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Disease coding for anaesthetic and peri-operative practice: an opportunity not to be missed?

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Diagnoses and outcomes in UK primary and secondary care systems are currently coded using the International Classification of Diseases (1CD10). [1] These and other data are submitted to the Secondary Users Service (SUS) [2] which provides information to clinical commissioners and stores data in the Hospital Episode Statistics (HES) [3] database. HES data are used to calculate hospital payment for services (such as payment by results [ref]) and also be used to assess effectiveness of care, monitor clinical activity trends, measure clinical quality and even to offer patients a choice of care provider [ref]. One might expect that anaesthetic interventions and complications are explicitly coded too. However this is not the case, despite the anaesthestic community generally being an early adopter of technology in other spheres. In this article, we explore the history of coding, how and why anaesthesia has missed out, and possible solutions.

A brief history of clinical coding

Disease and outcome coding was attempted first in the 17th century by John Graunt whose London Bills of Mortality recorded causes of death and examined childhood survival rates [4]. Florence Nightingale used outcome statistics (and innovative charting) during the Crimean war (1853-1856) when lobbying for the better equipment which decreased infection rates. [5] In 1853 the International Statistical Congress (later Institute) recommended an international classification of causes of death. Early efforts by Marc d'Espine of Geneva linking cause to process (gouty, herpetic, degenerative etc.) and William Farr of Shropshire, using anatomical causation, led in 1900 to the adoption of Jacques Bertillon's International List of Causes of Death, the system now known as the International Classification of

Diseases (ICD). [6] This was formalised and responsibility devolved to the World Health Organisation (WHO) in 1948. The current iteration used in the UK, ICD10, contains 17,935 disease and procedure codes whereas the modified system used for billing by Centers for Medicare and Medicaid Services (CMS) and the National Center for Health Statistics (NCHS) in the USA, ICD10-CM, has about 150,000; an important difference to which we will return later.

Other systems arose in addition to ICD10. In the 1980s Dr James Read, a Loughborough GP, created the eponymous 'Read Codes'. The Royal College of General Practitioners and the British Medical Association recommended national adoption by GPs which was implemented by the Department of Health in 1990. [7] [ref] The initial system was '4-byte' (four levels of alphanumeric hierarchy) superseded by the Read v2 '5-byte' version and then Clinical Terms Version 3 (CTV3). The alphanumeric construction and persistence of obsolete terms were limitations and CTV3 is due for retirement by 2018. [8]

SNOMED-Clinical Terms is an encyclopaedic system of clinical and pathological terms published biannually and its use as the single terminology for healthcare in the UK was endorsed in 'Personalised Health and Care 2020'. [9] SNOMED was developed from the 1965 Systematized Nomenclature of Pathology (SNOP) and after merging with CTV3 formed SNOMED CT in 1998. [10]

Where does 'anaesthesia' fit in coding?

Currently, UK hospitals still use the coding systems ICD10 and OPCS -4 (Office of Population Census and Surveys Classification of Interventions and

Procedures (formerly London, UK)). Both classifications suffer from limited lexicons and long delays for new content insertion. Neither is suited for recording anaesthetic outcomes, diagnoses or complications. OPCS-4 only includes anaesthesia as part of the surgical procedure codes; the only anaesthesia-specific outcome is 'X59.1 Preoperative anaesthetic death' i.e. why surgery didn't happen!

ICD10 categorises diseases and complications by letter and number and is rather Victorian in terminology. [11] Chapter I concerns 'certain infectious and parasitic diseases' coded **A00** to **B99**. Potentially, in-theatre complications fall into Chapter XIX '**Injury, poisoning and certain other consequences of external causes'** coded **S00-T98**. Anaesthesia is otherwise relegated to **'Complications of surgical and medical care, not elsewhere classified'** (**T80-T88**; Table 1). An external cause code from Chapter XX **'External causes of morbidity and mortality'** (**V01-Y98**) identifies the circumstance.

Table 1. Part of ICD10 section T88: Other complications of surgical and medical care not elsewhere classified.

T88 Other complications of surgical and medical care not elsewhere classified

T88.2 Shock due to anaesthesia

Shock due to anaesthesia in which the correct substance was properly administered

Excl.:

complications of anaesthesia (in):

- from overdose or wrong substance given (T36-T50)
- labour and delivery (O74.-)
- pregnancy (O29.-)
- puerperium (O89.-)

postoperative shock NOS (T81.1)

T88.3 Malignant hyperthermia due to anaesthesia

T88.4 Failed or difficult intubation

T88.5 Other complications of anaesthesia

Hypothermia following anaesthesia

During the 5th National Audit Project (NAP5) the acronym AAGA (Accidental Awareness under General Anaesthesia) was coined by one contributor (TC) and the NAP5 report recommended the creation of a database of future UK AAGA reports. [12] Given that AAGA is a complication that may reflect human error, equipment failure or pharmacogenomic variability in patient drug response we looked for an ICD10 code, but without success. We asked the WHO (*via* the Clinical Classifications Service, part of NHS Digital and the World Health Organisation-Family of Classifications (WHO-FIC) Collaborating Centre for the UK) for AAGA to be included in ICD10. Although the WHO agreed that such an outcome could be classified they did not accept that it required separate coding proposing it form a subset of T88.5 (Table 2). Notice, however, that if AAGA occurs during obstetric anaesthesia, the obstetric nature 'trumps' the anaesthetic aspect (even if the cause is secondary to equipment failure):

Table 2. WHO proposal for classifications of AAGA as subsets under T88.5 (see Table 1).

AAGA:
T88.5 Other complications of anaesthesia *Y48.- Drugs, medicaments and biological substances causing adverse effects in therapeutic use: Anaesthetics and therapeutic gases. Where it is specifically stated in the medical record that the AAGA was due to failure in dosage of anaesthetic, failure of effect of dosage of anaesthetic or an incorrect anaesthetic was given; assign external cause code Y63.6 Failure of dosage during surgical and medical care: Nonadministration of necessary drug, medicament or biological substance instead of Y48.-* *However, if a patient reports awareness during a procedure performed during pregnancy, labour, delivery or the puerperium using general anaesthesia, code O29.8 Other complications of anaesthesia during pregnancy, O74.8 Other complications of anaesthesia during labour and delivery or O89.8 Other complications of anaesthesia during the puerperium must be assigned instead of code T88.5.*
R41.8 Other and unspecified symptoms and signs involving cognitive functions and awareness *Y70.- Anaesthesiology devices associated with adverse incidents* *T88.5 Other complications of anaesthesia*

The opportunity not to be missed: SNOMED-CT

These developments were both heartening and disappointing. Yes, AAGA reached the bar for ICD-10 recognition, but it failed to warrant a named separate entity despite the fact that the US version (ICD10- CM) already contains the codes **T88.53 Unintended awareness under general anesthesia during procedure. T88.53XA ……. initial encounter, T88.53XD ……. subsequent encounter, T88.53XS ……. sequela** .

Because of the separate nature of ICD10 and ICD10-CM these codes cannot be used in the UK so trawling ICD-10 data for this specific complication is impossible; the same UK codes could equally apply to postoperative nausea and vomiting, prolonged drug effect or inadequate analgesia, etc. The same barrier applies to other anaesthetic codes. In ICD-10, **T88.4** tells us tracheal intubation was difficult but not why, although association with e.g. an obstetric code might suggest the cause. **T88.3** records malignant hyperthermia, but not the triggering agent.

Even where codes exist, outcome recording can fail. The clinician may record the outcome inaccurately, not at all, or in a way that cannot be identified by a clinical coder, so unless a subsequent hospital letter prompts a GP to code the information it disappears and cannot be recalled or interrogated. Interestingly, despite the unfamiliarity of the UK anaesthetic community with coding, **T88.4** (difficult tracheal intubation) was coded 940 times in 2014-2015 suggesting that this complication is either recognised by coders or recorded by clinicians. [13]

There are very few national anaesthesia databases other than the malignant hyperthermia database in Leeds [14] (which uses ICD-10 to code for billing purposes) and the National Reporting and Learning System (NRLS) which analyses patient safety reports [15] . Herein lies another clue as to why anaesthesia has missed out in coding terms; coding is arguably driven by billing and the lack of anaesthesia's direct involvement in billing may explain its absence from coding lexicons. Whether the nature of paper-only anaesthetic records has contributed to this lack of coding/billing is a matter for debate.

The advent of electronic patient records (EPR) changes the potential for coding in anaesthesia. Specific codes for adverse events such as malignant hyperthermia, difficult and failed tracheal intubation or awareness can be preselected within an EPR to make coding easy for the clinician. As well as allowing hospitals to bill for the increased clinical activity required in these situations it also permits continuous data collection and analysis, highlighting regions, hospitals, or even individuals with different reporting rates. The main problem with ICD-10 is that it doesn't have the detail needed to capture, identify and return rates of anaesthetic complications in a way that allows meaningful retrospective analysis. A complication may be correctly recorded and identified but the generic nature of the codes (except possibly malignant hyperthermia) makes subsequent analysis meaningless. The solution to this may lie with SNOMED CT which already contains multiple terms relating to anaesthetic complications and outcomes as concepts (Table 3).

Table 3. Examples of SNOMED CT terms

718447001 Difficult intubation (finding)
398196000 |Failed intubation (situation)|
427958009 History of difficult intubation (situation)
718449003 Expected difficult intubation (finding)
699030008 | Awareness under general anesthesia (finding)
699032000 | History of awareness under general anesthesia (situation)
247858004 | Fear of awareness under general anesthetic (finding)

These terms are the 'fully specified names' for each concept and each includes a 'semantic tag' (in brackets) which tells you the type of concept it is (i.e. in which hierarchy it sits). Concepts also have 'preferred terms' - names they are more commonly known by, without the semantic tag, and may also have one or more synonyms. The concepts and terms are linked together with attributes. Thus the finding of awareness under anaesthesia can stand alone or be part of the 'situation' of a patient history of awareness (Figure 1). The system also allows a report of awareness (699030008) during apparently adequate anaesthesia to be linked to terms 250806001, 364676005, 250840001 which relate to end tidal anaesthetic agent concentration, observation of anaesthesia and depth of anaesthesia, respectively. The authors are liaising with SNOMED to explore how the specialty can use the existing SNOMED content for these purposes. There is a strong argument that it is time for UK anaesthesia to adopt SNOMED CT to enable the reporting, recording and analysis of its own outcome data and thereby address the weakness of specialty-relevant data collection.

Conclusions

Outcomes (and associated costs) should drive service improvement, and coding allows nationwide identification, analysis and comparison of clinical activity and outcome. Accidental awareness during general anaesthesia is an adverse outcome, the documentation of which is now recommended by national report (NAP5). Current UK coding systems (ICD10, CTV3) do not include this outcome and although AAGA will be categorised within ICD10 in 2017 it will be as a generic complication in relation to drug administration and not identifiable as the cause. SNOMED-CT, the world's largest clinical terminology system, will replace CTV3 and ICD10 by 2020 and already includes terms that relating to most anaesthetic complications including AAGA. If the specialty is to achieve its already-stated aims, it is imperative that national bodies that lead UK anaesthesia formally engage with the coding systems to ensure that anaesthetic outcomes are represented. One barrier in the past has been our collective ignorance of the subject (which this paper hopes to address), but a driver is that if where a complication is coded, it can be billed for. An opportunity presents itself with the introduction of EPR and electronic records to anaesthesia. An essential start would be to adopt the SNOMED-CT terms in official documents such as the Royal College's Guidance for Professional Anaesthetic Services (GPAS); see [Ref.] www.xxx) and the AAGBI's 'glossies' containing advice about anaesthetic practice. Once embedded, pressure can be brought to bear on all NHS hospitals and trusts to use electronic patient records by means of specific GPAS guidance and in the case of those wishing to undergo ACSA accreditation, inclusion of an electronic anaesthetic record as a level one standard.

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References:

1. International Statistical Classification of Diseases and Related Health Problems 10th Revision. World Health Organization. http://apps.who.int/classifications/icd10/browse/2016/en (accessed 29th January 2017).
2. http://content.digital.nhs.uk/sus (accessed 29th January 2017).
3. http://content.digital.nhs.uk/hes (accessed 29th January 2017).
4. Graunt J. Capt. *Natural and Political observations mentioned in a following INDEX and made upon The Bills of Mortality.* St Paul's Churchyard, London: John Martyn, printer to the Royal Society, 1686.
5. Kopf EW. Florence Nightingale as Statistician. *Publications of the American Statistical Association.* 1916; **15:** 388-404.
6. History of the development of the ICD. World Health Organisation. http://www.who.int/classifications/icd/en/HistoryOfICD.pdf (accessed 29th December 2016)
7. Benson T. The history of the Read codes: the inaugural James Read Memorial Lecture 2011. *Informatics in Primary Care.* 2011; **19:** 173-182.
8. NHS Digital. https://digital.nhs.uk/article/1104/Read-Codes. (accessed 29th January 2017)
9. Personalised Health and Care 2020. HM Government. National Information Board 2014.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/384650/NIB_Report.pdf (accessed 29th January 2017).

10. International Health Terminology Standards Development Organisation (now SNOMED international). http://www.ihtsdo.org/snomed-ct/what-is-`snomed-ct/history-of-snomed-ct (accessed 29th January 2017)
11. International Statistical Classification of Diseases and Related Health Problems 10th Revision. World Health Organization. http://apps.who.int/classifications/icd10/browse/2016/en (accessed 29th January 2017).
12. Pandit JJ, Andrade J, Bogod DG, Hitchman JM, Jonker WR, Lucas N, Mackay JH, Nimmo AF, O'Connor K, O'Sullivan EP, Paul RG, Palmer JH, Plaat F, Radcliffe JJ, Sury MR, Torevell HE, Wang M, Hainsworth J, Cook TM; Royal College of Anaesthetists and the Association of Anaesthetists of Great Britain and Ireland. The 5th National Audit Project (NAP5) on accidental awareness during general anaesthesia: summary of main findings and risk factors. *Anaesthesia* 2014; **69:**1089-101.
13. NHS Digital. http://content.digital.nhs.uk/catalogue/PUB19124/hosp-epis-stat-admi-diag-2014-15-tab.xlsx (accessed 29th January 2017).
14. UKMH Registry. http://www.ukmhr.ac.uk/ (accessed 29th January 2017).
15. https://report.nrls.nhs.uk/nrlsreporting/ (accessed 29th January 2017)

Legend for figure:

Figure 1 SNOMED CT terms for the finding of anaesthetic awareness and a history of the same. Used with permission of SNOMED CT.