

## [Snomed-CT and learning health systems for NHS dentistry - a dream needing to become reality.](#)

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Key words: Snomed-CT, electronic health record, learning health system, dentistry.

**Abstract:**

There has been discussion and confusion about Snomed-CT, learning health systems (LHS), and its use in their relevance in dentistry. This article aims to provide clarity an overview of Snomed-CT, and learning health systems, as well as and discussing the all-too-often omitted patient and service benefits from their use that accompany Snomed-CT facilitation of learning health systems.

Learning health systems-LHS are delivering impactful benefits to patients s-outcomes and service s-provision globally in medicine. There are some examples in dentistry, but these are few and lack the nationalised co-ordinated efforts supporting UK general medical practice (GP) electronic health record (EHR) databases. These impacts require research and insights from large-scale, linked EHR databases – for which Snomed-CT will greatly facilitate.

This opinion piece discusses Snomed-CT, learning health systemsLHS, and the current state of EHR databases in dentistry with comparison to medical practice. Impactful examples of GP EHR database research are presented, as well as the potential benefits and disadvantages of EHR-based approaches in dentistry. Barriers to creating large dental EHR databases in dentistry the UK are discussed, and potential solutions offered.

Lastly, there is a call to action for multiple stakeholders including dental clinicians, patients, academics, public health professionals, software suppliers, commissioners, and government to co-ordinate efforts, including that of Snomed-CT implementation, so that dentistry does not get excluded from the benefits of an integrated learning health systems.

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## Introduction: What is Snomed-CT?

Between 2019 and 2023 there were many articles and discussions about Snomed-Clinical Terminology [CT] and its implementation in dentistry, especially in NHS general dental practice.<sup>1,2,3,4</sup> Yet lately this discussion seems to have fallen out of the public discourse, with a large amount of uncertainty and confusion remaining.

Snomed-CT, in a simple sense, is merely a “dictionary” of clinical terms,<sup>7</sup> (including dental), where each term has a unique number (Snomed code). There are codes for each diagnosis (e.g. dental amalgam filling present 278555002), for each body part (e.g. mandibular right first molar 28480000), and for each specific location (e.g. mesial surface tooth 8483002) – by combining these altogether, it specifies unambiguously an amalgam filling present on mesial LR6.

The advantages of using the Snomed-CT “dictionary” include that it is standardised and it facilitates dental software communication (interoperability) i.e. software can send recognised Snomed codes to other software,<sup>7</sup> if needed. Many stakeholder organisations (e.g. Office of Chief Dental Officer [OCDO], British Dental Association [BDA], Dental Software Suppliers Association [DSSA], and NHS England) have publicly stated the advantages of using Snomed-CT and support it – albeit there are very dissenting opinions on the specifics of implementation.<sup>1,3,5</sup>

## What is all the fuss about Snomed-CT?

In 2016, the Health and Social Care Act stated that all health care systems, including dentistry, should use Snomed-CT by 1<sup>st</sup> April 2020.<sup>6</sup> This was subsequently postponed until September 2021.<sup>3</sup> However, despite being formally law and “officially” mandated since then, its current status is not clear. The NHS Business Services Authority [BSA] (the body responsible for dental remuneration) has not requested reports in Snomed-CT.<sup>7</sup> There has been no enforcement of these Snomed-CT regulations.

Clinicians, especially general dental practitioners [GDP], are stuck trying to make sense of this: should we be using Snomed-CT now? When will we have to use Snomed-CT by? What even is the point of Snomed and all this?

The authors of this piece are working to improve dental care and services through data science approaches. The aim of this article is to provide clarity (or, at least, as much clarity as possible) in this area, as well as to highlight what we think has been inexcusably omitted from this discussion and debate: the clear benefits to patients and dental service provision.

To discuss these patient and dental service benefits of Snomed-CT, firstly, a broader viewpoint of healthcare systems is described for background required – a learning health system.

## What is a learning health system and why is it being proposed as a solution?

A learning health system (LHS) is “a research and innovation ecosystem in the NHS where innovation and new ways of working are encouraged, learnt from, and adapted”.<sup>8</sup> Data gathered directly from routine care,<sup>7</sup> and their continuous analyses,<sup>7</sup> are key to establishing a LHS, where this in turn is used to generate evidence and thereby improve patient care (figure 1).<sup>8,9</sup> A LHS can be any size, from hospitals, to regional community dental services, to group or single practices.

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What are the benefits? LHS-based systems are already delivering impactful improvements globally such as lowering post-operative complications, identifying cancer patients in distress, reducing wait times, and – such as an example from the UK – reducing unnecessary polypharmacy in frailty.<sup>10</sup> In a recent NHS England and Improvement Board discussion paper, the “major challenges in meeting the future health and care needs of an ageing population” were discussed, and a LHS was proposed as a solution.<sup>8</sup>

There are dental-related examples of LHS showcasing benefits for patients. For example, three large dental institutions in the USA created a LHS to monitor success of periodontal disease prevention (specifically, prevention of new periodontal pocketing and tooth loss) where a dashboard was created using clinical data so that the rate of success could be monitored leading to near-real time care outcome measures.<sup>11</sup>

A key element in establishing a LHS is the utilisation of electronic health record [EHR] databases. EHR are the digital records that are used to record clinical and other information as part of routine clinical care (i.e. not for the intended purpose of research alone). Dental clinicians will know these as patient notes that are entered digitally into software such as Dentally, Exact, R4, Pearl etc. for example.

Collecting data from EHR into large, safe, and anonymised databases allows for truly population-based studies to be conducted, and repeated, remarkably efficiently in near real-time, allowing for both public health surveillance and impactful research.

The benefits of EHR-based research have not gone unnoticed – a bibliographical search on Pubmed shows an explosion of studies related to the term “electronic health record” from 2009 to present day (figure 2). When the Covid-19 pandemic struck the UK, one of the emergency actions of the UK government was to establish a large, linked EHR database to survey and research Covid-19 on a population scale. This database, named CVD-COVID-UK, was a collaboration between Health Data Research UK, NHS Digital and the British Heart Foundation and contains the de-identified data for 57 million patients with resulting impactful research.<sup>12,13</sup> There are at least nine large national primary medical care EHR data resources in the UK alone, and a registry of datasets.<sup>14,15</sup>

## (Figure 2 to be inserted here)

What about learning health systems in dentistry? What is the current situation?

Yet, despite all these established benefits and resources being directed towards a medical LHS, there is a remarkable lack of similar effort in dentistry. Compared to the nine primary medical care datasets, there are no UK national EHR-based dental databases.

There are some examples of EHR-based research in dentistry globally, but this is largely from the USA and from secondary care environments.<sup>11,16,17</sup> EHR-based studies from the UK consist of either very small numbers of practices,<sup>18,19,20</sup> or are based upon treatment data submitted for remuneration.<sup>21,22,23</sup> Some of these studies using dental EHR were linked to other databases,<sup>21,23</sup> but none to existing primary medical care databases. In summary, while there are some examples of EHR-based research in dentistry, we are falling behind our medical colleagues in this area.

Several aspects of dentistry and oral health lend well to EHR-based research approaches: dental caries is the most common chronic condition both nationally and globally,<sup>24</sup> common dental diseases are largely preventable,<sup>24</sup> and there is a structured way of recording dental diagnoses/conditions (i.e. the dental chart/odontogram).

If dental databases were available, the UK is strongly placed to create world-leading linked medical-dental databases that would facilitate research and prevention efforts for important and controversial areas like systemic and oral health links (e.g cardiovascular disease, diabetes, dementia, infective endocarditis). ~~We could look at the causes of dental trauma and so inform policy for prevention.~~ This is in part due to having a nationalised health service that subsidises dental treatment (the NHS), which allows for greatly facilitated record linkage with a unique identifier (NHS number) assigned to every patient who accesses NHS care.

~~For example, a USA database of dental EHR regarding 269,536 patients from three different sites was used to determine the caries risk assessment and corresponding risk-based preventative treatments (specifically 1.1% fluoride toothpaste, topical fluoride, chlorhexidine mouthwash).<sup>25</sup> It found that patients with moderate, high, or extreme caries risk (identified by various methods) were delivered appropriate fluoride treatments in 56-93.8% of cases. Those sites not delivering appropriate treatments were supported with targeted training and resources to improve. Studies such as these identifying gaps in gold-standard care could easily be repeated here in the UK NHS, allowing for improvements in dental care and thereby patient oral health through increased prevention.~~

Not only would patients benefit but clinicians could feedback directly to commissioners and governmental bodies, with near real-time data, to improve their services and highlight issues. For example, NHS dental practices in high-needs areas could showcase the extent of their patients' treatment needs (e.g. how many patients with two or more active carious lesions attended in the last 6 months), and argue with this effective evidence base for more resource.

Patient records could be sent from GP to dental practice digitally: facilitating medical history taking, medical opinion on dental cases with complex medical history, and safeguarding; ~~and Similarly, records could be sent also~~ from dental practice to dental practice when a patient moves/is seen by another practice. ~~A survey of 118 dentists and doctors found that 66.3% reported sharing information through interoperable EHR as very important (8/10 on Likert scale) and 68.5% could recall an instance where having access to both dental and medical records electronically would have improved patient care.~~<sup>26</sup>

In a well set-up LHS, these benefits could be realised with efficiencies of digital systems.

What, then, is stopping dentistry from creating large EHR-based databases?

There are several barriers. Dental electronic health records are primarily stored within data silos in individual or groups of general dental practices. The current NHS primary dental contract remunerates based on reports of treatments received and not diagnoses made so this data is not collected nationally. There are several different dental practice management softwares which act

independently. Many authors have commented on this last point where interoperability (i.e. the ability of EHR softwares to communicate data to other sources) is poor in dentistry.<sup>27,28</sup>

This is what Snomed-CT is all about. If all services in the NHS (primary and secondary care, medical and dental etc.) use Snomed-CT, then each software can “talk to each other” and recognise, in standardised way, what is being communicated. Without a standardised coding language like Snomed-CT, achieving the benefits listed above is akin to the construction of the Tower of Babel.

None of these barriers are fatal, however. Cynics who doubt the viability of large primary care EHR databases in dentistry should be re-assured by the relatively recent precedent from our general medical practitioner [GP] colleagues who overcame these very barriers. Only decades ago, GP data was similarly siloed into individual/group practices with poor EHR software interoperability.

How was this overcome? Through several different approaches and efforts: the GP Systems of Choice standardised GP software tools and set interoperability criteria in the NHS, there was a push from public health teams for standardised information and collection, and commissioning bodies mandated the reporting of certain metrics for funding through the quality and outcomes framework (QOF). Stakeholders identified that large, linked EHR databases would be so beneficial to patients and healthcare services, that there was an appetite in terms of political will, resource, and culture-shift to overcome these seemingly challenging barriers.

The authors of this opinion piece ask:—where is the is appetite in dentistry?

#### What are the solutions and next steps?

We need a similar push in dentistry. GP Systems of Choice has evolved to NHS Digital Services for Integrated Care, with a goal of “improving digital products across care settings to support and enable an integrated care system, working with technology suppliers to deliver a choice of commonly assured, intuitive and innovative products and services” – general dental practitioner practices need to be included in this.<sup>29</sup>

No system is perfect and there are disadvantages to LHS and EHR databases. Only people who access dental services with a digital record system will have an EHR meaning that those without will not be included in associated research. Maintaining public trust in the use of safely anonymised and controlled data sharing is paramount so confirming to strict data governance is essential. An example of a data governance framework for which a dental EHR database could follow is that used by a GP EHR database: Clinical Practice Research Datalink [CPRD]<sup>30,31</sup>

Dental researchers need to be developed within existing health informatics research teams, with a co-ordinated effort from dental academic stakeholders. In medicine, there was a realisation that front line clinicians need to be involved in health informatics. This led to the creation of Clinical Information Officers – frontline clinicians (doctors, nurses, any clinical healthcare professional) with skills and training to implement and utilise data- and information-based methods to improve patient care and healthcare systems. These are desperately needed in the dental sphere also.

Nationally, commissioners and NHS-wide organisations need to mandate that dental EHR software vendors are interoperable, in a similar way to GP Systems of Choice in 2007. This follows the recommendation from the Report of the National Advisory Group on Health Information Technology in England - “National standards for interoperability should be developed and enforced, with an expectation of widespread interoperability of core data elements by 2020”.<sup>32</sup>

#### What about next steps for Snomed-CT?

Which again, brings us back to Snomed-CT. The clear next step is the implementation of Snomed-CT in dental services (both primary and secondary) which will unlock this potential. In the author's opinion, this can be achieved in general dental practice simply through existing dental software with no additional admin burden on the front-line clinician. There is no need for clinicians to have to input clinical data more than once.

All dental software under the UK Dental Software Suppliers Associated [DSSA] already have the functionality to convert their specific coding language into Snomed-CT. Most, but not all, software have automated this process using recommended codes for common procedures which means that no additional actions need to take place. The NHS BSA does supply a list of recommended codes<sup>33</sup> but currently the burden is being placed on the frontline clinician to enact these in practice.<sup>33</sup> Leadership organisations (such as OCDO, BDA, DSSA, ~~Public Health England~~, NHS England, Royal Colleges) need to come together to ensure that firstly, clinicians only enter clinical data once, and secondly, that entered data is extractable/interoperable into EHR databases. A win-win: no extra burden on clinicians, and the associated benefits to patient care.

In secondary care, the Getting It Right First Time [GIRFT] project published four guides to address identified issues with outpatient activity coding in June – one for each of Orthodontics, Oral Surgery, Paediatric and Restorative Dentistry.<sup>34</sup> These guides are aimed towards enabling correct and accurate coding of outpatient activity which needs to be recorded in a different coding "language" to Snomed, called OPCS-4. While these guides acknowledge Snomed-CT and describe that it serves a different purpose – the authors of this article wonder if it was a missed opportunity to map Snomed codes (which GIRFT acknowledges will be used more and more in secondary care) to these OPCS-4 codes.

### Summary and final thoughts

The authors acknowledge there are complexities in fully and formally implementing Snomed-CT use but felt obliged to highlight the benefits to patients through facilitating a LHS. The authors think that this aspect of the delay to implementing Snomed-CT has been overlooked – we are delaying patient benefit and improvement of care unnecessarily.

There are several stakeholders here who need to come together and agree a way forward, including OCDO, NHS England, BDA, DSSA, ~~Public Health England~~, Royal Colleges, academics, clinicians, and patient groups. All these groups have publicly acknowledged the importance and patient benefit that will result from Snomed-CT, yet barriers persist. These stakeholders are failing, and it is patients and clinicians who are paying the price in missed opportunity.

## **Conflict of interest**

The authors declare no conflict of interest.

Richard Fitzgerald is the primary author. Amitava Banerjee and Paul Coulthard provided knowledge, direction and editorial oversight. All authors reviewed the final draft before submission.

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There are dental-related examples of LHS showcasing benefits for patients. For example, three large dental institutions in the USA created a LHS to monitor success of periodontal disease prevention (specifically, prevention of new periodontal pocketing and tooth loss) where a dashboard was created using clinical data so that the rate of success could be monitored leading to near-real time care outcome measures.<sup>11</sup> A key element in establishing a LHS is the utilisation of electronic health record [EHR] databases. EHR are the digital records that are used to record clinical and other information as part of routine clinical care (i.e. not for the intended purpose of research alone). Dental clinicians will know these as patient notes that are entered digitally into software such as Dentally, Exact, R4, Pearl etc. for example.

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### What about learning health systems in dentistry? What is the current situation?

Yet, despite all these established benefits and resources being directed towards a medical LHS, there is a remarkable lack of similar effort in dentistry. Compared to the nine primary medical care datasets, there are no UK national EHR-based dental databases.

There are some examples of EHR-based research in dentistry globally, but this is largely from the USA and from secondary care environments.<sup>11,16,17</sup> EHR-based studies from the UK consist of either very small numbers of practices,<sup>18,19,20</sup> or are based upon treatment data submitted for remuneration.<sup>21,22,23</sup> Some of these studies using dental EHR were linked to other databases,<sup>21,23</sup> but none to existing primary medical care databases. In summary, while there are some examples of EHR-based research in dentistry, we are falling behind our medical colleagues in this area.

Several aspects of dentistry and oral health lend well to EHR-based research approaches: dental caries is the most common chronic condition both nationally and globally,<sup>24</sup> common dental diseases are largely preventable,<sup>24</sup> and there is a structured way of recording dental diagnoses/conditions (i.e. the dental chart/odontogram).

If dental databases were available, the UK is strongly placed to create world-leading linked medical-dental databases that would facilitate research and prevention efforts for important and controversial areas like systemic and oral health links (e.g cardiovascular disease, diabetes, dementia, infective endocarditis). This is in part due to having a nationalised health service that subsidises dental treatment (the NHS), which allows for greatly facilitated record linkage with a unique identifier (NHS number) assigned to every patient who accesses NHS care.

For example, a USA database of dental EHR regarding 269,536 patients from three different sites was used to determine the caries risk assessment and corresponding risk-based preventative treatments (specifically 1.1% fluoride toothpaste, topical fluoride, chlorhexidine mouthwash).<sup>25</sup> It found that patients with moderate, high, or extreme caries risk (identified by various methods) were delivered appropriate fluoride treatments in 56-93.8% of cases. Those sites not delivering appropriate treatments were supported with targeted training and resources to improve. Studies such as these identifying gaps in gold-standard care could easily be repeated here in the UK NHS, allowing for improvements in dental care and thereby patient oral health through increased prevention. Not only would patients benefit but clinicians could feedback directly to commissioners and governmental bodies, with near real-time data, to improve their services and highlight issues. For example, NHS dental practices in high-needs areas could showcase the extent of their patients' treatment needs (e.g. how many patients with two or more active carious lesions attended in the last 6 months), and argue with this effective evidence base for more resource. Patient records could be sent from GP to dental practice digitally: facilitating medical history taking, medical opinion on dental cases with complex medical history, and safeguarding. Similarly, records could be sent from dental practice to dental practice when a patient moves/is seen by another practice. A survey of 118 dentists and doctors found that 66.3% reported sharing information through interoperable EHR as very important (8/10 on Likert scale) and 68.5% could recall an instance where having access to both dental and medical records electronically would have improved patient care.<sup>26</sup>

In a well set-up LHS, these benefits could be realised with efficiencies of digital systems.

#### What, then, is stopping dentistry from creating large EHR-based databases?

There are several barriers. Dental electronic health records are primarily stored within data silos in individual or groups of general dental practices. The current NHS primary dental contract remunerates based on reports of treatments received and not diagnoses made so this data is not collected nationally. There are several different dental practice management softwares which act independently. Many authors have commented on this last point where interoperability (i.e. the ability of EHR softwares to communicate data to other sources) is poor in dentistry.<sup>27,28</sup>

This is what Snomed-CT is all about. If all services in the NHS (primary and secondary care, medical and dental etc.) use Snomed-CT then each software can “talk to each other” and recognise, in standardised way, what is being communicated. Without a standardised coding language like Snomed-CT, achieving the benefits listed above is akin to the construction of the Tower of Babel.

None of these barriers are fatal, however. Cynics who doubt the viability of large primary care EHR databases in dentistry should be re-assured by the relatively recent precedent from our general medical practitioner [GP] colleagues who overcame these very barriers. Only decades ago, GP data was similarly siloed into individual/group practices with poor EHR software interoperability.

How was this overcome? Through several different approaches and efforts: the GP Systems of Choice standardised GP software tools and set interoperability criteria in the NHS, there was a push from public health teams for standardised information and collection, and commissioning bodies mandated the reporting of certain metrics for funding through the quality and outcomes framework (QOF). Stakeholders identified that large, linked EHR databases would be so beneficial to patients and healthcare services, that there was an appetite in terms of political will, resource, and culture-shift to overcome these seemingly challenging barriers.

The authors of this opinion piece ask: where is this appetite in dentistry?

#### What are the solutions and next steps?

We need a similar push in dentistry. GP Systems of Choice has evolved to NHS Digital Services for Integrated Care, with a goal of “improving digital products across care settings to support and enable an integrated care system, working with technology suppliers to deliver a choice of commonly assured, intuitive and innovative products and services” – general dental practitioner practices need to be included in this.<sup>29</sup>

No system is perfect and there are disadvantages to LHS and EHR databases. Only people who access dental services with a digital record system will have an EHR meaning that those without will not be included in associated research. Maintaining public trust in the use of safely anonymised and controlled data sharing is paramount so confirming to strict data governance is essential. An example of a data governance framework for which a dental EHR database could follow is that used by a GP EHR database: Clinical Practice Research Datalink [CPRD]<sup>30,31</sup>

Dental researchers need to be developed within existing health informatics research teams with a co-ordinated effort from dental academic stakeholders. In medicine, there was a realisation that front line clinicians need to be involved in health informatics. This led to the creation of Clinical Information Officers – frontline clinicians (doctors, nurses, any clinical healthcare professional) with skills and training to implement and utilise data- and information-based methods to improve patient care and healthcare systems. These are desperately needed in the dental sphere also.

Nationally, commissioners and NHS-wide organisations need to mandate that dental EHR software vendors are interoperable, in a similar way to GP Systems of Choice in 2007. This follows the recommendation from the Report of the National Advisory Group on Health Information Technology in England - “National standards for interoperability should be developed and enforced, with an expectation of widespread interoperability of core data elements by 2020”.<sup>32</sup>

#### What about next steps for Snomed-CT?

Which again, brings us back to Snomed-CT. The clear next step is the implementation of Snomed-CT in dental services (both primary and secondary) which will unlock this potential. In the author’s

opinion, this can be achieved in general dental practice simply through existing dental software with no additional admin burden on the front-line clinician. There is no need for clinicians to have to input clinical data more than once.

All dental software under the UK Dental Software Suppliers Associated [DSSA] already have the functionality to convert their specific coding language into Snomed-CT. Most, but not all, software have automated this process using recommended codes for common procedures which means that no additional actions need to take place. The NHS BSA does supply a list of recommended codes, but currently the burden is being placed on the frontline clinician to enact these in practice.<sup>33</sup> Leadership organisations (such as OCDO, BDA, DSSA, NHS England, Royal Colleges) need to come together to ensure that firstly, clinicians only enter clinical data once, and secondly, that entered data is extractable/interoperable into EHR databases. A win-win: no extra burden on clinicians, and the associated benefits to patient care.

In secondary care, the Getting It Right First Time [GIRFT] project published four guides to address identified issues with outpatient activity coding in June – one for each of Orthodontics, Oral Surgery, Paediatric and Restorative Dentistry.<sup>34</sup> These guides are aimed towards enabling correct and accurate coding of outpatient activity which needs to be recorded in a different coding “language” to Snomed, called OPCS-4. While these guides acknowledge Snomed-CT and describe that it serves a different purpose – the authors of this article wonder if it was a missed opportunity to map Snomed codes (which GIRFT acknowledges will be used more and more in secondary care) to these OPCS-4 codes.

### Summary and final thoughts

The authors acknowledge there are complexities in fully and formally implementing Snomed-CT use but felt obliged to highlight the benefits to patients through facilitating a LHS. The authors think that this aspect of the delay to implementing Snomed-CT has been overlooked – we are delaying patient benefit and improvement of care unnecessarily.

There are several stakeholders here who need to come together and agree a way forward, including OCDO, NHS England, BDA, DSSA, Royal Colleges, academics, clinicians, and patient groups. All these groups have publicly acknowledged the importance and patient benefit that will result from Snomed-CT, yet barriers persist. These stakeholders are failing, and it is patients and clinicians who are paying the price in missed opportunity.

## **Conflict of interest**

The authors declare no conflict of interest.

Richard Fitzgerald is the primary author. Amitava Banerjee and Paul Coulthard provided knowledge, direction and editorial oversight. All authors reviewed the final draft before submission.

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**Snomed-CT and learning health systems for NHS dentistry - a dream needing to become reality.**

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Key words: Snomed-CT, electronic health record, learning health system, dentistry.

**Abstract:**

There has been discussion and confusion about Snomed-CT and its use in dentistry. This article aims to provide clarity, as well as discussing the all-too-often omitted patient and service benefit that accompany Snomed-CT facilitation of learning health systems.

Learning health systems are delivering impactful benefits to patient outcomes and service provision globally in medicine. There are some examples in dentistry, but these are few and lack the nationalised co-ordinated efforts supporting general medical practice (GP) electronic health record (EHR) databases. These impacts require research and insights from large-scale, linked EHR databases – for which Snomed-CT will greatly facilitate.

This opinion piece discusses Snomed-CT, learning health systems, the current state of EHR databases in dentistry with comparison to medical practice. Impactful examples of GP EHR database research are presented, as well as the benefits and disadvantages of EHR-based approaches in dentistry. Barriers to creating large EHR databases in dentistry are discussed, and potential solutions offered.

Lastly, there is a call to action for multiple stakeholders including dental clinicians, patients, academics, public health professionals, software suppliers, commissioners, and government to co-ordinate efforts, including that of Snomed-CT implementation, so that dentistry does not get excluded from the benefits of an integrated learning health system.

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## Introduction: What is Snomed-CT?

Between 2019 and 2023 there were many articles and discussions about Snomed-Clinical Terminology [CT] and its implementation in dentistry, especially in NHS general dental practice.<sup>1,2,3,4</sup> Yet lately this discussion seems to have fallen out of the public discourse, with a large amount of uncertainty and confusion remaining.

Snomed-CT, in a simple sense, is merely a “dictionary” of clinical terms, including dental, where each term has a unique number (Snomed code). There are codes for each diagnosis (e.g. dental amalgam filling present 278555002), for each body part (e.g. mandibular right first molar 28480000), and for each specific location (e.g. mesial surface tooth 8483002) – by combining these altogether, it specifies unambiguously an amalgam filling present on mesial LR6.

The advantages of using the Snomed-CT “dictionary” include that it is standardised and it facilitates dental software communication (interoperability) i.e. software can send recognised Snomed codes to other software, if needed. Many stakeholder organisations (e.g. Office of Chief Dental Officer [OCDO], British Dental Association [BDA], Dental Software Suppliers Association [DSSA], and NHS England) have publicly stated the advantages of using Snomed-CT and support it – albeit there are very dissenting opinions on the specifics of implementation.<sup>1,3,5</sup>

## What is all the fuss about Snomed-CT?

In 2016, the Health and Social Care Act stated that all health care systems, including dentistry, should use Snomed-CT by 1<sup>st</sup> April 2020.<sup>6</sup> This was subsequently postponed until September 2021.<sup>3</sup> However, despite being formally law and “officially” mandated since then, its current status is not clear. The NHS Business Services Authority [BSA] (the body responsible for dental remuneration) has not requested reports in Snomed-CT.<sup>7</sup> There has been no enforcement of these Snomed-CT regulations.

Clinicians, especially general dental practitioners [GDP], are stuck trying to make sense of this: should we be using Snomed-CT now? When will we have to use Snomed-CT by? What even is the point of Snomed and all this?

The authors of this piece are working to improve dental care and services through data science approaches. The aim of this article is to provide clarity (or, at least, as much clarity as possible) in this area, as well as to highlight what we think has been inexcusably omitted from this discussion and debate: the clear benefits to patients and dental service provision.

To discuss these patient and dental service benefits of Snomed-CT, firstly, a broader viewpoint of healthcare systems is described for background – a learning health system.

## What is a learning health system and why is it being proposed as a solution?

A learning health system (LHS) is “a research and innovation ecosystem in the NHS where innovation and new ways of working are encouraged, learnt from, and adapted”.<sup>8</sup> Data gathered directly from routine care, and their continuous analyses, are key to establishing a LHS, where this in turn is used to generate evidence and thereby improve patient care (figure 1).<sup>8,9</sup>

**(Figure 1 to be inserted here)**

What are the benefits? LHS-based systems are already delivering impactful improvements globally such as lowering post-operative complications, identifying cancer patients in distress, reducing wait times, and – such as an example from the UK – reducing unnecessary polypharmacy in frailty.<sup>10</sup> In a recent NHS England and Improvement Board discussion paper, the “major challenges in meeting the future health and care needs of an ageing population” were discussed, and a LHS was proposed as a solution.<sup>8</sup>

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Nationally, commissioners and NHS-wide organisations need to mandate that dental EHR software vendors are interoperable, in a similar way to GP Systems of Choice in 2007. This follows the recommendation from the Report of the National Advisory Group on Health Information Technology in England - “National standards for interoperability should be developed and enforced, with an expectation of widespread interoperability of core data elements by 2020”.<sup>27</sup>

### What about next steps for Snomed-CT?

Which again, brings us back to Snomed-CT. The clear next step is the implementation of Snomed-CT in dental services (both primary and secondary) which will unlock this potential. In the author’s opinion, this can be achieved in general dental practice simply through existing dental software with no additional admin burden on the front-line clinician. There is no need for clinicians to have to input clinical data more than once.

All dental software under the UK Dental Software Suppliers Associated [DSSA] already have the functionality to convert their specific coding language into Snomed-CT. Most, but not all, software have automated this process using recommended codes for common procedures which means that no additional actions need to take place. The NHS BSA does supply a list of recommended codes – but currently the burden is being placed on the frontline clinician to enact these in practice.<sup>28</sup> Leadership organisations (such as OCDO, BDA, DSSA, Public Health England, NHS England, Royal Colleges) need to come together to ensure that firstly, clinicians only enter clinical data once, and secondly, that entered data is extractable/interoperable into EHR databases. A win-win: no extra burden on clinicians, and the associated benefits to patient care.

In secondary care, the Getting It Right First Time [GIRFT] project published four guides to address identified issues with outpatient activity coding in June – one for each of Orthodontics, Oral Surgery, Paediatric and Restorative Dentistry.<sup>29</sup> These guides are aimed towards enabling correct and accurate coding of outpatient activity which needs to be recorded in a different coding “language” to Snomed, called OPCS-4. While these guides acknowledge Snomed-CT and describe that it serves a different purpose – the authors of this article wonder if it was a missed opportunity to map Snomed codes (which GIRFT acknowledges will be used more and more in secondary care) to these OPCS-4 codes.

### Summary and final thoughts

The authors acknowledge there are complexities in fully and formally implementing Snomed-CT use but felt obliged to highlight the benefits to patients through facilitating a LHS. The authors think that this aspect of the delay to implementing Snomed-CT has been overlooked – we are delaying patient benefit and improvement of care unnecessarily.

There are several stakeholders here who need to come together and agree a way forward, including OCDO, NHS England, BDA, DSSA, Public Health England, Royal Colleges, academics, clinicians, and patient groups. All these groups have publicly acknowledged the importance and patient benefit that will result from Snomed-CT, yet barriers persist. These stakeholders are failing, and it is patients and clinicians who are paying the price in missed opportunity.

## Conflict of interest

The authors declare no conflict of interest.

Richard Fitzgerald is the primary author. Amitava Banerjee and Paul Coulthard provided knowledge, direction and editorial oversight. All authors reviewed the final draft before submission.

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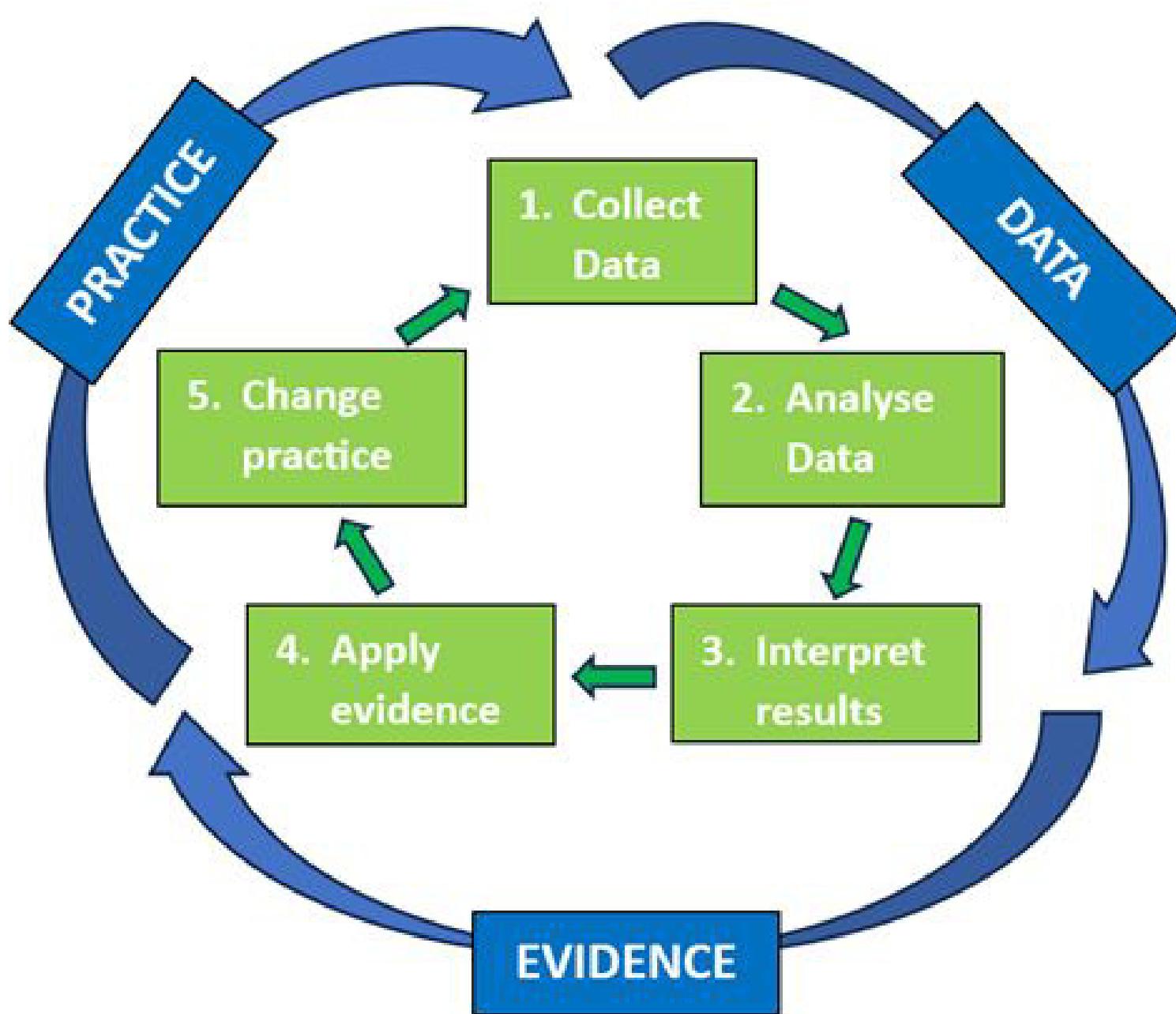


Figure 1 – Diagram of a learning health system. A learning health system allows for continuous collection and interpretation of data, constantly translated into evidence, upon which consistent improvement of practice and service can be based.

## Number of articles in Pubmed under MeSH term "Electronic Health Record" per year.

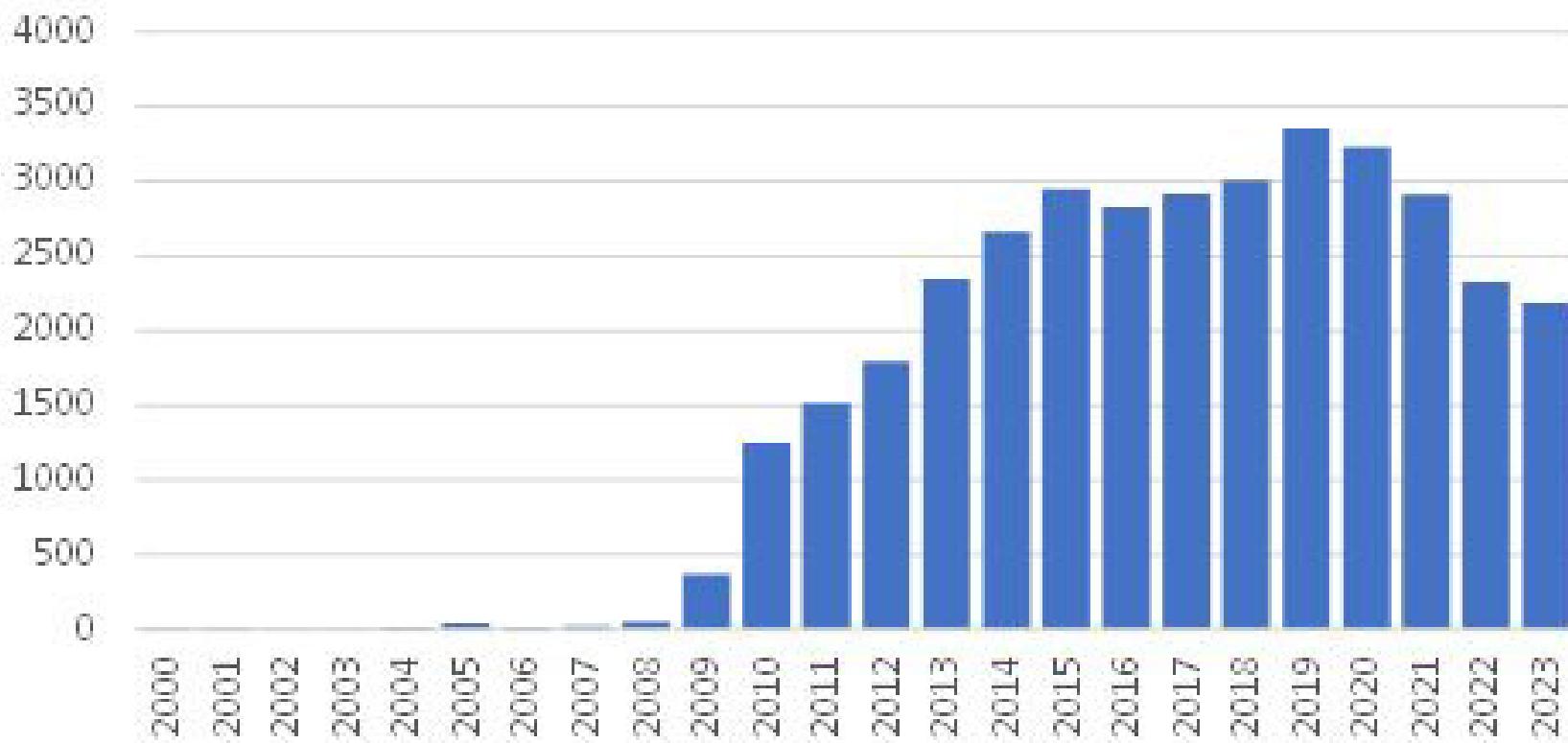


Figure 2 – Bar chart of number of articles in Pubmed under MeSH term "Electronic Health Record" per year, showing a large increase in published research activity since 2008.