

# Visual Functioning of Individuals and Communities: A Conceptual Framework

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**Abstract:** The prevalence of visual impairment and blindness increases dramatically with advancing age. The major diseases that cause visual impairment and blindness, specifically cataract, macular degeneration, and glaucoma, are age-related. The number of visually impaired Americans older than 40 years is projected to double by 2030. Half of all cases of blindness may be preventable. Research in the area of vision has developed into ophthalmologically defined silos that follow specific diseases or study subparts of the eye. To overcome the limitations of current subspecialty conceptualization of vision problems, it is necessary to develop new models that can expand the current research paradigms in new directions. This review paper details literature within a conceptual model to explain the increases in visual impairment, the age and other demographic disparities in prevalence, and the lack of vision screening, treatment, and rehabilitation. At the core of the conceptual framework are the twin phenomena of vision health as perceived by the individual and vision health as clinically-measured. Other domains of the framework include adaptation, vision demands, quality of life, and cues to using vision services such as access to care and social support. The framework incorporates multiple demographic, behavioral, and social factors that influence the vision health of individuals and communities. Areas of future research include population-based study of the knowledge, attitudes, and practices regarding vision health among both individuals and providers and multi-pronged interventions aimed at the individual, provider, organizational, and community levels to improve visual function.

**Keywords:** vision health, visual impairment, aging, individual and social determinants of health, conceptual framework

## Introduction

Diminished vision is associated with increases in mortality, injury, depression, physician visits, hospitalizations, and family stress.<sup>1-7</sup> In 2003, visual disorders cost approximately \$67.6 billion, of which \$48.7 billion were attributable to direct costs and \$18.9 billion were indirect costs.<sup>8</sup> Blindness, visual impairment, and eye diseases are on the rise; people with the most common causes of visual impairment are projected to double by 2030.<sup>9</sup> This paper proposes a conceptual model to explain the increases in visual impairment, the disparities in prevalence, and the lack of vision screening, treatment, and rehabilitation.

## Prevalence of visual impairment

In the U.S., 0.8% of individuals older than 40 years were blind in 2000.<sup>10</sup> Permanent vision loss, known as low vision, is prevalent in approximately 2% of individuals aged 40 years and older in the U.S.<sup>10</sup> More than 30 million Americans aged 40 years and older have one or more of the major eye diseases that can cause low vision and blindness, including cataract, age-related macular degeneration (AMD), glaucoma, or diabetic retinopathy.<sup>9</sup> A highly prevalent problem is uncorrected refractive error. In the U.S. approximately 76% of people aged 40 years and older with visual impairment could attain good vision with refractive correction, i.e. eye glasses or magnifiers.<sup>11</sup>

## Age, gender, and racial/ethnic variations in vision problems

Population-based studies in the U.S. and other nations have provided evidence for the variations and disparities in the prevalence and severity of visual impairment.<sup>12-16</sup>

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In developed countries, the prevalence of various ocular conditions including blindness and uncorrected refractive error increases in older age groups. In the U.S., the prevalence of vision problems increases with advancing age, using various definitions of visual impairment.<sup>12</sup> In addition to age differences, studies have reported that females have higher rates of visual impairment compared to males.<sup>17-19</sup> Approximately 64% of blind individuals globally are women; in industrialized nations, the age-adjusted prevalence of blindness is 63% higher in women compared to men.<sup>20</sup> Surveys have reported a higher prevalence of visual impairment and blindness in Blacks compared to non-Hispanic Whites.<sup>12,14,17,21</sup> African Americans bore a greater burden from cataract, glaucoma, and diabetic retinopathy compared to Whites in the Salisbury Eye Evaluation Study.<sup>21</sup> Differences and disparities have been noted in Latinos compared to other groups as well.<sup>22-23</sup> Latinos, primarily Mexican-Americans, tend to have higher rates of age-adjusted visual impairment than non-Hispanic Whites and lower rates compared to Blacks.<sup>24</sup> Research using Medicare data reported significantly higher rates of primary angle closure glaucoma among Asian Medicare recipients compared to Whites.<sup>25</sup> When comparing to published data for other racial/ethnic groups, Mansberger and colleagues reported a higher prevalence of visual impairment in American Indians/Alaska Natives.<sup>26</sup>

### Income and visual impairment

Lower income is associated with higher rates of visual impairment and blindness.<sup>27-29</sup> Economic differences exist in the rates of dilated eye examinations,<sup>30-31</sup> critical for detecting cataracts, diabetic retinopathy and AMD.

### Inadequate vision screening, treatment, and rehabilitation

Many people do not receive recommended screenings to detect visual impairment. Glaucoma is often detected in late stages when permanent visual damage has occurred.<sup>27</sup> Since approximately 50% of older adults with diabetes are unaware they have diabetes,<sup>32</sup> many at risk for diabetic retinopathy may not receive needed vision screening. According to the National Eye Institute (NEI), half of all cases of blindness might be preventable,<sup>9</sup>

with timely and adequate treatment. Individuals with low vision could benefit from rehabilitation such as occupational therapy, vocational training, orientation, and mobility training, but less than 15% of these individuals obtain rehabilitation services in the U.S.<sup>33</sup>

Research in the area of vision has developed into ophthalmologically defined silos that follow specific diseases, such as AMD and diabetic retinopathy, or study subparts of the eye, such as the cornea. This approach yields scientific advances in narrow areas while failing to integrate findings into the larger behavioral and social contexts where vision problems are experienced and treated. To overcome the limitations of current subspecialty conceptualization of vision problems, it is necessary to develop new models that can expand the current research paradigms in new directions.

## A Conceptual Model of Visual Function

At the core of the proposed conceptual framework are the twin phenomena of vision health as perceived by the individual and vision health as clinically-measured (Fig. 1). Extensive social science research has observed that biological impairments that are of importance to clinicians are often defined differently by the persons experiencing those biological problems; an individual's behavior is heavily shaped by those self-perceptions.<sup>34</sup> The relationship between self-perception and clinical measurement is mutually influencing. Information provided by clinicians regarding the risk of vision loss can change self-perception and, conversely, individuals who are worried about their vision and are not confident in their visual ability may perform worse on objective vision tests due to low motivation or confidence.

The interaction between self-perception and clinically-measured vision operates on the basis of a latent physiological level, given age-related changes in the eye, that is set within a community context that creates both the vision demands on individuals as well as adaptive vision resources. Depending on the visual demands created by different domains of daily life, different levels of self-defined vision health can create different consequences for varied life domains where vision is used, including activities at home and with family, work, travel, leisure, and other areas that affect individuals' quality of life. Vision health

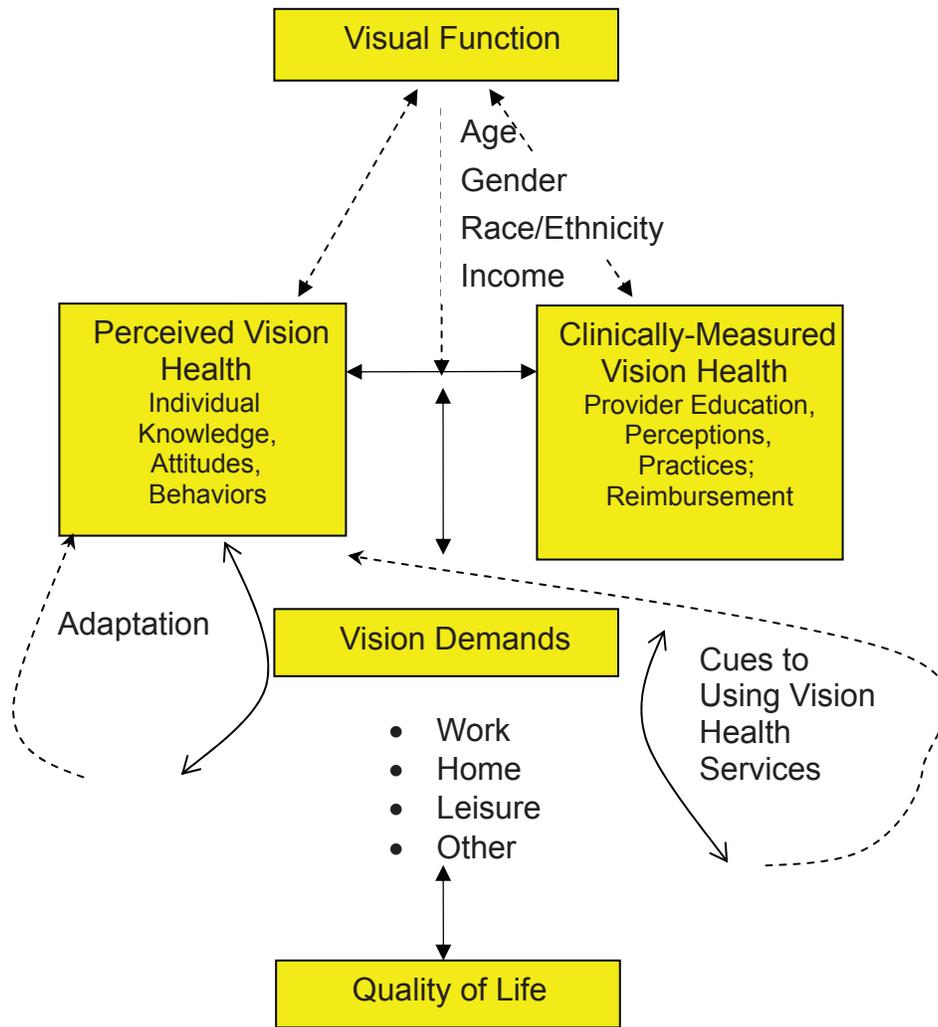


Figure 1. Conceptual Framework of Visual Function.

perceptions are also influenced by functional variations of the eye such as dry eyes, visual halos, and “floaters” that may only have a minor influence on visual acuity. Similarly, the social and normative context, including population concepts about what constitutes “normal” vision, affects perceived vision health. As perceived vision changes, individuals and those around them can make a variety of adaptations to allow them to continue their valued activities; individuals may also modify the activities they pursue. These adaptations feed back to the level of perceived vision health, which is a component of the individual’s overall self-concept. Vision health seeking behaviors depend on the adequacy of adaptations made, the perceptions of the individual about potential future vision health and risks,<sup>35</sup> and access to health and vision care.<sup>36</sup> The quality of those services and their

perceived effectiveness in promoting continued visual functioning will influence the continued use of those services, their impact on clinically important indicators of vision health, and the individual’s perceptions of vision health.

### Perceived vision health: individual knowledge, attitudes, and practices

Studies have shown that individuals perceive vision loss as a serious problem but have limited knowledge regarding vision and eye wellness. In surveys in Australia, more than 70% of interviewees had heard of glaucoma, but less than a third exhibited correct knowledge about this condition.<sup>37–38</sup> In another study, researchers found that 70% of participants lacked knowledge pertaining to AMD.<sup>39</sup> A reason for non-adherence with

diabetes vision screening may be the lack of individual knowledge about eye diseases.<sup>31</sup> Alexander (2005) found that only 5% of focus group participants undertook preventive eye care measures. The behavior was driven by the belief that vision was intact and the attitude that visits to eye care professionals are necessary only when new eye glass prescriptions need to be obtained.<sup>40</sup> A qualitative study including visually impaired individuals found that individuals do not understand the meaning of low vision and the benefits of low vision rehabilitation.<sup>41</sup>

Research has found that the youngest,<sup>37</sup> female,<sup>37,42</sup> and married individuals<sup>42</sup> exhibit more correct knowledge regarding eye diseases compared to their counterparts. Those with higher levels of educational attainment tend to be more knowledgeable about glaucoma.<sup>42</sup> Gasch and associates found that glaucoma awareness was lower in patients with less than a college education,<sup>43</sup> while Pfeiffer and colleagues found similar knowledge about the condition among university graduates and groups with lower educational attainment.<sup>44</sup>

Individual knowledge, attitudes, and behaviors are related to perceived vision; for example, people with decreased knowledge about vision and eye wellness would tend to have limited understanding about the importance of vision screening and might have undiagnosed eye conditions resulting in the perception that vision is intact.

### Cues to using vision health services

Cues to using vision health services affect both clinically-measured and self-perceived vision. For example, persons with limited English language proficiency might have less contact with the health care system resulting in undiagnosed eye conditions, which would in turn provide these individuals with a false sense of having good vision and a perception that there is no need to seek eye care.

**Access to Care.** Access to health care is problematic for the millions of Americans who lack medical insurance. Medicare Part B covers preventive services for glaucoma once every 12 months; however, only those at high risk for glaucoma, including people with diabetes or a history of glaucoma, can take advantage of this benefit. According to the California Health Interview Survey (CHIS), 21% of adults aged 40 years and older were not covered for eye exams in 2003.<sup>45</sup> Individuals with diabetes with health insurance that covered for eye care had an increased likelihood of

having had dilated eye examination in the Wisconsin Epidemiologic Study of Diabetic Retinopathy.<sup>46</sup>

In addition to medical insurance, other factors can reduce access to care including education and language proficiency. In the Los Angeles Latino Eye Study (LALES), those who did not follow American Diabetes Association (ADA) guidelines for vision screening had less education than respondents who met recommended guidelines.<sup>47</sup> English spoken at home was related to the receipt of eye care in another study.<sup>37</sup>

Access to care is problematic for minority populations. Only 30% of Black Medicare beneficiaries compared to 45% of White beneficiaries utilized eye care services in 1991.<sup>48</sup> African Americans are less likely to obtain glaucoma surgery than Whites,<sup>49</sup> which could be due to reduced access to the health care system. Wang and colleagues found that limited access to eye care was a key barrier to treatment for glaucoma and cataracts in Black Medicare beneficiaries.<sup>48</sup> In a literature review of 27 studies pertaining to eye examinations, the authors concluded that Latinos had lower rates of eye exams compared to non-Hispanic Whites,<sup>50</sup> which also could be associated with lower access to care.

**Social Support.** Social support may affect people's perceived vision<sup>4,51</sup> and vision care seeking behavior. A relationship between limited informal social support and visual impairment was reported in study of 1,219 adults aged 45 and older.<sup>52</sup> In an unpublished qualitative study, the majority of family members were not aware of the severe degree of visual loss that their relatives experienced.<sup>53</sup> Research on social support in the health services literature suggests that social support networks serve as bridging functions to health services use. This would be particularly true in vision health if network members had prior experience with vision problems, prioritized vision health, and understood the actions necessary to promote visual functioning. In addition, the informational and other resources of social support networks could assist an individual in adapting to vision changes.

### Adaptation

Ability to adapt to visual decline tends to influence self-perceived vision health as the greater this ability the higher the self-perceived status of vision may be. Research to date focuses primarily on the

negative impacts of visual decline, such as functional decline, falls, depression, and reductions of valued activities. Other than clinically-oriented research on low vision rehabilitation,<sup>54</sup> there is little research on positive changes in self-concepts and daily lives as a result of vision problems. Ability to adapt to vision loss may be dependent on the individual's personality, coping style, and psychological state.<sup>55</sup> Acceptance of visual loss may increase the likelihood of successful adaptation. Psychological factors affect the utilization of rehabilitation services; the use of such services helps one adapt to the presence of visual loss. Having less depressive symptoms may increase the likelihood of seeking such services.<sup>55</sup>

### Clinically-measured vision health

Self-perception and clinical measurement are related, since information provided by clinicians regarding the risk of vision loss can change self-perception. Clinically-measured vision is related to factors such as provider education, perceptions, and behaviors as well as health care system characteristics including reimbursement practices.

Researchers have reservations regarding the ability of general medical practitioners to maintain sufficient skills in the examination and treatment of vision problems.<sup>56</sup> The time spent teaching vision-related clinical skills in U.S. medical schools has been on the decline.<sup>57-58</sup> In a 1995 survey by the Association of University Professors of Ophthalmology, residency directors estimated that less than 50% of residents entering their programs met the minimum level of proficiency expected of internists when providing eye care.<sup>56</sup> Comprehensive routine eye examinations by internists are not common practice and are often administered only when the patient complains of vision problems.<sup>59</sup>

Provider perceptions may prevent patients from obtaining screening, treatment or rehabilitation services. For example, when diagnosing low vision, providers are to inform patients regarding the need for rehabilitation services. Patients in need for low vision rehabilitation services may not be referred for care due to various provider perceptions such as views regarding the availability of services in the area.<sup>60</sup>

The frequency of primary care doctors diagnosing eye diseases and making people aware of the need for exams is associated with provider reimbursement. Insufficient reimbursement was an

obstacle to performing eye exams in primary care settings in one study.<sup>61</sup> In Ontario, Canada, at the same time that reimbursement for eye examinations decreased, an overall decline in eye examination rates in persons with diabetes took place.<sup>62</sup>

### Vision demands and quality of life

The status of visual function can result in different consequences for varied life domains, such as activities at home and with family, work, travel, leisure, and other areas. Visual function affects quality of life within different domains such as general, near, distance, and color vision, role limitations, dependency, mental health, and social function.<sup>63-64</sup>

### Discussion

Visual impairment affects the quality of life of individuals and the general economy. Along with the aging of society, individual and provider perceptions and practices about vision and how to preserve it may be contributing to the growing burden of visual impairment. While research supports the components and interactive relationships of the conceptual framework, more research is needed to confirm the proposed domains and their relationship to each other, and to clarify which domains may be more important contributors to specific disparities in the prevalence of vision problems.

Existing approaches to eye and vision care are productive, but have limitations stemming from a narrow view strictly based on the single-disease model of investigation and care. Laboratory and clinical research is funded to elucidate the fundamental biological processes that underlie disease and to develop and test new diagnostic and therapeutic techniques, primarily within a disease-oriented paradigm. These programs mainly target diseases from a molecular and genetic perspective. Several epidemiological, population-based studies examined the prevalence, incidence, and clinical issues regarding eye diseases, but limited population-based research examined the knowledge, perceptions, attitudes, and behaviors of individuals and providers.

Most national intervention educational programs have been organized around specific eye conditions. For example, the National Eye Health Education Program (NEHEP), which is funded by the NEI to educate the public, currently has three educational programs focused on glaucoma, diabetes and low vision.<sup>65</sup> Recently NEHEP has added a more general

program for individuals 65 years or older and is exploring the possibility of adding a program on macular degeneration. The American Academy of Ophthalmology's EyeCare America program, for people who are at increased risk for glaucoma or who have diabetes, uses a similar disease-oriented approach. Categorizing intervention programs around diseases has limitations as communities do not organize around health complaints and many individuals are unaware they have eye diseases.

Future studies should focus on the influence of systems (e.g. health insurance, healthcare policy, availability of alternative/folk medicine) as well as environmental (e.g. community infrastructure, neighborhood safety, prevalence of poverty) and personal (e.g. knowledge, beliefs, culture/acclimation, demographics, religiosity, congenital conditions) factors on visual function and vision health.

As with most health issues, a multi-pronged approach is usually recommended in developing interventions aimed at the individual, provider, organizational, and community levels. Appropriate interventions resulting from the study of knowledge, perceptions and behaviors of individuals and providers should prove to be cost-effective. Proceeds of five dollars to the community have been estimated for each dollar spent on vision loss prevention.<sup>66</sup>

## Conclusion

This paper presents a conceptual framework clarifying determinants influencing visual function. Technological advancements will not slow down the increasing rates of visual impairment if individuals and societies are unaware that they have eye conditions that might result in potentially blinding eye conditions if left untreated. Unlike dental care, vision care has not developed a preventive message for the public. The eye and its function should be regarded and cared for in the context of the individual and the community.

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## Disclosure

The authors report no conflicts of interest.

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