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MAJOR REVIEW

Performance-based Measures of Visual Function

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Abstract. Review of the substantial literature reveals that the importance of performance-based measures of visual function is becoming increasingly recognized. Alone, or in combination with other assessment modalities, they have been shown to provide a reliable and valid means of evaluating visual ability. Further, they have been demonstrated to predict outcomes better than self-report or clinical measures alone. (**Surv Ophthalmol** 55:146–161, 2010. © 2010 Elsevier Inc. All rights reserved.)

Key words. performance assessment • performance-based measures • performance measures • quality of life • visual assessment • visual disability • visual function

I. Introduction

The measurement of health status and functional disability has always been an essential part of providing health care. Such assessment, including measurement of visual disability, has become increasingly important as people live longer and develop more diseases. Many visually impaired persons have difficulties in their daily activities. The inability to eat, dress, read, write, or travel from place to place results in lower quality of life (QoL) for many visually impaired people. This difficulty may be especially severe in older people, in whom there is a marked decrease in the range of functional abilities and often no clear distinction between aging and early onset of disease.[5] Evaluating the effect of impaired vision is complicated by the fact that there is often a mismatch between the actual amount of visual loss and the actual ability to function in the "real world"—some persons with dramatic loss function well, whereas others with only minor impairment report great difficulty in vision-related activities.

As health care has become more sophisticated, with an ever-increasing understanding of the molecular biological basis of health and disease, greater attention has been paid to individual components of health as they relate to the whole patient. Although this focus on the underlying biological basis of disease has provided a wealth of important information, there has been growing recognition that this focus has come at the cost of an excessive emphasis on isolated disease or organ systems. In response, many clinician-scientists have started to take seriously the development of methods of validly assessing the health of the whole person, including the health of the visual system, by evaluating functional ability in daily life. These efforts can best be introduced through a brief review of the various methods of medical assessment. The four major methods to assess health are presented in Table 1.

A. TEST A PERSON'S ABILITY

The only direct method of assessing whether and how well a person is able to perform a certain action

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TABLE 1

Methods of Health Assessment

I. Test a person's ability
II. Ask the person about his/her ability
III. Test components of a person's ability
IV. Test the factors that affect ability

is to have the person attempt to perform the action while an observer evaluates the level of their performance. Paradoxically, this method is the one least frequently used to assess measures that relate to health generally or visual function specifically. For example, using this system to determine how well a person can read a book requires having the person attempt to read a book while an observer evaluates how well the person does. Or, as another example, to assess whether a person can travel on a bus to the doctor's office requires observing the person "in the act."

B. OBTAIN A PERSON'S HISTORY

An important method of determining a person's ability to perform tasks is to ask the person. Asking, for example, "Can you take the bus to work?" is one way to assess a person's ability to travel on public transportation. The standard "medical history," which has been a fundamental part of most professionals' consideration of "the patient," gives the person an opportunity to say what he or she can and cannot do. In order to standardize the medical history and focus it more specifically, various health-related QoL questionnaires have been developed.

C. TEST A PERSON'S ABILITY TO PERFORM COMPONENTS OF AN ACTIVITY

A third way of assessing disability is to measure the person's ability to perform components of an activity through clinical testing. The advantage of such clinical measures is that they are usually easily made and are well standardized. However, this is an even less direct method and has the serious disadvantage that the correlation between a test of a person's ability to perform a component of an activity through clinical testing and the person's ability to perform the complete activity is variable and may be poor.[13] Although clinical tests of vision, such as visual acuity and visual field assessments, do require patients to perform components of certain visual activites, these tests are carried out in artificial environments that bear little resemblance to activities commonly encountered in daily life.

D. TEST THE FACTORS THAT AFFECT ABILITY

Even more removed from the direct assessment of ability or disability are laboratory and imaging tests such as those for blood pressure, eye pressure, serum chemistry, medical imaging, and so on. These report the most fundamental components of one's physiology and anatomy, can be most accurately measured, and can be highly standardized. They are essential in understanding why a particular person's ability to perform an activity may be impaired, but they are poor measures of a person's ability to perform the activity itself. Intraocular pressure, for example, is a factor affecting the health of the eye, secondarily, vision and, finally, the ability to act.

The point is an obvious one, but is routinely overlooked when considering health: the more removed an assessment method is from the actual task being assessed, the more likely the results are to be wrong. If one considers that the most common fundamental goal of ophthalmic care is to prevent patients from suffering visual impairment sufficient to produce disability in their daily lives, then it stands to reason that measurement of actual disability in daily life is perhaps the most salient endpoint when assessing the health of the visual system. Although one can perform many surrogate measures of actual visual ability in daily life through history taking, clinical assessments and laboratory investigations, it is important to recognize that the results of these different testing modalities are not simply interchangeable.

In light of these considerations, increasing attention is being directed toward ways to test the ability to perform visually intensive activities of daily living directly through so-called performance-based measures (PBMs). A performance measure can be defined as one in which an individual is asked to perform a specific task commonly encountered in daily living while being evaluated in a standardized manner using predetermined criteria. Such criteria may include counting the number of repetitions and number of errors made, or recording the time required to complete the task. The tasks tested are often selected based on activities that are common to nearly all individuals such as basic hygiene, self-care, mobility, and other "activities of daily living" (ADLs). Other, more cognitively demanding "instrumental activities of daily living" (IADLs) such as banking and filing income tax documentation are also commonly used. Our review primarily focuses on these performance-based measures; however, where appropriate, we also consider other methods of assessing vision. In the sections that follow we will examine some of the theoretical advantages and disadvantages of PBMs, introduce a framework for