An Attitude Scale for Evaluating Complexity of Surgical Procedures

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DURING the past three decades, considerable effort has been expended in attempting to establish a criterion for evaluation of surgical operative procedures based on their complexity. This effort resulted primarily from the trend, by general hospitals, to restrict the performance of certain types of surgery to persons considered qualified by training and experience (*1*). Thus, there was a need to distinguish between the surgical complexity of various operative procedures with respect to both the extent of medical staff privileges granted and the basic requirements for training surgeons (*2*). More recently, interest has grown in studying surgical complexity for the purpose of developing a tool for evaluating hospital utilization.

To conduct these studies, researchers have had to devise methods for evaluation of the surgical complexity of specific operative procedures. Over the years, however, the scientific study of surgical complexity has been seriously handicapped because surgical complexity has been extremely difficult to describe objectively and even more difficult to measure quantitatively.

This paper describes my effort to delineate surgical operative procedures based on their complexity.

Development of Attitude Scale

To devise a useful approach for evaluating the complexity of surgical procedures, a questionnaire was constructed which contained a list of surgical operative procedures. The questionnaire was submitted to a panel of university affiliated surgeons so that their attitudes toward the complexity of these procedures could be measured.

The concept of "attitude" is used here to denote the sum total of a surgeon's inclinations, feelings, and convictions. Admittedly, it is a subjective and personal concept rather than an actual scientific measurement. The use of this approach relied on the following two assumptions.

1. The clinical judgment and the professional experience of the surgeons qualifies them to evaluate objectively the complexity of various surgical procedures. It was assumed that the surgeons would take into account in their rating the skills required of them, the types of pre-operative and postoperative care needed, and the equipment and supportive staff needed.

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No evidence is available to prove or disprove this assumption, but rating scale methods have been used previously to obtain the judgments of professionals on the nature of their work. Scales have been constructed to measure attitudes of political scientists toward editorial positions of newspapers (*3*), attitudes of policemen toward the severity of criminal offenses (*4*), and attitudes of physicians toward their patients' need for hospitalization (*5*).

2. University affiliated surgeons, as a group, are more likely to be exposed to all levels of surgical complexity than surgeons who practice in smaller, less-specialized institutions. Evidence exists to support this assumption (*6–8*). The results of two studies revealed that some surgical operative procedures often considered most complex are performed relatively infrequently in community hospitals (*6,7*). The same procedures generally are performed in larger aggregates in university affiliated hospitals (*8*). Therefore, one can reasonably assume that university affiliated surgeons, as a group, are more likely to be exposed to all levels of surgery than any other group of surgeons.

Despite the limitations inherent in the preceding assumptions, particularly the first, I believe that an attitude scale questionnaire is the best method available for grading the surgical complexity of various operative procedures. Various types of attitude scales are available for a study such as mine. They differ in their method of construction, method of response, and basis for interpretation of scores (*9*). I used a differential scale with equal-appearing intervals on the continuum.

A differential scale consists of a number of items that are positioned on the scale according to a ranking or rating determined by a panel of judges. Differential scales traditionally are associated with the name of Thurstone (*10*), who was particularly interested in those with equal-appearing intervals. The distances between points are known on these scales, and equal numerical distances appear to represent equal distances along the continuum being measured. Thus, the distance between position 2 and 3 on the scale appears to be equal to the distance between 3 and 4 (*9*).

The first step in developing the attitude scale questionnaire that I used was the selection of the specific operative procedures to be included.

Selection of Procedures

As part of my larger study of regionalization in Vermont, I requested the Professional Activity Study (PAS) in Ann Arbor, Mich., to supply a listing of all operative procedures performed in 1967 in 10 short-term hospitals in Vermont. (PAS, a computerized medical record information system, is a program of the Commission on Professional and Hospital Activities.)

Only the operative procedures coded (3 digit, ICDA) as "the most important" on the PAS "case abstracts" were to be included. The procedures were to be listed in descending order, based on their numerical frequency. The computer printout listed 200 different procedures.

After the listings arrived, with the assistance of a surgical consultant, I decided to exclude certain procedures from consideration in this study.

The procedures excluded were (*a*) those which did not conform to the PAS definition of an "operated patient," (*b*) all ophthalmologic and plastic surgery, (*c*) all biopsies, (*d*) all closed reductions of fractures and other noncutting procedures, (*e*) all procedures customarily performed in physicians' offices (this study was restricted to operative procedures customarily performed in hospital operating rooms), (*f*) all procedures not performed at least five times in one of the 10 hospitals during 1967, and (*g*) all miscellaneous categories, including ambiguous ICDA definitions and secondary complications.

Operative procedures were neither included nor excluded on the basis of their suspected surgical complexity. Although the selection process was not a random sample of the procedures performed in the 10 hospitals, I made every possible effort not to bias the selection of procedures to be included in the questionnaire.

After the seven procedures described were excluded, 70 (3 digit, ICDA) remained. Certain similar operative procedures were then grouped together. (For example, tonsillectomy with adenoidectomy was grouped with tonsillectomy without adenoidectomy.) After the grouping process, 53 procedures remained; these were included in the attitude scale questionnaire.

Construction of Questionnaire

The following summarizes the steps taken in the construction of an attitude scale questionnaire.

The first step is specification of the attitude variable to be measured (surgical complexity). Surgical complexity is a term that is difficult to define objectively. The concept does not refer to any one specific characteristic of an oper-

ative procedure. Rather, it is the sum total of a surgeon's inclinations, feelings, and convictions about the potential difficulty of performing a particular operation. Because of this ambiguity in the meaning of surgical complexity, I decided not to define specifically the term in the questionnaire. Each surgeon on the panel was able to rate the operative procedure according to his belief of what makes a procedure surgically complex, whereas if the term had been defined specifically the surgeons may have been compelled to rate the procedures by a criterion which may not have represented their own professional judgment.

The second step is the design of a scale of values. Researchers usually use either a 9- or 11-point scale. I used a 9-point scale

Results of the attitude scale questionnaire on surgical complexity of 53 operative procedures

Rank order	Operative procedure	Mean score (standardized-converted)	Standard deviation	Number of surgeons participating
53	Open heart surgery on valves, great vessels, or congenital defect	8.0	0.79	78
52	Excision and destruction of lesion—intracranial, cerebral, and cerebral meningeal	7.0	1.20	77
51	Hysterectomy, radical (Wertheim's operation)	6.0	1.04	77
50	Partial lobectomy (pulmonary)	6.0	1.04	78
49	Abdominoperineal resection	6.0	.92	77
48	Partial or subtotal gastrectomy, gastric anastomosis or repair, and plastic operation on stomach	6.0	.78	78
47	Arthroplasty of hip with or without mechanical device	5.5	1.13	79
46	Spinal fusion	5.5	.94	79
45	Operations on ossicles of ear	5.5	1.63	75
44	Incision and drainage of intracranial abscess, hematoma or hygroma	5.0	1.38	78
43	Partial nephrectomy	5.0	1.10	79
42	Prostatectomy, perineal	5.0	.92	78
41	Radial mastectomy	5.0	.92	78
40	Glossectomy, complete or partial	5.0	1.27	77
39	Excision of intervertebral cartilage (prolapsed disk)	5.0	.99	79
38	Enterectomy or colectomy—partial	5.0	.99	79
37	Arthrodesis and stabilization of foot and ankle	4.5	1.04	77
36	Hysterectomy, vaginal	4.5	.71	77
35	Partial or subtotal thyroidectomy	4.5	.84	78
34	Repair and plastic operations on urethra	4.5	1.29	78
33	Operations on mastoid antrum	4.5	.99	77
32	Sympathectomy or excision of sympathetic nerve or ganglion	4.5	.83	78
31	Repair of cystocele	4.0	.96	76
30	Plastic operation on external ear	4.0	1.50	76
29	Open reduction of fracture at end of long bone with or without internal fixation	4.0	.97	79
28	Repair of femoral, ventral, incisional, umbilical, or recurrent inguinal hernia	4.0	1.05	78
27	Splenectomy	4.0	1.10	77
26	Cholecystectomy	4.0	1.10	77
25	Hysterectomy, abdominal	4.0	.83	78
24	Prostatectomy, transurethral	4.0	1.30	79
23	Pyloromyotomy (Fredet-Ramstedt operation)	3.5	.98	76
22	Amputation of thigh (below hip) or disarticulation of knee	3.5	1.11	79
21	Arthrotomy or division of capsule, cartilage, or ligament, or both	3.5	.93	79
20	Excision of salivary gland	3.5	1.23	77
19	Repair or plastic operation on breast	3.5	1.25	78
18	Appendectomy with drainage	3.0	.86	78
17	Colostomy	3.0	.89	77
16	Excision of semilunar cartilage of knee joint	3.0	.79	78
15	Operations on nasal septum with or without rhinoplasty	3.0	1.13	75
14	Orchiopexy	3.0	.81	79
13	Oophorectomy—complete or partial—or salpingectomy, or both	3.0	.83	77
12	Excision of external ear	2.5	1.04	76
11	Repair of inguinal hernia (except recurrent)	2.5	.85	78
10	Partial mastectomy	2.5	.92	77
9	Appendectomy without drainage	2.0	.85	76
8	Excision of hydrocele or hematocele	2.0	.80	77
7	Hemorrhoidectomy	2.0	.88	78
6	Ligation and division of fallopian tubes, bilateral	2.0	.90	78
5	Orchiectomy, unilateral or bilateral	2.0	.73	79
4	Cystotomy	2.0	.99	79
3	Tonsillectomy with or without adenoidectomy	2.0	.85	78
2	Amputation and disarticulation of toe or toes	1.5	.86	77
1	Excision of lymph	1.0	1.15	77

in this study, with the hope that this shorter scale would reduce the range of dispersion of the scale ratings.

The scale was not described, except for the two ends (1=least complex, 9=most complex). If the attitude scale had been defined with descriptive phrases, as in some types of rating scales, the fundamental characteristics of the present measurement method would have been altered (*10*). The reason for this is that the intervals between the numbers on the scale should represent apparently equal distances of surgical complexity as judged by the surgeon. If they had been labeled by descriptive phrases, there would have been no assurance that the successive intervals would have appeared equal to the panel of surgeons.

Selection of Panel

Choice of surgeons. After the questionnaire was constructed, a panel of surgeons to whom the questionnaire could be administered was selected. The selection was based on the following three criteria.

1. The surgeons had to have had a faculty appointment in the department of surgery of the Johns Hopkins University School of Medicine.

2. The surgeons had to operate routinely (or serve as anesthesiologists) at the Johns Hopkins Hospital. This restriction was based on the desire to include only surgeons who were performing surgery in the environment of a university hospital. Some surgeons with faculty appointments did not perform surgery regularly in a university hospital; they admitted their patients primarily to smaller community hospitals. Also, it was possible for a surgeon to hold a faculty appointment and be relatively inactive as a surgeon.

3. The surgeons had to practice one of the following specialties: general surgery, urology, plastic surgery, orthopedic surgery, pediatric surgery, otolaryngology, neurological surgery, or anesthesiology. These specialties were selected because they required, except anesthesiology, 1 or more years of training in general surgery. Training in general surgery provides experience in a wide variety of operative procedures. Anesthesiologists were included in the study because of their unique role in surgery.

Size of panel selected. In their original study Thurstone and Chave used 300 subjects (*10*). Subsequent research has indicated that reliable attitude scale values can be obtained with much smaller groups of subjects (*11*). Uhrbrock (*12*) obtained judgments from two groups of 50 judges each. The correlation between the scale values obtained independently from the two panels of judges was 0.99. Correlations as high as 0.99 have been reported by Rossander (*13*) for scale values obtained independently from two panels with as few as 15 judges in each group.

The available evidence suggests that a relatively small number of judges can be used to obtain reliable scale values using the method of equal-appearing intervals. Moreover, by reducing the number of judges on the panel from the 300 Thurstone and Chave used, the amount of time and effort involved in administering the questionnaire could be significantly reduced.

For the purpose of my study, a panel of 80 surgeons was selected —96 percent of the 83 surgeons who met the three criteria previously mentioned and who had been sent the attitude scale questionnaire.

Questionnaire Administration

The administration of the questionnaire took place in two stages. The first stage was a pretest, and the second was the actual administration of the questionnaire. The list of 53 surgical operative procedures was mimeographed, and a copy was sent with an accompanying introductory letter to each of the 83 surgeons.

Since the purpose of the attitude scale questionnaire was to compare the relative surgical complexity of operative procedures, differences among raters as to the range of numbers they use in rating the procedures were not considered relevant. Therefore, each rater was standardized around his own mean score, thereby reducing the variance between raters due to their choice of range of numbers.

To obtain standardized mean scores, the following procedure was used: (*a*) each rater's mean score was computed, (*b*) each rater's mean score was subtracted from his score for each of the 53 procedures, (*c*) by use of the standardized score, the mean score for each operative procedure was computed, and (*d*) in order to simplify the viewing of the mean scores, the standardized mean scores were transformed to an 8-point positive scale; thus, —3.00 became +1.00 and +4.00 became +8.00.

The results of the attitude scale questionnaire are shown in the table.

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In an effort to devise a useful approach for evaluating the surgical complexity of operative procedures, a questionnaire containing a differential attitude scale was constructed. The questionnaire, which contained a list of 53 surgical operative procedures, was completed by a panel of 80 university affiliated surgeons. The object of this effort was to devise a method whereby the "attitude" of a panel of surgeons toward the surgical complexity of a wide range of operative procedures could be measured.

The concept of attitude was used to denote the sum total of a surgeon's inclinations, feelings, and convictions about the surgical complexity of specific operative procedures. It was a subjective and personal concept, rather than an actual scientific measurement of operative procedures.

The use of this approach relied on two assumptions. First, that the clinical judgment and the professional experience of a panel of surgeons qualified them to evaluate objectively the surgical complexity of various operative procedures. Second, that university affiliated surgeons, as a group, were more likely to be exposed to all levels of surgical complexity than surgeons who practice in smaller, less specialized institutions.

The approach described yielded a scale of values which compares the relative surgical complexity of a wide range of operative procedures customarily performed in hospitals. Although with obvious limitations, the scale of 53 operative procedures may provide a useful tool for studying hospital utilization for surgery. The scale permits analysis of data obtained from hospitals in a specific State or region and determination of whether or not patients requiring more complex operative procedures are hospitalized at institutions with a higher technical adequacy, that is, wider scope of services, a surgical staff with more sophisticated training, and a higher concentration of professional support personnel per patient.