Development of a National Core Dataset for Preoperative Assessment

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Abstract

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. 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.

Keywords
Preoperative care, dataset, hospital information systems, core dataset, database

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-
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 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 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.

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

Table 1  Data items that were conceptually related
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”.

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
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-

Table 3  Data items in the core dataset

<table>
<thead>
<tr>
<th>Categories</th>
<th>Data items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient history</td>
<td>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, Attral 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, Greater blood vessel diseases (aorta), Smoking</td>
</tr>
<tr>
<td>Physical examination</td>
<td>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</td>
</tr>
<tr>
<td>Supplementary examination and consultation</td>
<td>Supplementary examination, Consultation</td>
</tr>
<tr>
<td>Final judgment</td>
<td>American Society of Anesthesiologists physical status class (ASA class), Lee risk score, Informed consent, Anesthesia technique, Indication for endocarditis prophylaxis</td>
</tr>
</tbody>
</table>

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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 perioperative-assessment dataset with IOTAs per and postoperative datasets IOTAs methodology will be used to uniformly describe all data items [15]. This methodology implies concept modeling according to SNOMED CT [4] terminology using Protégé [5]. 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.

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.

Acknowledgments

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