

Appendix 1: health surveys

1. *Short Form-36 Health Survey (SF-36)* - is a self-assessment health status questionnaire (SF-36v2™) composed of 36 questions about socio-demographic, health and personal behavior [1]. It was designed for use in clinical practice and research, health policy evaluations and general population surveys [2]. It has been proven useful in monitoring general and specific populations, comparing the burden of different diseases and differentiating the health benefits produced by different treatments [3-4].

The 36 questions in the SF-36 survey capture the subject's perception of their general health by sorting them into multi-item scales that assess 8 concepts. The 8 subscales are as follows:

Physical Functioning (PF) - assesses limitations on normal physical activities (lifting, climbing stairs, bending, kneeling, walking moderate distance), designed to estimate the severity of the limitation. (10 questions)

Role/Physical (RP) - assesses limitation on the individual's work function that is caused by physical health problems. "Role" may apply to work or everyday responsibilities (a job, community activity or volunteer work) typical for a specific age. (4 questions)

Bodily Pain (BP) - assesses the severity of pain and the extent to which it interferes with daily activities. (2 questions)

General health (GH) - assesses physical health status (current and prior health), and has been documented to be a good predictor of health care expenditures. (10 questions)

Vitality/ Energy (VT) - assesses a subjective feeling of well-being including energy and fatigue. (4 questions)

Social Functioning (SF) – assesses the quantity and quality of interaction with others (social relationships), extending measurements beyond exclusively physical and mental health concepts. (2 questions)

Role/ Emotional (RE) – assesses limitations in the individual’s work functions, but restrict the cause of the distinct from those caused by the physical problems. (3 questions)

Mental Health /Emotional well - being (MH) - assesses the 4 major mental health dimensions of anxiety, depression, loss of behavioral or emotional control and psychological well-being. (5 questions)

The SF-36 also provides 2 important summery measures of health-related quality of life: Physical Component Summary (PCS) and Mental Component Summary (MCS) scales. The strength of both scales lies in their ability to distinguish a physical from a mental outcome [5]. The items and dimensions in SF-36 were constructed using the Likert method of summated ratings. The raw score of each of the eight SF-36 dimensions was derived by summing the item scores, and converted to a value for the dimension from 0 (worst possible health state measured by the questionnaire) to 100 (best possible health state). The raw score was then re-calculated across the dimension as follows:

$$\text{Transformed scale} = \left[\frac{\text{Actual raw score} - \text{lowest possible raw score}}{\text{Possible raw score range}} \right] \times 100$$

The PCS and MCS scores were calculated using the standard scoring algorithms [5-8].

Finally, all 8 scales were standardized to overall population norm using the norm base scale (NBS) algorithms (mean=50, SD=10 in the 1998 general U.S. population); higher scores represents better performance [9]. Multiple groups have agreed that the minimal clinically important changes in the mental and physical summary scores are roughly 2 to 2.5 points [10,11].

The Short-Form 12 (SF-12) Health Survey and the SF-8 Health Survey are shorter forms derived from the original SF-36 health survey and were developed in order to improve efficacy and lower costs. However, the SF-12 reproduces the eight-scale profile with fewer levels than SF-36 scales and yields less precise scores. The physical and mental summary scores for the SF-12 have been shown to correlate highly with the same summary scores from the SF-36.

2. *The Mini Mental State Exam (MMSE)* – is a brief 30-point questionnaire test that is used to screen for cognitive impairment and dementia [12]. It is also used to estimate the severity of cognitive impairment and to follow the course of cognitive changes in an individual over time and response to treatment. The exam includes 11 questions, requires only 5-10 min to administer, which concentrates only on the cognitive aspects of mental functions (arithmetic, memory and orientation) and excludes questions concerning mood, abnormal mental experiences and the form of thinking. Maximum total score is 30. Any score ≥ 25 points (out of 30) indicates a normal cognition. Below this, scores can indicate severe (≤ 9 points), moderate (10-20 points) or mild (21-24 points) cognitive impairment

[13]. The raw score may also need to be corrected for educational attainment and age [14].

3. *Quantitative clock drawing test (Rouleau)*[15]- has been used for decades as a screening test for cognitive impairment [16,17] and as a complement to other quick screening tests such as the MMSE. The clock drawing test taps into a series of cognitive domains that may be impaired early in Alzheimer's disease, such as: verbal understanding, memory, spatial knowledge, abstract thinking, planning, concentration and visuoconstructive skills [18,19]. In stroke, clock drawing is impaired with a variety of lesion sites [20]. It has several advantages including its simplicity, speed of administration and the potential to be less offensive to patients. The subjects were instructed to draw on a blank sheet of paper a clock with all the numbers and set the hands for 10 after 11. Following this drawing, the patients were instructed to copy, as accurately as possible, a clock from a model with the hands set at the same specific time.

Errors in clock drawing are classified according to the following categories: omissions, perseverations, rotations, misplacements, distortions, substitutions and additions. Clock drawing was scored using the Rouleau scoring system (10-point scale) [15]. The scale assessed the integrity of the clock face (0–2), the presence and sequence of the numbers (0–4), and the presence and placement of the hands (0–4); higher scores indicate a higher level of CDT performance. A qualitative analysis was also performed which related to the size of the clock, graphic difficulties, stimulus-bound responses, conceptual deficits, spatial or planning deficits and perseveration. In this study we chose to present only the quantitative analysis.

4. *Color Trail Test (CTT)* - is a neuropsychological test of visual attention and task switching. It requires cognitive flexibility and visuomotor skills to complete the task [20]. It can provide information about visual search speed, scanning, speed of processing, mental flexibility, as well as executive functioning. Poor performance is known to be associated with many types of brain impairment; in particular frontal lobe lesion. It is also sensitive to detecting cognitive impairments such as Alzheimer's disease and dementia [21]. The test relies on the use of colored numbered circles and universal sign language symbols and therefore reduces the potential confounding effect of language and cultural bias [20]. For the Color Trails 1 trial (CTT1), the subject rapidly connects circles numbered 1 through 25 in sequence. For the Color Trails 2 trial (CTT2), the subject rapidly connects numbered circles in sequence, but alternates between pink and yellow colors. Color Trail 1 mainly reflects visual scanning and processing speed, and Color Trail 2 requires visual scanning, attention, and mental flexibility, making an executive function task. The examiner uses a stopwatch to record the length of time to complete each trial along with qualitative features of performance, such as near-misses, prompts, number sequence errors, and color sequence errors. Score is given as time for execution in seconds which is then standardized according to age and education level [20]. Scores are divided according to clinical performance (Table 1).

5. *Cognistat*- the neurobehavioral cognitive status examination is a brief screening instrument designed to provide a rapid analysis of major cognitive impairment in three general areas: level of consciousness, orientation, and attention span; and five major ability areas: language, constructional ability, memory, calculation skills, and reasoning/

judgment [22]. Rather than providing a summation score like the majority of other screening examinations, the Cognistat independently assesses these cognitive functions. Performance in each subsection can be rated on a scale of average, mildly impaired, moderately impaired, and severely impaired. More than 150 peer-reviewed scientific articles describe Cognistat's use in patients with stroke, dementia, traumatic brain injury, major psychiatric disorders and substance abuse [23,24]. We required to use only the judgment subsection from the Cognistat examination since this area was not represented in the MMSE. This subsection consists of practical judgment questions in the form of: "what would you do if...?". This section is scored from 0-6 while 4-6 represents an average score, 3-mild impairment, 2-moderate impairment and 1-severe impairment [24].

6. *Duke Activity Status Index (DASI)* - is a 12-item questionnaire that utilizes self-reported physical work capacity to estimate peak metabolic equivalents (METs) and has been shown to be a valid measurement of functional capacity for patients with cardiovascular disease [25-29]. DASI offers considerable advantages for the evaluation of functional capacity in clinical studies, because it is brief, standardized for use as self-administered questionnaire, and has been shown to correlate well with the "gold standard" for functional capacity-maximal oxygen uptake during exercise testing [25]. The 12-item instrument measures activities of daily living for which each item is weighted by its known metabolic cost (Table 2) [25]. The sum of positive responses form the individual patient DASI score. Higher scores represent better physical functioning. Scoring the Duke Activity Status Index:

Functional Capacity in METS = (DASI score) x 0.43 + 9.6 then divide by 3.5

7. *Barthel ADL Index (BI)* - is an ordinal scale used to measure performance in activities of daily living (ADL) [30]. Each performance item is rated on this scale with a given number of points assigned to each level or ranking [31]. It uses ten variables describing ADL and mobility. A higher number is associated with a greater likelihood of being able to live at home with a degree of independence following discharge from hospital. The newer, modified scale include 0–10 points for every variable [32,33]. The BI is considered a reliable disability scale for stroke patients [34].

Table 1: Color trail test score range to its clinical interpretation.

Score range	Clinical interpretation
>107	Above average
92-106	Average
85-91	Below average
77-84	Mild impairment
70-76	Mild to moderate impairment
62-69	Moderate impairment
55-61	Moderate to severe impairment
0-54	Severe impairment

Table 2: DASI 12-item activities of daily living weighted by its metabolic cost.

Activity: Can You...	Wight
1. Take care of yourself, ie, eat, dress, bath, or use the toilet?	2.75
2. Walk indoors such as around your house?	1.75
3. Walk a block or 2 on level ground?	2.75
4. Climb a flight of stairs or walk up a hill?	5.50
5. Run a short distance?	8.00
6. Do light work around the house like dusting or washing dishes?	2.70
7. Do moderate work around the house like vacuuming, sweeping floors, or carrying in groceries?	3.50
8. Do heavy work around the house like scrubbing floors or lifting or moving heavy furniture?	8.00
9. Do yard work like raking leaves, weeding, or pushing a power mower?	4.50
10. Have sexual relations?	5.25
11. Participate in moderate recreational activities like golf, bowling, dancing, doubles tennis, or throwing a baseball or football?	6.00
12. Participate in strenuous sports like swimming, singles tennis, football, basketball, or skiing?	7.50

*DASI-Duke activity status index

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Appendix 2: table

Comparison of baseline characteristic, procedural variables and in-hospital complications between patients who improved cognitive function (MMSE) and who did not.

Baseline characteristics	MMSE-improved (n=20)	MMSE-not improved (n=16)	P value
Age (years)	82.2±3.9	83.6±4.6	0.33
Gender –male	12 (60%)	7(43.7%)	0.33
Diabetes mellitus	8 (40%)	3 (18.75%)	0.16
Hypertension	19 (95%)	13 (81.25%)	0.19
Dyslipidemia	19 (95%)	11 (68.75%)	0.03
Atrial fibrillation	6 (30%)	5 (31.25%)	0.93
Renal failure	5 (55%)	6 (36.5%)	0.41
Prior stroke	2(10%)	3(18.7%)	0.45
NYHA functional III/IV	19 (95%)	15 (93.7%)	0.87
Logistic EuroSCORE (%)	14.4±10.7	15.6±12.5	0.75
STS score (%)	7.1±4.0	7.9±5.2	0.60
Access –			
Transfemoral	17 (85%)	14 (87.5%)	0.83
General anesthesia	4 (20%)	6 (37.5%)	0.24
Major vascular complication	3 (15%)	3 (18.75%)	0.76
Blood transfusion	2 (10%)	1 (6.25%)	0.68
Renal failure (total)	1 (5%)	1 (6.25%)	0.87
Pacemaker implantation	3 (15%)	2 (12.5%)	0.83
Stroke /Transient ischemic attack	0 (0)	1 (6.25%)	0.25
Hospital duration (days)	4.2±1.1	4.8±2.0	0.26

* Values are expressed as n (%) or mean ± SD unless otherwise noted.

MMSE, mini mental status examination; NYHA, New York Heart Association; STS, Society of Thoracic Surgeons;