <p>Duration of study: 18 months: six-month fee intervention period from September 2003 to February 2004 followed by a 12-month follow-up period to allow for the recording of any continuing effects of the interventions on dentists' decisions to place fissure sealants</p> <p>Setting: Scotland, in areas representing the four most deprived categories (out of seven) in the Scottish post code based system defining deprivation</p>
Participants	<p>Unit of randomisation: Dentists</p> <p>Unit of assessment/analysis: Patient-level outcomes were measured, but the results were presented at dentist-level i.e. the mean percentage of 12- to 14-year-olds receiving fissure sealants for second permanent molars per dentist (weighted by number of children seen)</p> <p>Method of recruitment:</p> <ul style="list-style-type: none"> ● Dentists: Dentists working in deprived areas were recruited using strategies recommended in recent reviews (Foy 2003) ● Patients: All 12- to 14-year-olds seen by study dentists during the first six months of the study (during which a fee could be claimed by the dentists in the fee-for-service arm) were identified through National Health Service records. A random sample of 25 per dentist was chosen to be assessed (although not all of these children were included in the analysis because some dentists were lost to follow-up, some children's patient records went missing and some children were found not to have erupted second permanent molars) <p>Inclusion criteria:</p> <ul style="list-style-type: none"> ● Dentists: <ul style="list-style-type: none"> ○ Treating at least four 11- to 13-year-olds per month on average during 2002 ○ Working in a deprived area (i.e. in categories 4 to 7 of the 7-category Scottish deprivation categories [DEPCAT] classification) ○ A maximum of one dentist per dental practice (chosen at random) was included ● Patients: <ul style="list-style-type: none"> ○ 12- to 14-year-olds ○ Children who visited a study dentist during the first six months of the study (during which a fee could be claimed by the dentists in the fee-for-service arm) <p>Exclusion criteria:</p> <ul style="list-style-type: none"> ● Dentists: <ul style="list-style-type: none"> ○ Orthodontist ○ Moved/moving ○ Retired/retiring ○ Maternity leave ○ Sick leave ○ Salaried ● Patients: <ul style="list-style-type: none"> ○ Children who were found not to have erupted second permanent molars were excluded from the analysis <p>External validity: The participating dentists may have had different characteristics to</p>

	<p>the non-participating dentists. Out of the 284 dentists who were eligible to take part, 131 (46%) refused or did not respond (and a further four were not randomised due to being late recruits etc). In choosing to take part, the dentists would have the possibility (depending on which arm they were randomised to) of claiming fee-for-service remuneration on top of their normal capitation remuneration, therefore those that chose not to take part may be less motivated to claim the small sums associated with the fee-for-service remuneration, at least in the context of the study (the fees were to be claimed from the research team rather than via the routine National Health Service channel). In addition, all the dentists were working in deprived areas, which would have different levels of need compared to Scotland as a whole</p>
Interventions	<p>Interventions:</p> <ul style="list-style-type: none"> • Fee-for-service remuneration: GBP 6.80 for each second permanent molar fissure sealed during a six-month period - the level of the fee was set so that it was consistent with the fee level payable through the normal National Health Service system for a <i>restorative</i> fissure sealant application (which may involve removal of enamel caries prior to sealant placement without the insertion of filling composite) and for <i>preventive</i> sealing of third permanent molars (the fee did not affect National Health Service capitation payments which were GBP 2.76 per month to age 12 and GBP 4.01 thereafter) • Education regarding evidence-based practice (1-day workshop in four regions run by experts from The Cochrane Oral Health Group, The Centre for Evidence-based Dentistry and The Dental Health Service Research Unit) • Both fee-for-service and education <p>Control: no specific intervention</p> <p>Applicability:</p> <ul style="list-style-type: none"> • The average age at baseline was from 13.20 years in the education arm to 13.26 years in the both fee-for-service and education arm, and the data on fissure sealant placement was collected up to 18 months after this baseline, so some of the children may have already started to experience decay if their second permanent molars erupted at around 12 years old. Attempting to place fissure sealants soon after the eruption of second permanent molars is considered preferable to waiting a fairly long time after eruption, so the percentage of children with fissure sealants at the end of the study may have been attenuated (this could apply across all of the study arms). Records of any caries already present or any restorations placed would be useful as this could impact on the proportion of fissure sealants placed i.e. dentists in the study may have placed restorations instead of sealants. The authors noted that only two-thirds of eligible dentists claimed a fee, perhaps due to the fact that the child already had caries in their second permanent molars • The fee-for-service remuneration did not affect National Health Service capitation payments which were GBP 2.76 per month to age 12 and GBP 4.01 thereafter. The impact of the fee-for-service remuneration was therefore over and above the impact from capitation • The authors suggested that the dentists may have found it too inconvenient to claim a fee from the research team, rather than via the routine National Health Service channel, which would normally be the route for claiming fee-for-service remuneration
Outcomes	<p>Primary outcomes:</p> <p>1) Measures of clinical behaviour of primary care dentists</p>

	<ul style="list-style-type: none"> • Mean percentage of 12- to 14-year-olds receiving fissure sealants for second permanent molars per dentist (weighted by number of children seen) • Risk differences for fee-for-service vs. no fee-for-service and education vs. no education <p>2) Healthcare costs (including costs of (i) introducing the incentives, (ii) the transaction, (iii) the information systems and (iv) monitoring)</p> <ul style="list-style-type: none"> • Cost-effectiveness of fee-for-service vs. control, education vs. control and both vs. control (reported as the "% change in outcome per £[GBP]") <p>Adverse outcomes: None stated</p>	
Source of funding	Chief Scientist Office, Scottish Executive and Scottish Higher Education Funding Council	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	<p><i>"Sampling, randomisation, and analysis were conducted at arm's length from the study base by the Health Services Research Unit, University of Aberdeen"</i></p> <p>The authors state that they carried out randomisation using minimisation, a form of covariate-adaptive randomisation. The process involved four practice-based variables which were obtained pre-randomisation from National Health Service records: the deprivation category for the area of practice, the number of partners in the practice, the throughput of 11- to 13-year-olds and the number of restorative sealant claims in 2002</p>
Allocation concealment (selection bias)	Low risk	<p><i>"Sampling, randomisation, and analysis were conducted at arm's length from the study base by the Health Services Research Unit, University of Aberdeen"</i></p> <p>As minimisation was used to randomise the dentists, the dentists would have to have been recruited before the random sequence was generated, which therefore reduces selection bias</p>
Blinding of outcome assessment (detection bias) Dental health	High risk	<p><i>"A random sample of 25 [patients] per dentist was taken, and data collection forms were sent to each dentist for completion from practice records 12 [months] post-intervention"</i></p>

		<p>Blinding was not possible for the dentists, who acted as the outcome assessors after they had received the intervention i.e. data collection forms were sent to each dentist for completion using patient records, which means that the outcome measure depended on the accuracy of the dentists' reports</p> <p>The authors stated that given that the sealant placement did not attract a National Health Service fee-for-service payment - and therefore did not generate a National Health Service-held record - it was not possible to corroborate the dentists' sealant placement records. Equally, National Health Service-held records of the dental visit during which the sealant was placed are not reliable as no such record would occur if no other fee-attracting treatment was given during the visit and the child did not require re-registration. The authors stated that other reasons for mismatches are scanning error, transcription error, and delayed submission of claim forms from the practice to the National Health Service body responsible for fee payment. The authors carried out a crosscheck of National Health Service-held records of dental visit dates and practice-reported dates of sealant placement and found matches in 28% (109) of cases</p> <p>The authors stated that while it is possible that bias was introduced, this would have applied equally across the intervention arms but this statement is not verifiable. However, the outcome was objective, which lowers the risk of bias even though the outcome was not assessed blindly</p>
<p>Incomplete outcome data (attrition bias) All outcomes</p>	<p>Unclear risk</p>	<p>There does not appear to be an imbalance of missing data across the fee-for-service and control arms (for example, four dentists in both the fee-for-service and control arms were lost to follow-up), nor an imbalance in the reasons behind missing data in these arms (for example, 7.1% of children were excluded from the fee-for-service arm and 10.4% of children were excluded in the control arm because they did not have</p>

Clarkson 2008 (Continued)

		<p>erupted second permanent molars). However, the authors do not appear to have conducted statistical analyses to check for possible imbalances, which may have occurred, particularly between the arm where dentists received fee-for-service remuneration and education (six dentists were lost to follow-up in this arm) and the education arm (two dentists were lost to follow-up in this arm)</p> <p>The data were analysed using the intention-to-treat principle. For example, dentists who did not attend the education intervention were mailed the course material and retained in the study on an intention-to-treat basis, thus reducing the use of incomplete outcome data</p>
Selective reporting (reporting bias)	Unclear risk	No protocol is cited and it is not stated whether all the prespecified primary outcomes have been reported
Other bias	Unclear risk	<p><i>"There was a lower baseline of sealant treatment of second permanent molars in the fee and both arms. No other significant baseline differences in practice or practitioner characteristics were found"</i></p> <p>The baseline characteristics and baseline outcomes of the arms were generally balanced (partly due to the fact that minimisation using four dental practice-level variables was carried out at the beginning of the study), thereby reducing the possibility of confounding. No statistically significant differences in baseline characteristics of dental practices/dentists were found between the arms. However, there was a slight imbalance between arms in the patient-level characteristics measured at baseline i.e. there were statistically significant lower percentages of children having at least one sealant treatment of <i>second</i> permanent molars at baseline in the fee-for-service and both fee-for-service and education arms compared to the education and control arms. Even so, the primary analysis (which adjusted for a number of variables including the number of sealants placed</p>

Clarkson 2008 (Continued)

		<p>in <i>first</i> permanent molars pre-intervention) found a statistically significant difference in favour of the dentists receiving fee-for-service remuneration. However, the secondary analysis (which did not adjust for baseline differences) did not reach statistical significance</p> <p>The risk of contamination is not a concern as dentists (rather than patients) were randomised and it is unlikely that communication between dentists in the different arms could have occurred as a maximum of one dentist per dental practice was selected</p>
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Coventry 1989

<p>Methods</p>	<p>Study type: Cluster-randomised control trial (with parallel group design) Duration of study: 3 years: July 1986 to June 1989 Setting: Six areas in England and two areas in Scotland</p> <ul style="list-style-type: none"> ● Capitation arms <ul style="list-style-type: none"> ○ Northern urban community: Salford ○ Commuter suburb community: Bromley ○ Rural community: Norfolk ○ Scottish community: Grampian ● Fee-for-service arms <ul style="list-style-type: none"> ○ Northern urban community: Doncaster ○ Commuter suburb community: Wycombe ○ Rural community: Hereford and Worcester ○ Scottish community: Fife
<p>Participants</p>	<p>Unit of randomisation: Health Service administrative areas Unit of assessment/analysis: Dental practices (the number of dentists varied over time as dentists joined and left dental practices, so the number of dental practices was the stable and primary parameter), dentists, patients, parents and administrators Method of recruitment:</p> <ul style="list-style-type: none"> ● Health Service administrative areas: Areas in England (representing northern urban, commuter suburb and rural communities) and Scotland were considered. ● Dental practices/dentists: Letters were sent to all dentists on the Family Practitioner Committees (FPC)/Health Boards lists in the selected areas inviting them to join the study, and evening meetings (to which all dentists were invited) were arranged through the appropriate local dental committees. Visits were made to individual dental practices on request of the dentists and all telephone calls or letters from dentists were answered as comprehensively as possible. The number of dentists varied over time as dentists joined and left dental practices, so the number of dental practices was the stable and primary parameter <p>Inclusion criteria:</p> <ul style="list-style-type: none"> ● Health Service administrative areas: Selection was carried out by the study personnel. The four pairs were matched and represented northern urban, commuter

	<p>suburb, rural and Scottish communities. The pairs were matched initially on the patterns of treatment of the dentists in the areas, defined as the mean number of fillings per course of treatment provided for 10- to 14-year-olds. Other secondary factors were then taken into account, these were dentist-to-population ratios, housing population densities and proportion of the population receiving fluoride in the water supply. Information on the levels of dental health of the child populations was not available so a baseline dental health survey was carried out so that comparisons could be made retrospectively</p> <ul style="list-style-type: none"> ● Dental practices/dentists: Negative consent was used, such that all dentists were included in the study except those who specifically refused to take part, or who were deemed ineligible <p>Exclusion criteria:</p> <ul style="list-style-type: none"> ● Health Service administrative areas: Areas where less than 50% of dentists could be included were excluded - one area that was initially considered (Kingston and Richmond) was replaced (by Wycombe) because more than 50% of the dentists refused to take part ● Dental practices/dentists: Dental practices which did not treat children or that were confined to orthodontics were excluded <p>External validity: The participating dentists may have had different characteristics to the non-participating dentists. However, out of the 513 dental practices which were eligible to take part, only 159 (31%) refused to take part (negative consent was used, so those that did not reply were included). Also, the dental practices were not choosing whether or not they would be willing to work under a certain remuneration system (as the remuneration system would apply to participating and non-participating dentists in the Health Service administrative areas chosen), only whether or not they would be willing to take part in the study. In addition, the study took place in a range of areas with varying socioeconomic and environmental circumstances</p>
<p>Interventions</p>	<p>Intervention: Capitation remuneration for routine continuing dental care of children (with fee-for-service for initial treatment to make the children dentally fit before entering the capitation system, and for orthodontics, general anaesthetics, domiciliary visits, out-of-hours recalls, oral surgery and items involving laboratory work)</p> <p>Control: Fee-for-service remuneration for dental care of children</p>
<p>Outcomes</p>	<p>Primary outcomes:</p> <p>1) Measures of clinical behaviour of primary care dentists</p> <ul style="list-style-type: none"> ● For various age groups: <ul style="list-style-type: none"> ○ Mean number of examinations per child ○ Mean number of teeth filled per child ○ Mean percentage of children having one or more teeth extracted ○ Mean percentage of children receiving active preventive advice ○ Mean percentage of children receiving a scaling ○ Mean percentage of children receiving one or more fissure sealants ○ Mean percentage of children having radiographs ○ Percentage of participating dentists referring patients to the Community Dental Service (and percentage of non-participating dentists) ○ Percentage of dental practices arranging for in-practice emergency treatment of their patients out of routine surgery hours ○ Percentage of dental practices arranging for out of practice emergency

	<p>treatment of their patients out of routine surgery hours</p> <p>2) Measures of health service utilisation</p> <ul style="list-style-type: none"> ● Mean number of visits per child <p>3) Measures of patient outcomes</p> <ul style="list-style-type: none"> ● For 14- to 15-year-olds: <ul style="list-style-type: none"> ○ Percentage with caries on at least one tooth ○ Mean decayed/missing/filled permanent teeth (DMFT) (and among regularly attending children) ○ Mean number of decayed teeth (and among regularly attending children) ○ Mean number of missing teeth (and among regularly attending children) ○ Mean number of sound filled teeth ○ Mean number of sound and carious filled teeth ○ Mean number of filled teeth among regularly attending children ○ Percentage with at least one fissure sealant (and among regularly attending children) ● For 5- to 6-year-olds: <ul style="list-style-type: none"> ○ Percentage with caries on at least one tooth ○ Mean decayed/missing/filled primary teeth (dmft) (and among regularly attending children) ○ Mean number of decayed teeth (and among regularly attending children) ○ Mean number of missing teeth (and among regularly attending children) ○ Mean number of filled teeth (and among regularly attending children) ○ Percentage with arrested caries on at least one tooth <p>4) Healthcare costs (including costs of (i) introducing the incentives, (ii) the transaction, (iii) the information systems, and (iv) monitoring)</p> <ul style="list-style-type: none"> ● Mean expenditure in GBP per dentist year in participating dental practices during 1988 (percentage change from fee-for service) ● Mean expenditure in GBP per child in participating dental practices during 1988 (percentage change from fee-for service) <p>Secondary outcomes:</p> <p>1) Measures of non-clinical behaviour of primary care dentists such as rates of performing specified non-clinical behaviours (e.g. education and training)</p> <ul style="list-style-type: none"> ● Proportion of dentists reporting introducing innovations into their dental practices <p>2) Measures of unintended consequences including supplier-induced demand (Birch 1988), changes to the types of treatment offered and limitations to access</p> <ul style="list-style-type: none"> ● Mean values for temptation expressed by dentists to over-prescribe ● Mean values for temptation expressed by dentists to under-prescribe ● Mean values of clinical freedom expressed by dentists ● Percentage of principals stating that administration had increased greatly/slightly (over the last three years) <ul style="list-style-type: none"> ● Percentage of principals stating that bureaucratic intervention had increased/been unchanged/decreased (over the last three years) ● Percentage of dentists stating views on the accuracy of payment
Source of funding	Department of Health
Notes	

<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	<i>"[A] senior officer of the British Dental Association spun a coin to decide which one of each pair of areas should transfer to capitation and which should remain under fee-for-service"</i>
Allocation concealment (selection bias)	Low risk	Randomisation of the Health Service administrative areas was conducted after the dentists had joined the study, by a senior officer of the British Dental Association, which therefore reduces selection bias
Blinding of outcome assessment (detection bias) Dental health	High risk	<p>The outcome assessors varied for different outcomes:</p> <ul style="list-style-type: none"> • Dental health: high risk. Unblinded non-participant dentists were trained and calibrated to assess the dental health of a random sample of the children in schools, and the outcomes they measured would have had an element of subjectivity. For example, the authors stated that even though the examiners were taught specific criteria for arrested caries, the diagnoses were idiosyncratic to each examiner (however, the same examiner examined each of the two age groups in each pair of areas, alternating between areas to avoid the possibility of bias due to possible changes in diagnostic standards over time) • Patterns of treatment: high risk. The patterns of treatment provided by a sample of the dentists were obtained from the unblinded participant dentists. The outcomes were objective (e.g. the number of children who had radiographs) but they were self reported • Patterns of practice and referral: high risk. The unblinded participant dentists' answers, which would have had an element of subjectivity, were obtained by a questionnaire and unblinded community dental officers in the study areas were asked to record data on the number of referrals and reasons given for referral

		<ul style="list-style-type: none"> • Dentists' satisfaction and the profession's views: high risk. The unblinded participant dentists' subjective views were obtained by a questionnaire and the subjective views of representatives of local dental committees in the four capitation areas, representatives of the General Dental Service Committee of the British Dental Association and participant dentists were obtained via structured interviews and meetings • Parents' satisfaction: unclear risk. The subjective views of a sample of parents were obtained by a questionnaire. They were not blinded, but the authors stated that many parents were unaware of the remuneration system under which their children were treated • Administrators' satisfaction: high risk. The unblinded administrators' subjective views were obtained at meetings at several stages in the study • Costs: low risk. The outcomes were objective
<p>Incomplete outcome data (attrition bias) All outcomes</p>	<p>Unclear risk</p>	<p><i>"During the course of the study, only nine capitation practices chose to withdraw... Two practices withdrew from the control area..."</i></p> <p>The number of dental practices which dropped out was very low: 9 (4.9%) in the capitation areas, and 2 (1.2%) in the fee-for-service areas</p> <p>The dental health outcomes of 5- to 6-year-olds and 14- to 15-year-olds in each area were collected from a random sample of children from lists provided by the Dental Practice Boards. For 14- to 15 year-olds, 1919 children were examined, 68% of the usable sample (due to parents refusing consent, not replying etc.) For 5- to 6-year-olds, 1938 (69%) were examined. However, the authors do not state the percentage of those who were examined (out of all those who were eligible) in each study arm, nor whether there was an imbalance in the reasons for not being examined</p> <p>For the mean expenditure per 0- to 15-year old, all payments made to study dentists for the treatment of 0- to 5-year-olds during</p>

Coventry 1989 (Continued)

		1988 were divided by the estimated numbers of children treated. However, the estimated number is only an approximation as it was impossible to eliminate double-counting, particularly in the fee-for-service system. This means that there is bias that places the capitation arm at a disadvantage
Selective reporting (reporting bias)	Unclear risk	No protocol is cited and it is not stated whether all the prespecified primary outcomes have been reported
Other bias	High risk	Within each of the four replicates in the study there were only two Health Service administrative areas randomised, so the sample sizes were extremely small, which would lead to randomisation providing little protection against confounding. The baseline characteristics and baseline outcomes of the pairs of areas were shown to be unbalanced, which provides evidence of confounding. Although the authors attempted to match the pairs, there were few variables to match them on, which led to the imbalances. For example, in Fife there was an established practice to refer children to the Community Dental Service for preventive treatment (mainly for the placement of fissure sealants) but this procedure was not an important element in any other area (including Grampian, which was matched with Fife). In addition, information on the levels of dental health of the child populations was not available so a baseline dental health survey was carried out so that comparisons could be made retrospectively. The analysis showed that the mean decayed/missing/filled primary teeth (dmft) in 5- to 6-year-olds and 8- to 9-year-olds was significantly greater in Salford compared to Doncaster, and in Bromley compared to Wycombe. This was also true of the mean decayed/missing/filled permanent teeth (DMFT) in 8- to 9-year-olds and 11- to 12-year-olds (though not in 14- to 15-year-olds) in Salford compared to Doncaster. There were no other significant differences in mean decayed/missing/filled

Coventry 1989 (Continued)

		<p>primary teeth (dmft) and mean decayed/missing/filled permanent teeth (DMFT) between matched pairs. Where there were significant differences they all favoured the fee-for-service areas i.e. dental health tended to be better in the fee-for-service areas</p> <p>Other concerns in cluster-randomised control trials are recruitment bias between clusters involved in different interventions (but the dentists were recruited before randomisation, so the bias should not be present) and loss of clusters (which did not occur)</p> <p>The risk of contamination is not a concern as areas (rather than dentists or patients) were randomised</p> <p>Regularly attending children (from the random samples of 5- to 6-year-olds and 14- to 15-year-olds selected from the Dental Practice Boards) were defined as those who had visited the same dentist during the previous year. Using this definition, 70% of the original lists were regular attenders. As the authors noted, it was difficult to define regular attenders in a study which only lasts 3 years. This was made more problematic for the fee-for-service areas in England as the Dental Practice Board kept records for dentists rather than patients and in the capitation areas the patient registrations were built up gradually over a period of months as patients attended for courses of treatment</p>
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GBP: Pound Sterling

Characteristics of excluded studies [ordered by study ID]

Study	Reason for exclusion
Blinkhorn 1996	Uncontrolled before-after study (extension of Coventry 1989 study examining patients who had been in the fee-for-service arm and subsequently switched to capitation)
Chalkley 2008	Before-after study (on the effect of changing from fee-for-service remuneration to activity-based remuneration) with an inadequate control group

(Continued)

Fiset 2000	Uncontrolled before-after study (on the effect of introducing fee-for-service remuneration for providing fluoride varnish)
Holloway 1997	Uncontrolled before-after study (extension of Coventry 1989 study examining patients who had been in the fee-for-service arm and subsequently switched to capitation)
Mayer 2000	Interrupted time series with data analysed at limited time points between the interventions
Mellor 1994	Observational study on the resource costs of capitation maintenance care (extension of the capitation arm of the Coventry 1989 study)
Mellor 1997	Uncontrolled before-after study (extension of Coventry 1989 study examining patients who had been in the fee-for-service arm and subsequently switched to capitation)
Rosen 1977	Cohort study (with two samples of matched patients from dental practices with different payment mechanisms)

APPENDICES

Appendix I. Search strategies

MEDLINE (OVID)

Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) <1946 to Present>

Search date: 11 June 2013

1 (dentist\$ and (reimburs\$ or pay or payment? or copay\$ or "co-pay\$" or remunerat\$ or fee or fees)).ti. [Screen all]

2 Fees, Dental/

3 Dentists/ec [economics]

4 (dental or dentist\$).ti,hw. and (billing? or co-insur\$ or coinsur\$ or co-pay\$ or copay\$ or deductible? or earning? or fee or fees or financial or income? or pay or pays or payor? or payee? or payment? reimburs\$ or remunerat\$ or salary or salarie? or financial incent\$ or pay or payment? or "per capita").ti.

5 (dental or dentist\$).ti,hw. and ((billing or co-insur\$ or coinsur\$ or co-pay\$ or copay\$ or deductible? or fee or fees or financial or pay or pays or payor? or payee? or payment or reimburs\$ or remunerat\$) adj3 (incentiv\$ or coverage or insurance? or patient? or plan? or model or mechanism? or structure? or user?)).ab.

6 ((dental or dentist\$) adj3 (billing? or earning? or fee or fees or income? or reimburs\$ or remunerat\$ or salary or salarie? or financial incent\$ or pay or payment? or "per capita")).ab.

7 (exp Dentists/ or General practice, dental/) and (Income/ or Financ\$.ti,hw. or (fee or fees or payment? or billing).ti,ab,hw.)

8 (exp Dentists/ or General practice, dental/) and (economic\$ or payment? or reimbursement?).ti,ab,hw.

9 (exp Dentists/ or General Practice, Dental/) and (exp Financial Management/ or "insurance, dental"/)

10 (Dental Care/ or Dental Care for Aged/ or Dental Care for Children/ or Dental Care for Chronically Ill/ or Dental Care for Disabled/) and (fee or fees or payment? or pay or reimburs\$ or billing or copay\$ or "co-pay\$").ti,ab.

11 (exp Diagnosis Oral/ or exp Dental Prophylaxis/ or exp Tooth Preparation/) and (fee or fees or payment? or pay or reimburs\$ or billing or copay\$ or "co-pay\$").ti,ab.

12 "Salaries and Fringe Benefits"/ and (dentist\$.ti. or *Dentists/ or General practice, dental/)

13 Partnership Practice, Dental/ec, og or Dentist's Practice Patterns/ec, og or exp Dental Care/ec, og or Dentistry/og

14 or/2-13 [Dentists & Finance/Reimb Terms]

15 exp *Dentists/
16 General Practice, Dental/ or Dentist's Practice Patterns/
17 Practice Management, Dental/
18 Preventive Dentistry/ or Public Health Dentistry/ or State Dentistry/
19 (dentistry or ((dental or dentist\$) and (general or practice or practitioner?))).ti.
20 (general dental adj2 (practice or practitioner? or doctor?)).ti,ab.
21 ((general or family or primary care) adj2 dentistry).ab.
22 (dentist? or dentistry).ti,hw. and (general practice or general practitioner? or general dental).ti,ab.
23 ((dentist\$ or dental).ti,hw. and generalist?.ti.) or ((dental or dentist\$) adj3 generalist?).ab.
24 or/15-23 [Dentists/Dental Practice/Dentistry]
25 "fees and charges"/ or capitation fee/ or fee-for-service plans/ or fees, medical/ or "rate setting and review"/
26 insurance, health, reimbursement/ or reimbursement mechanisms/ or fee-for-service plans/ or blue cross blue shield insurance plans/
or "physician payment review commission"/ or prospective payment system/ or reimbursement, incentive/
27 exp economics, dental/
28 (capitation? or co-pay\$ or copay\$ or fee or fees or pay or payer? or payment? or reimburs\$ or remunerat\$ or salaries or salaried or salary).ti.
29 (remunerat\$ or reimburs\$).ab.
30 (fixed salar\$ or fixed payment? or fixed fee or fixed fees or fee-for-service or pay-for-performance or cap\$ fee? or capitation or dental fee? or medical fee? or co-pay\$).ab.
31 ((pay or reimburs\$ or financial or salary or "per capita" or remunerat\$) adj2 (algorithm? or incentiv\$ or model? or structur\$ or incenti\$ or "per capita")).ti,ab.
32 financial management/
33 ("accounts payable and receivable"/ or financial audit/ or "patient credit and collection"/) and (innovat\$ or model? or strategy or strategies).ti,ab.
34 or/25-33 [Payment/Reimbursement]
35 (pre-trial? or post-trial?).ti,ab.
36 intervention?.ti. or (intervention? adj6 (clinician? or collaborat\$ or community or complex or DESIGN\$ or doctor? or educational or family doctor? or family physician? or family practitioner? or financial or GP or general practice? or hospital? or impact? or improv\$ or individual?e? or individualizing or interdisciplin\$ or multicomponent or multi-component or multidisciplin\$ or multi-disciplin\$ or multifacet\$ or multi-facet\$ or multimodal\$ or multi-modal\$ or personalie? or personalizing or pharmacies or pharmacist? or pharmacy or physician? or practitioner? or prescrib\$ or prescription? or primary care or professional\$ or provider? or regulatory or regulatory or tailor\$ or target\$ or team\$ or usual care)).ab.
37 (pre-intervention? or preintervention? or "pre intervention?" or post-intervention? or postintervention? or "post intervention?").ti,ab. [added 2.4]
38 (hospital\$ or patient?).hw. and (study or studies or care or health\$ or practitioner? or provider? or physician? or nurse? or nursing or doctor?).ti,hw.
39 demonstration project?.ti,ab.
40 (pre-post or "pre test\$" or pretest\$ or posttest\$ or "post test\$" or (pre adj5 post)).ti,ab.
41 (pre-workshop or post-workshop or (before adj3 workshop) or (after adj3 workshop)).ti,ab.
42 trial.ti. or ((study adj3 aim?) or "our study").ab.
43 (before adj10 (after or during)).ti,ab.
44 ("quasi-experiment\$" or quasiexperiment\$ or "quasi random\$" or quasirandom\$ or "quasi control\$" or quasicontrol\$ or ((quasi\$ or experimental) adj3 (method\$ or study or trial or design))).ti,ab,hw. [ML]
45 ("time series" adj2 interrupt\$).ti,ab,hw. [ML]
46 (time points adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten or eleven or twelve or month\$ or hour? or day? or "more than")).ab.
47 pilot.ti.
48 Pilot projects/ [ML]
49 (clinical trial or controlled clinical trial or multicenter study).pt. [ML]
50 (multicentre or multicenter or multi-centre or multi-center).ti.
51 random\$.ti,ab. or controlled.ti.
52 (control adj3 (area or cohort? or compare? or condition or design or group? or intervention? or participant? or study)).ab. not (controlled clinical trial or randomized controlled trial).pt. [ML]

53 "comment on".cm. or review.ti.pt. or randomized controlled trial.pt. [ML]
54 review.ti. [EM]
55 (rat or rats or cow or cows or chicken? or horse or horses or mice or mouse or bovine or animal?).ti.
56 exp animals/ not humans.sh. [ML]
57 (or/36-52) not (or/53,55-56) [EPOC Methods Filter 2.4 Medline]
58 (randomized controlled trial or controlled clinical trial).pt. or randomized.ab. or placebo.ab. or clinical trials as topic.sh. or randomly.ab. or trial.ti.
59 exp animals/ not humans.sh.
60 58 not 59 [Cochrane RCT Filter 6.4.d Sens/Precision Maximizing]
61 14 or (24 and 34) [Dentists & Reimbursement]
62 61 and 60 [RCT]
63 (and/57,61) not 62 [EPOC]
64 1 not (or/62-63) [TI KW]

EMBASE (OVID)
Database: Embase Classic+Embase <1947 to July 17 2012>
Search date: 11 June 2013

1 (dentist\$ and (reimburs\$ or pay or payment? or copay\$ or "co-pay\$" or remunerat\$ or fee or fees)).ti.
2 (patient? adj2 pay\$).ab. and (dentist? or dental).ti.ab. [add to ML]
3 or/1-2 [KW screen all, no filters]
4 Fees, Dental/
5 (dental or dentist\$).ti,hw. and (billing? or co-insur\$ or coinsur\$ or co-pay\$ or copay\$ or deductible? or earning? or fee or fees or financial or income? or pay or pays or payor? or payee? or payment? reimburs\$ or remunerat\$ or salary or salarie? or financial incent\$ or pay or payment? or "per capita").ti.
6 (dental or dentist\$).ti,hw. and ((billing or co-insur\$ or coinsur\$ or co-pay\$ or copay\$ or deductible? or fee or fees or financial or pay or pays or payor? or payee? or payment or reimburs\$ or remunerat\$) adj3 (incentiv\$ or coverage or insurance? or patient? or plan? or model or mechanism? or structure? or user?)).ab.
7 ((dental or dentist\$) adj3 (billing? or earning? or fee or fees or income? or reimburs\$ or remunerat\$ or salary or salarie? or financial incent\$ or pay or payment? or "per capita").ab.
8 or/4-7 [Dentists & Finance/Reimb --KW combine with filters]
9 (dentistry or ((dental or dentist\$) and (general or practice or practitioner?))).ti.
10 (general dental adj2 (practice or practitioner? or doctor?)).ti,ab.
11 ((general or family or primary care) adj2 dentistry).ab.
12 (dentist? or dentistry).ti,hw. and (general practice or general practitioner? or general dental).ti,ab.
13 ((dentist\$ or dental).ti,hw. and generalist?.ti.) or ((dental or dentist\$) adj3 generalist?).ab.
14 dentist/ or dental practice/ or exp *preventive dentistry/ or *dental procedure/ or *dental care/
15 or/9-14 [Dentists/Dentistry]
16 reimbursement/
17 fee/ or capitation fee/ or medical fee/ or prospective payment/ or prospective pricing/
18 physician income/ or health care financing/
19 *health economics/
20 (health insurance/ or blue cross blue shield/ or medicaid/ or medicare/ or national health insurance/ or private health insurance/ or *public health insurance/) and (model? or strategy or strategies or structure? or organi?ation\$).ti,ab.
21 (capitation? or co-pay\$ or copay\$ or fee or fees or pay or payer? or payment? or reimburs\$ or remunerat\$ or salaries or salaried or salary).ti.
22 (remunerat\$ or reimburs\$).ti,ab.
23 (fixed salar\$ or fixed payment? or fixed fee or fixed fees or fee-for-service or pay-for-performance or cap\$ fee? or capitation or dental fee? or medical fee? or co-pay\$).ab.
24 ((pay or reimburs\$ or financial or salary or "per capita" or remunerat\$) adj2 (algorithm? or incentiv\$ or model? or structur\$ or incenti\$ or "per capita").ti,ab.
25 (patient? adj3 (fee or fees or pay\$)).ab. [Add to ML]
26 accounting/ and (innovat\$ or model? or strategy or strategies or structure?).ti,ab.
27 (pay or payment? or fee or fees or copay\$ or co-pay\$).ab. or (or/16-26) [Payment/Reimbursement]
28 controlled clinical trial/ or controlled study/ or randomized controlled trial/ [EM]

29 (book or conference paper or editorial or letter or review).pt. not randomized controlled trial/ [Per BMJ Clinical Evidence filter]

30 (random sampl\$ or random digit\$ or random effect\$ or random survey or random regression).ti,ab. not randomized controlled trial/ [Per BMJ Clinical Evidence filter]

31 (animal\$ not human\$).sh,hw.

32 28 not (or/29-31) [Trial filter per BMJ CLinical Evidence]

33 intervention?.ti. or (intervention? adj6 (clinician? or collaborat\$ or community or complex or DESIGN\$ or doctor? or educational or family doctor? or family physician? or family practitioner? or financial or GP or general practice? or hospital? or impact? or improv\$ or individuali?e? or individuali?ing or interdisciplin\$ or multicomponent or multi-component or multidisciplin\$ or multi-disciplin\$ or multifacet\$ or multi-facet\$ or multimodal\$ or multi-modal\$ or personali?e? or personali?ing or pharmacies or pharmacist? or pharmacy or physician? or practitioner? or prescrib\$ or prescription? or primary care or professional\$ or provider? or regulatory or regulatory or tailor\$ or target\$ or team\$ or usual care)).ab.

34 (pre-intervention? or preintervention? or "pre intervention?" or post-intervention? or postintervention? or "post intervention?").ti,ab. [added 2.4]

35 (hospital\$ or patient?).hw. and (study or studies or care or health\$ or practitioner? or provider? or physician? or nurse? or nursing or doctor?).ti,hw.

36 demonstration project?.ti,ab.

37 (pre-post or "pre test\$" or pretest\$ or posttest\$ or "post test\$" or (pre adj5 post)).ti,ab.

38 (pre-workshop or post-workshop or (before adj3 workshop) or (after adj3 workshop)).ti,ab.

39 trial.ti. or ((study adj3 aim?) or "our study").ab.

40 (before adj10 (after or during)).ti,ab.

41 ("quasi-experiment\$" or quasiexperiment\$ or "quasi random\$" or quasirandom\$ or "quasi control\$" or quasicontrol\$ or ((quasi\$ or experimental) adj3 (method\$ or study or trial or design\$))).ti,ab,hw. [ML]

42 ("time series" adj2 interrupt\$).ti,ab,hw. [ML]

43 (time points adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten or eleven or twelve or month\$ or hour? or day? or "more than")).ab.

44 pilot.ti.

45 Pilot projects/ [ML]

46 (clinical trial or controlled clinical trial or multicenter study).pt. [ML]

47 (multicentre or multicenter or multi-centre or multi-center).ti.

48 random\$.ti,ab. or controlled.ti.

49 (control adj3 (area or cohort? or compare? or condition or design or group? or intervention? or participant? or study)).ab. not (controlled clinical trial or randomized controlled trial).pt. [ML]

50 "comment on".cm. or review.ti,pt. or randomized controlled trial.pt. [ML]

51 review.ti. [EM]

52 (rat or rats or cow or cows or chicken? or horse or horses or mice or mouse or bovine? or animal?).ti.

53 exp animals/ not humans.sh. [ML]

54 (animal\$ not human\$).sh,hw. [EM]

55 *experimental design/ or *pilot study/ or quasi experimental study/ [EM]

56 ("quasi-experiment\$" or quasiexperiment\$ or "quasi random\$" or quasirandom\$ or "quasi control\$" or quasicontrol\$ or ((quasi\$ or experimental) adj3 (method\$ or study or trial or design\$))).ti,ab. [EM]

57 ("time series" adj2 interrupt\$).ti,ab. [EM]

58 (or/33-44,47-49) or experimental design/ or between groups design/ or quantitative methods/ or quasi experimental methods/ [PscInfo]

59 exp animals/ or animal?.ti,id,hw. [PscInfo]

60 (or/33-49) not (or/50,52-53) [EPOC Methods Filter 2.4 Medline]

61 (or/33-40,43-44,47-48,55-57) not (or/51,54) [EPOC Methods Filter 2.4 EMBASE]

62 58 not (or/51-52,59) [EPOC Methods Filter 2.4 PscInfo]

63 8 or (15 and 27) [Dentists & Reimbursement]

64 63 and 32 [RCT]

65 (and/61,63) not 64 [EPOC]

66 3 not (or/64-65) [TI KW]

The Cochrane Library (OVID)

EBM Reviews - Cochrane Central Register of Controlled Trials <July 2012>, EBM Reviews - Cochrane Database of Systematic Reviews <2005 to July 2012>, EBM Reviews - Database of Abstracts of Reviews of Effects <3rd Quarter 2012>, EBM Reviews - Health Technology Assessment <3rd Quarter 2012>, EBM Reviews - NHS Economic Evaluation Database <3rd Quarter 2012>
 Search Date 11 June 2013

-
- 1 ((dental or dentist\$) and (billing? or co-insur\$ or coinsur\$ or co-pay\$ or copay\$ or deductible? or earning? or fee or fees or financial or income? or pay or pays or payor? or payee? or payment? reimburs\$ or remunerat\$ or salary or salarie? or financial incent\$ or pay or payment? or "per capita")).ti.
 - 2 (dental or dentist\$).ti,hw. and ((billing or co-insur\$ or coinsur\$ or co-pay\$ or copay\$ or deductible? or fee or fees or financial or pay or pays or payor? or payee? or payment or reimburs\$ or remunerat\$) adj3 (incentiv\$ or coverage or insurance? or patient? or plan? or model or mechanism? or structure? or user?)).ab,kw.
 - 3 ((dental or dentist\$) adj3 (billing? or co-pay\$ or copay\$ or earning? or fee or fees or income? or reimburs\$ or remunerat\$ or salary or salarie? or financial incent\$ or pay or payment? or "per capita")).ab.
 - 4 or/1-3 [Dentists-Reimbursement]
 - 5 (dentist\$ or dental practice? or dental practitioner? or (dental\$ adj2 provider?)).ti,ab,kw.
 - 6 General Practice, Dental/ or Dentist's Practice Patterns/
 - 7 Practice Management, Dental/
 - 8 Preventive Dentistry/ or Public Health Dentistry/ or State Dentistry/
 - 9 or/5-8 [Dentists]
 - 10 "fees and charges"/ or capitation fee/ or fee-for-service plans/ or fees, medical/ or "rate setting and review"/
 - 11 insurance, health, reimbursement/ or reimbursement mechanisms/ or fee-for-service plans/ or blue cross blue shield insurance plans/ or "physician payment review commission"/ or prospective payment system/ or reimbursement, incentive/
 - 12 exp economics, dental/
 - 13 (remunerat\$ or reimburs\$).ti,ab,kw.
 - 14 (capitation? or co-pay\$ or copay\$ or fee or fees or fixed salar\$ or pay or pays or payer? or payment? or salaries or salaried or salary).ti,ab,kw.
 - 15 ((economic or financial or "per capita") adj3 (algorithm? or incentiv\$ or model? or structur\$ or incenti\$ or "per capita")).ti,ab,kw.
 - 16 financial management/
 - 17 ((accounts adj2 (pay\$ or receiv\$)) or financial audit\$ or ((credit or fee or fees or pay\$) adj3 collect\$)).ti,ab,kw.
 - 18 or/10-17 [Reimbursement Terms]
 - 19 4 or (and/9,18) [Results search date August 9-2012]
 - 20 from 19 keep 1-26 [Trials]
 - 21 from 19 keep 27 [CDSR]
 - 22 from 19 keep 28 [DARE]
 - 23 from 19 keep 29 [HTA]
 - 24 from 19 keep 30 [ECON]

Cochrane Database of Systematic Reviews and DARE, NHS EED, HTA, MTH (WILEY)

Search date: 11 June 2013

ID	Search
#1	(dentist or dental):ti,ab,kw
#2	(reimburs or financial or "pay" or "pays" or payment):ti,ab,kw
#3	(#1 AND #2)

CINAHL (Ebsco)

Search date: 11 June 2013

#	Query
S67	s1 NOT (s65 or s66) [TI KW]
S66	(s56 and s64) NOT s65 [EPOC results]
S65	(s13 or (s21 and s30)) AND (S63 and S64) [RCT results]
S64	s13 or (s21 and s30) [Dentists & Reimbursements]
S63	S57 or S58 or S59 or S60 or S61 or S62 [RCT Filter]
S62	TI (“control* N1 clinical” or “control* N1 group*” or “control* N1 trial*” or “control* N1 study” or “control* N1 studies” or “control* N1 design*” or “control* N1 method*”) or AB (“control* N1 clinical” or “control* N1 group*” or “control* N1 trial*” or “control* N1 study” or “control* N1 studies” or “control* N1 design*” or “control* N1 method*”)
S61	TI controlled or AB controlled
S60	TI random* or AB random*
S59	TI (“clinical study” or “clinical studies”) or AB (“clinical study” or “clinical studies”)
S58	(MM ”Clinical Trials+“)
S57	TI ((multicent* n2 design*) or (multicent* n2 study) or (multicent* n2 studies) or (multicent* n2 trial*)) or AB ((multicent* n2 design*) or (multicent* n2 study) or (multicent* n2 studies) or (multicent* n2 trial*))
S56	S32 or S33 or S34 or S35 or S36 or S37 or S38 or S39 or S40 or S41 or S42 or S43 or S44 or S45 or S46 or S47 or S48 or S49 or S50 or S51 or S52 or S53 or S54 or S55 [EPOC Filter]
S55	TI ((time points n3 over) or (time points n3 multiple) or (time points n3 three) or (time points n3 four) or (time points n3 five) or (time points n3 six) or (time points n3 seven) or (time points n3 eight) or (time points n3 nine) or (time points n3 ten) or (time points n3 eleven) or (time points n3 twelve) or (time points n3 month*) or (time points n3 hour*) or (time points n3 day*) or (time points n3 ”more than“)) or AB ((time points n3 over) or (time points n3 multiple) or (time points n3 three) or (time points n3 four) or (time points n3 five) or (time points n3 six) or (time points n3 seven) or (time points n3 eight) or (time points n3 nine) or (time points n3 ten) or (time points n3 eleven) or (time points n3 twelve) or (time points n3 month*) or (time points n3 hour*) or (time points n3 day*) or (time points n3 ”more than“))
S53	TI (multicentre or multicenter or multi-centre or multi-center) or AB random*
S52	TI random* OR controlled
S51	TI (trial or (study n3 aim) or ”our study“) or AB ((study n3 aim) or ”our study“)
S50	TI (pre-workshop or preworkshop or post-workshop or postworkshop or (before n3 workshop) or (after n3 workshop)) or AB (pre-workshop or preworkshop or post-workshop or postworkshop or (before n3 workshop) or (after n3 workshop))

(Continued)

S49	TI (demonstration project OR demonstration projects OR preimplement* or pre-implement* or post-implement* or postimplement*) or AB (demonstration project OR demonstration projects OR preimplement* or pre-implement* or post-implement* or postimplement*))
S48	(intervention n6 clinician*) or (intervention n6 community) or (intervention n6 complex) or (intervention n6 design*) or (intervention n6 doctor*) or (intervention n6 educational) or (intervention n6 family doctor*) or (intervention n6 family physician*) or (intervention n6 family practitioner*) or (intervention n6 financial) or (intervention n6 GP) or (intervention n6 general practice*) Or (intervention n6 hospital*) or (intervention n6 impact*) Or (intervention n6 improv*) or (intervention n6 individualize*) Or (intervention n6 individualise*) or (intervention n6 individualizing) or (intervention n6 individualising) or (intervention n6 interdisciplin*) or (intervention n6 multicomponent) or (intervention n6 multi-component) or (intervention n6 multidisciplin*) or (intervention n6 multi-disciplin*) or (intervention n6 multifacet*) or (intervention n6 multifacet*) or (intervention n6 multimodal*) or (intervention n6 multi-modal*) or (intervention n6 personalize*) or (intervention n6 personalise*) or (intervention n6 personalizing) or (intervention n6 personalising) or (intervention n6 pharmaci*) or (intervention n6 pharmacist*) or (intervention n6 pharmacy) or (intervention n6 physician*) or (intervention n6 practitioner*) Or (intervention n6 prescrib*) or (intervention n6 prescription*) or (intervention n6 primary care) or (intervention n6 professional*) or (intervention* n6 provider*) or (intervention* n6 regulatory) or (intervention n6 regulatory) or (intervention n6 tailor*) or (intervention n6 target*) or (intervention n6 team*) or (intervention n6 usual care)
S47	TI (collaborativ* or collaboration* or tailored or personalised or personalized) or AB (collaborativ* or collaboration* or tailored or personalised or personalized)
S46	TI pilot
S45	(MH "Pilot Studies")
S44	AB "before-and-after"
S43	AB time series
S42	TI time series
S41	AB (before* n10 during or before n10 after) or AU (before* n10 during or before n10 after)
S40	TI ((time point*) or (period* n4 interrupted) or (period* n4 multiple) or (period* n4 time) or (period* n4 various) or (period* n4 varying) or (period* n4 week*) or (period* n4 month*) or (period* n4 year*)) or AB ((time point*) or (period* n4 interrupted) or (period* n4 multiple) or (period* n4 time) or (period* n4 various) or (period* n4 varying) or (period* n4 week*) or (period* n4 month*) or (period* n4 year*))
S39	TI ((quasi-experiment* or quasiexperiment* or quasi-random* or quasirandom* or quasi control* or quasicontrol* or quasi* W3 method* or quasi* W3 study or quasi* W3 studies or quasi* W3 trial or quasi* W3 design* or experimental W3 method* or experimental W3 study or experimental W3 studies or experimental W3 trial or experimental W3 design*)) or AB ((quasi-experiment* or quasiexperiment* or quasi-random* or quasirandom* or quasi control* or quasicontrol* or quasi* W3 method* or quasi* W3 study or quasi* W3 studies or quasi* W3 trial or quasi* W3 design* or experimental W3 method* or experimental W3 study or experimental W3 studies or experimental W3 trial or experimental W3 design*))
S38	TI pre w7 post or AB pre w7 post
S37	MH "Multiple Time Series" or MH "Time Series"

(Continued)

S36	TI ((comparative N2 study) or (comparative N2 studies) or evaluation study or evaluation studies) or AB ((comparative N2 study) or (comparative N2 studies) or evaluation study or evaluation studies)
S35	MH Experimental Studies or Community Trials or Community Trials or Pretest-Posttest Design + or Quasi-Experimental Studies + Pilot Studies or Policy Studies + Multicenter Studies
S34	TI (pre-test* or pretest* or posttest* or post-test*) or AB (pre-test* or pretest* or posttest* or "post test*) OR TI (preimplement* or pre-implement*) or AB (pre-implement* or preimplement*)
S33	TI (intervention* or multiintervention* or multi-intervention* or postintervention* or post-intervention* or preintervention* or pre-intervention*) or AB (intervention* or multiintervention* or multi-intervention* or postintervention* or post-inter-vention* or preintervention* or pre-intervention*)
S32	(MH "Quasi-Experimental Studies")
S31	TI ((pre-trial? or post-trial?)) OR AB ((pre-trial? or post-trial?))
S30	S22 or S23 or S24 or S25 or S26 or S27 or S28 or S29
S29	MH financial management
S28	AB ((pay or reimburs* or financial or salary or "per capita" or remunerat*) N2 (algorithm? or incentiv* or model? or structur* or incenti* or "per capita")) OR TI ((pay or reimburs* or financial or salary or "per capita" or remunerat*) N2 (algorithm? or incentiv* or model? or structur* or incenti* or "per capita"))
S27	AB fixed salar* or fixed payment? or fixed fee or fixed fees or fee-for-service or pay-for-performance or cap* fee? or capitation or dental fee? or medical fee? or co-pay*
S26	AB remunerat* or reimburs*
S25	TI capitation? or co-pay* or copay* or fee or fees or pay or payer? or payment? or reimburs* or remunerat* or salaries or salaried or salary
S24	MH economics, dental+
S23	MH insurance, health, reimbursement OR MH reimbursement mechanisms OR MH fee for service plans OR MH prospective payment system OR MH reimbursement, incentive
S22	MH ("fees and charges") OR MH capitation fee OR MH fee for service plans OR MH ("rate setting and review")
S21	S14 or S15 or S16 or S17 or S18 or S19 or S20
S20	((TI (dentist* or dental) or MW (dentist* or dental)) AND TI generalist?) AND AB ((dental or dentist*) N3 generalist?)
S19	(TI (dentist? or dentistry) or MW (dentist? or dentistry)) AND (TI (general practice or general practitioner? or general dental) or AB (general practice or general practitioner? or general dental))

(Continued)

S18	AB (general or family or primary care) N2 dentistry
S17	TI (general dental N2 (practice or practitioner? or doctor?)) OR AB (general dental N2 (practice or practitioner? or doctor?))
S16	TI dentistry or ((dental or dentist*) and (general or practice or practitioner?))
S15	MH Preventive Dentistry OR MH Public Health Dentistry
S14	MH Dentists+
S13	S2 or s3 or s4 or s5 or s6 or s7 or s8 or s9 or s10 or s11 or s12
S12	(MH "Dental Care+/OG/EC") OR MH "Dentistry/OG"
S11	MH ("Salaries and Fringe Benefits") AND (TI dentist* or MH *Dentists)
S10	MH (Diagnosis Oral+ or Dental Prophylaxis+) AND (TI (fee or fees or payment? or pay or reimburs* or billing or copay* or "co-pay*")) OR AB (fee or fees or payment? or pay or reimburs* or billing or copay* or "co-pay*"))
S9	MH (Dental Care or Dental Care for Aged or Dental Care for Children or Dental Care for Chronically Ill or Dental Care for Disabled) AND (TI (fee or fees or payment? or pay or reimburs* or billing or copay* or "co-pay*")) OR AB (fee or fees or payment? or pay or reimburs* or billing or copay* or "co-pay*"))
S8	MH Dentists+ AND MH (Financial Management+ or "insurance, dental")
S7	MH Dentists+ AND (TI(economic* or payment? or reimbursement?) or AB (economic* or payment? or reimbursement?) or MW (economic* or payment? or reimbursement?))
S6	MH Dentists+ AND ((TI (Income/ or Financ*) or MW (Income/ or Financ*)) or (TI(fee or fees or payment? or billing) or AB (fee or fees or payment? or billing) or MW (fee or fees or payment? or billing)))
S5	AB (dental or dentist*) N3 (billing? or earning? or fee or fees or income? or reimburs* or remunerat* or salary or salarie? or financial incent* or pay or payment? or "per capita")
S4	(TI (dental or dentist*) OR MW (dental or dentist*)) AND AB ((billing or co-insur* or coinsur* or co-pay* or copay* or deductible? or fee or fees or financial or pay or pays or payor? or payee? or payment or reimburs* or remunerat*) N3 (incentiv* or coverage or insurance? or patient? or plan? or model or mechanism? or structure? or user?))
S3	(TI (dental or dentist*) OR MW (dental or dentist*)) AND TI (billing? or co-insur* or coinsur* or co-pay* or copay* or deductible? or earning? or fee or fees or financial or income? or pay or pays or payor? or payee? or payment? reimburs* or remunerat* or salary or salarie? or financial incent* or pay or payment? or "per capita")
S2	(MH "Dentists/EC")
S1	TI dentist* and (reimburs* or pay or payment? or copay* or "co-pay*") or remunerat* or fee or fees)

EconLit, Dissertations & Theses (ProQuest)

Search date: 11 June 2013

all(dentist*) AND all(reimburs* OR remunerat* or pay OR payment* or financial or "co-pay*" or budget* or medicaid or HMO or fee or fees or "health maintenance organisation*" or "health maintenance organization*" or "preferred provider*" or "managed care")
PAIS International, Political Science, Worldwide Political Science Abstracts (ProQuest)

Search date: 11 June 2013

Searched for: ti(dentist* OR "dental care") AND (reimburs* OR remunerat* or pay OR payment* or financial or "co-pay*" or budget* or medicaid or HMO or fee or fees or "health maintenance organisation*" or "health maintenance organization*" or "preferred provider*" or "managed care")

Databases: ProQuest Dissertations & Theses (PQDT) ProQuest Dissertations & Theses (PQDT)

ti(dentist* OR "dental care") AND (reimburs* OR remunerat* or pay OR payment* or financial or "co-pay*" or budget* or medicaid or HMO or fee or fees or "health maintenance organisation*" or "health maintenance organization*" or "preferred provider*" or "managed care")

Appendix 2. Data extraction form

1) Clarkson 2008

Number of participants

Detail	Fee-for-service only	Control
Number randomised	Dentists: 37 Patients: 925	Dentists: 39 Patients: 957
Number analysed	Dentists: 33 (89.2%) Patients: 698 (75.5%)	Dentists: 35 (89.7%) Patients: 730 (76.3%)
Number not analysed and reasons	<p>Dentists:</p> <ul style="list-style-type: none"> ● Lost to follow-up <ul style="list-style-type: none"> ○ 4 (10.8%) ○ Reason: 2 dentists left the study and 2 refused to take part after randomisation <p>Patients:</p> <ul style="list-style-type: none"> ● Lost to follow-up: <ul style="list-style-type: none"> ○ 161 (17.4%) ○ Reason: Most of the children were patients of the dentists who were lost to follow-up but also there were 39 missing patient records ● Excluded from analysis: <ul style="list-style-type: none"> ○ 66 (7.1%) ○ Reason: Lack of erupted second permanent molars 	<p>Dentists:</p> <ul style="list-style-type: none"> ● Lost to follow-up <ul style="list-style-type: none"> ○ 4 (10.3%) ○ Reason: 2 dentists left the study and 2 refused to take part after randomisation <p>Patients:</p> <ul style="list-style-type: none"> ● Lost to follow-up: <ul style="list-style-type: none"> ○ 127 (13.3%) ○ Reason: Most of the children were patients of the dentists who were lost to follow-up but also there were 48 missing patient records ● Excluded from analysis: <ul style="list-style-type: none"> ○ 100 (10.4%) ○ Reason: Lack of erupted second permanent molars

Characteristics at baseline

Detail	Fee-for-service only	Control
Dental practice-level variables for minimisation		
Number of partners		
Single-handed	13 (39)	14 (40)
Two/three partners	10 (30)	9 (26)
Four or more	10 (30)	12 (34)
Deprivation area of dental practice - n (%)		
4	18 (55)	16 (46)
5	8 (24)	10 (29)
6/7 (most deprived)	7 (21)	9 (26)
Restorative fissure sealant claims 2002 - n (%)		
None	9 (27)	11 (31)
1 - 5	10 (30)	8 (23)
6 or more	14 (42)	16 (46)
Throughput 11- to 13-year-olds - n (%)		
Low (48 - 95)	9 (27)	9 (26)
Medium (96 - 143)	14 (42)	11 (31)
High (> 143)	10 (30)	5 (43)
Other dental practice/dentist-level variables		
Child patients with sealant on any second permanent molar - mean % (SD)	32.8 (26.5)	38.4 (28.9)
Child patients with sealant on any first permanent molar - mean % (SD)	10.7 (16.6)	13.4 (15.1)
Cluster size - median (interquartile range)	19 (22, 24)	20 (22, 24)
High population density (> 100 people/hectare) - n (%)	8 (25)	9 (25)

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Hygienist in dental team - n (%)	14 (42)	16 (46)
Gender of dentist - n (%)		
Female	12 (36)	15 (43)
Male	21 (64)	20 (36)
Dentist working part-time (< 9 sessions/ week) - n (%)	6 (19)	6 (17)
Number of years qualified as a dentist - mean (SD)	18.9 (8.6)	19.7 (8.2)
Patient-level variables		
Age of children - mean (SD)	13.21 (0.96)	13.24 (0.98)
Gender of children - n (%)		
Female	348 (49.9)	368 (50.4)
Male	350 (50.1)	362 (49.6)
Deprivation area of dental practice - n (%)		
4	375 (53.7)	334 (45.8)
5	173 (24.8)	220 (30.1)
6/7 (most deprived)	150 (21.5)	176 (24.1)
Sealant on any second permanent molar - n (%)	75 (10.7)	98 (13.4)
Sealant on any first permanent molar - n (%)	229 (32.8)	280 (38.4)
n: number of participants SD: standard deviation		

Methods and suitability of outcome assessment

Outcome	Outcome assessment	
	Method	Comments
Mean percentage of 12- to 14-year-olds receiving fissure sealants for second permanent molars per dentist (weighted by number of children seen)	Data collection forms were sent to dentists for completion using patient records The dentists only received the fee-for-service remuneration in the first six months of the study but the data were collected 18 months after the start of the trial	Dentists may not keep accurate patient record cards, particularly if they prioritise treatment, which could be exacerbated under a fee-for-service remuneration system The effects of the fee-for-service remuneration would have been attenuated if 18-month data were analysed
Incremental cost-effectiveness of fee-for-service vs. control	The economic evaluation calculated incremental cost-effectiveness in terms of the "% change in outcome <i>per</i> £[GBP]". The costs included the costs of dentists' time taken to seal two teeth (based on average earnings), the cost of consumables obtained from clinical guidelines and expert opinion of two experienced practitioners, the cost of hygienist or dental nurse time and costs to parents (travel costs, out-of-pocket costs, and the time costs incurred by parents travelling to a sample of dentists, which were collected from questionnaires handed to parents at dental practices and used to calculate an average cost per child). The outcome in the ICER is not explicitly stated and so can only be assumed to be sealant placement. In order to avoid double-counting, the fees paid to the dentists were excluded as they represent transfer payments from the state (i.e. the study funds; the shadow cost of public funds due to the collection of taxes raised to fund the fees is ignored) and the cost of the dentists' time was already included. The marginal costs of administering any new fee were investigated and assumed to be negligible. The intervention costs also included education and training	The economic evaluation does not involve a follow-up of fissure sealant retention or cost savings due to prevention of dental diseases Furthermore, the evaluation does not take into account the payments from the state (i.e. the fee-for-service remuneration) so the only costs taken into account are the costs to the parents and to the dental practices (in terms of staff time and consumables). An alternative perspective would be to investigate the cost-effectiveness from the point of view of the state, which pays the fee-for-service (in place of the dental practices), and the parents

GBP: Pound Sterling
ICER: incremental cost-effectiveness ratio

Methods and suitability of analysis

Outcome	Analysis	
	Method	Comments
Mean percentage of 12- to 14-year-olds receiving fissure sealants for second permanent molars per dentist (weighted by number of children seen)	<p>The primary analysis used analysis of covariance (ANCOVA) under the intention-to-treat principle and weighted by the number of patients seen per dentist. The ANCOVA analysis adjusted for the deprivation category of the area of the dental practice, the number of partners in practice, the throughput of 11- to 13-year-olds and the number of restorative fissure sealants placed on <i>first</i> permanent molars at baseline. However, it did not adjust for the percentage of children having at least one sealant treatment of <i>second</i> permanent molars at baseline even though there were lower percentages in the fee-for-service and both fee-for-service and education arms compared to the education and control arms, which could have an impact on the results</p> <p>The authors stated that estimation of main effects (the risk difference for fee-for-service vs. no fee-for-service and education vs. no education) required 150 dentists assessing 25 children each for 80% power at a 5% significance level to detect a 15% difference from a 22% "baseline" control group level (Southwick 1999). This calculation assumed an intracluster correlation of 0.3 (the 'cluster effect'). However, 149 dentists were randomised and data were collected from only 133 dentists, the median number of children per dentist was less than 25 (the mean was not reported) and the intracluster correlation was 0.315. The outcome for the control group (no fee-for-service) was 26.3% and the unadjusted risk difference for fee-for-service vs. no fee-for-service did not reach statistical significance (7.1, 95% CI -1.9 to 16.1). However, the adjusted risk difference did (9.8, 95% CI 1.8 to 17.8)</p>	<p>Due to the fact that the analysis was at the level of the dentists rather than the patients, the problem of lack of independence between observations from the same cluster does not arise. In addition, this approach avoids unit-of-analysis errors. However, aggregating patient-level variables to higher-order variables and then conducting an analysis at this higher level means that all within-group information is discarded (because it takes the average of the patient-level variable divided by one hundred to create a percentage) which can considerably reduce the power of the study</p> <p>In order for ANCOVA to be effective, the covariate must be <i>linearly</i> related to the dependent variable, but no indication of whether the covariates were linearly related to the dependent variables is explicitly given, so this must be assumed</p> <p>In addition, ANCOVA requires homogeneity-of-regression slopes. In this case, this assumption may not be met because the effect of fee-for-service remuneration on the percentage of children receiving fissure sealants for second permanent molars may be different between dentists working in areas with different levels of deprivation etc. i.e. there may be interaction terms involving the covariates and the fee-for-service variable. The authors stated that a sensitivity analysis with unadjusted outcomes confirmed the result of the primary ANCOVA analysis but the paper reported that the unadjusted risk difference for fee-for-service vs. no fee-for-service did not reach statistical significance (7.1, 95% CI -1.9 to 16.1) but the adjusted risk difference did (9.8, 95% CI 1.8 to 17.8). Multilevel models (before testing for differences between intervention arms) can be used as an alternative to ANCOVA because they have the advantages that they do not require the assumption of homogeneity-of-regression</p>

(Continued)

		<p>slopes and they are designed to deal with intraclass correlation, which would be necessary to consider if the analysis was at the level of the patients</p> <p>The number of dentists randomised was lower than the number required to provide data on at least 25 children each, according to the authors' statement</p>
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Results

Detail	Outcome	Mean (SD)								Risk difference for fee-for-service vs. no fee-for-service (95% confidence interval)	
		Fee-for-service only		Control		Education only		Fee-for-service and education		No fee-for-service (all)	
Measures of clinical behaviour of PCDs	Mean percentage of 12- to 14-year-olds receiving fissure sealants for second permanent molars per dentist (weighted by number of children seen)	35.1 (28.4)	25.3 (25.5)	27.4 (30.8)	30.8 (23.1)	32.9 (25.7)	26.3 (28.0)	9.8 (1.8 - 17.8)	7.1 (-1.9 - 16.1)		

† The model adjusted for the baseline dental practice-level covariates (deprivation category for the area of dental practice, number of partners in practice, throughput of 11- to 13-year-olds and the number of restorative fissure sealants placed on first permanent molars at baseline). The intraclass correlation is 0.315
 PCD: primary care dentist
 SD: standard deviation

Detail	Outcome	
Healthcare costs	Incremental cost-effectiveness of fee-for-service vs. control (reported as the % change in outcome <i>per</i> £[GBP] ⁴). (The outcome in the ICER is not explicitly stated and so can only be assumed to be sealant placement)	0.10
GBP: Pound Sterling ICER: incremental cost-effectiveness ratio		

2) Coventry 1989

Number of participants

Detail	Capitation	Fee-for-service
Number randomised	Health service administrative areas: 4 (Salford (S), Norfolk (N), Bromley (B), Grampian (G))	Health service administrative areas: 4 (Doncaster (D), Hereford and Worcester (H), Wycombe (W), Fife (F))
	Patients 14- to 15-year-olds Total: 2980 (no breakdown of data between capitation and fee-for-service areas was reported) 5- to 6-year-olds Total: 2980 (no breakdown of data between capitation and fee-for-service areas was reported)	
Number analysed	Dental practices†: Total: 183 (67%) S: 25 (81%) N: 90 (74%) B: 29 (49%) G: 39 (63%) Dentists initially included†: Total: 322 (65%) S: 50 (81%) N: 144 (73%) B: 62 (58%) G: 66 (65%) Patients 14- to 15-year-olds: Total: 967 S: 250 N: 240 B: 236 G: 241 5- to 6-year-olds: Total: 989 S: 247	Dental practices†: Total: 171 (71%) D: 30 (83%) H: 68 (69%) W: 40 (74%) F: 33 (62%) Dentists initially included†: Total: 366 (72%) D: 75 (82%) H: 138 (68%) W: 90 (74%) F: 63 (67%) Patients 14- to 15-year-olds: Total: 952 D: 239 H: 225 W: 254 F: 234 5- to 6-year-olds: Total: 949 D: 219

(Continued)

	N: 238 B: 251 G: 253	H: 251 W: 234 F: 245
Number not analysed and reasons	<p>Dental practices† :</p> <ul style="list-style-type: none"> ● Lost to follow-up <ul style="list-style-type: none"> ○ 9 (4.9%) ○ Reason: It was found (in large group practices) to be difficult to control for the administration of all the forms involved and there were problems associated with transferring patients in these dental practices when there was a rapid turnover of associates, plus the exclusion of private practice for children was a problem 	<p>Dental practices† :</p> <ul style="list-style-type: none"> ● Lost to follow-up <ul style="list-style-type: none"> ○ 2 (1.2%) ○ Reason: The dentists objected to the wording of the parent satisfaction questionnaire
	<p>Patients:</p> <p>14- to 15-year-olds:</p> <ul style="list-style-type: none"> ● Lost to follow-up <ul style="list-style-type: none"> ○ 144 ○ Reason: Children could not be contacted because they were no longer living at the addresses provided by the Dental Practice Boards and several other reasons which the authors did not report ○ 93 ○ Reason: Parents refused consent ○ 549 ○ Reason: Parents did not reply ○ 256 ○ Reason: Children were not examined when examiners attended the children's schools (reason not reported) <p>5- to 6-year-olds: 2175</p> <ul style="list-style-type: none"> ● Lost to follow-up <ul style="list-style-type: none"> ○ 168 ○ Reason: Children could not be contacted because they were no longer living at the addresses provided by the Dental Practice Boards and several other reasons which the authors did not report ○ 68 ○ Reason: Parents refused consent ○ 569 ○ Reason: Parents did not reply ○ 237 ○ Reason: Children were not examined when examiners attended the children's schools (reason not reported) 	

† The number of dentists varied over time as dentists joined and left dental practices, so the number of dental practices was the stable and primary parameter

Characteristics at baseline

Detail	Capitation	Fee-for-service
Variables for matching pairs of areas		
Mean number of fillings per course of treatment provided for 10- to 14-year-olds (calculated differently in England and Scotland)	S: 1.03 N: 0.67 B: 0.68 G: 0.62	D: 0.96 H: 0.66 W: 0.67 F: 0.69
Population per dentist	S: 5041 N: 4029 B: 2657 G: 4010	D: 4629 H: 4000 W: 3286 F: 3588
Percentage of households with more than one person per room (calculated differently in England and Scotland)	S: 4.1 N: 1.9 B: 2.4 G: 32.8	D: 3.2 H: 2.3 W: 2.4 F: 32.4
Fluoride in water supply	S: No N: Yes B: No G: No	D: No H: Yes W: No F: No
Patient-level variables with differences between the matched pairs		
Mean dmft		
5- to 6-year-olds	S: 3.6** B: 1.3**	D: 2.8** W: 0.8**
8- to 9-year-olds	S: 4.6* B: 2.7**	D: 3.7* W: 1.9**
Mean DMFT		
8- to 9-year-olds	S: 0.9* B: 0.3	D: 0.7* W: 0.3
11- to 12-year-olds	S: 2.0* B: 0.9	D: 1.6* W: 1.0
14- to 15-year-olds	S: 4.5 B: 2.7	D: 4.1 W: 2.6
Dental practice/dentist-level variables with differences between the matched pairs (no consistent patterns were found across all four pairs)		
Proportion of single-handed to group practices	B: lower	W: higher

(Continued)

Estimates submitted per dentist	S: higher	D: lower
Estimates for children only submitted per dentists	S: no difference N: lower	D: no difference H: higher
<p>* $P \leq 0.05$ ** $P \leq 0.01$ dmft: decayed/missing/filled primary teeth DMFT: decayed/missing/filled permanent teeth Health service administrative areas: B: Bromley; D: Doncaster; F: Fife; G: Grampian; H: Hereford and Worcester; N: Norfolk; S: Salford; W: Wycombe</p>		

Methods and suitability of outcome assessment

Outcome	Outcome assessment	
	Method	Comments
Dental health outcomes and healthcare cost outcomes	N/A	There is a lack of descriptions of standards used in the examination process and limited description of how costs were obtained for the cost-effectiveness analysis (e.g. no time preference information is provided nor details regarding full economic costing (Mellor 1994))
Patterns of treatment outcome measures	A random sample of 25 dentists were asked to provide information about their treatment of a random sample of up to 90 of their patients. A statistical comparison of the data collection form and the information in a sample of patient records from each dentist showed substantial agreement	Dentists may not keep accurate patient record cards, particularly if they prioritise treatment, which could be exacerbated under a fee-for-service remuneration system
Mean values for temptation expressed by dentists to over-prescribe and to under-prescribe Mean values of clinical freedom expressed by dentists	These outcome measures were measured on a visual analogue scale and there was no indication that they were validated	The clinical significance of any differences found within matched pairs is unknown
Healthcare cost outcomes	All payments made to study dentists for the treatment of 0- to 5-year-olds during 1988 were divided by the estimated numbers of children treated. However, the estimated number is only an approximation as it was impossible to eliminate double-counting, particularly in the fee-for-service	The mean expenditure per 0- to 15-year-old should only be considered as close approximations, and there is bias that places the capitation arm at a disadvantage The cost of treating the children in the Community Dental Service would not have been taken into account in the eco-

(Continued)

	<p>system</p> <p>Participating dentists in capitation areas referred significantly more children to the Community Dental Service compared to dentists in fee-for-service areas; this is despite the fact that non-participating dentists in the capitation areas tended to refer significantly fewer children compared to non-participating dentists in fee-for-service areas</p>	<p>conomic analysis</p>
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Methods and suitability of analysis

Outcome	Analysis	
	Method	Comments
All outcome measures	<p>The study authors stated that they intended to treat each matched pair as separate, thus the overall study would contain four replicates under contrasting socioeconomic and environmental circumstances. However, the authors sometimes pooled the results of the replicates and occasionally tested the overall differences between capitation areas and fee-for-service areas for statistical significance (in addition to noting where there were consistent trends among the pairs)</p> <p>Health Service administrative areas were the unit of randomisation, but not the unit of analysis</p>	<p>The matched pairs of areas were very different from each other, so indicating where there were consistent trends in all pairs is more appropriate than testing the statistical significance of overall differences between capitation areas and fee-for-service areas. In addition, there were many outcome measures, often assessed for numerous age groups and for each of the pairs of areas, which can lead to the 'multiple testing problem' for which techniques have been developed to control the false positive error rate</p> <p>The unit of analysis (e.g. dentists, patients, parents and administrators) was often not the same as the unit of randomisation. This leads to unit-of-analysis error, where P values are artificially small (though the estimates of effect are unbiased), leading to false positive conclusions that the intervention had an effect</p>

Results

Detail	Outcome	Mean	
		Capitation	Fee-for-service
Primary outcomes assessed			
Measures of clinical behaviour of PCDs	Mean number of examinations per child		

(Continued)

0- to 5-year-olds	All: 1.5* S: 1.6 B: 1.4 N: 1.4 G: 1.5*	All: 1.7* D: 1.7 W: 1.6 H: 1.6 F: 1.8*
6- to 12-year-olds	All: 1.6* S: 1.7 B: 1.6* N: 1.6 G: 1.6*	All: 1.8* D: 1.8 W: 1.8* H: 1.8 F: 1.9*
13- to 15-year-olds	All: 1.6* S: 1.7 B: 1.5* N: 1.7 G: 1.5	All: 1.7* D: 1.7 W: 1.7* H: 1.7 F: 1.7
6- to 15-year-olds (<i>sic</i>)	All: 1.6* S: 1.7 B: 1.5* N: 1.6 G: 1.5	All: 1.7* D: 1.7 W: 1.7* H: 1.7 F: 1.6
Mean number of teeth filled per child		
0- to 5-year-olds	S: 0.30 B: 0.19 N: 0.16 G: 0.30*	D: 0.39 W: 0.17 H: 0.23 F: 0.49*
6- to 12-year-olds	S: 0.63* B: 0.41 N: 0.53 G: 0.69	D: 0.89* W: 0.43 H: 0.62 F: 0.90
13- to 15-year-olds	S: 0.87 B: 0.43 N: 0.63 G: 0.95	D: 1.06 W: 0.50 H: 0.84 F: 1.34
0- to 15-year-olds	S: 0.60* B: 0.34 N: 0.44 G: 0.63*	D: 0.78* W: 0.34 H: 0.44 F: 0.91*
Mean percentage of children having one or more teeth extracted		

(Continued)

0- to 5-year-olds	S: 7 B: 1 N: 2 G: 8	D: 8 W: 1 H: 2 F: 7
6- to 12-year-olds	S: 19* B: 7 N: 8* G: 21	D: 28* W: 10 H: 14* F: 22
13- to 15-year-olds	S: 13 B: 12 N: 11 G: 13	D: 17 W: 9 H: 14 F: 16
0- to 15-year-olds	S: 13* B: 7 N: 7* G: 14	D: 18* W: 7 H: 10* F: 15
Mean percentage of children receiving active preventive advice		
0- to 5-year-olds	Total: 38* S: 48* B: 34* N: 31 G: 41	Total: 21* D: 14* W: 14* H: 32 F: 24
6- to 12-year-olds	Total: 36 S: 47* B: 36 N: 28 G: 34	Total: 27 D: 21* W: 22 H: 35 F: 30
13- to 15-year-olds	Total: 34 S: 43 B: 28 N: 28 G: 36	Total: 26 D: 23 W: 18 H: 34 F: 31
0- to 15-year-olds	Total: 36* S: 46* B: 33 N: 29 G: 37	Total: 25* D: 19* W: 18 H: 34 F: 28
Mean percentage of children receiving a scaling		

(Continued)

0- to 5-year-olds	All: 16* S: 24* B: 18* N: 13* G: 12*	All: 39* D: 46* W: 30* H: 31* F: 48*
6- to 12-year-olds	All: 26* S: 28* B: 30* N: 26* G: 22*	All: 58* D: 62* W: 55* H: 49* F: 69*
13- to 15-year-olds	All: 36* S: 35* B: 38* N: 38* G: 34*	All: 65* D: 69* W: 57* H: 62* F: 73*
0- to 15-year-olds	All: 26* S: 29* B: 28* N: 25* G: 23*	All: 54* D: 59* W: 48* H: 47* F: 63*
Mean percentage of children receiving one or more fissure sealants		
6- to 12-year-olds	S: 8 B: 8 N: 4 G: 17*	D: 6 W: 4 H: 4 F: 10*
13- to 15-year-olds	S: 4 B: 4 N: 4 G: 8	D: 6 W: 3 H: 5 F: 4
6- to 15-year-olds	S: 6 B: 6 N: 4 G: 13	D: 6 W: 4 H: 4 F: 7
Mean percentage of children having radiographs		
6- to 12-year-olds	S: 3 B: 1 N: 1 G: 0	D: 3 W: 1 H: 0 F: 1

(Continued)

	13- to 15-year-olds	S: 8 B: 7 N: 7 G: 6	D: 13 W: 12 H: 11 F: 4
	6- to 15-year-olds	S: 12 B: 14* N: 18 G: 9	D: 19 W: 26* H: 17 F: 13
	0- to 15-year-olds	S: 8 B: 8* N: 9 G: 5	D: 12 W: 13* H: 10 F: 6
	Percentage of participating dentists referring patients to the Community Dental Service (percentage of non-participating dentists referring patients to the Community Dental Service)	27* (19*)	19* (29*)
	Percentage of dental practices arranging for in-practice emergency treatment of their patients out of routine surgery hours	44**	28**
	Percentage of dental practices arranging for out of practice emergency treatment of their patients out of routine surgery hours	56**	72**
Measures of health service utilisation	Mean number of visits per child		
	0- to 5-year-olds	All: 1.7* S: 1.9 B: 1.5 N: 1.7 G: 1.7*	All: 1.9* D: 2.0 W: 1.7 H: 1.8 F: 2.2*
	6- to 12-year-olds	All: 2.4* S: 2.6* B: 2.0* N: 2.3 G: 2.5*	All: 2.8* D: 2.9* W: 2.6* H: 2.5 F: 3.0*

(Continued)

	13- to 15-year-olds	All: 2.5* S: 2.6* B: 2.0* N: 2.8 G: 2.6*	All: 3.1* D: 3.4* W: 2.7* H: 3.1 F: 3.1*
	0- to 15-year-olds	All: 2.2* S: 2.4* B: 1.9* N: 2.2 G: 2.3*	All: 2.6* D: 2.8* W: 2.3* H: 2.5 F: 2.8*
Measures of patient outcomes	14- to 15-year-olds		
	Percentage with caries on at least one tooth	S: 75 B: 58 N: 68 G: 77	D: 74 W: 57 H: 70 F: 81
	Mean DMFT	S: 3.3 B: 1.8 N: 2.6 G: 4.2	D: 3.0 W: 1.9 H: 2.7 F: 4.4
	Mean DMFT among regularly attending children†	S: 3.3 B: 1.8 N: 2.6 G: 4.1	D: 3.0 W: 1.9 H: 2.6 F: 4.2
	Mean number of decayed teeth	S: 0.32 B: 0.31 N: 1.33** G: 0.80	D: 0.16 W: 0.24 H: 0.58** F: 0.65
	Mean number of decayed teeth among regularly attending children†	S: 0.32 B: 0.31 N: 1.39** G: 0.94	D: 0.16 W: 0.26 H: 0.59** F: 0.61
	Mean number of missing teeth	S: 0.16 B: 0.03 N: 0.05 G: 0.46	D: 0.12 W: 0.04 H: 0.08 F: 0.47
	Mean number of missing teeth among regularly attending children†	S: 0.14 B: 0.04 N: 0.07 G: 0.45	D: 0.11 W: 0.02 H: 0.08 F: 0.37

(Continued)

Mean number of sound filled teeth	S: 2.8 B: 1.4 N: 1.2* G: 2.9	D: 2.8 W: 1.7 H: 2.0* F: 3.3
Mean number of filled teeth among regularly attending children†	S: 2.8 B: 1.5 N: 1.1** G: 2.8	D: 2.7 W: 1.6 H: 1.9** F: 3.2
Mean number of sound and carious filled teeth	S: 2.9 B: 1.5 N: 1.5** G: 3.0	D: 2.8 W: 1.7 H: 2.2** F: 3.5
Percentage with at least one fissure sealant	Total: 18** S: 10 B: 19 N: 13** G: 31	Total: 22** D: 14 W: 19 H: 21** F: 35
Percentage with at least one fissure sealant among regularly attending children†	S: 2.8 B: 1.5 N: 1.1** G: 2.8	D: 2.7 W: 1.6 H: 1.9** F: 3.2
5- to 6-year-olds		
Percentage with caries on at least one tooth	S: 62 B: 26 N: 38 G: 51	D: 67 W: 31 H: 32 F: 62
Mean dmft	S: 3.0 B: 0.9 N: 1.1 G: 2.6**	D: 3.0 W: 1.1 H: 1.1 F: 3.7**
Mean dmft among regularly attending children†	S: 2.8 B: 0.7 N: 1.1 G: 2.6	D: 3.2 W: 1.1 H: 0.8 F: 3.2
Mean number of decayed teeth	S: 2.0 B: 0.5 N: 0.6 G: 1.6*	D: 1.8 W: 0.7 H: 0.5 F: 2.0*

(Continued)

	Mean number of decayed teeth among regularly attending children†	S: 2.0 B: 0.3* N: 0.5 G: 1.5	D: 2.0 W: 0.7* H: 0.4 F: 1.7
	Mean number of missing teeth	S: 0.49 B: 0.08 N: 0.13 G: 0.56*	D: 0.56 W: 0.04 H: 0.16 F: 0.86*
	Mean number of missing teeth among regularly attending children†	S: 0.36 B: 0.03 N: 0.11 G: 0.58	D: 0.56 W: 0.06 H: 0.11 F: 0.67
	Mean number of filled teeth	S: 0.51 B: 0.29 N: 0.38 G: 0.43**	D: 0.66 W: 0.39 H: 0.43 F: 0.80**
	Mean number of filled teeth among regularly attending children†	S: 0.47 B: 0.29 N: 0.45* G: 0.49*	D: 0.67 W: 0.31 H: 0.31* F: 0.81*
	Percentage with arrested caries on at least one tooth	S: 20 B: 2 N: 0 G: 4	D: 21 W: 3 H: 1 F: 4
Healthcare costs	Mean expenditure in GBP per dentist year in participating dental practices during 1988 (percentage change from fee-for service)	All: 9430 (31) S: 10,517 (19) B: 5185 (-9) N: 10,030 (35) G: 10,343 (48)	All: 7193 D: 8870 W: 5708 H: 7417 F: 6976
	Mean expenditure in GBP per child in participating dental practices during 1988 (percentage change from fee-for service)		
	0- to 5-year-olds	All: 15.98 (41)‡ S: 16.43 (27) B: 16.83 (58) N: 15.50 (46) G: No data	All: ‡ D: 12.97 W: 10.66 H: 10.64 F: No data
	6- to 12-year-olds	All: 23.00 (27)‡ S: 24.99 (20) B: 22.32 (36) N: 22.47 (27)	All: 18.12‡ D: 20.86 W: 16.39 H: 17.63

(Continued)

		G: No data	F: No data
	13- to 15-year-olds	All: 36.81 (48)‡ S: 36.13 (27) B: 31.28 (35) N: 38.00 (58) G: No data	All: 24.94‡ D: 20.55 W: 16.67 H: 17.29 F: No data
	0- to 15-year-olds	All: 22.67 (27) S: 24.77 (21) B: 22.85 (37) N: 24.19 (40) G: 19.20 (9)	All: 17.90 D: 20.55 W: 16.67 H: 17.29 F: 17.68
Secondary outcomes assessed			
Measures of non-clinical behaviour of PCDs	Proportion of dentists reporting introducing innovations into their dental practices	56**	69**
Measures of unintended consequences	Mean values for temptation expressed by dentists		
	To over-prescribe	16.1**	31.0**
	To under-prescribe	58.3**	37.7**
	Mean values of clinical freedom expressed by dentists	68.2**	58.6**
	Percentage of principals stating that administration had (over the last three years)		
	Increased greatly	41**	10**
	Increased slightly	42**	35**
	Percentage of principals stating that bureaucratic intervention had (over the last three years)		
	Increased or been unchanged	70**	50**
	Decreased	30**	50**
	Percentage of dentists stating views on the accuracy of payments (significance levels are not clearly stated)		
	Accurate	40	62
	Inaccurate	18	14

(Continued)

	Don't know	42	24
* $P \leq 0.05$			
** $P \leq 0.01$			
† Regularly attending children are defined those who had visited the same dentists during the previous year. Using this definition, 70% of the original lists were regular attenders			
‡ Only for England			
dmft: decayed/missing/filled primary teeth			
DMFT: decayed/missing/filled permanent teeth			
GBP: Pound Sterling			
Health service administrative areas:			
B: Bromley; D: Doncaster; F: Fife; G: Grampian; H: Hereford and Worcester; N: Norfolk; S: Salford; W: Wycombe			
PCD: primary care dentist			

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Data input/synthesis: PRB, AMG, JP

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DECLARATIONS OF INTEREST

There are no financial conflicts of interest and the authors declare that they do not have any associations with any parties who may have vested interests in the results of this review.

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External sources

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DIFFERENCES BETWEEN PROTOCOL AND REVIEW

Juliet Price joined the review team. We did not undertake an assessment of heterogeneity, reporting bias, data synthesis and subgroup analysis given that there were only two included studies.

INDEX TERMS

Medical Subject Headings (MeSH)

*Dental Care [economics; methods; psychology]; *Remuneration; Capitation Fee; Dentists [*economics; *psychology]; Fee-for-Service Plans; Randomized Controlled Trials as Topic; Salaries and Fringe Benefits

MeSH check words

Adult; Child; Humans