

ASSESSMENT OF FUNCTION IN ROUTINE CLINICAL PRACTICE: DESCRIPTION OF THE COOP CHART METHOD AND PRELIMINARY FINDINGS

EUGENE NELSON,¹ JOHN WASSON,¹ JOHN KIRK,¹ ADAM KELLER,¹
DONALD CLARK,¹ ALLEN DIETRICH,¹ ANITA STEWART² and MICHAEL ZUBKOFF¹

¹Department of Community and Family Medicine, Dartmouth Medical School, Hanover, New Hampshire, U.S.A. and ²The RAND Corporation, Santa Monica, California, U.S.A.

Abstract—The COOP Project, a primary care research network, has begun development of a Chart method to screen function quickly. The COOP Charts, analogous to Snellen Charts, were pretested in two practices on adult patients ($N = 117$) to test feasibility, clinical utility, and validity. Patients completed questionnaires containing validated health status scales and sociodemographic variables. Practice staff filled out forms indicating COOP Chart scores and clinical data. We held debriefing interviews with staff who administered the Charts. The results indicate the Charts take 1–2 minutes to administer, are easy to use, and produce important clinical data. The patterns of correlations between the Charts and validity indicator variables provide evidence for both convergent and discriminant validity. We conclude that new measures are needed to assess function in a busy office practice and that the COOP Chart system represents one promising strategy.

Health status measurement Ambulatory care Functional health Physical health Mental health Validity

I. INTRODUCTION

The maintenance of patients' functional health—physical, mental, and role performance—is recognized as a major goal of medical practice [1]. The Dartmouth Primary Care Cooperative Information Project (COOP Project), one of the first clinical groups to focus attention on the measurement of functional health in office practice, is developing a promising new method

for efficiently assessing function in routine office practice [2]. This paper describes our new "COOP Chart" strategy for screening function and presents preliminary findings on its validity and utility.

A strong trend toward treatment of the functional health of patients is re-emerging in medical practice [3]. In addition to the physician's traditional goal of safeguarding biological function, many physicians are trying to find new ways to improve or maintain their patients' physical, mental, and social function [4, 5]. Assessment of patient function, however, presents a difficult challenge to office-based physicians [6]. The most obvious problems are those of time and money. Most physicians see their patients only three or four times per year. Moreover, these visits tend to be rather brief, with most lasting from 6 to 15 minutes [7]. Many of these visits are initiated by the patient for new problems or exacerbations of existing conditions. Management of these acute conditions often leaves little time to assess functional

Drs Nelson and Wasson are Associate Professors of Community Medicine, Dr Kirk is Assistant Professor of Clinical Community and Family Medicine and Mr Keller is an Instructor in Community and Family Medicine. Dr Clark is Adjunct Assistant Professor and Dr Dietrich Assistant Professor of Community and Family Medicine. Dr Stewart is a Senior Analyst at The RAND Corporation, and Dr Zubkoff is Professor of Community and Family Medicine at Dartmouth Medical School, and Professor of Health Economics at Amos Tuck School of Business Administration.

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health. Not only is the time available short, but also reimbursement for low-technology office practice is modest compared to test- and procedure-oriented delivery of care.

During the past decade many outstanding functional status measurement systems have been developed by investigators working in different academic centers [8-13]. All of these measures have demonstrated reliability and validity, and all have been used successfully in clinical trials or health services research projects. Unfortunately, few, if any, of the existing methods for assessing functional status, except perhaps for the New York Heart Association's heart disease classification system or the Katz activities of daily living rating system, have been integrated into routine medical practice [14, 15].

Despite their availability, functional measures have not been widely adopted by physicians in office practice who provide the majority of health care. One reason for this is their mode of administration. All of the newly developed, state-of-the-art measures are time-consuming and rely on data collected either from the patient (by a trained interviewer or by patient self-completed questionnaires) or from the knowledgeable clinician (who relates the patient's status based on detailed knowledge of the patient).

Most ambulatory practices will run into problems when they attempt to integrate these data collection techniques (i.e. self-administered questionnaires, structured interviews, or clinical ratings) into conventional patterns of office patient flow. We believe that this problem can be solved by using a brief screening followed by an in-depth assessment. The COOP charts, described next, represent a first attempt to develop the brief screening "component" of an office-based system to assess function.

II. METHODS

A. Design principles and development of strategy

The COOP Project recognizes the value of a functional approach to the practice of medicine but at the same time is sensitive to the problems of efficiently assessing function in busy office practices [16, 17]. Consequently, our attempts to develop measures of health and functioning for ambulatory care are guided by these practical design principles:

The set of office-based measurements should:

- produce reliable and valid data on a core set of functional dimensions (i.e. physical, mental, and role function)
- be conveniently integrated into routine data collection activities normally performed in office practice
- be applicable to a wide range of problems and diagnoses
- have a high degree of face validity and scores that are easy to interpret
- be judged by clinicians to possess clinical utility.

We call our measurement system the "COOP Chart" method because individual scales for each measure are displayed on a chart that can be handed to the patient or placed on the wall of an examining room. In some respects the COOP Charts are similar to Snellen Charts, which medical practices have used for decades to screen quickly for visual acuity.

The conceptual ideas that underlie our strategy for assessing function came from many different sources. These include clinical researchers such as Katz and Goldman [12, 15], health status investigators such as Ware in particular [18], and medical philosophers such as Dubos who state that maintenance of function is a central goal of medicine [19].

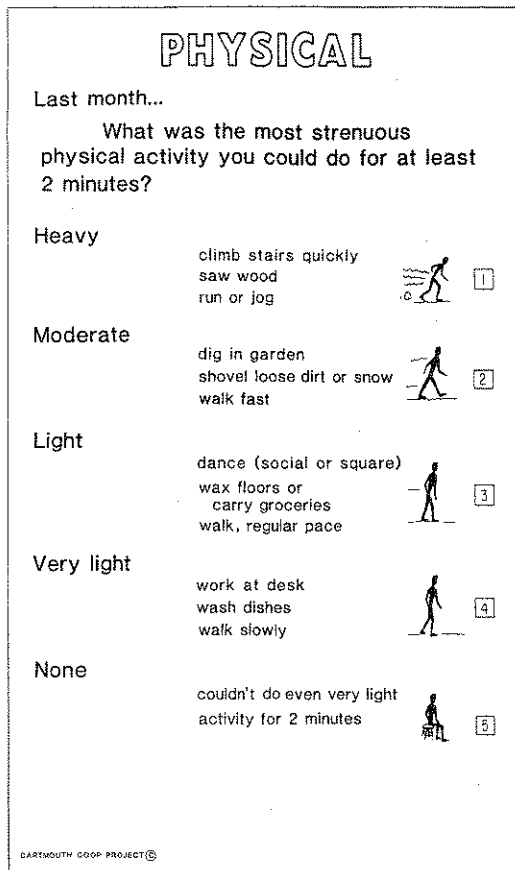
B. Data collection methods

To facilitate integrating the measurement of function into the practice's standard data collection routine, the COOP Charts are administered to patients at the beginning of the visit by whomever in the practice is responsible for measuring vital signs, height, weight, and blood pressure. This person shows the patient the COOP Charts, one at a time, and asks the patient to read the question and to indicate which answer fits him best.

We constructed three Charts for this study and each function measure was revised several times prior to pretesting. Each 8.5 × 14-in. Chart consists of a nontechnical title, a straightforward question referring to the past month, and five response choices. Each response is illustrated with a drawing that graphically represents the equivalent level of a five-point ordinal scale. High scores always represent unfavorable scores on the measure. An example of a Chart used during the period of this study to measure physical function is given in Fig. 1.*

The pretest reported herein summarizes

*The Appendix reproduces the current version of the Physical Function COOP Chart. Full sets are available from the authors.



Current health perceptions (4)	0.80
Work performance (6)	0.65

The RAND scales, developed as general measures of health status for adults, have been used in both patient and community samples. In addition to RAND scales, the questionnaire included common sociodemographic variables such as date of birth, sex, education, and household composition. The patient self-administered questionnaires took about 10 minutes to complete.

Second, the staff person in the practice who would normally take the patient's blood pressure and vital signs used the Charts to obtain physical, emotional, and role function scores for each patient. Results from the Charts and data on other variables (e.g. date of birth, sex, stability of health status, and diagnostic information) were recorded on a special clinician coding form.

Debriefing interviews were conducted with practice staff to obtain qualitative data. We asked them about the logistic difficulty associated with using the Charts and elicited their judgements about accuracy and potential clinical utility.

Fig. 1. Pretest version of COOP Chart on physical function.

results from two practices. One pretest site was a solo, fee-for-service general internal medicine practice located in the small, relatively affluent rural community of New London, New Hampshire. The second site was the general medicine clinic based at the Veterans Administration Hospital in White River Junction, Vermont.

A series of 117 adult patients age 18 and older who visited these two practices for follow-up care was entered into the study. Quantitative data were collected from two sources. First, patients completed self-administered health questionnaires while sitting in the waiting room before seeing the physician. The questionnaires included a series of short-form, health status scales developed at The RAND Corporation and Beth Israel Hospital in Boston [20, 21]. The "RAND" scales included in the questionnaire were:

Title (number of items)	Reliability: Cronbach's alpha
Physical abilities (11)	0.82
Mental health (5)	0.80
Role activity (2)	0.67

C. Data analysis

We employed the multitrait-multimethod technique of validity assessment [22]. This involves testing the relationship between one set of measures (i.e. the COOP Charts) and a second set of measures that is constructed differently (i.e. the relevant RAND multi-item scales that correspond to the COOP Charts) to assess convergent validity and discriminant validity. For example, we examined the association between each respective COOP Chart and the relevant RAND "paired" measure to gauge convergent validity. The RAND measures capture dimensions of health that are similar but not identical to COOP scales. Therefore, if the COOP measures have convergent validity, we would expect to observe moderate to strong associations between corresponding COOP/RAND measures. If discriminant validity is good, then correlations between different measures of the same concept (e.g. COOP Physical and RAND Physical) should exceed correlations among different concepts measured either by different methods (e.g. COOP Physical with RAND Mental) or by the same method (COOP Physical with COOP Mental). Other validity

variables analyzed were patient's age, sex, education, work ability, current health perceptions, number of active diagnoses, and recent health stability.

III. RESULTS

A. Qualitative findings

A total of 10 practice staff from two sites (four physicians, two physician assistants, three nurse practitioners, and one medical assistant/receptionist) used the Charts. Before starting the pretest, we oriented them to study procedures and use of the Charts in a one-hour workshop.

Debriefing interviews with practice staff generated these qualitative findings:

—It took 1–2 minutes per patient to administer all three Charts.

—The Charts were easy to give to patients without disrupting office routine.

—Patients enjoyed working with the Charts and appeared to understand their meaning without difficulty.

—Usually the Charts produced findings that were consistent with the staff's impression of functioning level.

—On numerous occasions the Charts revealed substantially greater levels of dysfunction than previously recognized by the clinician.

—Use of the Charts frequently opened avenues of communication on clinical topics that would likely have gone unnoticed.

—Medical staff believed the Charts produced accurate information that was useful clinically.

B. Characteristics of study population

Table 1 shows the demographic and health characteristics of the 79 patients from the Veterans Administration general medical clinic and the 38 patients from the private practice who were entered into the study ($N = 117$, see Table 1). Sixty-three percent of the patients were male; all adult age groups were included in the sample; and most patients had a high school education. Almost one-half had two or more major chronic conditions (46%). Two-thirds of the patients had conditions rated stable at time of visit; the remaining patients had experienced either a flare-up or new problem and were visiting the practice for this reason.

C. Level of function

Figure 2 displays the level of physical, emotional, and social function based on the Charts used in the pretest.

Table 1. Demographic and clinical characteristics of patients in the pretest sample ($N = 117$)*

Descriptive variable	Percentage of patients
Age	
20–44	15
45–64	35
65–74	33
75+	17
Sex	
Female	37
Male	63
Education	
Less than high school	26
High school	43
More than high school	31
Number in household	
Live alone	14
1 other person	45
2 other people	26
3 or more people	15
Health status past month	
Stable	66
New complaint/flare-up	34
Number of chronic diagnoses	
1 diagnosis	54
2 diagnosis	29
3 or more diagnoses	17

*The four demographic variables listed in Table 1 are based on patient self-report questionnaire data; the two health characteristics come from the special coding form completed by practice staff.

Most patients had low scores, indicating good function. On the other hand, a minority of patients appear to have had moderate to major levels of limitations. Thirteen to 18% of patients scored in the two most dysfunctional categories (i.e. level 4 or 5) on each Chart.

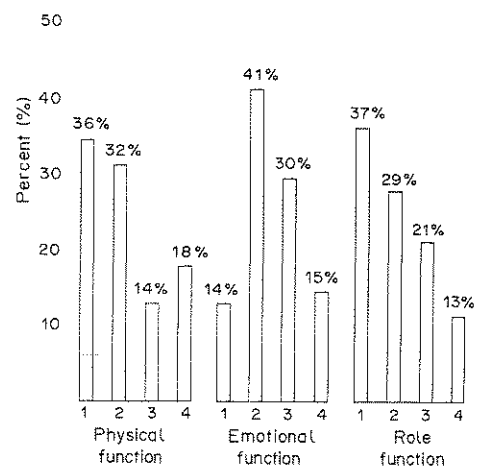


Fig. 2. Histogram displaying percentages of patients by level of limitation in function. Numbers below bars denote decreasing levels of function: 1, No limitations; 2, Minor limitations; 3, Moderate limitations; 4, Major limitations.

D. Convergent and discriminant validity

The correlations between the COOP/RAND paired and unpaired measures are given in Table 2. Convergent validity correlations (paired measures shown in italics) are all statistically significant ($p < 0.001$) and range from -0.40 for role functioning to -0.74 for emotional functioning. (The signs are negative because high scores on COOP Charts reflect more dysfunction whereas high scores on RAND measures denote less dysfunction). The average convergent validity correlation is -0.64 . In con-

trast, five of six unpaired measures have correlations lower than the smallest convergent validity correlation. The one exception is the correlation between the COOP Role Function measure and the Rand Physical Abilities scale ($r = -0.59$).

Table 3 displays the pattern of intercorrelations among COOP Charts and RAND scales respectively. RAND scale results are shown for two different populations: (1) patients in the COOP's New England pretest ($N = 117$); and (2) HMO patients in a national interview study ($N = 1003$). Most correlations between different

Table 2. Correlation between COOP Charts and RAND health status measures ($N = 117$)*

Functional measures	COOP Charts			RAND Scales		
	Physical	Emotional	Role	Physical	Emotional	Role
COOP Charts						
Physical	1.00					
Emotional	0.20†	1.00				
Role	0.50‡	0.37§	1.00			
RAND Scales						
Physical	<i>-0.71§</i>	-0.17	-0.59§	1.0		
Emotional	-0.21†	<i>-0.74§</i>	-0.37§	0.20†	1.0	
Role	-0.35§	-0.10	<i>-0.40§</i>	0.53§	0.20†	1.0

*High scores on COOP Charts denote poor function whereas high scores on RAND measures indicate good function. Therefore, negative correlations between COOP and RAND measures show that values with similar verbal meaning are associated.

†Indicates Pearson product-moment correlations significant at $p < 0.05$.

‡Indicates Pearson product-moment correlations significant at $p < 0.01$.

§Indicates Pearson product-moment correlations significant at $p < 0.001$.

Italicized values are COOP/RAND paired measures.

Table 3. Intercorrelations among COOP Charts and RAND measures (New England and HMO patients)*

Measure and population	Intercorrelations			
COOP Charts:				
New England patients ($N = 117$)	P	E	R	C
Physical function (P)	1.00			
Emotional function (E)	0.20	1.00		
Role function (R)	0.50	0.37	1.00	
Current health perceptions (C)	0.43	0.21	0.47	1.00
RAND Scales:				
New England patients ($N = 117$)	P	M	R	C
Physical abilities (P)	1.00			
Mental health (M)	0.20	1.00		
Role activity (R)	0.53	0.20	1.00	
Current health perceptions (C)	0.48	0.24	0.22	1.00
RAND Scales:				
HMO Patients ($N = 1003$)	P	M	R	C
Physical abilities (P)	1.00			
Mental health (M)	0.22	1.00		
Role activity (R)	0.71	0.21	1.00	
Current health perceptions (C)	0.60	0.39	0.56	1.00

*The two correlation matrices for New England patients ($N = 117$) are based on data collected for this study; the correlation matrix for the HMO patients ($N = 1003$) is based on data collected in a study titled "A Survey of Public Attitudes Towards Health Maintenance Organizations," conducted in 1984 by Louis Harris and Associates for The Henry J. Kaiser Family Foundation. The first two panels of Table 3 contain information from Table 2; it is repeated here to facilitate comparisons with the lower panel.

aspects of functioning measured in both ways and both populations are positive, statistically significant, and small to moderate in size. The strength of the association between physical and role functioning is particularly large. The overall pattern of associations within the COOP and RAND measures respectively are remarkably similar; both the size and sign of the coefficients are comparable.

The magnitude of the validity correlations in Table 2 are generally larger than the correlations between different health constructs. The statistical significance of these differences was evaluated using dependent group *t*-tests calculated by MTMM.BAS, a computer program for analyzing multitrait-multimethod matrices [23]. Of 24 comparisons, 17 were statistically significant in the hypothesized direction.

Eight separate comparisons for each of the three COOP Charts produces a total of 24 comparisons in all. These comparisons involve correlations between different traits measured by different methods (i.e. heterotrait-heteromethod comparisons, of which there were 12) and the correlations between different traits measured by the same method (i.e. heterotrait-monomethod comparisons, of which there were 12 as well).

E. Other indicators of validity

Table 4 shows the correlations between the COOP Charts and assorted health and sociodemographic variables. These results generally agreed with our expectations with respect to both the direction and the relative sizes of the

associations. They are also consistent with other work, which has shown that the patient's perception of current health is more closely related to physical and role function than to emotional health status and that physical function and age are correlated (with older patients having more limitations) [18]. The associations of limitations in work performance with both physical and role function make intuitive sense. The number of chronic diagnoses at time of visit was associated with dysfunction in all three domains, whereas patients who had experienced a new problem or flare-up in the past month had more dysfunction only in the dimension of emotional functioning.

IV. DISCUSSION

A. Results summary

These pretest results are encouraging. First, we learned that using the Charts to assess function is feasible. Both test settings are busy practices that put patient care, not research, first. The clinicians indicated that: (1) the Charts were easy to use; (2) patients appeared to enjoy them; (3) use of the Charts did not interrupt patient flow; and (4) they took only 1–2 minutes to administer.

Second, the clinicians believe that the Charts have clinical utility. Several indicated that they would start using them with hospitalized patients and nursing home residents because they represented a fast but accurate way to assess function. The clinicians thought the

Table 4. Correlations between COOP Charts, sociodemographic and health variables ($N = 117$)

Other measures	COOP Charts		
	Physical function	Emotional function	Role function
Sociodemographic variables			
Age	0.23¶	-0.16	0.01
Education	-0.30**	0.03	-0.22§
Work performance*	0.54**	0.12	0.51**
Health variables			
Current health perceptions†	-0.42**	-0.20§	-0.47**
Number of chronic diagnoses‡	0.32**	0.31**	0.33**
Health status past month‡	0.08	0.22§	0.05

*Work performance is a 6-item, self-reported RAND scale (alpha reliability = 0.65); higher values denote "poor" work performance.

†Current health perceptions is a 4-item self-report RAND scale (alpha reliability = 0.80); higher values denote "good" perceived health.

‡Number of chronic diagnoses and health status in the past month are medical staff-reported data; higher values reflect more diagnoses and more "flare-ups" in the past month.

§Indicates Pearson product-moment correlations significant at $p < 0.05$.

¶Indicates Pearson product-moment correlations significant at $p < 0.01$.

**Indicates Pearson product-moment correlations significant at $p < 0.001$.

COOP Charts would be most useful for monitoring patients with chronic disease or for documenting baseline values for patients receiving a comprehensive physical examination.

Third, the results of this study in general support the convergent and discriminant validity of the Chart method. The convergence among different measures of the same concept and the discrimination between measures of different concepts are evidence of validity of these measures.

On the other hand, much work is left to be done. The convergent validity for the Role Function Chart was unsatisfactory. This may be due to the relatively low internal consistency for its RAND paired measure or to inherent differences in the operational definitions of the Chart and RAND measures. We did not evaluate test-retest reliability of the Charts, and we may not have used the best available validity indicators or the most appropriate 'long-form' measures of the constructs assessed by the Chart method. Studies to address these issues are currently underway.

B. Potential clinical utility

Our ultimate goal is to develop a system for screening, assessing, monitoring, and maintaining patient function. For applications in clinical practice, the system might have five distinct steps: (1) screening, (2) assessment, (3) diagnosis, (4) planning care, and (5) monitoring function. The first and last steps do not take long and could be done on all patients at prescribed intervals, for example, during complete health examinations or chronic disease follow-up visits. The three intervening steps—assessment, diagnosis, and planning care—are only done on the small subset of patients with substantial dysfunction.

Use of the COOP Chart system in routine clinical practices could have many potential benefits [24]. It could:

- generate quantitative, baseline functional profiles
- improve physician-patient communication by identifying and promoting discussion of functional problems that bother patient
- discover treatable problems causing dysfunction
- trigger changes in management that produce better patient outcomes
- facilitate early identification of deterioration in patient function

—develop systematic methods to make style of practice more functionally oriented.

Given this potential benefits list, it may be useful to summarize two actual cases drawn from our pretest experience to illustrate the point.

Case No. 1. An established elderly female patient under treatment for congestive heart failure and hypertension and who was known well by her internist was given the Physical Function Chart. The patient indicated her activity level was 4 or "very light". The surprised physician had assumed that the patient was functioning at a substantially higher level. He questioned the patient and discovered that she had major limitations caused by her arthritis, which heretofore had gone unrecognized.

Case No. 2. A middle-aged male patient with emphysema and atherosclerotic vascular disease was being seen on a routine chronic disease follow-up visit. His physical condition appeared to be stable. When given the Emotional Function and Role Function Charts, he indicated substantial dysfunction in both areas. This prompted further data collection and resulted ultimately in a diagnosis of depression, which was subsequently treated.

In both these cases use of the Charts improved communication, sparked better data collection, led to discovery of a treatable problem, and resulted in a change in treatment management with the potential to improve patient day-to-day functioning.

We believe that measures of function and related indicators of health status should be added to the repertoire of "vital function" assessments used in routine office practice. To achieve this goal, however, new measures are needed. They should be as simple to administer as taking weight, temperature, pulse, and blood pressure. At the same time, these new measures must produce results that are reliable and clinically useful. They should, on occasion, lead directly to management actions that improve the health outcomes of patients. Rubenstein *et al.* [25] have shown that careful functional evaluation of elderly hospitalized patients can lead to lower costs and better health outcomes. It remains to be seen whether a similar strategy can produce comparable results in office practice.

V. CONCLUSION

The COOP Chart strategy has several advantages. First, physicians believe that functional

assessment is important to perform yet easily accomplished with the Charts. Second, patients appear to enjoy using the Charts and appreciate the channels of communication that they initiate. Third, the Charts may help clinicians and patients develop a shared view of the impact of disease on the patient's own life and thereby expand the clinician's understanding of what is wrong with the patient and what might be done to better manage the patient's problem [26, 27]. The Chart system may have substantial clinical utility, because physicians often fail to recognize "spontaneously" the full burden of illness experienced by patients and because patients may not inform their physicians about functional problems unless they are prompted to do so.

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