Validation of a Patient Self-Administered Pre-Anaesthetic Screening Questionnaire

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Abstract

Background: In order to optimize the efficiency of the preoperative assessment workflow, a self-administered questionnaire for patients was designed (based on the Dutch national minimum dataset). This study describes the validation of this questionnaire.

Methods: A sample size of 457 subjects was calculated. In total 471 patients were recruited. The patient self-administered questionnaire, containing 49 items, was implemented within a web-based preoperative assessment system. Evidence of criterion validity was evaluated by the agreement between the patient's responses and the anaesthesia caregiver's (physician assistant, anaesthesia resident, anaesthetist) assessment. The anaesthesia caregiver's assessment was considered to be the "gold standard". Percentage agreement was used as the measure of criterion validity.

Results: 44 questions were classified as having moderate to good criterion validity. The 5 questions that had poor criterion validity were further assessed. In general, most of the mismatches were either caused by ambiguity in the interpretation of the specific question or indistinctness of definitions. After correcting the raw data set only 3 questions were classified as having poor criterion validity.

Conclusions: To develop a useful preassessment tool, questions must be evaluated for criterion validity and improved if needed. Three of the original questions will need less ambiguous versions formulated. In our opinion, this questionnaire can be used in as a triage system tool, in automated preoperative assessment for ambulatory surgery.

Keywords: Preoperative Assessment; Selection Criteria.

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Introduction

Since the introduction of pre-operative screening clinics (POSC), patient care and healthcare efficiency have been improved [1-6]. In order to standardize and optimize logistics of the perioperative assessment process, questionnaires are being used [7-10]. Although many preoperative assessment questionnaires (PAQ) exist, only a few have been validated for patient self-administration. In 2003, Hilditch and colleagues validated a 17 item PAQ and found good correlation between answers given by the patient and corresponding responses to a structured interview conducted by an anaesthetist [7]. However, this study had a few methodological imperfections. Firstly, the study was not powered for the primary outcome; second, only patients for urological and orthopaedic surgery were included and therefore did not cover the whole hospital's pre-surgical population as suggested in the conclusion; thirdly, anaesthetists were not "blinded" for the answers given by the patients, and fourth; the PAQ, in our opinion, lacks crucial pre-operative information (e.g. history of allergies, problems with mouth opening). Therefore, we developed a more extensive PAQ and aimed to validate it in a methodological correct manner.

A 49-item PAQ was constructed, founded on a National Dutch Minimal Dataset (NDMD, Table 1). This dataset reflects risk factors for perioperative outcome, based on expert consensus and a review of literature [11]. In 2011 we developed a web-based preoperative assessment tool in which the American Society of Anesthesiologists (ASA) classification, as assessed by this tool, agreed closely with the clinical assessment [12]. Although a good correlation was observed, we also found that 37% of miscalculated ASA scores were caused by incompletely filled out questionnaires by anaesthesia caregivers (AC): physician assistant, anaesthesiology resident or anaesthesiologist. We hypothesised that the number of miscalculated ASA scores could be reduced if the patients filled out the PAQ themselves and were able to create their own ASA score. This study, therefore, describes the validation of an electronic patient self-administered, 49 item, NDMD based PAQ.

Materials and Methods

The project was classified as a service evaluation by the Central Committee on Research involving Human Subjects (CCRS), meaning that formal ethical approval was unnecessary. Local approval was gained from our institution's audit committee. The study was set in a general teaching hospital, with no cardiac surgery or intracranial surgery.

Sample size was calculated, using EpiTools [13]. Estimated true proportion, confidence level and desired precision were respectively set at 95%, 95% and 4%. Using these settings a sample size of 457 participants was calculated. A total of 471 patients were recruited.

In an in-hospital point-of-care environment patients completed the PAQ unaided, choosing from one of three response options: "yes", "no" or "uncertain". Some questions (marked as $ in Table 1) contain free text boxes as an option for further answer explanation. The PAQ was implemented in an electronic, web-based preoperative assessment system (Synopsis IQ, Vf 1.2.18 Informatics, Glasgow, Scotland). Only patients with Dutch as their first language were recruited. After completing the PAQ, a structured interview of the same questions was taken by a "blinded" AC. This means that the AC was unaware of the answers given by the patient in the previous electronic setting. The response gained by the AC was considered to be the 'gold standard' [14. 154].

Evidence of criterion validity was evaluated by the agreement between the patient's responses and the AC's assessment. The Kappa (j) coefficient is often used as measure of agreement. However, the j

Table I The 49-item containing questionnaire.

	General items	
1	Are you in good physical condition?*	Yes / No/ uncertain
2	Do you use any medication?	Yes / No/ uncertain $
3	Do you have high blood pressure?	Yes / No/ uncertain
4	Do you have a high cholesterol level?	Yes / No/ uncertain
5	Do you suffer from diabetes?	Yes / No/ uncertain
6	Have you ever had spontaneous bleeds in the joints (e.g. in the knee) or do you bleed often and extremely long (e.g. after a tooth extraction or an operation)?	Yes / No/ uncertain
7	Have you lost a lot of weight without meaning to in the last 6 months?	Yes / No/ uncertain
8	Are you allergic (over-sensitive) to certain substances? **	Yes / No/ uncertain $
9	Do you smoke?	Yes / No/ uncertain
10	Do you drink?	Yes / No/ uncertain
11	Do you use hard drugs such as cocaine, heroine, XTC, or have you ever done so?	Yes / No/ uncertain
12	Do you wear contact lenses?	Yes / No/ uncertain
13	Do you suffer from motion sickness (car sick, sea sick, air sick, etc.)	Yes / No/ uncertain
14	Are there any other, not yet mentioned, illnesses/complaints or operations that may be of relevance to the planned operation?	Yes / No/ uncertain $
15	Do you have religious/moral objections to receiving blood or blood products?	Yes / No/ uncertain
16	Do you suffer from anaemia?	Yes / No/ uncertain
17	Do you regularly visit your general practitioner?	Yes / No/ uncertain
	Anaesthetic items	
18	Have you ever undergone an operation under general or loco-regional anaesthetic?	Yes / No/ uncertain $
19	Did you experience any problems with anaesthetics?	Yes / No/ uncertain $
20	Did anyone in your family experience any problems with anaesthetics?	Yes / No/ uncertain
21	Are you seeing another specialist for complaints unrelated to the operation you are undergoing now?	Yes / No/ uncertain $
22	Are anxious/ nervous about the planned operation / anaesthesia?	Yes / No/ uncertain
23	Do you have a preference for a particular type of anaesthetic?	Yes / No/ uncertain
	Airway assessment	
24	Do you have a strongly reduced mobility in your neck or jaw?	Yes / No/ uncertain
25	Do you have serious problems opening your mouth (less than 2 fingers wide) ?	Yes / No/ uncertain
26	Do you have serious dental problems	Yes / No/ uncertain
	Cardiac assessment	
27	Are you restricted by the condition of your heart (-function)? ***	Yes / No/ uncertain
28	Have you ever had a painful, tight or uncomfortable feeling in your chest?	Yes / No/ uncertain
29	Have you ever suffered a heart attack?	Yes / No/ uncertain
30	Has your heart ever stopped spontaneously?	Yes / No/ uncertain
31	Have you ever had a valve, bypass operation or a catheterization procedure of the heart?	Yes / No/ uncertain
32	Have you ever had an irregular heartbeat or palpitations (excepting in circumstances where you were stressed or emotionally strained) ?	Yes / No/ uncertain
33	Have you ever been diagnosed with a heart murmur?	Yes / No/ uncertain
34	Do you have a pacemaker?	Yes / No/ uncertain
	Pulmonary assessment	
35	Do you suffer from asthma?	Yes / No/ uncertain
36	Have you ever been diagnosed with lung emphysema, COPD or chronic bronchitis?	Yes / No/ uncertain
37	Do you suffer from sleep apnoea?	Yes / No/ uncertain
38	Do you need to cough often / produce slime?	Yes / No/ uncertain
	Cerebral assessment	
39	Have you ever suffered a stroke or brain bleed?	Yes / No/ uncertain
40	Have you ever suffered a blackout or did you faint?	Yes / No/ uncertain
41	Have you ever had an (epileptic) fit?	Yes / No/ uncertain
	Other organ assessment	
42	Have you ever had a kidney disease?	Yes / No/ uncertain
43	Have you ever had jaundice or a liver disease?	Yes / No/ uncertain
44	Do you suffer from heartburn or a burning reflux?	Yes / No/ uncertain
45	Have you ever had a bowel disease?	Yes / No/ uncertain
46	Have you ever had a gastric ulcer?	Yes / No/ uncertain
47	Have you ever had an infectious disease?	Yes / No/ uncertain
48	Have you ever had deep vein thrombosis?	Yes / No/ uncertain
49	Have you ever had cancer?	Yes / No/ uncertain

* apart from problems such as knee, hip, etc., which may restrict you?   ** allergic reactions were classified from mild (itching) to severe (shock, airway obstruction)
**** in that you get tired or short of breath when doing something physical?

coefficient is unreliable when the prevalence is < 5% or > 95%[16]. The prevalence before the start of this study was expected to be low because of the relatively healthy patient population. Therefore percentage agreement was used as measure of criterion validity [17]. Percentage agreement is defined as the number of correct answers divided by the total number of answers. If percentage agreement was 95% or higher then the question was considered to have good criterion validity. Questions with a percentage agreement between 90% and 95% were considered to have moderate criterion validity. If percentage agreement was below 90%, criterion validity was considered to be poor. Data were analysed using Microsoft Excel for Mac 2011, version 14.3.2.

Results

All patients completed the PAQ within 30 minutes.

Table 2 shows the demographic parameters of the studied patient population.

Table 2 Patient Demographics.

Parameter	Average	95% CI*
Age (yrs)	50.8	49.5 - 52.1
BMI (kg.m^{-2})	26.2	25.6 – 26.8
Male gender	60%	
No AP	94.80%	
AP 1	1.87%	
AP 2	1.24%	
AP 3/4	0.21%	
No CHF	95.44%	
CHF 1	1.66%	
CHF 2	1.24%	
CHF 3/4	0.21%	
DM	5.30%	
No COPD	86.72%	
COPD 1	10.37%	
COPD 2	2.70%	
COPD 3/4	0%	
HT	23.70%	
ASA 1	51.87%	
ASA 2	43.36%	
ASA 3	3.53%	
ASA 4	0.21%	

Table 3 (a) shows the percentage agreement and the criterion validity of the PAQ. Good criterion validity was found for 33 of the 49 questions (67%). 11 questions (22%) were classified moderate and 5 questions (10%) as poor criterion validity. These last 5 questions were further analysed. Question 3 "Do you have high blood pressure?" had poor criterion validity because 62% of the mismatched patient group did not value "treated hypertension" as "hypertension".

Question 18 "Have you ever undergone an operation under general or loco-regional anaesthetic?" and 19 "Did you experience any problems with the anaesthetic?" gained poor criterion validity because respectively 83% and 79% of the mismatches were caused by an automated analysis error as remark differences in the free text box were falsely included in the evaluation.

Question 23 "Do you have a preference for a particular type of anaesthetic?" gained poor criterion validity because 69% of the mismatched patient group reported "uncertain" where the AC classified as either spinal or general anaesthesia.

Question 27 "Are you restricted by the condition of your heart (-function)?" had poor criterion validity because 77% of the mismatched patient group reported "uncertain" where the AC classified as either "yes" or "no".

In general, mismatches were caused by ambiguity in the interpretation of the specific question, indistinctness of definitions or differences in the free text boxes. Therefore, a correction was made in the raw dataset (table 3 (b)). In the corrected dataset, question 3, 23 and 27 still gained poor criterion validity.

Discussion and Conclusions

Over the past decades, the exponential growth in digital technology has influenced the digital patient-caregiver connectivity. Therefore, the use of electronic PAQ's can be seen as a logical step in modernisation of preoperative assessment. This has also been reported by the National Health Service (NHS) in the "Digital by default; The delivery choice for England's population" [10]. Since preoperative assessment is a tool to optimise pre-, intra-, and post-operative planning, rather than to influence patient outcome, electronic PAQ's might lead to quality improvement, logistical benefits and enhancement of cost-effectiveness [10, 18–20]. The need for good quality PAQ's is therefore desirable.

We have shown that the majority of questions (94%) had moderate or good criterion validity in our patient self-administered electronic PAQ. However, for Question 3, "Do you have high blood pressure?", Question 23, "Do you have a preference for a particular type of anaesthetic?" and Question 27, "Are you restricted by the condition of your heart (-function)?" alternative, less ambiguous questions have to be formulated. For instance, 77% of the patients of the mismatched group scored "uncertain", in question 27 meaning that they did not fully understand this question. Since the goal of this question is to detect limitations in cardiac function a more suitable option would be to subdivide the question into groups of metabolic equivalent from intense (e.g. jogging) to light (e.g. writing) physical activity.

The goal of question 23 is to detect anaesthetic preference, however 69% of the mismatched patient group answered "uncertain". This might mean that the patient is indifferent, or cannot decide what is the best anaesthetic choice by a lack of information.

A more direct question like; "Do you object to spinal anaesthesia?" might be more suitable. We suggest that after adaptation of these three questions, our electronic patient self-administered PAQ is mandatory to be used as a tool in automated online preoperative assessment,

In summary, questions need to be rephrased if they exhibit unclear definitions, unclear understanding, or lack of information. In conclusion we suggest this PAQ could be implemented after adaptation of these three questions. With this improved PAQ in combination with decision logic, it could be possible that patients create their own ASA score.

Table 3(a) and **3(b)** Percentage agreement and criterion validity of raw data (a) and corrected data (b)..

Question	% Agreement (a)	Criterion Validity (a)	% Agreement (b)	Criterion Validity (b)
1	91.3	Moderate	91.3	Moderate
2	90.0	Moderate	90.0	Moderate
3	89.9	Poor	89.9	Poor
4	95.3	Good	95.3	Good
5	98.7	Good	98.7	Good
6	95.9	Good	95.9	Good
7	99.1	Good	99.1	Good
8	92.1	Moderate	92.1	Moderate
9	96.8	Good	96.8	Good
10	93.6	Moderate	93.6	Moderate
11	97.6	Good	97.6	Good
12	99.4	Good	99.4	Good
13	98.1	Good	98.1	Good
14	93.4	Moderate	93.4	Moderate
15	96.8	Good	96.8	Good
16	97.2	Good	97.2	Good
17	95.1	Good	95.1	Good
18	89.6	Poor	90.7	Moderate
19	86.5	Poor	96.6	Good
20	94.4	Moderate	94.4	Moderate
21	93.4	Moderate	93.4	Moderate
22	94.2	Moderate	94.2	Moderate
23	70.6	Poor	71.9	Poor
24	95.5	Good	95.5	Good
25	98.5	Good	98.5	Good
26	97.2	Good	97.2	Good
27	88.4	Poor	89.5	Poor
28	91.9	Moderate	91.9	Moderate
29	98.5	Good	98.5	Good
30	99.1	Good	99.1	Good
31	98.9	Good	98.9	Good
32	90.9	Moderate	90.9	Moderate
33	96.3	Good	96.3	Good
34	99.3	Good	99.3	Good
35	98.5	Good	98.5	Good
36	95.7	Good	95.7	Good
37	95.9	Good	95.9	Good
38	95.2	Good	95.2	Good
39	97.6	Good	97.6	Good
40	94.8	Moderate	94.8	Moderate
41	98.9	Good	98.9	Good
42	98.7	Good	98,7	Good
43	97.6	Good	97,6	Good
44	99.1	Good	99,1	Good
45	97.0	Good	97,0	Good
46	97.2	Good	97,2	Good
47	95.9	Good	95,9	Good
48	98.1	Good	98,1	Good
49	98.9	Good	98,9	Good

References

1. Badner NH, Craen RA, Paul TL, Doyle JA. Anaesthesia preadmission assessment: a new approach through use of a screening questionnaire. *Canadian Journal of Anaesthesia* 1998;**45(1)**:87–92.

2. Boothe P, Finegan BA. Changing the admission process for elective surgery: an economic analysis. *Canadian Journal of Anaesthesia* 1995;**42(5 Pt 1)**:391–4.

3. Conway JB, Goldberg J, Chung F. Preadmission anaesthesia consultation clinic. *Canadian Journal of Anaesthesia* 1992;**39(10)**:1051–7.

4. MacDonald JB, Dutton MJ, Stott DJ, Hamblen DL. Evaluation of pre-admission screening of elderly patients accepted for major joint replacement. *Health Bulletin* 1992;**50(1)**:54–60.

5. Pollard JB, Zboray AL, Mazze RI. Economic benefits attributed to opening a preoperative evaluation clinic for outpatients. *Anesthesia and Analgesia* 1996;**83(2)**:407–410.

6. Roizen MF. Preoperative evaluation: a shared vision for change. *Journal of Clinical Anesthesia* 1997;**9(6)**:435–6.

7. Hilditch WG, Asbury AJ, Jack E, McGrane S. Validation of a pre-anaesthetic screening questionnaire. *Anaesthesia* 2003;**58(9)**:874–7.

8. Mendes FF, Machado EL, de Oliveira M, Brasil FR, Eizerik G, Teloken P. Preoperative evaluation: screening using a questionnaire. *Brazilian Journal of Anesthesiology* 2013;**63(4)**:347–51.

9. Reeves SW, Tielsch JM, Katz J, Bass EB, Schein OD. A self-administered health questionnaire for the preoperative risk stratification of patients undergoing cataract surgery. *American Journal of Ophthalmology* 2003;**135(5)**:599–606.

10. Young C. WA: Digital by default. The delivery choise for England's population. In. *London: Transform* 2012: 20–2.

11. Ahmadian L, Cornet R, Kalkman C, de Keizer NF. Development of a national core dataset for preoperative assessment. *Methods of Information in Medicine* 2009;**48(2)**:155–61.

12. Zuidema X, Tromp Meesters RC, Siccama I, Houweling PL. Computerized model for preoperative risk assessment. *British Journal of Anaesthesia* 2011;**107(2)**:180–5.

13. http://epitools.ausvet.com.au. Date of access 04-07-2013.

14. Tromp Meesters RC, Hettinga AM, van den Brink G, Postma CT, Scheffer G. Task shifting and quality of care in practice; physician assistants compared with anaesthesiology residents in the preoperative anaesthesiology outpatient clinic. *Nederlands Tijdschrift voor Geneeskunde*. 2013;**157(35)**:1646-51.

15. Nicholson A, Coldwell CH, Lewis SR, Smith AF. Nurse-led versus doctor-led preoperative assessment for elective surgical patients requiring regional or general anaesthesia. *The Cochrane Database of Systematic Reviews* 2013;11:CD010160:1-33.

16. Kraemer HC, Periyakoil, V. S., Noda, A. Kappa coefficients in medical research. *Statistics in Medicine* 2002;**21**:2109-29.

17. Grove WM, Andreasen, N. C., McDonald-Scott, P. Reliability studies of psychiatric diagnosis. *Theory and practice. Archives of General Psychiatry* 1981;**38(4)**:408-13.

18. Keay L, Lindsley K, Tielsch J, Katz J, Schein O. Routine preoperative medical testing for cataract surgery. *The Cochrane Database of Systematic Reviews* 2012;3:CD007293:1-34.

19. Flamm M, Fritsch G, Hysek M, Klausner S, Entacher K, Panisch S, Soennichsen AC. Quality improvement in preoperative assessment by implementation of an electronic decision support tool. *Journal of the American Medical Informatics Association* 2013;**20(e1)**:91-6.

20. Mendes FF, Mathias LA, Duval Neto GF, Birck AR. [Impact of preoperative outpatient evaluation clinic on performance indicators.]. *Revista Brasileira de Anestesiologia* 2005;**55(2)**:175-87.