



# Standardized dental diagnostic terminology

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## Abstract

Medicine has long benefited from the International Classification of Disease (ICD), which was adopted in 1900 as an international standard for describing diagnosis. Dentistry and dental quality improvement activities have not enjoyed the same benefits of ICD as medicine has, due to the limited representation of oral health diagnoses in ICD. The advent of Electronic Health Records (EHRs) has served as a catalyst to fill this knowledge representation gap in dentistry, and standardized dental diagnostic terminologies are in their early days of broader adoption. Within the clinical setting, dental practitioners are key stakeholders in the consistent documentation of oral health diagnoses: documentation of ICD diagnoses in medicine is nearly ubiquitous in part because medical billing requires documentation of diagnosis. In the dental setting, where documentation of diagnosis is not currently a requirement for billing, practitioners perceive both motivations for and barriers against the adoption and use of this foundational tool.

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## Introduction

In medicine, the International Classification of Diseases (ICD) [1] underpins core health and health research activities – including the analysis of the general health situation of population groups, monitoring the incidence and prevalence of diseases, classifying diseases, enabling storage and retrieval of diagnostic information for epidemiological and quality purposes, and resource allocation decision making by countries [1].

In dentistry, diagnostic terms are an underutilized but powerful tool. One of the reasons that the dental profession has not been able to take advantage of standardized dental diagnostic terms is that ICD has not had sufficiently broad coverage of spe-

cific oral health diagnoses [2]. In the absence of terms describing specific diagnoses, one must often resort to selecting catch-all terms to capture those diagnoses labeled as ‘not otherwise specified.’ Recognizing the importance of specific diagnostic terms to clinical care and public health, the SNODDS terminology has been created (a harmonization of the SNODENT and Diagnostic Dental System (DDS) terminologies) and was recently approved as an American National Standards Institute (ANSI) standard.

## History of standardized diagnostic terminologies

While standardized diagnostic terminologies are now an integral part of medical care, their development and acceptance



had many false starts, beginning over 250 years ago. In 1763, François Bossier de Lacroix (aka Savages) published *Nosologia methodica* the first published classification system of diseases, inspired by the classification of plants [3]. Twenty-two years later, the charismatic William Cullen (1710-1790) published his own classification of disease under the title *Synopsis nosologiae methodicae*: Cullen's classification was the most broadly used in the early 1800s. In 1853, William Farr and Marc d'Espine, created an internationally applicable uniform classification of causes of death, which never was universally accepted.

The first generally adopted set of standardized diagnoses was the Bertillon Classification of Causes of Death, created in 1893 by Jacques Bertillon. In 1898, the American Public Health Association (APHA) recommended the adoption of the Bertillon Classification by registrars of Canada, Mexico, and the United States of America. The APHA also recommended the implementation of a revision process every decade. Consequently, the first international conference to revise the International Classification of Diseases (ICD) or International List of Causes of Death, as it was then called, convened in 1900. In 1948, the World Health Organization (WHO) took responsibility for the now renamed International Classification of Diseases, Injuries, and Causes of Death with the sixth edition.

Please see **Table 1** for selected current diagnostic terminologies relevant to oral health and **Box 1** for an explanation of terms used in this manuscript.

### Current representation of oral health conditions in standardized diagnostic terminologies

Diseases of the oral cavity were codified in the early revisions of ICD; however, ICD codes for oral diseases were not sufficiently subdivided and were difficult to use due to the scattered arrangement of codes throughout the ICD volumes. Consequently, the ICD-DA, or the Application of the International Classification of Diseases to Dentistry and Stomatology was added at the time of the eighth revision of the ICD in 1965. Despite these efforts, ICD's coverage of oral and dental diagnoses remained insufficient [4-6]. In the U.S. the Centers for Medicare and Medicaid Services (CMS) and the National Center for Health Statistics (NCHS) developed the ICD-10 Clinical Modification (ICD-10-CM) for classifying diagnoses, medical coding and reporting for billing purposes. The ICD-10-CM is based on the ICD-10, the statistical classification of disease published by the World Health Organization (WHO), which replaced ICD-9. There are 69, 823 ICD-10-CM diagnostic codes [7]. There is more information and detail within these codes than its American predecessor ICD-9-CM with just 14, 025 diagnostic codes. However, both lack detailed and meaningful oral health diagnoses [2].

SNOMED was developed in 1965 by the College of American Pathologists (CAP) as SNOP (Systematized Nomenclature of Pathology), and later extended into other medical fields. In 1999, through collaboration with the National Health Service (NHS) SNOMED Clinical Terms (SNOMED CT) was developed. SNOMED CT is a comprehensive, multilingual clinical healthcare terminology for use in the EHR. Developed as a reference terminology [8], it contains more than 311, 000 unique terms organized into hierarchies. In 2007 the International Health Terminology Standards Development Organization (IHTSDO) acquired SNOMED CT (and the rights to all older versions). IHTSDO, recently renamed SNOMED International [9], is a healthcare standard development organization (SDO), is a membership organization with twenty-nine member countries participating as of 2017

[10]. SNODENT, a Systematized Nomenclature for Dentistry, was devised by the American Dental Association (ADA) in the early 1990's (DIOC 2009). In 1998, the ADA entered into an agreement with CAP, licensing them to incorporating SNODENT into SNOMED. In 2012, SNODENT was incorporated into the SNOMED CT medical code set, thanks to a licensing agreement with IHTSDO. SNODENT is composed of diagnoses, signs, symptoms and complaints and currently includes over 8000 terms. Up until its inclusion into SNOMED CT, SNODENT was only available by license and was maintained by the ADA's Advisory Committee on Dental Electronic Nomenclature, Indexing and Classification (ACODENIC), a group comprised of representatives from each recognized dental specialty. As a result, SNODENT uptake by the general practitioner was minimal.

### SNODDS dental diagnostic terminology

To meet the need for a comprehensive yet concise set of dental diagnostic terms, a happy medium between ICD sparseness and SNOMED enormosity, an academic work group came together in 2009 to create and implement novel dental diagnostic terminology [11], funded by a National Institutes of Health grant R01 DE021051. This terminology, first called EZ-Codes, then renamed DDS (Dental Diagnostic System) enjoyed early adoption in the US and Europe.

This novel terminology was built upon existing best practices. It incorporated the description and sub-classification of periodontal terms following the American Academy of Periodontology format [12]; it adopted the recommendations of the American Board of Endodontics [13] to classify diagnosis in two dimensions-symptomaticity and reversibility; it included the American Academy of Pediatric Dentistry's caries risk assessment procedure for assessing caries risk and followed best practices in caries diagnoses using the principles of the International Caries Detection and Assessment System (ICDAS); and lastly, it included terms relating to removable prosthodontics.

In 2016 through collaborations with the American Dental Association (ADA) and SNOMED this early terminology was harmonized with SNODENT and renamed SNODDS [14]. In 2017, it received American National Standards Institute ANSI accreditation. With around 1800 terms, SNODDS is developed as an interface terminology with SNOMEDCT as its reference terminology. An interface terminology is a "bridge" which allows the user to describe the diagnosis using natural language, which is then mapped to the reference terminology using formal language. Once medical/dental information is captured with the interface terminology, it is mapped on the backend to ICD and SNOMED CT, the two relevant reference terminologies. In the context of an EHR, the usability of an interface refers to how easy it is for providers to interact with the terminology as represented in the EHR [15]. Usability increases when the terminology is enhanced with attributes that improve the efficiency of selecting terms [16,17]. **Box 2** illustrates how diagnostic terms are represented in the various terminologies; with the SNODDS terms representing the harmonization of the SNODENT and DDS terms.

### Barriers to the adoption of a standardized diagnostic terminology in dentistry

During the development and early implementation years of the dental diagnostic terminology, two national conferences were held to discuss barriers against broad adoption of standardized dental diagnostic terms. Participants included representatives from electronic health record vendors, insurance

companies, government, dental professional organizations, dental academic centers and large dental group practices. Common concerns about implementing standardized dental diagnostic terms centered on cultural barriers, ease of use, return on investment, and technical issues. Additionally, steps towards harmonization of the original DDS terminology with SNODENT into SNODDS and SNODDS becoming an ANSI standard was considered advantageous for increased utilization of standardized dental diagnostic terminologies in the dental profession.

## Conclusions

Our medical counterparts have been capturing the causes of death for centuries using standardized terms. In 21st century dentistry, we do not capture why a tooth becomes non-vital or why one is extracted, much to the detriment of clinical dentistry, dental public health and dental quality improvement efforts. The SNODDS dental diagnostic terminology interfaces to the rich yet complex characterization available in SNODENT. Diagnoses are the cornerstone of clinical practice and without a doubt the most important first step of any successful treatment.

## Tables

**Table 1:** Selected Diagnostic Terminologies Relevant to Oral Health

Terminology	Focus
International Classification of Diseases (ICD)	First published in 1893 and revised at 10-year intervals. The coding system consists of a core classification of three digit codes that are the minimum required to report mortality statistics to the WHO. A fourth digit provides an additional level of detail. ICD-9-CM is compatible with ICD-9 and provides extra levels of detail in many places by adding fourth-digit and fifth-digit codes. Most of the diagnoses in the United States are coded in ICD-9-CM allowing compliance with international treaty (by conversion to ICD-9) and supporting billing requirements.
Systemized Nomenclature of Human and Veterinary Medicine Clinical Terms (SNOMED-CT)	In 1996, SNOMED changed from a multi-axial structure to a more logic-based structure called Reference Terminology [8,18]. In 1999, the College of American Pathologists and the NHS merged their products into SNOMED-CT[19] containing terms for 344,000 concepts. Despite the broad coverage of SNOMED-CT, it continues to allow users to create new ad hoc terms through post coordination of existing terms.
SNODENT	Since the early 1990s, the American Dental Association (ADA) has led the creation of SNODENT, the Systematized Nomenclature for Dentistry. SNODENT is composed of diagnoses, signs, symptoms and complaints, and currently includes over 7,700 terms. However, SNODENT is not available for use by the general practitioner or any dental schools. In June 2012, The ADA signed a licensing agreement with the International Health Terminology Standards Development Organization (IHTSDO) to allow for the integration of SNODENT into the SNOMED CT medical code set.
	licensing agreement with the International Health Terminology Standards Development Organization (IHTSDO) to allow for the integration of SNODENT into the SNOMED CT medical code set.

**Box 1:** Explanation of Terms

**Interface Terminology:** A set of terms designed to be compatible with the natural language of the user, used to mediate between a user's colloquial conceptualizations of concept descriptions and an underlying reference terminology [15].

**Reference Terminology:** A terminology where each term has a codable, computer-usable definition to support retrieval and data aggregation [20].

**Usability:** The ease (e.g., speed, level of comfort, accuracy) with which its users can accomplish their intended tasks (e.g., documentation of patient care) [15].

**Box 2:** Example of diagnostic terms represented in the various diagnostic terminologies

ICD 9	ICD 10	SNOMED	DDS	SNODENT	SNODDS*
Aplasia and hypoplasia of cementum	Aplasia and hypoplasia of cementum	Aplasia of cementum (disorder)	Cementum aplasia	Aplasia of cementum (disorder)	Aplasia of cementum (disorder)
Aplasia and hypoplasia of cementum	Aplasia and hypoplasia of cementum	Aplasia of cementum (disorder)	Cementum hypoplasia	Hypoplasia of cementum (disorder)	Hypoplasia of cementum (disorder)
Pulp degeneration	Secondary or irregular dentine	Secondary dentin	Pulp sclerosis	Secondary dentin (disorder)	Secondary dentin (disorder)

Dentinal dysplasia	Dentinal dysplasia	Dentin dysplasia, type I (disorder)	Dentin Dysplasia - Shield I	Dentin dysplasia, type I (disorder)	Dentin dysplasia, type I (disorder)
Dentinal dysplasia	Dentinal dysplasia	Dentin dysplasia, type II (disorder)	Dentin Dysplasia - Shield II	Dentin dysplasia, type II (disorder)	Dentin dysplasia, type II (disorder)
Arrested dental caries	Arrested dental caries	Arrested dental caries (disorder)	Non-active initial superficial enamel caries	Arrested dental caries (disorder)	Non-active initial superficial enamel caries
Dental caries limited to enamel	White spot lesions [initial caries] on smooth surface of tooth	Incipient enamel caries (disorder)	Active initial superficial enamel caries	Incipient enamel caries (disorder)	Active initial superficial enamel caries
Dental caries limited to enamel	Dental caries	Incipient enamel caries (disorder)	Active initial deep enamel caries	Incipient enamel caries (disorder)	Active initial deep enamel caries
Pulpitis	Irreversible pulpitis	Irreversible pulpitis (disorder)	Symptomatic irreversible pulpitis	Symptomatic irreversible pulpitis (disorder)	Symptomatic irreversible pulpitis (disorder)
Acute gingivitis, plaque induced	Acute gingivitis, plaque induced	Gingivitis	Plaque induced gingival disease with local contributing factors	Localized tooth-related factors that modify or predispose to plaque-induced gingival disease (disorder)	Gingivitis due to dental plaque with local contributing factor (disorder)
Chronic localized periodontitis	Chronic periodontitis, localized	Localized adult periodontitis (disorder)	Localized Moderate Chronic Periodontitis	Localized adult periodontitis (disorder)	Localized moderate chronic periodontitis (disorder)

\*The terms in the SNODDS terminology represent the recent harmonization of the terms in the DDS and SNODENT terminology.

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