Development of a National Core Dataset for Preoperative Assessment

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Summary
Objective: To define a core dataset for preoperative assessment to leverage uniform data collection in this domain. This uniformity is a prerequisite for data exchange between care providers and semantic interoperability between health record systems.
Methods: To design this core dataset a combination of literature review and expert consensus meetings were used. In the first meeting a working definition for "core dataset" was specified. Subgroups were formed to address major headings of the core dataset. In the following eight meetings data items for each subheading were discussed. The items in the resulting draft of the dataset were compared to those retrieved from an earlier literature review study. In the last two expert meetings modifications of the dataset were performed based on the result of this literature study.
Results: Based on expert consensus a draft dataset including 82 data items was designed. Seventy-six percent of data items in the draft dataset were covered by the literature study. Nine data items were modified in the draft and 14 data items were added to the dataset based on input from the literature review. The final dataset of 93 data items covers patient history, physical examination, supplementary examination and consultation, and final judgment.
Conclusions: This preoperative-assessment dataset was defined based on expert consensus and literature review. Both methods proved to be valuable and complementary. This dataset opens the door for creating standardized approaches in data collection in the preoperative assessment field which will facilitate interoperability between different electronic health records and different users.

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1. Introduction

The preoperative risk assessment is an important part of the anesthetic care of patients and contributes to determining the required anesthetic policy and the resources needed during and after surgery [1–3]. It includes an interview with the patient to take history of previous conditions and procedures; physical examination of the patient; a review of medication; and ordering and reviewing of preoperative tests [4, 5]. The preoperative assessment can uncover hidden conditions that may cause problems both during and after surgery, thereby helping health care professionals to reduce perioperative mortality and morbidity rates [6, 7], to shorten the length of stay in the hospital, and to determine whether the patient needs any optimizations before surgery to be as fit as possible for the anesthesia and surgery [8]. It is therefore crucial that preoperative-assessment records contain all information required to fulfill these functions. However, it is still unclear which preoperative-assessment data exactly should be collected.

Traditionally, preoperative assessment took place in the hospital the day before surgery which often led to situations in which there was not enough time available to adequately optimize the patient before surgery. Consequently, health care cost increased and quality of care decreased [4, 9]. Performing the assessment some days in advance provides the opportunity to reduce surgical delays and to minimize late surgery cancellations resulting in more cost-effective health care [4]. To this end, preoperative-evaluation clinics were introduced, which led to involvement of more people from different disciplines such as nurses, anesthesiologists, and surgeons in the preoperative process. Exchange of preoperative information among the healthcare personnel involved in preoperative assessment is therefore critical, especially when the patient's anesthesia will be performed by another anesthesiologist than the one who performed the preoperative assessment.

In 2007, the Dutch Health Care Inspectorate reported that a multidisciplinary and standardized approach and teambuilding in the preoperative process are needed. It was also identified that a standard in preoperative-assessment data components is lacking [10, 11]. The lack of such a standard results in preventable errors and double work as care providers re-do the preoperative assessment of their colleagues. All over the world, healthcare settings individually choose what data should be collected for the preoperative as-

sessment varying from small to extensive datasets [10]. Although one might think that the more data is collected during preoperative assessment the better the patient will be prepared for surgery, there is no evidence for this. Contrarily, studies showed that collecting more, unnecessary, information and doing unnecessary tests lead to paying attention to issues that were unimportant for the preoperative assessment [7, 12]. Firstly, this can cause harm to the patients due to borderline or false-positive results, secondly it increases health care costs [4, 7, 13].

Variation in data collection impedes the use of patient data for direct care and deters data reuse for many other applications[14]. Hence, there is clearly a need to move towards a unified and unequivocal dataset across hospitals. To realize this, the Netherlands Society of Anesthesiologists (NVA) established a committee to design a national preoperative-assessment dataset. The rationale is to give centers a clear statement about what data to collect. The aim is to provide a unique dataset to be used across preoperative settings in the Netherlands to facilitate better communication and as much as possible prevent reassessment in the case of patient referral within and between hospitals. This article describes the development process and the data items defined in the preoperative-assessment dataset. The definition of this preoperative dataset is part of a larger project to design an international, standardized perioperative dataset, led by the International Organization for Terminology in Anesthesia (IOTA)[15]. This organization was created by the Data Dictionary Task Force (DDTF) of the Anesthesia Patient Safety Foundation (APSF) in the USA with the mission to create a standardized terminology for the global anesthesia community.

2. Methods

To design this dataset a combination of literature review and expert consensus was used. As depicted in ▶Figure 1 the development of the (inter)national core dataset for preoperative assessment proceeded in the following (concurrent) stages.

2.1 Literature Review Study

To investigate data collection of preoperative assessment in the international literature a systematic PubMed search has been performed. Keywords and MeSH terms related to preoperative care, assessment and possible ways of data collection in the preoperative period were used (as more extensively described in [10]). All articles describing the routinely collected preoperative-assessment data were considered and all data items that were part of the preoperative assessment were extracted from the relevant articles. Finally, 32 articles were included and 540 distinct data items were extracted. Data items covered the following categories: demographic history detail; past history of clinical finding; functional finding; behavior finding; family history; patient status observation; review of medication; procedure; physical examination procedure; laboratory test; diagnostic procedure; preoperative evaluation, anesthesia; and administrative information. From the extracted data items, only 57 data items (10.5%) were mentioned in 25% or more of the included articles [10].

2.2 Consensus of Experts

In 2007, the Netherlands Society of Anesthesiologists (NVA) established a collaborative, multidisciplinary consensus-based committee to develop a national core dataset for preoperative assessment. An ad-hoc committee of 12 anesthesiologists and two medical informaticians was installed. At the first meeting attendees agreed on the aim and the scope of the core dataset. The working definition of "core dataset" that represents the purpose is: "the NVA-accredited smallest set of data and their definitions, necessary for general preoperative assessment of the risks for (adult) patients in relation with the surgical procedures and the anesthesia". This core dataset aims to record information applicable for all preoperative-assessment patients. The committee agreed to define the core preoperative-assessment dataset, allowing organizations to add data items which may be needed for more complex and specific cases. It was decided that the data items in the core dataset could differ from the questions asked to patient to collect the data. E.g. whereas patient may be asked about "chest pain", the corresponding data item is "angina pectoris".

To define the general data categories included in the content of the dataset the ASA practice advisory was used [5]. The American Society of Anesthesiologists (ASA) published this practice advisory as a reference framework for anesthesiologists to carry out the preoperative assessment. It does not contain individual data items.

At the second meeting, the major headings of the core dataset were determined, and committee subgroups were formed to address the major headings. These headings were: airway; allergy; neurology, cognition and psychiatry; coagulation; cardiopulmonary; endocrine; and general. The initial data items for each major heading were determined by its subgroup. Data items were sent to the other members of the committee to get their opinions about the defined data items. In five consensus meetings of the committee, these initial data items and feedback of each member were discussed. Data items were extended or restricted until agreement was reached. Data items were included if the relevance in the context of the aim and scope of the core dataset was clear and when limited variability of the data elements existed. To include or exclude a data item experts discussed whether a data item is important in the context of anesthesia and surgical risk assessment or whether missing the data item during the assessment would result in problems for the patient. The data items related to general information about the patient including demographic details, behavioral findings such as alcohol drinking; and those which provide information on the operation to be done were included. Additionally, data items that are required for determining validated and frequently used risk scores in the assessment were added. The next step consisted of merging the data elements proposed by the various subgroups, and eliminating the duplications. Based on the outcome of this consultative process the draft of national core dataset for preoperative assessment was created.

2.3 Comparing the Result of the Literature Review Study with the Draft of the Dataset

A comparison was made between the results of the literature review study and the data

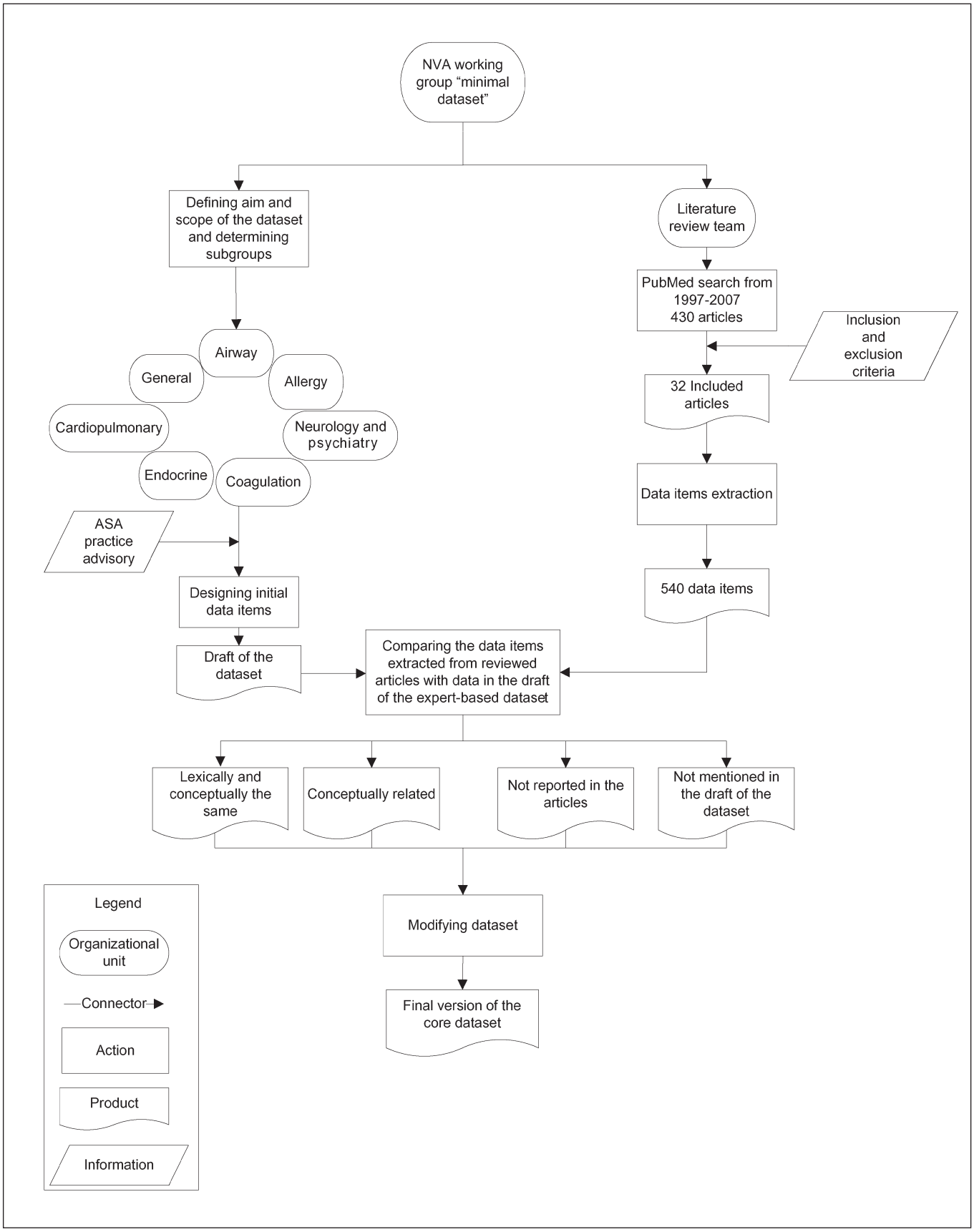

Fig. 1 The development process of core dataset for preoperative assessment

items determined in the expert-based draft of the dataset. Data items of these two collections were compared both lexically and conceptually by a medical informatician (LA). For the comparison, data items were used that were reported in more than 25% of the included articles. The comparison resulted in four categories which were handed to the experts in a consensus meeting; 1) data items that were lexically and conceptually the same, 2) data items that were conceptually related (e.g. a data item suggested to be included in the core dataset is the Wilson score, whereas in the literature review study we found data items "range of motion of neck, and head", "jaw movement"; and "buck teeth" which are different components of the Wilson score [16]); 3) data items that were not reported in the articles of the literature review study; and 4) data items that were not mentioned in the draft dataset.

The results of the comparison of the literature review and the expert-based draft of the dataset were discussed in two consensus meetings and the required modifications were performed.

3. Results

3.1 Development Process

Based on consensus, the experts in the designing committee defined 82 data items in the draft of the dataset. As the objective was to design a core dataset applicable for all surgical cases, the most important data items were added to the dataset, and residual categories were used to cover all possible relevant patient conditions in the dataset, such as "other liver diseases". The comparison between the results of the literature review study and the data items determined in the consensus meetings showed that in total 76 percent of the data items were lexically and conceptually the same. In general the literature included more detailed and specific data items. For example, in the expert-based dataset two specific liver diseases, "hepatitis-non-A" and "liver cirrhosis" were defined whereas the literature review showed seven data items such as hepatic failure, cirrhosis, and jaundice. Experts in the designing committee tried to use scores and scales instead of separated data items to describe patient conditions; e.g. Lee risk score, Ramsay score and Wilson score. ▶Table 1 shows conceptually related data

Table 1 Data items that were conceptually related

Categories	Data items in the expert-based dataset	Data items in the literature review	Final data items in the core dataset
Patient history	Hepatitis non A	Hepatitis	Hepatitis
	Cerebral tumor	Malignancy	Malignancy
	Myelum tumor	Malignancy	Malignancy
	History of heart valve operation	Artificial heart valve	History of artificial heart valve implantation
	Percutaneous transluminal coronary angioplasty (PTCA)	Revascularization	History of percutaneous coronary intervention
	Claudication	Leg weakness	Data item was deleted
	Patient in waiting list for renal transplantation	Renal transplant	Data item was deleted
	Large vessel disease	Vascular heart disease, cerebral vascular disease, peripheral vascular disease	Three data items were added: cerebrovascular diseases, great blood vessel disease (aorta) and peripheral vascular diseases
	Glucose intolerance	Hypoglycemia	Glucose intolerance
	Neuromuscular disease	Musculoskeletal disease, and neurological disease	Neuromuscular disease remained and data item musculoskeletal disease was added
	Ramsey score	Alert, oriented, cooperative, awake	Richmond Agitation Sedation Scale (RASS score)
	Glasgow coma scale	Alert, oriented, cooperative, awake	Glasgow coma scale
Physical examination	Wilson score	Range of motion of neck, head, and shoulders; jaw movement and buck teeth	Wilson score remained in the dataset and further details regarding different parts of this score were added
	Aspiratory stridor	Airway obstruction	Airway obstruction

items. The last column of Table 1 shows the finally chosen or modified data items as defined by experts after discussing the differences between the literature review and the draft dataset. Data items "hepatitis-non-A", "cerebral tumor", "myelum tumor", "patient in waiting list for renal transplantation" and "inspiratory stridor" defined in the expert-based draft were considered to be too specific and were modified according to what was found in the literature review. Six data items in the draft of the dataset were not mentioned in the literature review study (▶see Table 2). After discussion, these data items remained in the dataset without any changes.

Ten data items were reported in the included articles in the review study while the experts in the committee did not include them in the draft of the core dataset (▶see Table 2). These data items were discussed and eight of these ten data items were added to the final version of the dataset: "diagnosis", "alcohol drinking", "use of illicit drugs", "anemia", "arthritis", "difficulty in communication", "specification of procedure", and "auscultation of lung". To capture "chest x-ray", the data item "supplementary laboratory tests" defined in the draft of the dataset was modified to "supplementary examination" covering laboratory tests, examinations and imaging. The data item "gastrointestinal diseases" was replaced by "pyrosis/ regurgitation".

Table 2
Data items that were reported either only by experts or only in the included article in the literature review

Categories	Data items mentioned only by experts	Data items reported only in the literature review
Patient history	Address and telephone	Purpose of the operation/ diagnosis
	Transplantation	Alcohol drinking
	Implantable cardioverter defibrillator (ICD)	Use of illicit drugs
		Anemia
		(Rheumatoid) arthritis
		Difficulty in communication
		Specification of procedure
		Gastrointestinal diseases
Physical examination	Oxygen	Auscultation of lung
Supplementary laboratory test and consultation		Chest X ray
Final judgment	Lee risk score	

3.2 Final Version of the Dataset

After comparing the data items in the draft dataset with those retrieved from the literature, six data items were deleted, 17 new data items (14 data items based on literature and three new data items) were added, and nine data items were modified. Once required modifications were performed in total 93 data items were included in the core dataset. These data items were categorized into four categories: patient history, physical examination, supplementary examination and consultation, and final judgment (▶Table 3). The highest number of data items was related to the category "patient history". Table 3 is a summary of the final dataset on a high level of aggregation. As well as specific data items some residual categories were defined if necessary. The final dataset also includes for example the allergic substances and type of allergic reaction, and the date of some diseases such as angina pectoris, cerebrovascular accident and transient ischemic attack. The complete description of the core dataset can be acquired from the authors.

4. Discussion

The preoperative core dataset was designed to guide the documentation of preoperative assessment through the use of consistent data items across various health care settings. In summary, this dataset includes 93 data items. As information concerning patient history is an essential component of the preoperative assessment and influential for further examinations and tests [2, 5] the majority of data items (72 out of 93) in the core dataset was in this category. The comparison between the expert-based dataset and the result of the literature review helped the committee to modify the dataset by adding disregarded data items and removing unnecessary items. Nearly all data items which were reported in more than 25% of included articles of the literature review and which were not included in the expert-based draft of the dataset were added to the final version of the dataset. Moreover, comparing the conceptually related data items in these two collections led the experts to define more general data items which are useful for a core dataset. These accomplishments showed the necessity of performing the literature review next to the expert consensus.

As the literature was very diverse and in order to avoid committee members to blindly trust the literature, the results of the literature review were provided to the experts only to check their decisions on what data items should be included in the final version of the core dataset. The results of the literature review could have been provided beforehand, but this would have made it impossible to compare the results from the literature with the expert-based dataset.

This dataset has been designed as a framework to preoperative assessment health care setting and it does not cover the complete assessment of every surgical case. The current core dataset includes some residual categories such as "other liver diseases" or "other neurological disorders" which have to be made more explicit when applicable. This flexibility

Table 3 Data items in the core dataset

Categories	Data items
Patient history	Date of birth Gender Citizen number Patient name Patient number Address Telephone E-mail address Objection/limitation to receiving blood products Difficulty in communication Alcohol drinking Use of illicit drugs Malignancy (active) Allergy Medication Side effects Preoperative screening date Procedure date Referring specialist Referring specialty Diagnoses Procedure Specification of procedure (location, laterality, nature) Blood loss risk Past operation Family history of anesthesia complication Post operative nausea and vomiting Exercise tolerance Angina pectoris Dyspnea Atrial fibrillation History of myocardial infarction History of coronary artery bypass graft History of artificial heart valve implantation History of heart transplantation History of other heart diseases History of percutaneous coronary intervention History of congestive heart diseases History of atrial fibrillation History of valvular heart diseases Congenital heart diseases Pacemaker/implantable cardiac defibrillator Echo result if performed Diagnosed hypertension Cerebrovascular diseases Peripheral vascular disorders Great blood vessel diseases (aorta) Smoking
Patient history	Asthma Chronic obstructive pulmonary disease (COPD) Obstructive sleep apnea Pulmonary function test (PFT) result if performed Renal failure Hepatitis Liver cirrhosis Bleeding tendency Coagulation disorders Anemia Diabetes Secondary diabetic complication/polyneuropathy Glucose intolerance Hyperthyroidism Musculoskeletal diseases Rheumatoid diseases Pyrosis/regurgitation Lumbar injury Morbus Parkinson Cerebral aneurysm Epilepsy Neuromuscular diseases Psychiatric disorders Richmond Agitation Sedation Scale (RASS) Glasgow Coma Scale
Physical examination	Length Weight Intubation difficulty Dental status Wilson score Mallampati grade Craniofacial abnormality Upper pulmonary obstructive disease Heart rate Blood pressure Heart sound Oxygen Lung Auscultation
Supplementary examination and consultation	Supplementary examination Consultation
Final judgment	American Society of Anesthesiologists physical status class (ASA class) Lee risk score Informed consent Anesthesia technique Indication for endocarditis prophylaxis

enables using the dataset for all centers with any complexity level of surgical cases. To accomplish a whole preoperative assessment more data items may be required. Any extension to this dataset is allowed as long as the core dataset can be shared by all healthcare settings. The aim was to find a balance between the practicalities of data collection and the usefulness of data to manage patient's risks.

This dataset includes data items that are important for the risk assessment of the patient and that health care providers would like to know before performing anesthesia or surgery. To use this dataset in the real preoperative-assessment process in a way which is understandable for the patient these data items will be accompanied by a list of ques-

tions to address to the patient. E.g. to determine whether a patient has a "angina pectoris", a data item mentioned in the dataset, the patient may be asked whether (s)he has pain in the chest or uses medications such as nitroglycerin.

Among studies in other domains regarding designing a core dataset [17–21] none benefited from a systematic literature review. Simmons and his colleagues [19] designed a national dataset for monitoring diabetes patients and reviewed only three published datasets and made a draft of the core dataset and distributed it to 147 specialists. Based on the specialists' views they decided whether a data item should be included in the dataset. However, their response rate was only 18%. Moreover, our consensus meetings were real face to face meetings which supported extensive discussion on all data items and resulted in overall agreement. It is doubtful whether this could be reached as easy by using teleconference and emails as used in [21].

These national datasets would improve clearness and uniformity of written communication among clinicians and provide information that is both essential and desirable for patient management. Moreover, the implementation of this dataset in the healthcare settings would prevent costly reassessment.

This paper describes some of the numerous activities for standardizing the perioperative dataset. The next step consists of creating a proper data dictionary for the designed dataset to improve common understanding of data items and to standardize definitions and ensure consistency of use [22]. To this end, the elements defined in the consensus meetings will be presented as data items and their values. For each data item, a working definition will be provided, and allowed values will be specified. To integrate the preoperative-assessment dataset with IOTA's per- and postoperative datasets IOTA's methodology will be used to uniformly describe all data items[15]. This methodology implies concept modeling according to SNOMED CT[a] terminology using Protégé[b]. SNOMED CT is used to support the electronic exchange of preoperative data with other specialties and across information systems to provide continuity [23], which may result in better and safer patient care. To fulfill this capability, SNOMED CT concepts will be used in an HL7 Reference Information Model (RIM) architecture which facilitates the implementation of an interoperable dataset. The designed dataset and associated data dictionary will be reviewed and updated regularly.

[a] http://www.ihtsdo.org/snomed-ct/, last accessed June 30, 2008

[b] http://protege.stanford.edu/overview/protege-owl.html, last accessed June 30, 2008

5. Conclusions

The combination of literature review and expert consensus provided a good foundation for designing the core dataset. This approach may be useful for designing datasets in other domains. The large diversity in the preoperative assessment data collection found by the literature review shows that expert panels are needed to determine the appropriate data items. On the other hand, only using the experts' consensus would not be sufficient, as they may simply overlook some data items. The literature helped our experts to carry out useful modifications in the dataset. This core dataset will enable healthcare settings to evolve towards standardization of the preoperative assessment and interoperability.

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