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**Three key points:**
- Profiles routinely-collected dental services data in England, Scotland, Wales and Northern Ireland
- Maps how different studies have used these data to date
- Makes recommendations for how the utility of these nationally important datasets can be increased

**Unlocking the potential of NHS primary care dental datasets**

**Authors:** Deborah Moore, Thomas Allen, Dwayne Boyers, Kate McKenzie, Wendy Thompson, Blessing Nyakutsikwa, Iain Pretty, Martin Tickle

**Introduction:** Maximising the use of routinely-collected health data for research is a key part of the UK Government's Industrial Strategy. Rich data are generated by NHS primary care dental services, but the extent of their use in research is unknown.

**Aims:** To profile the utility of the post-2006 NHS dental datasets for research, map how they have been used to date, and develop recommendations to maximise their utility.

**Methods:** The content of and access to the four UK NHS dental datasets was collated using publicly available information and a free-text questionnaire completed by the relevant data controllers. A scoping review was carried out to identify and map literature that has utilised NHS dental activity data.

**Results:** The contents of the UK NHS dental activity datasets are described, alongside how they may be accessed for research. Strengths and weaknesses of these datasets for research are highlighted. The scoping review identified 33 studies which had utilised NHS dental activity data since 2006. We classified 15 as public health practice, 11 as service evaluation and seven as research.

**Conclusion:** In comparison to other NHS activity datasets, it appears that the UK dental datasets have been underutilised for research. We make 11 recommendations on how their utility for research may be increased.
Introduction

Maximising the use of health data for research, innovation and improvements in health and care services is a key element of the UK Government’s Industrial Strategy. The ambition is for the UK to be at the centre of the health data science revolution within the next twenty years. The size of the NHS and the national health research infrastructure that has been set in place over the last fifteen years means that the UK is already well placed to achieve this aim. Further recent progress includes the introduction of 10 new standards for data security across all of health and social care, the implementation of the national data opt-out consent service and the establishment of the UK Health Data Research Alliance, a new national institute for health data science with the aim of supporting access to health data for research and innovation in an ethical and trustworthy environment.

The NHS dental datasets were originally designed as an accounting and payments system and represent a largely untapped resource that could provide world-leading opportunities for research and innovation. More specifically the datasets could have significant application in three important areas:

- Epidemiological surveillance of population disease and service use
- Applied research, both observational studies and interventional studies to support clinical trials
- Quality improvement by the collection of quality indicators and support of iterative quality improvement cycles

NHS dental datasets have key qualities which make them well-suited to support these activities. They are centrally processed and held, providing the potential for ready access for the above purposes. They have national coverage enabling the use of very large sample sizes, contain standardised information on service use, costs, and in some cases, health status. The data have the advantage of being quality assured for payment purposes, and individuals can be tracked over time enabling long term follow-up; crucially the data are a by-product of care provision therefore data collection costs are miniscule compared to traditional methods used in surveys and trials. With appropriate consent or approvals they are linkable to other datasets at an individual level using a unique identifier and at geographical level via postcode. These data also represent what is happening in real time to patients and services so are of direct relevance for decision makers.

Since the introduction of the 2006 NHS contract in England & Wales, the NHS dental contracts
in the four home countries have been diverging with this divergence likely to widen as each
country undertakes contract reform.7 If the promise of exploiting NHS dental datasets is to be
fully realised, data produced through these new contracts needs to be compatible to enable
UK-wide approaches to surveillance, research and quality improvement. It would seem timely
prior to any significant contract changes to assess how these datasets have been used for
research and whether divergence in the data collected is an obstacle to NHS dentistry
participating in the health data science revolution.

The aims of this paper are to:

1. Profile the utility of the UK NHS dental datasets for research
2. Understand how these datasets have been used for research to date
3. Make recommendations for their future development to support research

Part 1: Profile the utility of UK NHS dental datasets for research

Methods: Publicly available information regarding the dental data in England, Wales,
Scotland and Northern Ireland was reviewed; this included reports, websites and
downloadable datasets. In addition, a free text questionnaire was sent to the relevant data
controller for each country, alongside a request for any reports that would be useful in
understanding the datasets. Any clarifications were resolved through direct communications
with the relevant department.

Results: Table 1 provides an overview of the contents of the UK NHS dental datasets.

Table 1 Comparison of NHS primary care dental activity datasets across England, Wales, Scotland and Northern Ireland

Population coverage and scope:

The most recent data indicate that NHS dental services regularly see more than half of the UK
population:

- England: 50% of adults (within two years) and 59% of children (within 12-months) 8
• Wales: 55% of the population\(^9\) (within two years)
• Scotland: 67% of the population\(^10\) (within two years)
• Northern Ireland 61% of adults (within two years) and 75% of children (within 12-months)\(^11\)

Large volumes of data are submitted by NHS dental practitioners at the end of every course of treatment, including urgent episodes of care.\(^12\) These data are used to administer payments to dental practitioners, to facilitate the collection and processing of NHS patient charges, to inform the monitoring of dental services and service planning, and to guard against fraud. Whilst there are broad similarities in terms of coverage and purpose of the dental datasets across the UK, there are several important differences. Historically, all dentists providing care on behalf of the NHS in the UK received a payment for each ‘item of service’ that had been carried out on a patient, with hundreds of designated codes for each type of procedure, size of restoration and material. In 2006, a new dental contract was introduced in England and Wales, which paid dentists a set monthly fee, in return for a pre-specified level of activity.\(^13\) Rather than the hundreds of individual items of service that were recorded previously, activity in England and Wales is now measured in just three ‘bands’ of treatment complexity, covering 19 clinical procedure categories.\(^13\) Therefore, the level of detail on the treatment provided is now much lower than in Scotland and Northern Ireland, who have retained item of service coding (Table 1).

The type of dental services that submit data via this system varies across the UK. In all countries the majority of data will be related to care provided in high-street general dental practices; including care delivered on a domiciliary or emergency basis and by orthodontists and specialist oral surgeons working in primary care. In England, the same data are also submitted by the community dental service (CDS) and, from 2020, will also be submitted by the Welsh CDS. The CDS are a specialised primary care referral service who treat adults and children with complex needs. In Scotland, CDS data is only available from 2014 and in Northern Ireland the CDS does not submit data via this route. Data about dental treatment that is provided in secondary care is recorded under a different system to that profiled in Table 1. Briefly, patient-level data for dental outpatient, in-patient and day case treatment is recorded with all other hospital activity and will include specialty, diagnosis and procedure code, as well as demographic variables. Further information on accessing secondary care data can be provided by Public Health Scotland,\(^14\) the Honest Broker Service\(^15\) in Northern Ireland, NHS Digital\(^16\) in England and the NHS Wales Informatics Service.\(^17\)
The availability of information on dental prescribing is also variable across the UK. In each of the nations, dentists complete NHS prescription forms by hand. The issuing of a prescription is a chargeable item of service for dentists in Scotland and Northern Ireland, so is recorded within the core dental activity datasets described in Table 1. However, no details of the drug prescribed or the dose are included. In England, “antibiotics prescribed” can be optionally recorded by the dentist on the FP17 form, but these data have been found to be so incomplete as to be unusable for monitoring or research purposes. In Wales, the option to record “antibiotics prescribed” on the FP17W form was recently removed. The detail of the dose and type of medication prescribed is collated when the medications are dispensed, as part of the system to remunerate pharmacies. In Scotland, Wales and Northern Ireland, electronic pharmacy systems now enable dental prescriptions data to be linked to the dental practice (Scotland), dentist (Wales), or dentist and dental practice (Northern Ireland), but not to individual patients (A.Karki, Public Health Wales, personal communication, 28th January 2021). In England, it is not possible to relate dental prescriptions data to individual dentists, patients or dental practices. A dashboard is available that illustrates the type and number of dental prescriptions in relation to the English geographic region of the pharmacy where the items were dispensed, but this was last updated in March 2020.

The datasets were not originally designed to provide information on the health of individual patients, but in recent years additional data fields have been added which may increase their utility for research. In England in 2017 the epidemiological index commonly used to summarise lifetime experience of dental decay (number of Decayed, Missing and Filled Teeth, DMFT) was added to the mandatory clinical dataset. As part of the dental contract reform programme in Wales, from April 2020 the treating practitioner is asked to submit the number of decayed teeth and the total number of teeth. Furthermore, dentists in Wales now submit a summary assessment of the patient’s medical, social, and dental, risk and need status. Dental contract reform is also ongoing in England, with the intention for dental practices to submit a patient-level risk assessment for future decay, periodontal (gum) disease, tooth wear and oral cancer.

Data access: In all countries, routinely published reports and datasets provide data on population access to primary care dentistry, the activity of the services and the profile of the dental workforce. This is aggregated data, presented at the level of health and social care board, local authority or clinical commissioning group. In addition, the relevant data controllers can be contacted for data requests under the Freedom of Information Act. To avoid the potential for re-identification, small numbers are suppressed in these releases. For
access to more detailed data, a specific application process must be followed which will incur
a processing fee and a data sharing agreement between parties:

**England and Wales:** To access individual-level dental data, an application must be submitted
to the NHS Business Services Authority (NHSBSA). The NHSBSA advise researchers to
discuss their project with the UK Health Research Authority (HRA) first to determine which
regulatory approvals are required. Depending on the level of anonymisation and linkage
involved, this approval from an NHS Research Ethics Committee (NHS REC) and the HRA’s
Confidentiality Advisory Group (CAG) may be necessary. To start the application process,
a comprehensive form must be submitted along with an initial assessment fee. NHSBSA can
then advise on feasibility, timescales and estimated processing costs. The only reference
made to other data sets that are available for linkages are the Hospital Episode Statistics held
by NHS Digital. Individual-level data considered ‘potentially identifiable’ will need to be
securely hosted, analysed and destroyed within an NHS-compliant secure research
environment, or “Data Safe Haven”. All named users will need to demonstrate appropriate
data protection training and access to the data will be audited.

**Scotland:** The first step is to make an enquiry to the electronic Data Research and Innovation
Service (eDRIS) team within Public Health Scotland. After submission of a brief enquiry
form outlining the research proposal, a research coordinator will review the enquiry, advise on
feasibility and provide a cost estimate. Access to information collated by PHS (formerly ISD
Scotland) requires approval from the Scottish Public Benefits and Privacy Panel (PBPP). Linking the dental data to other sources of information is supported and a wide range of health
and social care datasets are available. If data linkage is required, this will be carried out by
a trusted third party using the available personal identifiers, before anonymisation and addition
of a unique identifier specific to the project. The completed anonymised dataset will then be
transferred to the National Safe Haven, which is an approved secure environment for storage
and analysis hosted by the University of Edinburgh but accessible remotely via a virtual private
network (VPN). Users will need to demonstrate appropriate training and sign an end-user
agreement in line with the Scottish Information Sharing Toolkit.

**Northern Ireland:** The Family Practitioner Services Information Unit, within the HSC Business
Services Organisation, can undertake data linkage and follow-up for research studies where
participant consent is in place. For studies without consent where anonymised data is required
applicants can apply to the HSC Honest Broker Service for Health and Social Care. The
Honest Broker Service is the main Trusted Research Environment for accessing health-
related data for research purposes in Northern Ireland. A range of datasets from across health...
and social care are held, including pharmaceutical services and secondary care activity data.

For anonymised data, ethical approval is only required if the request includes linkage to external datasets. Applications are reviewed and approved by the Honest Broker Service Governance Board and charges apply to cover the processing costs. Any data provided must be hosted and analysed within the HBS’s Data Safe Haven. At present there is no remote access to the Safe Haven and researchers must physically go to the building in Belfast, but plans are in place for this to be made possible via the UK Secure electronic Research Platform (UK SeRP) from early 2021 (N.Mill, HSC BSO, personal communication, 1st December 2020).

This review of the contents of the NHS dental activity datasets has revealed both strengths and weaknesses in their utility for research:

**Strengths:** The increased use of unique identifiers in recent years opens up the potential for linkage to other administrative datasets and the creation of longitudinal cohorts, although this is more complete in Scotland and Northern Ireland than England and Wales. In Scotland and Northern Ireland, detailed information about the treatment provided obtained from item of service codes as well as the ability to identify tooth level data provides opportunities for research into the longevity and real-world effectiveness of different treatments at both the patient and tooth level. In England and Wales, the move towards collecting information on dental disease and medical, social, dental and behavioural risks, offers the potential for greater insight into predictors of disease, preventive interventions, and greater consideration of confounding factors and effect modifiers. The availability of an individual measure of socio-economic status, in the form of the NHS charges exemption category, is a strength of all of the datasets. The approach in Scotland and Northern Ireland of accessing the data via a central repository containing multiple datasets from health and social care is appealing from a researcher’s perspective. Having a dedicated service may smooth the application process and offer greater potential for linkages.

**Weaknesses:** The identified strengths are not all found within any one dataset. In particular, none of the datasets contain information on both the level of existing dental disease or risk factors, in combination with detailed tooth-level treatment information. The removal of tooth-level data from the datasets in England and Wales in 2006 limited the potential for longitudinal follow-up of the survival of individual restorations, or teeth. Patient ethnicity is not recorded in Scotland and Northern Ireland and in England and Wales it is an optional field which is not well completed, meaning important health inequalities may be unmeasured. After ‘White British’ the next most common categories in 2018/9 were ‘N/A’ and ‘patient declined’ (K.Gray, NHSBSA personal communication, 13th October 2020). It must also be remembered
that some private dental treatment can be provided for a patient who is mostly receiving NHS
dental care. Therefore, the NHS record may not include all dental treatment that the patient
has undergone. The DMFT data in England has not been formally validated and its completion
relies on an accurate and up to date dental charting, which is not always available. A
further issue with the DMFT measure is that the guidance on completing the return advises
practitioners to include any extracted teeth within the ‘missing’ count, rather than only those
extracted due to caries. Thus, it is not directly comparable with the DMFT measure as
commonly reported in epidemiological surveys.

Most, but not all, dental practices now use electronic software to record their clinical notes.
These systems are not networked into wider NHS records systems (for example the patient’s
general medical practice records). At present there is no requirement for symptoms or
diagnosis codes to be included in the data extract that is transmitted to the NHS, limiting the
potential for research into the natural history of oral conditions and the impact of medical
comorbidities on patient outcomes. Although computer-issued prescriptions and electronic
prescribing are now widespread across the NHS, they are not yet available to NHS
dentists. Furthermore, there is currently no requirement to include unique identifiers for
patients on handwritten prescriptions, and no statutory requirement for dentists to
communicate with a patient’s medical practitioner when prescribing for dental use. Linkage
of dental prescribing data to wider healthcare datasets is, therefore, a manually intensive
process which has been attempted but abandoned in England (M. Dockett, NHS BSA,
personal communication, 2nd July 2020).

Part 2: Scoping Review: How the NHS routinely-collected dental datasets have been
used for research to date

Methods: The scoping review was carried out according the guidance issued by the Joanna
Briggs Institute (JBI), and is reported according to the PRISMA extension for scoping
reviews.

Research question: How extensively have the NHS dental datasets been utilised for oral
health research purposes from 2006 onwards?

Eligibility criteria
• Studies utilising routinely-collected NHS dental activity data to understand the oral health of individuals or populations in England, Wales, Northern Ireland or Scotland

• Only studies which use NHS data collected to support the monitoring of dental contracts after 2006 were included. This was to ensure that the research reflects the datasets as they currently are.

• Studies exclusively concerned with dental workforce were excluded to maintain the focus on the use of data to understand the oral health of populations or individuals

The following databases were searched in March and April 2020: PubMed, Medline, All EBM reviews and Embase. The search terms were adapted for the particular database (see Supplementary Table 1 for details of the search dates, terms and limits used in each search).

For Medline, All EBM reviews and Embase the search terms were (Dental OR Dentistry) AND (NHS Business Services Authority OR NHS BSA OR NHS Business Services Organisation OR NHS BSO OR NHS Information Services Division OR NHS ISD). After feedback from stakeholders, the search term “HSC Business Services Organisation” (rather than NHS) was also tested. Using this term a smaller number of results were returned and no further potentially relevant studies were identified, therefore the original search searches using “NHS” were retained. Where possible, database searches were limited to human, English language and studies published between 2006-2020. Google Scholar searches were carried out with the focus on each of UK dental data controllers in turn, for example (NHS ISD dental data Scotland). The Google Scholar results were screened until there was a full page (10 results per page) where no results appeared relevant to oral or dental health. No restrictions were placed on study type and grey literature was included where routinely-collected NHS dental data had been used. The reference lists of retrieved full-text articles were scanned for further relevant studies and studies identified through existing knowledge were also assessed at full-text.

Study titles and abstracts were screened in duplicate by two review authors and potentially relevant studies were read in full. Authors agreed on study inclusion in pairs (DM & KMcK and TA & DB). To separate out studies that had used the routinely-collected data for research from those that had used it for other purposes, we planned apriori to map the study type against the HRA’s guidance on defining research.49 Data charting was carried out in duplicate, using an Excel template with the following headings: First author, year, country, protocol / final report, aim, ethical approval (Y/N), type of NHS data used, date of NHS dental data collection, key findings, study topic, HRA study type, reviewer notes. Review authors resolved any differences in their initial data extraction in pairs (DM & KMcK and TA & DB).
After initial data extraction, the study classifications and topics were then further refined as a whole dataset, to create the final synthesis. For study type, this was achieved by comparing the initial HRA study classifications and evaluating the coherence of the decisions across all studies and referencing back to the HRAs guidance. The aim was to ensure that the classifications were coherent and consistent. Similarly, the initial subject topics were reviewed and, in some cases, combined or separated, to create the 'subject themes' presented in Figure 2. The aim was to provide sufficient detail to be of value to the reader without becoming unmanageable, as well as achieving internal homogeneity and external heterogeneity within the themes. Modifications from the initial classification were discussed and agreed by three review authors (DM, DB, TA).

Results

A PRISMA flow chart illustrating the search process is presented in Figure 1. The total number of records that were screened was 701 (338 from database searches and 363 from Google Scholar searches and existing knowledge). Based on their titles and abstracts, 51 articles were selected for assessment in full. After reading, 18 were excluded and 33 met the inclusion criteria and were included in the analysis. Protocols where the final report was available were excluded in favour of the final report and if there were separate papers related to the same study only one paper was included. We identified three protocols for ongoing research studies that plan to utilise routinely-collected NHS data that were not included in the analysis, but may be of interest to the reader.

The references for the included studies and the classification of the type of study according to the HRA’s Defining Research table, alongside the country where the data was collected, are shown in Table 2. The identified subject themes are illustrated in Figure 2. Further detail on the type of NHS data used, main findings, subject topic and HRA study classification is presented for each study in the Study Summary Table (Supplementary Table 2).

Table 2 HRA study type, country and references of included studies

Most of the studies identified could have been classified as more than one of the HRA’s study types. For the purposes of this review, studies where the key focus of the paper was how the
population has interacted or is projected to interact with dental services in the future, were classed as public health practice. This includes issues like equity of access to services. Studies that considered the outcomes, efficiency, quality or volume of services, sometimes in addition to equity, were classed as service evaluations. Studies classified as research made use of wider theoretical models or attempted to derive estimates or conclusions that could be applied to other contexts, through the use of experimental methods including sampling and / or a control or comparator group. HRA guidance states that NHS REC approval is normally “but not always” required for research studies.

Figure 2 Frequency chart illustrating subject themes of studies identified and HRA study type

Narrative synthesis

We did not identify any studies that were classified as clinical audits. This may be because most clinical audit is carried out in a local setting and whilst it is used for clinical governance and quality improvement purposes, may not be written up for publication. The most common type of study were those we classified as public health practice. The main health issue being investigated was equity of access to different types of NHS dental services for particular population groups. Inequalities were investigated in terms of age, deprivation, geography, ethnicity, and family structure. Other studies combined historic NHS dental data with wider demographic data to inform service planning as part of health needs assessments. One study investigated the potential utility of NHS dental data to support dental antimicrobial stewardship and one was investigating the pre-diagnosis dental attendance of patients diagnosed with oral cancer, to inform early detection strategies.

The majority of service evaluations that we identified were evaluating the effectiveness of new interventions. The interventions being assessed were community oral health improvement programs, policies (NICE guidance on third molar extractions and the introduction of a new dental contract), and a training initiative. Four considered the efficiency (costs, level of activity and / or outcomes achieved) of an existing service. One made reference to the quality of clinical preventive care that was delivered in general dental services, in view of high rates of dental general anaesthesia in children.

We classified seven studies as research. One linked dental registration data to socio-demographic and vital statistics data, informed by a theoretical framework on the changes in...
health investment between childhood and adolescence. Two investigated the effectiveness of different dental contracting policies on the treatments provided by dental practitioners, using experimental methods such as matched-control and difference-in-difference. Two studies were randomised controlled trials; one assessing the effectiveness of individualised audit and feedback on dentists’ antibiotic prescribing rate, and the other, the effectiveness and economic value of ‘scale and polish’ treatments and oral hygiene advice. One study investigated the influence of patient, treatment and performer factors on the quality of orthodontic outcome. Finally, a study seeking to develop a complex intervention to reduce antibiotic prescribing compared information from the NHSBSA dental services dataset to that in the NHSBSA prescription services dataset, to investigate the utility of the dental data as an outcome measure.

None of the studies classified as public health practice or service evaluations had formal ethical approval from an NHS Research Ethics Committee (NHS REC), but two received approval from a University committee. In contrast, four of the seven studies classified as research were approved by an NHS Research Ethics Committee (NHS REC), and one was reviewed but was deemed not to require formal approval. The remaining two received University ethical approval.

Discussion

The aims of this paper were to profile the utility of the NHS dental activity datasets and evaluate how they have been used for research purposes to date, with a view to making recommendations for the future. Our review of the coverage, content and accessibility of these datasets has identified substantial potential in terms of population coverage and there are some features which lend themselves well to oral health research, particularly the increased use of unique identifiers. Despite this, the majority of studies that we identified in our scoping review were focused on the performance of specific services or the way the population interacts with them. This is understandable given that the data was designed to support operational delivery and monitoring, but a tally of just eight research studies in 13 years indicates that the true research potential of these datasets has yet to be fully realised.

A strength of our approach was that we were able to draw on existing networks and relationships to identify and engage with the relevant data controllers in each country. This ensured we were able to add additional detail to publicly available information, cross-check
the accuracy of our findings and ensure that the information presented was up to date. With regards to the scoping review, the main strengths are the use of a defined scoping review process, the reproducible search strategy, the wide range of databases searched and the inclusion of review authors from dental and non-dental backgrounds. Using the HRA’s guidance on defining research also gave us a clear framework against which to map the studies, although some interpretation was required. The limitations of our review are that we only included studies in English, although for a paper concerned with UK data, we do not expect that this had a significant impact. A further limitation is that we did not register the protocol in advance, in accordance with more recent guidance on scoping reviews.85

There is a growing body of literature regarding the use of routinely-collected data to support research. The number of papers returned when searching “routine$ NHS data” in PubMed has increased every year over the last decade, from 154 results in 2010 to 710 in 2020. In addition to primary research, many of these papers are “data resource profiles”, which provide a detailed description of specific administrative datasets.86–88 This is the first paper that we know of which has profiled the four UK primary care dental activity datasets and mapped their previous use for research purposes. In common with researchers in other fields, we identified both strengths and weaknesses of these routinely-collected datasets for research, but the dental datasets have been little used for research compared with others.86–88 For example, the Clinical Practice Research Datalink (CPRD) database, which contains anonymised patient data from a network of GP practices, has been utilised in over 2,600 peer-reviewed publications.89 Similarly, in 2016 Hospital Episode Statistics for Admitted Patient Care were estimated to have been used in over 500 research publications.87 An exploratory PubMed search suggests a further 394 such papers have been published since then. Application of NHS datasets for purposes other than payment is valuable and it is important to support developments to enable this use within dentistry.

The current NHS routinely-collected dental data primarily measures treatment activity and is therefore extremely limited as a source of information about the quality of care provided. Our scoping review only identified one paper84 which addressed the factors influencing the quality of treatment outcomes and this was specifically with regards to orthodontics, where the routine data submission contains an assessment of the level of need at both the start and end of treatment. This is not a feature of any of the UK data collection systems for general dentistry. A 2009 review of dental service provision in England, commonly referred to the ‘Steele review’, made recommendations regarding quality improvement of dental care.90 The review stated that both dentists and service commissioners reported a lack of information to support quality improvement, and recommended a return to the collection of tooth-level treatment data, as is
still the case in Scotland and Northern Ireland. This has not occurred and limits the potential for studies into the survival of different types of dental treatments or teeth (as per Lucarotti and Burke using pre-2006 data),\textsuperscript{42} or the treatment outcomes of individual dentists; all important dimensions of technical quality.\textsuperscript{91}

At present there is no universally accepted understanding of what ‘quality’ means in dentistry, but recent work has contributed to progressing this and could offer additional insights into how routinely-collected data might be adapted to support improvements in patient care.\textsuperscript{91,92} Facets of quality such as patient reported outcomes and experiences, and provision of interventions that are evidence-based and appropriate for the need and risk level of the patient are also important topics for health services research.\textsuperscript{91} Since 2013 in England all NHS services (including dental practices) are required to submit the ‘Friends and Family’ measure of patient experience,\textsuperscript{93} but there is no minimum response rate requirement and no such centrally-collated system exists in Scotland, Wales or Northern Ireland. The recent addition of an annual patient-level need and risk rating to the routinely-collected data in Wales may support work regarding the appropriateness of the care delivered, but again this is not currently in place in the other UK countries.

There are a diverse range of stakeholders with an interest in routinely-collected NHS dental services data. In addition to the original function of financial management of the dental system, in an ideal world, these datasets would be able to support patient choice, practice-level quality improvement initiatives, dental epidemiology, evaluation of health promotion interventions, and to inform the early identification of risks to patient safety and/or professional standards.\textsuperscript{94} Collectively, the authors of this paper have recent experience of applying to access NHS dental data for research, across England, Wales, Scotland and Northern Ireland. Drawing on this experience and the findings of this review, we offer the following recommendations for maximizing the utility of dental activity datasets for research:

1. A shared understanding between key stakeholders of what the routinely-collected dental activity data can and should be used for, and how best to support this, is required. This should be developed in partnership, including patients, dentists, data controllers, policy makers, regulators and academics.

2. Alignment of some core information across the four UK datasets would create many more opportunities for research. The ten priority topics for oral and dental research in the UK were identified by the James Lind Alliance in 2018 using a priority setting partnership approach.\textsuperscript{95}
These topics should inform any future modifications of the NHS dental datasets to support research. A similar type of consensus / priority setting partnership approach could be employed to inform any future developments of the datasets more generally.

3. Custodians of NHS dental data and dental research institutes should join the UK Health Data Research Alliance. The alliance is working to remove common barriers to health data research and encourage responsible access to clinical and administrative data.

4. A single point of access for a range of health and social care datasets, with end-to-end support to navigate the application process would be very helpful for researchers in all UK countries. Greater detail is needed on the opportunities for linkages to other datasets in England and Wales.

5. Meta-data, including a comprehensive data dictionary, should be publicly available for the dental datasets. Ideally, this would be aligned across the different countries and understandable to non-dental professionals. Supporting the creation of such meta-data is a key part of the Health Data Research Innovation Gateway, hosted by the UK Health Data Research Alliance.

6. A key initial step in the process of accessing routinely-collected data for research is for the data controller and the research team to develop a common understanding of the categorisation of the data that is being requested. The boundaries between anonymised, pseudonymised and potentially-identifiable data are open to interpretation and this cannot be decided by the research team alone. This step should be undertaken prior to contacting external bodies for advice (such as the HRA), as this classification impacts on which regulatory approvals will be required.

7. The addition of unique identifiers (e.g. NHS numbers) to dental records should be as high as possible in all areas of the UK, to support the linkage of longitudinal data and to other health and social care datasets.

8. Dental prescriptions should include unique identifiers for both the patient and the dentist and this information should be collated electronically. This is necessary for clinical audit and quality improvement, patient safety, health economics and to support antimicrobial stewardship.
9. The 2009 Steele review’s recommendation to return to the collection of tooth-level treatment data in England and Wales should be implemented.

10. In England, the National Information Standard has been adapted to require healthcare providers to use SNOMED CT in their electronic patient record systems, and Scotland, Northern Ireland and Wales also have programmes of work underway.\(^9^6\) SNOMED is a consistent means of recording conditions, treatments, diagnoses and procedures. Initially the SNOMED roll out replaced the used of Read codes in GP systems, but, since April 2020 dental software systems must now also include SNOMED reference data.\(^9^7\) By ensuring the use of a consistent coding system there is the opportunity to use practice based clinical data in a vendor agnostic manner; offering the potential for more detailed assessment of longitudinal data. It is important to ensure that research teams are involved in developing the systems to access and utilise these data.

11. A network of general dental practices that are supported to submit enhanced clinical data, equivalent to the G.P equivalent (CPRD), would be a huge asset for dental research, including clinical trials. The feasibility of such a programme should be considered as part of future developments.

Acknowledgements

We would like to thank Nikki Dodds and Kirsty Gray at the NHS Business Services Authority, Jennifer McCrea, James McGregor, Martin Mayock and Alan Harbinson at the HSC Business Services Organisation, and Ahmed Mahmoud at Public Health Scotland for their help and support in scoping the contents of and access to the NHS dental activity datasets. The views expressed are those of the author(s) and not necessarily those of the the listed organisations or the Department of Health and Social Care.

Authors’ contributions. Deborah Moore led the conception and development of the study design, the scoping review search, analysis and interpretation, and drafting and submission of the manuscript. Thomas Allen contributed to the scoping review search, analysis and interpretation, contributed to the drafting of the manuscript and approved the final version. Dwayne Boyers contributed to the scoping review search, analysis and interpretation, contributed to the drafting of the manuscript and approved the final version. Kate McKenzie contributed to the scoping review search, analysis and interpretation, and approved the final
version of the manuscript. Wendy Thompson contributed to the drafting of the manuscript and approved the final version. Blessing Nyakutsikwa contributed to the scoping review analysis and interpretation, contributed to the drafting of the manuscript and approved the final version. Iain Pretty contributed to the development and conception of the study, the drafting of the manuscript and approved the final version. Martin Tickle contributed to the conception and development of the study design, the drafting of the manuscript and approved the final version.
<table>
<thead>
<tr>
<th></th>
<th>England and Wales</th>
<th>Scotland</th>
<th>Northern Ireland</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data Controller</strong></td>
<td>NHS Business Services Authority Dental Services</td>
<td>Public Health Scotland Data and Intelligence (ISD Scotland until end of 2020)</td>
<td>HSC Business Services Organisation Family Practitioner Unit</td>
</tr>
<tr>
<td><strong>Name of dental dataset</strong></td>
<td>NHSBSA Dental Services Activity Data</td>
<td>Management Information &amp; Dental Accounting System (MIDAS)</td>
<td>FPS Dental Payment System Data</td>
</tr>
<tr>
<td><strong>Number of patient records in database</strong></td>
<td>~269 million (from Jan 2014)</td>
<td>~7 million</td>
<td>~3 million</td>
</tr>
<tr>
<td><strong>How is the data captured?</strong></td>
<td>Submitted electronically or on paper based FP17 forms (England) or FP17(W) forms (Wales)</td>
<td>Submitted electronically or on GP17 forms</td>
<td>Submitted electronically or on HS45 forms</td>
</tr>
<tr>
<td><strong>How up to date is the data?</strong></td>
<td>Claims for completed treatment must be submitted within 2 months. Database updated daily</td>
<td>Claims for completed treatment must be submitted within 3 months. MIDAS is refreshed monthly</td>
<td>Claims for completed treatment must be submitted within 6 months. Database updated daily</td>
</tr>
<tr>
<td><strong>How far back can data be accessed?</strong></td>
<td>Data retention period is currently 10 years but this is under review and may be reduced. Data is more complete post-2015</td>
<td>1999 but data only considered complete from 1st April 2000</td>
<td>2007 but data is more complete post-2015</td>
</tr>
<tr>
<td><strong>Can records be linked to individuals using a unique identifier?</strong></td>
<td>From 2016 onwards NHS number can be populated in around ~78% of records</td>
<td>Community Health Index Number is recorded in ~95% of records</td>
<td>Health and Care Number is included on all records since 2015</td>
</tr>
<tr>
<td><strong>How detailed is the clinical treatment data?</strong></td>
<td>Category of treatment and number of teeth e.g. “extraction”, “filling”. Exact tooth cannot be provided.</td>
<td>Exact type of treatment including material and size. From 2013 exact tooth can be provided from 2013.</td>
<td>Exact type of treatment including material and size. Exact tooth can be provided.</td>
</tr>
<tr>
<td><strong>Are there any indicators of oral health, medical or social risk factors?</strong></td>
<td><strong>England</strong>: Number of Decayed, Missing and Filled Teeth (DMFT) from 2017 <strong>Wales</strong>: From 2020, number of decayed teeth, total number of teeth and clinical risk factors (ACORN)</td>
<td>‘Special Needs’ indicator if the patient has a severe mental/physical disability or severe learning disability.</td>
<td>‘Special Needs’ indicator if the patient has a severe mental/physical disability or severe learning disability.</td>
</tr>
<tr>
<td>What information about the treating dentist is available?</td>
<td>Age, gender, General Dental Council (GDC) registration number, date of first registration with GDC</td>
<td>Age, gender, GDC number, date of first registration with GDC</td>
<td>Age, gender, GDC number, date of registration with GDC</td>
</tr>
</tbody>
</table>

Table 4 HRA study type, country and references of included studies

<table>
<thead>
<tr>
<th>Type of study</th>
<th>Key features</th>
<th>Number</th>
<th>Country where the NHS dental data collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical audit</td>
<td>Designed to answer: “Does this service reach a particular standard?”</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>PH practice</td>
<td>Designed to answer: “What are the health issues in this population and how do we address them?”</td>
<td>15</td>
<td>England [56,59,62-69] (10) Scotland [57,58,61,70] (4) Wales [25] (1)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>33</strong></td>
<td></td>
</tr>
</tbody>
</table>
Figure 3 PRISMA flow diagram illustrating search process
Figure 4 Frequency chart illustrating subject themes of studies identified and HRA study type

- Clinical quality: 1 Public health practice, 1 Service evaluation
- Oral cancer: 1 Public health practice
- Health needs assessment: 4 Public health practice
- Antimicrobial stewardship: 1 Public health practice, 1 Service evaluation
- Effectiveness of interventions: 4 Research, 6 Service evaluation
- Service efficiency: 4 Public health practice
- Equity of access: 9 Public health practice, 1 Service evaluation
References

doi:10.1108/01443589410070806

2. NHS Digital. New UK Health Data Research Alliance to boost medical research and
improve future health and care. News and Events (2018). Available at:
30th March 2020)


at:


dental practitioner services in Northern Ireland : a mixed-methods study. 8, (2020).

https://app.powerbi.com/view?r=eYlrljoiyTRILMiijYTeMTgwMi00ZTdiLTgzMWUtZGM5Y2NmMTI5MGE4liwidCi6jiUwZjYwNzFmlWjizmUtNDAxYS04ODAzLTY3Mzc0OGU2MjIlMilsMmQj9h. (Accessed: 8th December 2020)


12. NHS. Understanding NHS Dental Charges. (2020). Available at:


14. Public Health Scotland Data and Intelligence (previously ISD Scotland). A-Z Subject


18. NICE. Prescription Writing. BNF (2020).


96. NHS Digital. SNOMED CT. (2020). Available at:

97. NHS Business Services Authority. SNOMED CT. *NHS Dental Services* (2020).


## Supplementary Table 1: Search Strategies

### Definitive Searches 31.03.20-29.04.20

<table>
<thead>
<tr>
<th>Search focus and date</th>
<th>Databases &amp; limits</th>
<th>Search Terms</th>
<th>Records returned</th>
<th>After duplicates removed</th>
<th>Records screened</th>
</tr>
</thead>
<tbody>
<tr>
<td>Google Scholar 2006-2020</td>
<td>NHS BSA dental data</td>
<td>9740</td>
<td>9740</td>
<td>120 (first 12 pages of results)</td>
<td></td>
</tr>
</tbody>
</table>
## Supplementary Table 1: Search Strategies

### Definitive Searches 31.03.20-29.04.20

<table>
<thead>
<tr>
<th>Search focus and date</th>
<th>Databases &amp; limits</th>
<th>Search Terms</th>
<th>Records returned</th>
<th>After duplicates removed</th>
<th>Records screened</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Existing knowledge</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Snowballing / forward backwards citation searches</td>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>UK wide 29.04.20</td>
<td>Medline 2016 to April 28, 2020</td>
<td>1 (dental or dentist&amp;).mp. [mp=ti, ab, tx, kw, ct, ot, sh, hw, tn, dm, mf, dv, fx, dq, nm, kf, ox, px, rx, ui, sy] (429431)</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All EBM Reviews</td>
<td>13 (NHS Business Services Authority or NHS BSA or NHS Business Services Organisation or NHS BSO or NHS Information Services Division or NHS ISD).mp. [mp=ti, ot, ab, tx, kw, ct, sh, hw, tn, dm, mf, dv, fx, dq, nm, kf, ox, px, rx, an, ui, sy] (44)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Embase 1980 to 2020 Week 17 Limits 2006 to 2020</td>
<td>14 1 and 13 (14)</td>
<td>15 remove duplicates from 14 (10)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Scotland and Northern Ireland 29.04.20</td>
<td>PubMed All Fields. 1st Jan 2006- 29th Apr 2020</td>
<td>(((dentistry or dental)) AND &quot;nhs business services organisation&quot;) OR &quot;nhs information services division&quot;</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>4</td>
<td>Scotland 2006-2020</td>
<td>Google Scholar</td>
<td>NHS ISD dental data Scotland</td>
<td>647</td>
<td>647</td>
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</tbody>
</table>
## Supplementary Table 1: Search Strategies

### Definitive Searches 31.03.20-29.04.20

<table>
<thead>
<tr>
<th>Search focus and date</th>
<th>Databases &amp; limits</th>
<th>Search Terms</th>
<th>Records returned</th>
<th>After duplicates removed</th>
<th>Records screened</th>
</tr>
</thead>
<tbody>
<tr>
<td>29.04.20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Wales 29.04.20</td>
<td>Google Scholar 2006-2020</td>
<td>NHS BSA dental data Wales</td>
<td>1,200</td>
<td>1,200</td>
<td>110 (11 pages)</td>
</tr>
<tr>
<td>6 Northern Ireland (NHS BSO) 29.04.20</td>
<td>Google Scholar 2006-2020</td>
<td>NHS BSO dental data Northern Ireland</td>
<td>65</td>
<td>65</td>
<td>50 (5 pages)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>1197</strong> Databases (342) Google Scholar (11,652) Other (3)</td>
<td><strong>11993</strong></td>
<td><strong>701</strong> Databases (338) Google Scholar (360) Other (3)</td>
</tr>
<tr>
<td>Included Studies</td>
<td>Routine NHS data used</td>
<td>Key Findings</td>
<td>Topic</td>
<td>Study classification (HRA)</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
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<td>-------</td>
<td>---------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Country¹, year and first author</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Eng, Wales &amp; Scot. (2012) McArdle</td>
<td>NHS Hospital Episodes Statistics (HES) database, NHS Business Support Agency (NHSBSA) database and data from the Information Services Division (ISD) of the NHS in Scotland.</td>
<td>There was an increase in the mean age of patients receiving third molar surgery (TMS) (25 years in 2000 to 32 years in 2010). The most common age for TMS increased from 26 to 29 years. The introduction of clinical guidelines led to a decrease of 30% in the number of patients needing third molar removal in a secondary care setting. However, there was a 97% increase in the number of patients since 2003. The number of dental caries resulting in third molar removal also increased.</td>
<td>Effectiveness of Interventions</td>
<td>Service Evaluation</td>
</tr>
<tr>
<td>2</td>
<td>Eng. &amp; Scot. (2018) Ramsey</td>
<td>Resource utilisation data for NHS treatments at dental practices over the trial follow-up period were collected using routine sources held by the ISD of the Scottish Government and the NHSBSA in England. Dental claims data were linked to the trial data set on an individual level to each trial participant</td>
<td>Scheduling 6 monthly or 12-monthly periodontal instrumentations (PIs) did not provide any additional benefit compared to not providing this treatment unless desired or recommended. There was also no difference between gingival inflammation/bleeding and patient-centred outcomes. Participants thought both interventions were of value and were willing to pay for both with a higher financial value placed on PI in comparison to oral hygiene advice (OHA)</td>
<td>Effectiveness of Interventions</td>
<td>Research</td>
</tr>
<tr>
<td>3</td>
<td>Eng, Scot, N.Ireland. (2016) Brocklehurst</td>
<td>Data recording the extent of NHS clinical activity undertaken by the practice held by the Business Services</td>
<td>Many dental services were noted as not performing to maximum capacity compared to the most efficient practice in the sample. The management of inputs and outputs in NHS dentistry in Northern Ireland was influenced by Capitation. No improvement in the levels of</td>
<td>Effectiveness of Interventions</td>
<td>Research</td>
</tr>
</tbody>
</table>

¹ Country refers to the country where the NHS routine dental data was collected
**Supplementary Table 2: Study Summary Table**

<table>
<thead>
<tr>
<th>Authority (the Information Services Division in Scotland and the Business Services Organisation in Northern Ireland provided the corresponding data for those jurisdictions). Data on Units of Dental Activities, Courses of Tx and patients seen were linked to role substitution data to look at the effect of role substitution on efficiency at generating outputs</th>
<th>prevention following capitation remuneration was noted. The number of extractions did increase, however.</th>
<th>Effectiveness of Interventions</th>
<th>Service Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scotland (2010) Turner</td>
<td>Dental service, Fluoride varnish and Referrals linked to community health index numbers which show children's participation in Childsmile</td>
<td>These linkages have greatly improved the comprehensive assessment of the Childsmile programme on Children's health in Scotland. The data has helped determine factors that promote the programme intake as well as the cost-effectiveness of the programme</td>
<td>Effectiveness of Interventions</td>
</tr>
<tr>
<td>Scotland (2012) Ulhaq</td>
<td>Orthodontic treatment claims and deprivation data. GP17 (O) forms submitted to NSS Practitioner Services Division (PSD) for payment authorisation by the Scottish Dental Practice Board (SDPB) provided the necessary data for this study</td>
<td>There was a higher uptake of orthodontic services in the least deprived areas. Orthodontic treatment uptake was nearly twice as high for patients from the least disadvantaged areas (OR 1.90, 95% CI 1.86 – 1.94) in comparison to those from the more deprived areas.</td>
<td>Equity</td>
</tr>
<tr>
<td>Scotland (2012)</td>
<td>Restorative activity data collected from the Information Services Division (ISD) of the NHS</td>
<td>There is a considerable need for specialist restorative dentistry services. Restorative dentistry requests and complexity of treatment seem to increase with age.</td>
<td>Service efficiency</td>
</tr>
<tr>
<td>Yeung</td>
<td>National Services Scotland and National Records of Scotland (NRS)</td>
<td>Nearly 70% of the Scottish population were registered with an NHS dental service (September 2010). Only 5% of these registrations, however, were with the SGDs. An inverse dental care relationship was observed for children getting NHS dental care in the GDS but not for adults. The registration rates of adults and children for the SGDS were highest amongst the most deprived.</td>
<td>Equity</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>---</td>
</tr>
<tr>
<td>7</td>
<td>Scotland (2013) Jones</td>
<td>Routine administrative data collected from the ISD of NHS National Services Scotland. Some of the data utilised included: a) Dental registrations for all ages were used and were split into adults (&gt;18 years) and children (&lt;18 years) b) Service registration (non-salaried General Dental Services (GDS) or salaried General Dental Service (SGDS)) and c) The Scottish Index of Multiple Deprivation (SIMD) quintile based on the area of residence</td>
<td>Equity</td>
</tr>
<tr>
<td>9</td>
<td>Scotland (2015) Anopa</td>
<td>NHS dental claims data for 2009/10 The nursery toothbrushing programme ran at an estimated annual cost of £1.8 million per year. There was decrease overtime on the costs of dental treatments for five-year-old children. The expected savings from the toothbrushing programme were two and a half times higher than</td>
<td>Effectiveness of Interventions</td>
</tr>
<tr>
<td>No.</td>
<td>Location</td>
<td>Study Details</td>
<td>Findings</td>
</tr>
<tr>
<td>-----</td>
<td>--------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>10</td>
<td>Scotland</td>
<td>The Prescribing Information System for Scotland (PRISMS) database and the MIDAS database which contains information relating to all NHS treatment claims made by dentists in the General Dental Service</td>
<td>There was a significant reduction (-5.7%, 95% CI -10.2% TO -1.1%; p = 0.01) in dentists' antibiotic prescribing rate in the audit and feedback (A&amp;F) intervention in comparison to dentists in the control group.</td>
</tr>
<tr>
<td>11</td>
<td>Scotland</td>
<td>MIDAS—primary care dental service data SMR01—hospital discharge data NDIP—5-year and 11-year dental treatment need data</td>
<td>Following adjustments for sociodemographic factors, looked after children were 2.65 times more likely (95% CI 2.30 to 3.05) to have an urgent need for dental treatment at five years of age. They were also almost twice as likely (OR 1.91, 95% CI 1.78 to 2.04) to have their teeth extracted under general anaesthesia.</td>
</tr>
<tr>
<td>12</td>
<td>Scotland</td>
<td>OCC cases in the Scottish Cancer Registry and MIDAS NHS dental claims database records</td>
<td>It was estimated that dentists potentially came across one case of Oral Cancer every ten years. Oral Cavity Cancer (OCC) was encountered every 16.7 years, and Oropharyngeal cancer (OPC) every 25 years. Half of all OC patients, however, had not had a dental consultation two years before diagnosis</td>
</tr>
<tr>
<td>13</td>
<td>England</td>
<td>Dental practice records provided by NHSBSA</td>
<td>It was observed that practice location had a significant effect on the opulation accessing a service. People from the most deprived sections of the North East Community were more likely to access services close to where they lived</td>
</tr>
<tr>
<td>14</td>
<td>England</td>
<td>Number of new interventions on FP17s under different types of contracts using NHSBSA dental activity data</td>
<td>In the post-2006 dental contract there was an increase in the uptake of treatments such as dental extractions which require the least amount of time and a decrease in the uptake of time-consuming procedures such as bridgework, crowns, root fillings and radiographs. Adjustments made to</td>
</tr>
</tbody>
</table>
**Supplementary Table 2: Study Summary Table**

<table>
<thead>
<tr>
<th>Study Description</th>
<th>Source</th>
<th>Methodology</th>
<th>Findings</th>
<th>Public Health Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>15. England (2013) Simons</td>
<td>NHS BSA dental attendance data</td>
<td>Utilising a community based mobile dental unit presents an opportunity to eliminate barriers to dental care access, in both the treatment of vulnerable children and as the first step in the dental care pathway.</td>
<td>Effectiveness of Interventions</td>
<td>Service Evaluation</td>
</tr>
<tr>
<td>16. England (2014) Csikar</td>
<td>NHS BSA dental claims data including Fluoride Varnish applications</td>
<td>Fluoride varnish application training for Dental Nurses was observed to increase the use of fluoride varnish in dental practice.</td>
<td>Effectiveness of Interventions</td>
<td>Service Evaluation</td>
</tr>
<tr>
<td>19. England (2016) Wanyonyi</td>
<td>NHS Dental sedation claims FP17s</td>
<td>Sedation of patients in dental care practice increased with increasing social deprivation with the most deprived quintile having 31.5% of all patients being sedated at least once in primary dental care. However, this gradient was only noticeable amongst children and young adults and flattened amongst middle-aged and older adults.</td>
<td>Equity</td>
<td>Public Health Practice</td>
</tr>
<tr>
<td>20. England (2017)</td>
<td>NHS BSA claims data (FP17s) submitted by general dental practitioners in the North West of</td>
<td>NHS dental care visits decreased with increasing age; From 49% in the 65-74 age group, 39% in the 75 – 84 years age group and 23% in the over 85 years age group. Among the older age.</td>
<td>Equity</td>
<td>Public Health Practice</td>
</tr>
<tr>
<td>Study Reference</td>
<td>Authors</td>
<td>Study Location</td>
<td>Study Summary</td>
<td>Study Type</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------</td>
<td>----------------</td>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td>21 England (2017) Price</td>
<td>Price</td>
<td>NHSBSA orthodontic activity data submitted by primary care dentists who were working under state-funded NHS contracts in North West England</td>
<td>Significant inefficiencies were noticeable in the NHS orthodontic services, with an estimated £2.3 million lost due to discontinuation (7.6% of all treatments) and an additional £1.6 million needed for residual services (5.2% of all treatments). Over a third of cases had unrecorded IOTN outcome scores. Children from deprived communities were observed to have worse outcomes compared to those from more well-off communities.</td>
<td>Efficiency</td>
</tr>
<tr>
<td>22 England (2018) Crosse</td>
<td>Crosse</td>
<td>Orthodontic activity data for children using data provided by NHSBSA</td>
<td>To meet the projected need for orthodontics in Northamptonshire, Bedford Borough, Central Bedfordshire, Luton, Milton Keynes and Hertfordshire, it is estimated that between thirteen and fifteen thousand orthodontic case starts per annum need to be commissioned</td>
<td>Health Needs Assessment</td>
</tr>
<tr>
<td>23 England (2018) Geddis-Regan</td>
<td>Geddis-Regan</td>
<td>Number of courses of domiciliary care provided using data supplied by NHSBSA</td>
<td>There was a sizeable variation in the number of domiciliary claims made across various England regions in 2015, with a limited association between the number of claims and population size. An association between area levels of deprivation and the number of domiciliary claims made per 100,000 population was observed, but this association lacked consistency. No association was found between area proportions of adults aged 60+ and the numbers of domiciliary claims per 100,000 population</td>
<td>Equity</td>
</tr>
<tr>
<td>24 England (2018)</td>
<td>England</td>
<td>Anonymised, aggregated data sets supplied by NHSBSA, summarising activities by neighbourhood</td>
<td>40% of children abstained from dental visits in one year. Fluoride varnish was only included in 1 out of 7 courses of treatment and 1 out of 83 fissure sealant. For children under 16 years, seven in</td>
<td>Clinical Quality</td>
</tr>
<tr>
<td>Study</td>
<td>Title</td>
<td>Data Source</td>
<td>Findings</td>
<td>Recommendations</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
<td>-------------</td>
<td>----------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Lucas</td>
<td>(electoral ward), patient characteristics and (Course of Treatment) CoT for all &lt;18-year-olds in the area</td>
<td>every thousand were admitted for dental general anaesthetic, with one in thirteen being repeat admissions. Incidence rates were highest among 5–9-year-olds, in the most deprived neighbourhoods, and areas with higher fluoride varnish use rates. Most children had more than four teeth removed, with younger children having more teeth removed than older children. Preventive interventions were found to be underutilised by GDPs in this region, given the high needs.</td>
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<td>26</td>
<td>England (2019) Thompson</td>
<td>NHS BSA data on antibiotics prescribed from FP17s and dental attendance figures</td>
<td>According to NHS prescription service records, 3.4 million antibiotic items were dispensed NHS dental patients by community pharmacists across England in 2015. However, the NHS Dental Services identified 1.3 million antibiotic items prescribed by NHS primary care dentists in England during the same reporting period. Therefore, they were 2.6 million fewer antibiotics recorded as prescribed by dentists than were known to be dispensed by pharmacists.</td>
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<td>27</td>
<td>England (2019) Maguire</td>
<td>NHSBSA data on activities of NHS contracted services and sedation claims. Data on hospital admissions for dental extractions under general anaesthesia provided by PHE</td>
<td>There are extensive and important variations in population experience of sedation across England. Such differences are difficult to explain on purely clinical grounds.</td>
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<td>28</td>
<td>England (2020)</td>
<td>NHS administrative data, Office for National Statistics and 2016/2017 National</td>
<td>Deprivation was associated with decreased dental attendance rates. White ethnicity, single</td>
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<td>Salomon-Ibarra, Dental Epidemiology Programme</td>
<td>Parenthood and caries prevalence were associated with increased rates.</td>
<td>Service Efficiency</td>
<td>Service Evaluation</td>
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<td>Wales, Richmond (2012)</td>
<td>NHSBSA data on orthodontic activity for Wales</td>
<td>Apparent inefficiencies in the orthodontic services in Wales for the period of 2008/2009 were observed with children having varied access to services in the 22 local health boards. Around £12 million was spent on orthodontics. A potential shortfall of 508 orthodontic treatment was also observed for children between 12 to 17 years. Out of 135 GDS/PDS orthodontic contracts, 27 provided no active treatment (only assessments), and 62 provided less than 50 treatments annually. Cost per units of orthodontic activity (UOA) ranged from £58 to £74. With improved contracts and efficiency, the orthodontic budget seems sufficient to meet the population's orthodontic needs.</td>
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<td>Wales, Quach (2019)</td>
<td>Performer and patient information were obtained by use of a questionnaire and FP17OW forms, respectively. A calibrated investigator recorded the Index of Orthodontic Treatment Need (IOTN), Peer Assessment Rating (PAR) and the Index of Complexity, Outcome and Need (ICON) on start- and end-study models for each case.</td>
<td>The highest quality of orthodontic outcomes was achieved by dual arch fixed appliances carried out by orthodontic specialists in non-corporate environments. Individuals with the greatest need for treatment according to IOTN Dental Health Component (DHC) and Aesthetic Component (AC) AC gain the most with regards to improvement completed in PAR score.</td>
<td>Clinical Quality</td>
<td>Research</td>
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<td>Wales, Dispensing data submitted by community pharmacies in Wales compiled by NHS Wales Shared Services (2019)</td>
<td>Linking routinely collected antibiotic dispensing data and NHS general dental services data to produce personalised feedback profiles for general</td>
<td>Antimicrobial Stewardship</td>
<td>Public Health Practice</td>
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<td>Study</td>
<td>Author(s)</td>
<td>Methods</td>
<td>Findings</td>
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<td>32</td>
<td>N. Ireland Telford (2012)</td>
<td>Data on adolescents aged 11 or 12 years in April 2003 obtained from the Northern Ireland Longitudinal Study (NILS) and monthly dental registration data</td>
<td>There is a decrease in dental registration rates during the transition from childhood to adulthood. This could reduce the population's dental health with the risk being higher in males than females. There is a need to review the role of children's services within dentistry.</td>
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<td>33</td>
<td>N. Ireland Brocklehurst (2020)</td>
<td>Data extracted from submitted HS45 forms by the BSO</td>
<td>A shift to the capitation-based payment system seems to suppress clinical activity, including prevention. Equally, GDPs returning to a Fee-for-service (FFS) remuneration system seem to return to levels observed in the baseline period. A permanent change to Capitation would likely lead to immediate changes similar to those reported in the pilot, but that behaviour in terms of availability and usage would find an equilibrium somewhere between the FFS and capitation levels listed in the pilot.</td>
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