

Arlene R. Gordon Research Institute

CURRENT RESEARCH PROJECTS: ABSTRACTS & PUBLICATIONS

UPDATED – 6/2007



**111 East 59th Street
New York, NY 10022-1202**

**Toll Free: 800-829-0500
Tel: 212-821-9200
Fax: 212-821-9706**

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Current ResearchUpdated: 6/2007

PSYCHOSOCIAL RESEARCH

EVALUATION RESEARCH

VISION AND ACCESSIBILITY RESEARCH

Section II

Publication ListUpdated: 9/2005

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Abstracts of Current Research Projects

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**111 East 59th Street
New York, NY 10022-1202**

**Tel: (212) 821-9200
Fax: (212) 821-9706
Toll Free: (800) 829-0500**

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ABSTRACTS OF CURRENT RESEARCH PROJECTS

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The Anxiety Disorders Screening and Intervention Program (ADSIP) for Older Adults with Age-Related Vision Impairments

Overview

The primary aim of this study was to implement and evaluate a screening and intervention model for anxiety among older adults with vision impairments. Anxiety symptoms and disorders are associated with increased disability, lower levels of well-being, higher health care costs, and poorer rehabilitation outcomes. Anxiety is especially prevalent among elders with chronic disabilities, especially elders with age-related eye diseases who lose vision after a lifetime of being sighted. Yet, elders suffering from anxiety are often unidentified and left untreated. To address this problem, this project trained agency social work and rehabilitation staff to systematically screen, evaluate, and treat anxiety symptoms and disorders among our elderly consumers using the Problem Solving Therapy (PST) approach.

Method

The Anxiety Disorders Intervention and Follow-Up Program (ADIFP) proceeded in four stages. First, brief in-service training programs for all social work and rehabilitation staff were held. Second, clinical staff conducted anxiety screening with as many new consumers as possible, age 65 and older, using the Beck Anxiety Inventory (BAI). In the third stage, selected social workers were trained to conduct a brief program of PST for anxiety. This intervention approach increases problem-solving efficacy, which can lead to a reduction of anxiety symptoms. The intervention for this project consisted of three counseling sessions and one follow-up session. In the fourth stage, the PST program was implemented and evaluated. Those meeting the criteria for at least mild/moderate anxiety were invited to participate in the program and were randomly assigned to the immediate treatment group (to receive PST in addition to their usual rehabilitation services), or the delayed treatment (to receive all of the usual services with the option of receiving PST in approximately two months). Pre- and post-service telephone interviews were conducted.

Status/Findings

Recruitment of participants for PST therapy continued until the end of August 2005, with all services and follow-up interviews to be completed by November, 2005. To date, project accomplishments and findings include:

- ◆ 44 clinical staff members (social workers, rehabilitation professionals) were provided training in understanding anxiety disorders in later life and in using the Beck Anxiety Inventory (BAI) to screen for anxiety symptoms among older Lighthouse consumers.
- ◆ 7 social workers were trained to provide Problem Solving Therapy (PST) to older adults with vision impairments.
- ◆ 421 screenings were conducted with older Lighthouse consumers.
- ◆ Almost one-third of all visually impaired older adults had at least mild anxiety symptomatology and 11% had moderate or severe anxiety.
- ◆ Higher levels of anxiety were associated with younger age, being female, having more health problems, being unmarried, and not having macular degeneration.
- ◆ 27 older adults meeting BAI criteria agreed to participate in the Problem Solving Therapy intervention; 16 were randomized into the immediate treatment group, and 11 into the delayed treatment.

- ◆ To date, a total of 41 sessions of PST have been delivered to 13 older adults and eight more are waiting to begin the intervention program.

- ◆ Analyses comparing change over time of the eight participants in the immediate treatment with that among the eight in the delayed treatment group found that:
 - Anxiety symptoms in both groups seemed to follow the same pattern, with decreased levels of anxiety over time.
 - Depressive symptomatology significantly decreased in the immediate treatment group, compared to a slight, but not statistically significant decline in the delayed treatment group.
 - Functional disability slightly decreased in the immediate treatment group, but slightly increased in the delayed treatment group.

This pilot project for a randomized control study is important for its attempt to investigate the feasibility and applicability of a promising psychosocial intervention for older, frail, and visually impaired adults. PST has been rarely evaluated for the treatment of anxiety disorders in adults, although substantial research has identified a negative correlation between anxiety and effective problem-solving. Our experience with this program has highlighted that problems with anxiety are present for a significant subgroup of older visually impaired adults, with one-third evidencing at least mild anxiety symptoms and one-tenth with moderate to severe symptoms. Those involved in the PST intervention found it helpful, with positive self-reported assessments of the program. Furthermore, we have suggestive evidence of its positive impact on levels of anxiety, depression and functional ability.

Investigators: Amy Horowitz, DSW/PhD, Principal Investigator
Joann P. Reinhardt, Co-Investigator
Zvi Dan Gellis, PhD, Co-Investigator
Thalia MacMillan, MSW, Project Coordinator
Tina Calia, M.A., Research Assistant
Rosetta Chao, CSW, Clinical Low Vision Social Worker
Sharon Danoff, CSW, Social Worker
Colleen Dillon, CSW, Social Worker
Lilly Jackanin, CSW, Senior Social Worker
Linda Kirk, CSW, Social Worker
Amy Loewenberg, CSW, Director of Independent Living Services
Linda Schulz, CSW, Director of Independent Living Services
Marsha Sideris, CSW, Social Worker

Funded by: New York State Office of the Attorney General

Project Period: May 2004 – August, 2005

Updated: 9/2005

Behavioral Risk Factors and Dual Sensory Impairment

Overview

Current estimates of dual sensory impairment among older adults are as high as 21%. However, the lack of established empirical relationships between behavioral risk factors (i.e., smoking, alcohol consumption, lack of exercise, and obesity), and vision, hearing and dual sensory impairments has seriously limited health promotion and disease prevention efforts. Furthermore, the prevalence of vision, hearing and dual sensory impairments is greater among minority elders. For example, compared to Whites, African-Americans have a higher rate of legal blindness and glaucoma as well as poorer low-frequency hearing. However, research on dual impairment among minority elders has been seriously overlooked although this population is at a heightened risk for chronic health problems and resultant disability.

The aim of the project is to systematically examine and identify the prevalence of and behavioral risk factors for vision, hearing, and dual sensory impairments among White, Black and Hispanic adults aged 50 and over in the United States. Racial/ethnic and gender differences in the prevalence and incidence of vision, hearing and dual sensory impairments will also be examined. The research will provide both the scientific community and the aging network with yet unavailable information for understanding racial/ethnic differences in how modifiable health behaviors are linked to the development of vision, hearing and dual sensory impairment in later life. Such information will help promote visual and auditory health by providing recommendations for behavioral prevention.

Method

The study makes use of existing information from two national panel data sets, the Health and Retirement Survey (HRS) and the Assets and Health Dynamics Among the Oldest Old (AHEAD). These surveys contain information on over 20,000 individuals and their spouses regarding health status and transitions, health behavior, health care utilization, family structure, and income. Interview questions also specifically addressed vision, hearing, and socioeconomic/demographic characteristics. These data include a large number of people from minority populations, allowing for the investigation of racial/ethnic differences in prevalence, incidence and risk factors related to vision, hearing and dual sensory impairments over time.

Sensory impairment status was obtained with the following two questions: "With your glasses/contact lenses or hearing aid, is your eyesight/hearing excellent, very good, good, fair or poor?" Respondents were classified as nonimpaired, singly vision or hearing impaired, or dual impaired based on these items.

Findings

Among U.S. preretirees (ages 51 to 61), 11% reported some degree of vision impairment and 13% reported some degree of hearing impairment in 1992. The percentage of vision impairment increased from 11% to 18%, while there was a 3% increase in hearing impairment over the 8 years of the HRS study. The prevalence of dual impairment among preretirees was 4% at the baseline in 1992, rising to 5% after eight years.

More than 27% of the older adults (i.e., age 70 and over) reported some degree of vision impairment and 27% reported some degree of hearing impairment in 1993. Over the five-year course of the study, vision impairment increased to 33%, while hearing impairment rose to 34%. Among older adults, 12% were dually impaired in both vision and hearing in 1993. This proportion rose to 17% after five years.

Behavioral Risk Factors - A number of behavioral and lifestyle factors were significantly related to the risk of single and dual sensory loss among preretirees and older adults, primarily alcohol consumption and use of tobacco. Light and moderate alcohol consumption was found to be protective of vision, hearing and dual sensory impairment concurrently and over time. Current and past smoking were found to increase the risk of vision, hearing and dual sensory impairment concurrently and over time. The effect was most pronounced among heavy smokers. In terms of body weight among preretirees, being obese increased the risk of hearing and dual impairment concurrently. But obesity was not related to sensory loss in the older adult population, while being underweight reduced the risk of sensory loss in this group. Light physical activity reduced the risk of vision and dual impairments, while frequent vigorous exercise was related to vision, hearing and dual sensory loss among preretirees.

Health and Sociodemographic Factors - Circulatory health conditions (i.e., hypertension, diabetes, and heart disease) were found to be risk factors for vision, hearing and dual sensory impairments. Gender comparisons revealed that females had lower risk of vision, hearing and dual sensory impairments. Being married was negatively related to vision impairment among preretirees, however marital status was not a significant predictor of sensory loss among the older adults. Blacks and Hispanics have higher risk of vision impairment, but a lower risk of hearing impairment compared to Whites. The increased risk for vision loss among Hispanics was primarily among preretirees. Higher education and income levels were found to be protective of sensory loss in later life. Lower status occupations (i.e., unskilled work) were related to sensory loss among the preretirees and the oldest-old. Finally, being older increased the odds of sensory loss in general. Not only was the prevalence of vision, hearing and dual sensory loss higher among persons 70 and older in comparison to preretirees, but among older adults, each additional year of age increased the risk of sensory loss approximately 2% to 8%.

Conclusions

This research provides the scientific community and the aging population with previously unavailable information of how modifiable health behaviors are linked to the development of vision, hearing and dual sensory impairment in later life. These results have the potential to help promote visual and auditory health by providing counsel for behavioral prevention (i.e., reducing the use of tobacco and heavy alcohol consumption, supporting moderate use of alcohol and increasing the prevalence of physical activity and healthy bodyweight).

Status

The final report was submitted to the M. C. Adams Charitable Trust in March 2003.

Publications

Brennan, M. (2003). Impairment of both vision and hearing among older adults: Prevalence and impact on quality of life. *Generations*, 27 (1), 52-56.

Su, Y., & Brennan, M. (2003). *Behavioral risk factors and dual sensory impairment*. Final report submitted to the M. C. Adams Charitable Trust. New York: Arlene R. Gordon Research Institute of Lighthouse International.

Su, Y., & Brennan, M. (2005). *Behavioral risk factors and dual sensory impairment*. Manuscript under review.

Presentations

Brennan, M. (2003, August). *Sensory impairment, race and cognitive function in older adults*. Poster session presented at the annual convention of the American Psychological Association, Toronto, Ontario, CA.

Brennan, M., & Su, Y. (2003, November). *Incidence and prevalence of dual sensory impairment in adults 70 years and older over 5 years*. Poster session presented at the annual scientific meeting of the Gerontological Society of America, San Diego, CA.

Su, Y., & Brennan, M. (2002, November). *Behavioral risk factors of dual sensory impairment in older adults*. Poster session presented at the annual scientific meeting of The Gerontological Society of America, Boston, MA.

Investigators: Ya-Ping Su, PhD, Co-Principal Investigator
Mark Brennan, PhD, Co-Principal Investigator

Funded by: M. C. Adams Charitable Trust

Project Period: 10/1/01 - 3/30/03

Updated: 9/2005

Control Strategies and Mental Health in Impaired Elders

Overview

The primary aim of this longitudinal study is to examine the strategies used by older persons with visual impairment to balance and rebalance control in daily life, and to understand the course and consequences of such strategies over time. Because late-life vision loss constitutes a major threat to one's sense of competence and control, the proposed study provides a unique opportunity to apply the life-span theory of control (Heckhausen & Schulz, 1995) to a prototypical age-related loss characterized by gradual onset and progressive deterioration. In addition, differences in assimilative and accommodative coping dispositions (Brandtstädter & Renner, 1990) that may underlie patterns of control-related coping behavior will be examined.

Method

The study sample consists of 364 older persons with a recent onset of age-related vision loss due to macular degeneration, a common cause of vision loss in late life. Data are being collected through in-person interviews at baseline, 1- and 2 year follow ups, with one interim telephone interviews each year at 6 and 18 months to capture both short and long-term stability and change in the use of control strategies over time, and the latter's relationship to functional and psychological well-being. Analyses will address concurrent associations (cross-sectional) and prospective relationships (longitudinal) using regression, individual growth modeling, and structural equation modeling (SEM) techniques.

Status

Sample recruitment as well as data collection of baseline, 6-months and 1-year follow-up interviews is completed. Data collection of 18-months and 2-year follow-up interviews is still in progress but is anticipated to be completed in the beginning of 2008. Preliminary results based on baseline data have been presented at conferences on multiple occasions (see below), and a series of manuscripts reporting on baseline data are being prepared for submission to peer-reviewed journals.

Results (baseline data, N=364)

Control Scale Development

A critical component of this project is the development of the Vision-Specific Optimization in Primary and Secondary Control Scale (VIS-OPS), a domain-specific version of the general Optimization in Primary and Secondary Control scale (OPS; Heckhausen, Schulz, & Wrosch, 1998). The VIS-OPS contains 31 items and is comprised of four subscales representative of the four lifespan control domains; selective primary control (SPC; 6 items), compensatory primary control (CPC; 9 items), selective secondary control (SSC; 9 items), and compensatory secondary control (CSC; 7 items). Confirmatory factor analysis (CFA) was conducted on the four VIS-OPS subscales using structural equation modeling conducted with M-plus version 4.0 (Müthen & Müthen, 1998-2007). Goodness of fit was evaluated with the Root Mean Square Error of Approximation (RMSEA), with values of less than .08 considered acceptable fit. The SPC subscale fit the data well as a unidimensional measure (RMSEA = .024). The SSC scale fit the data well after the deletion of one item with weak factor loadings (RMSEA = .047). For the CSC subscale, the sequential elimination of two weakly loading items resulted in excellent model fit (RMSEA = .00). The CPC subscale was a more complicated issue. Initial CFA of the CPC subscale indicated poor model fit. We then conducted an exploratory factor analysis that indicated the presence of three factors for CPC items; CPC Informal Help, CPC Technical Aids, and CPC Unusual Means. The three-factor solution for the CPC items fit the data well (RMSEA = .037). Further work revealed that the

three CPC subscales are explained by a second-order factor of general CPC. Chronbach's alphas for the revised version of the OPS show acceptable inter-item reliability; SPC = .61, CPC = .71, SSC = .73; CSC = .64.

Compensatory Strategies and Well-Being

We examined the role of different types of compensatory strategies in mediating the effect of functional disability on well-being based on the full baseline sample of $n=364$, using structural equation modeling. Three types of compensatory strategies were measured: use of technical aids (e.g., magnifiers, or special lighting), other people's help (e.g., help from family or friends), and new/unusual means (e.g., relying on other senses or memory to compensate for the vision loss). As expected, functional disability had indirect effects on well-being outcomes, as mediated by compensatory strategies. The model fit the data well (RMSEA = .058; 90% CI = .044-.073). Participants with greater disability reported more use of help from others and of unusual means, but they reported less use of technical aids. Technical aids use was related to better well-being, while use of unusual means and other's help indicated poorer well-being. Findings demonstrated the importance of compensatory strategies for adaptation to late life disability, and revealed differential effects for specific strategy types.

Vision-Specific Control Strategies and Well-Being

To address the cross-sectional aspects with regard to the role of control strategies, we finalized our analyses of the use of vision-specific control strategies and their relationship with psychological well-being (i.e., self acceptance, personal growth, and positive affect), utilizing the complete baseline data ($n=364$). Hierarchical regression analyses revealed that control strategies explained a significant proportion of the variance in the outcomes (between 4% and 9%) over and above demographics, disability, and social support. The direction of the effects was that more strategy use was related to better well-being. In terms of individual effects, one of the subcategories of compensatory primary control, the use of adaptive aids, was particularly important in the prediction of personal growth, and selective and compensatory secondary control emerged as important predictors of self acceptance and positive affect.

Publications

Boerner, K., Horowitz, A., Reinhardt, J. P., & Brennan, M. (2004). Coping behavior and mental health in elders with vision loss: Preliminary findings from a longitudinal study. *Maximizing Human Potential*, 12(2), pp. 3, 7.

Presentations

Boerner, K., Brennan, M., Horowitz, A., & Reinhardt, J. P. (November, 2006). Coping with functional loss in later life: Compensatory strategy use and well-being. In H. W. Wahl & K. Boerner (Chairs), *Adaptation under constraints: Chronic conditions and very old age*. Symposium presented at the annual scientific meeting of The Gerontological Society of America, Dallas TX.

Brennan, M., & Boerner, K. (November, 2005) *Psychometric Analysis of the TEN-FLEX Coping Scales: Evidence for 2nd-order Factors and Further Psychometric Development*. Poster to be presented at the annual scientific meeting of The Gerontological Society of America, New Orleans, LA.

Brennan, M., Boerner, K., Horowitz, A., & Reinhardt, J. P. (August, 2005). *Problem solving and adaptation to age-related vision loss*. Poster presented at the annual convention of The American Psychological Association. Washington, DC.

- Brennan, M., Boerner, K., Horowitz, A., & Reinhardt, J. P. (November 2007). *Further development of the vision-specific OPS scale: Differentiating three dimensions of compensatory primary control*. Poster submitted to the annual scientific meeting of The Gerontological Society of America, San Francisco, CA.
- Brennan, M., Boerner, K., Reinhardt, J. P., & Horowitz, A. (November, 2004). *Applying the Life-span Theory of Control in Adjustment to Chronic Illness: The Development of the Vision-Specific OPS Scale*. Poster presented at the annual meeting of The Gerontological Society of America, Washington, DC.
- Horowitz, A., Boerner, K., Brennan, M., & Reinhardt, J. P. (November, 2004). *Successful aging within the context of disability: Use of control strategies by visually impaired elders*. In D. Jopp (Chair). *Successful development and aging: On the impact of resources, strategies, and beliefs*. Paper presented at the annual meeting of The Gerontological Society of America, Washington, DC.
- Horowitz, A., Boerner, K., Brennan, M., & Reinhardt, J. P. (November 2007). *Tackling late life challenges: Control strategy use as a function of disability*. In H. W. Wahl (Chair), *Crossroads of psychological, social and physical function: Implications for disability research*. Symposium submitted to the annual scientific meeting of The Gerontological Society of America, San Francisco, CA.
- Horowitz, A., Boerner, K., Brennan, M., & Reinhardt, J. P. (November, 2005). *Coping with Age-Related Vision Loss: The Role of Domain-Specific Control Strategies as well as Assimilative and Accommodative Coping for Well-Being*. In K. Boerner (Chair), *Coping with disability in later adulthood*. Symposium to be presented at the annual scientific meeting of The Gerontological Society of America, New Orleans, LA.
- Horowitz, A., Boerner, K., Reinhardt, J. P., & Brennan, M. (November, 2002). *Applying the Life-Span Theory of Control to research on adaptation to age-related vision loss*. Paper presented at the annual meeting of The Gerontological Society of America, Boston, MA.

Investigators: Amy Horowitz, DSW, Principal Investigator
Joann P. Reinhardt, PhD, Co-Investigator
Mark Brennan, PhD, Co-Investigator
Kathrin Boerner, PhD, Co-Investigator/Project Director
Luba Popivker, BA, Admin/Research Assistant
Meghan Marty, MA, EdM, Research Assistant

Funded by: National Institute of Mental Health (NIMH)

Project Period: 5/15/02 - 4/30/07

Updated 6/2007

Depression, Disability, & Coping in Midlife

Overview

The primary goal of this research is to better understand the implications and consequences of a chronic disability in middle adulthood. Vision impairment is the second most prevalent disability among middle-aged and older adults (NCHS, 1993), affecting 7.2 million Americans between the ages of 45 and 64 (The Lighthouse, Inc., 1995). Although little is known about how middle-aged adults deal with such a disability, recent evidence from a prior study conducted by the principal investigator (NIMH 1 R03 MH65382, K. Boerner, PI) shows that the risk for subsequent mental health problems such as clinically relevant levels of depression tends to be higher for middle-aged compared to older adults (Boerner, 2004). Also, the disability is likely to interfere with the pursuit of goals common during this point of adult life, which can result in a significant interruption of daily routines and emotional distress (Wheeler & Munz, 1990).

Research addressing the process of adaptation over the life span has shown that, in the case of loss and decline, adaptive coping approaches involve the ability to adjust one's goals and preferences to what is feasible instead of trying to pursue blocked goals (e.g., Brandtstädter, 1999). Prior work by the PI demonstrated that such coping tendencies were particularly beneficial for the mental health of middle-aged adults who reported high levels of vision-related disability (Boerner, 2004). There is also preliminary evidence from a study of vision loss among older adults suggesting that a person's concrete day-to-day coping with goal interference should be assessed in addition to dispositional coping tendencies (Horowitz et al, 2005). Thus, the proposed research seeks to characterize the situation of a thus far understudied group, middle-aged adults with visual impairment, by assessing their important life goals, the extent to which their disability interferes with these goals, and how they cope with this goal interference.

The insights gained from this research will have several important implications: 1) findings can serve to identify those who are at risk for poor adaptation (e.g., developing clinical depression); 2) coping processes identified as beneficial can be incorporated into preventative and therapeutic mental health interventions as well as into rehabilitative treatment programs; and 3) given that intervention goals which encompass important life goals are more likely to result in successful rehabilitation outcomes (Sivaraman Nair, 2003), it is important to understand how life goals can be affected by midlife disability.

Methods

200 middle-aged adults (age 40-64) will be recruited from a community-based vision rehabilitation agency. Structural Equation Modeling (SEM) will be employed to test the direct and indirect effects of impairment status, goal interference, and coping on mental health outcomes.

Status

Data collection is in progress.

Project Team: Kathrin Boerner, Ph.D., Principal Investigator
Paula Orozco, B.A, Research Assistant
Luba Popivker, B.A., Research Assistant
Amy Horowitz, PhD, Consultant
Mark Brennan, PhD, Statistical Consultant

Funded by: NIMH

Project Period: 1/1/07 - 12/31/08

Depression, Disability, and Rehabilitation among Vision Impaired Elders

Overview

There is extensive evidence in the research literature documenting high levels of comorbidity between physical illness and depression in later life. Among disabled elders, depression is associated with greater levels of functional disability and poorer medical outcomes.

This study builds upon the growing body of research regarding the interrelationships among chronic impairment, disability, and depression by focusing on the visually impaired elderly, for whom rates of both functional disability and depression are particularly high compared to elders with other age-related disabilities. Using a longitudinal design, the study examines the course of depression over time as it affects, and is affected by, impairment severity, functional ability and rehabilitation service utilization. Furthermore, utilizing a stress and coping conceptual model, the extent to which these relationships are mediated by personal and social resources is also examined. Most importantly, the focus on a sample seeking rehabilitation permits an empirical challenge to the assumption of inevitable, reciprocal decline in functional and depressive status among the disabled elderly. By following both the natural course of depression and the natural course of rehabilitative service utilization, the study examines the extent to which, and mechanisms by which, this nonpsychiatric intervention (i.e., vision rehabilitation) may influence short- and long-term depression status among the visually disabled elderly.

Method

A sample of visually impaired elders has been drawn from applicants to the Lighthouse, age 65 years and older. Subjects were assessed 4 times (at baseline, 6, 12 and 18 months) in order to examine both short- and long-term causal relationships among the key variables of impairment, disability, rehabilitation and depression. Depression was assessed using both a continuous symptomatology measure (CES-D) and a clinical diagnostic interview (SCID for DSM-IV). Analyses are addressing concurrent associations (cross-sectional) and prospective relationships (longitudinal) using regression and structural equation modeling (SEM) techniques.

Findings

Recruitment of the baseline sample and all follow-up data collection has been completed. A total of 584 baseline, 455 Time-2, 418 Time-3, and 386 Time-4 interviews have been conducted; with 354 participants completing all four interviews. Selected findings from ongoing analyses include:

Prevalence and Correlates of Major and Subthreshold Depression - Rates of both major and subthreshold depression among participants were higher than those found among general samples of community-based elders. Among the baseline sample (n=584), 7.2% met DSM-IV diagnostic criteria for a current major depression disorder (MDD), 26.9% had a subthreshold depression (defined as including: minor depression, dysthymia, major depression in partial remission, or significant depressive symptomatology <CES-D scores of 16+>), while 65.9% were not depressed. Logistic analyses were conducted to identify the most salient independent factors differentiating each depressed group from the nondepressed. The three groups did not significantly differ in age, gender, race, education, marital status or living arrangements; all common risk factors for depression identified in prior research. This suggests that general sociodemographic factors may be less important as risk factors for depression when the focus is on a disabled elderly population. The profiles of independent risk factors for both depressed groups were remarkably similar. That is, compared to the nondepressed, both those with subthreshold and major depression were significantly more likely to have poorer perceived adequacy of social support, lower self efficacy, and a past history of depression. Greater functional disability and

experiencing at least one negative life event in the past year were significant only in differentiating those with subthreshold depression from the nondepressed, although the odds ratios for those with major depression approached significance. The only variable to emerge as significant in differentiating elders with subthreshold versus major depression was having a past major depression which resulted in a 4.5 times greater risk of having a major, over a subthreshold depression. Thus, elders with major and subthreshold depression have very similar profiles, which highlights the importance of identifying and treating elders with both disorders.

Personal and Social Resources as Mediators of the Disability-Depression Link - Through structural equation modeling, the mediating effects of social resources (negative support and perceived adequacy and availability of social support) and personal resources (active, acceptance, and self-distraction coping, and self-efficacy) were tested. Functional disability was influenced by both subjective vision loss severity and health status, but not by clinical vision impairment (acuity and contrast sensitivity). The effect of functional disability on depression, however, was fully mediated by social resources and personal resources; with each of the latter also having direct positive effects on depression. Findings provide further support that it is not necessarily the objective severity of an impairment that is associated with disability (or depression) but the subjective experience. Findings further highlight that personal and social resources largely mediate the negative mental health effects of disability. Thus, a focus on maximizing a person's personal and social resources needs to be a critical part of any intervention for depression among disabled elders.

Depression and Rehabilitation Service Use - Findings indicated that 12% of the 6-month follow-up sample did not follow through on their application and received no services in the 6 months following the research interview. Logistic regression analyses to predict service use (yes/no), with predisposing, enabling and need factors accounted for in the equation, found that CES-D scores did not predict service use, but those with a diagnosis of major depression were 64% less likely to use any rehabilitation services. There was no significant effect of subthreshold depression on service use. Looking only at service utilizers and using hierarchical regression models, CES-D scores again did not predict the number of service hours, but a major depression diagnosis was a significant predictor of fewer hours of service. Findings suggest that the relationship between depression and rehabilitation service use is not strictly linear and that a threshold of depression severity needs to be crossed to have a negative impact on rehabilitation service utilization.

Six-Month Change In Depression - Examination of change in depression at the 6-month follow-up (n=455) indicated that 60.4% of the Time-2 sample (n=455) were consistently not depressed, 14.5% were consistently depressed (either consistent major or subthreshold depression), 15.8% had either a remission or improvement in depression status, and 9.2% had an incident depression.

The September 11th attacks and depressive symptomatology - Given our ongoing assessments of depressive symptomatology among elders in the New York area, we were in a unique position to examine the impact the 9/11/01 attacks may have had on mental health in terms of introducing bias into our results. For this examination, we selected participants who were interviewed two months prior and two months following the September 11th attacks (n=168; 111 in the Pre-Attack Group and 57 in the Post-Attack Group). Mean CES-D scores were plotted by week. Although there was a spike in mean CES-D scores in the four days immediately following September 11th (i.e., mean score = 13.6), subsequent average scores demonstrated the normal variability. In addition, ANOVA tests were conducted comparing Pre- and Post-Attack group, age, gender, and education factors for significant differences in CES-D scores. There were no significant main effects for any of these factors, or any significant interactions between these factors and Pre/Post-Attack group status. Thus, the terrorist attacks of 9/11/01 were not found to introduce any statistically significant bias in these outcome variables of depressive symptoms.

Hearing Problems as an Added Risk Factor for Depression in Older Adults with Vision Loss - Because prior studies have shown a positive relationship between single impairments of vision and hearing and depression in older adults, it was hypothesized that vision impaired older adults who also reported difficulty with hearing would have higher levels of depression compared to their peers (controlling for comorbid health conditions and ADL ability). Results showed that the severe dual impaired group (self reported poor/very poor hearing) reported the highest average CES-D scores ($M = 16.9$) and were the most likely to have received a diagnosis of current major depression or any mood disorder (e.g., major or minor depression, partial remission, dysthymia).

Prescription medication, over-the-counter products, and vitamin use by visually impaired older adults - Analyses were conducted to examine the use of prescription medications, vitamins, and over-the-counter products by older adults with vision problems. The number of prescription medications taken daily ranged from 0 to 15, with a mean of 4.2, the use of daily vitamins ranged from 0 to 13 with a mean of 2.2, and over-the-counter product use ranged from 0 to 6 with a mean of .79. Aspects of health largely explained use of prescription medications and over-the-counter products, while the use of vitamins was explained by demographic variables (e.g., age, gender, and education). Further analyses examined factors associated with the use of an eye-multivitamin at both baseline and at the 18-month follow-up. Twenty percent of participants were using an eye-multivitamin at baseline, and 22% were doing so at follow-up. At baseline, those individuals with a diagnosis of macular degeneration were more likely, while African-Americans were less likely, to use an eye-multivitamin. At the 18-month follow-up, individuals who used an eye-multivitamin at baseline and those who had macular degeneration were more likely to be still using an eye-multivitamin, while those receiving Medicaid, indicating lower SES status, and those with increased disability were less likely to use one.

The Effect of Rehabilitation Service Use on Functional Disability and Depression - Over Time in Older Adults with Vision Loss – Analyses used baseline, 6- and 12-month follow-up data, and full information maximum likelihood was used to fit a mean and covariance structure model to all available data, which allowed the examination of change over time in functional disability and depression in relation to rehabilitation service hours. Results showed decreased depression at both 6- and 12-months postbaseline, but functional disability increased over time. Use of more than an average amount of rehabilitation service was associated with a significantly lower rate of increase in functional disability at Time 2 and Time 3. Rehabilitation use was not significantly associated with change in depression over time. However, associations between the functional disability and depression change variables were significant and positive. Significant positive change in depression (greater decline in symptoms) was associated with better than average status (less decline) in functional ability. This provides some evidence for an indirect effect of rehabilitation on change in depression through change in functional disability. Results show a promising impact of rehabilitative services with regard to enhanced functioning in everyday activities.

The Impact of Assistive Device Use on Disability and Depression Among Older Adults with Age-Related Vision Impairments – Adaptive technology can be conceptualized as a resource used by older adults to minimize the disabling effects of health conditions and maintain competence in everyday life. Analyses examined the contribution of optical device and adaptive aid utilization to *change* in functional disability and depression among older adults with age-related vision impairments. The sample for these analyses was comprised of participants ($n=455$) who were interviewed preservice and at the six-month follow-up. Hierarchical regression analyses were conducted with functional disability and depressive symptoms as criteria. Optical and assistive device use were entered in the final step, preceded by Time-1 criterion scores, demographics, change in disability/depression, and total rehabilitation service hours. Findings indicated that optical, but not adaptive device use, was a significant predictor of declines in functional disability and depressive symptoms over time. It is proposed that these differential effects result from the fact that optical devices allow for greater continuity in the way tasks are accomplished (i.e., reading still performed visually); while adaptive aids are more likely associated with greater disability and involve

learning new methods to compensate for lost functions (e.g., talking books), and thus are not as desirable either functionally or psychologically.

Changes in Vision and Health and Change in Depression – To better understand the interrelationships of vision impairment, physical comorbidity and depression, this study examined changes in vision and health and change in depressive symptoms among participants over the first three data points using structural latent-change analysis. Variables for the measurement model included vision acuity, contrast sensitivity, self-rated health, number of health conditions, and the Center for Epidemiological Studies Depression Scale (Radloff, 1977) to estimate initial status (i.e., intercept) and change (i.e., slope) latent factors. The resultant model fit the data well. Vision status was found to worsen over time as expected. There were no overall significant changes in health and depression latent scores. There were significant effects of individual change among these latent factors over time, despite the lack of significant average change. While there were no significant effects of change in vision or initial status on health in change in depression over time, there was a significant effect of change in health on change in depression; those whose health worsened experienced an increase in depressive symptoms. Also, change in vision status was not significantly related to change in health status, which may indicate a disassociation of vision status as a health condition among participants. Findings suggest that vision rehabilitation applicants with deteriorating health are at a higher risk for an increase in depressive symptoms over time.

Publications

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- Horowitz, A., Reinhardt, J. P., & Kennedy, G. (2005). Major and subthreshold depression among older adults seeking vision rehabilitation services. *American Journal of Geriatric Psychiatry, 13* (3), 180-187.

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- Brennan, M., Horowitz, A., Reinhardt, J. P., Raykov, T., & MacMillan, T. (2005, August). *Changes in vision and health and change in depression*. Poster presented at the annual convention of the American Psychological Association, Washington, DC.
- Horowitz, A., Brennan, M., & Reinhardt, J. P. (2003, December). *Disability, depression, and use of optical and adaptive aids among older adults with vision loss*. Paper session presented at the International Conference on Aging, Disability and Independence, Arlington, VA.
- Horowitz, A., & Reinhardt, J. P. (2001, November). Social support and depression among disabled elders. In M. Cantor (Chair), *Social support networks: The influence of contextual factors*. Symposium conducted at the annual scientific meeting of The Gerontological Society of America, Chicago, IL.
- Horowitz, A., & Reinhardt, J. P. (2002, April). *Clinical and subsyndromal depression in chronically impaired community-dwelling elders*. Paper presented at the Joint Conference of The National Council on Aging and the American Society on Aging, Denver, CO.
- Horowitz, A., Reinhardt, J. P., Brennan, M., MacMillan, T., & Cantor, M. (2003, November). *Is depression a barrier to rehabilitation service use?* Poster presented at the annual scientific meeting of The Gerontological Society of America, San Diego, CA.
- Horowitz, A., Reinhardt, J. P., Brennan, M., & Raykov, T. (2004, April). *Mediating the disability-depression link: The role of personal and social resources*. Paper presented at the 2004 Joint Conference of the American Society on Aging and The National Council on the Aging, San Francisco, CA.
- MacMillan, T., Cantor, M., Horowitz, A., Reinhardt, J., & Brennan, M. (2004, November). *Activity level and satisfaction among chronically impaired older adults: The case of vision impairment*. Paper presented at the annual scientific meeting of the Gerontological Society of America, Washington, D.C.
- MacMillan, T., Horowitz, A., & Reinhardt, J. P. (2002, April). *Prescription medication, over-the-counter products, and vitamin use by visually impaired older adults*. Paper presented at the Joint Conference of The National Council on Aging and the American Society on Aging, Denver, CO.
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- Reinhardt, J. P., Horowitz, A., Raykov, T., MacMillan, T., & Brennan, M. (2004, November). *Rehabilitation service use, functional disability, and depression over time in older adults with vision loss*. Paper presented at the annual scientific meeting of the Gerontological Society of America, Washington D.C.

Investigators: Amy Horowitz, DSW, Principal Investigator
Joann P. Reinhardt, PhD, Co-Investigator
Mark Brennan, PhD, Data Analyst
Verena Cimarolli, MA, Research Coordinator (to 7/2001)
Thalia MacMillan, MSW, Research Coordinator (from 7/2001)

Funded by: National Eye Institute

Project Period: October 1999 - September 2004

Updated: 9/2005

Disability, Perceived Overprotection, and Mental Health in Young and Middle-Aged Adults with Visual Impairments

Overview

The purpose of the proposed research was to investigate the role of perceived overprotection, a negative type of social support exchange, as a risk factor for negative mental health outcomes (depression and anxiety) among adults with visual impairment between the ages of 22 and 64 years. Perceived overprotection is defined as a feeling of being unnecessarily helped or overly restricted by support providers and has been primarily studied in the population of individuals 65 years of age and older. In this age group, perceived overprotection has been found to be associated with higher levels of depression in stroke patients, cancer patients, and healthy, community-dwelling older adults. Overprotection has also been found to be associated with lower levels of well-being and psychosocial adaptation in older adults with age-related vision loss. The goal of this study was to explore the interrelationships among vision loss severity, functional disability, positive social support, perceived overprotection and mental health (depression and anxiety) in adults between the ages of 22 and 64. Based on the theoretical framework of the Learned Helplessness Theory (Seligman, 1992), it was hypothesized that perceived overprotection would be positively related to [a] depression and [b] anxiety, even after controlling for vision loss severity, functional disability, and positive social support.

Method

Participants were 114 adults with visual impairment between the ages of 22 and 64 who had completed the service process. Data for this cross-sectional study were collected through 30-minute telephone interviews. Hierarchical Multiple Regression analyses were conducted to test the two study hypotheses.

Findings

As hypothesized, perceived overprotection functioned as a predictor of depressive symptomatology, even after controlling for vision loss severity, functional disability and perceived positive support. Specifically, individuals who were of races other than African-American, who had lower levels of perceived family support, who had lower levels of perceived friend support, and higher levels of perceived overprotection were more likely to report more depressive symptoms. In addition, perceived overprotection functioned as a predictor of anxiety symptoms, even after controlling for vision loss severity, functional disability and perceived positive support. Specifically, individuals who reported a higher number of health problems and higher levels of perceived overprotection were more likely to report more anxiety symptoms. Findings from this research not only add to the conceptual knowledge about social support and chronic impairment, but also will help to identify those who are at risk for mental health problems.

Publications

Cimarolli, V. R. (2006). Perceived overprotection and distress in adults with vision impairment. *Rehabilitation Psychology, 51*, 338-345.

Cimarolli, V. R., & Wang, S., (2006). Social support differences among employed and unemployed adults who are visually impaired. *Journal of Visual Impairment and Blindness, 100*, 545-556..

Presentation

Wang, S., & Cimarolli, V. R. (2006, May). *Perceived overprotection as a risk factor for mental health problems*. Poster presented at the 18th Annual Convention of the Association for Psychological Science, New York, NY.

Investigators: Verena Cimarolli, Principal Investigator
Amy Horowitz, DSW/PhD, Consultant
Mark Brennan, PhD, Statistical Consultant
Hillary Gauthier, MPS, Research Assistant

Funded by: National Institute of Mental Health (NIMH)

Project Period: 7/04 – 6/05

Updated: 6/2007

Driving Transitions and Mental Health in Impaired Elders

Overview

The transition from driver to ex-driver is a challenging turning-point for older disabled adults that can influence not only mobility, but also social ties, the ability to work, one's sense of independence, and public safety. An increasing number of Americans will face this transition as the population ages. However, little is known about the psychological and social influences on driving transitions.

The purpose of this 5-year study is to better understand the ways older adults with vision problems adapt and make decisions about their driving. Specifically, we will identify the personal, social, and contextual factors that contribute to the decision to self-regulate or stop driving, as well as the reciprocal associations between well-being and changes in driving behavior. In addition, we draw on a model of health behavior change (Maes and Gebhardt, 2002) to examine how a person's goal structure can either facilitate or block a change in driving behavior and the impact of changes in driving or driving cessation on well-being.

Method

A total of 380 older adult drivers (age 55+) will be recruited from a community-based vision rehabilitation agency and low-vision clinics. Three in-person interviews will be conducted (baseline, year 1, year 2), with two brief telephone interviews at 6 and 18 months from baseline. Three telephone interviews will also be conducted with a contact (family or friend chosen by the primary participant) at baseline, year 1, and year 2. Cross-sectional and longitudinal associations will be analyzed with Regression-, Individual Growth-, and Structural Equation Modeling techniques.

Status

Recruitment and data collection are in progress. Baseline data collection is expected to end in October 2006, and all data collection will be completed in 2008. Follow-up interviews have begun for the earliest baseline participants.

Preliminary analyses were conducted with 40 participants and findings summarized for an abstract submitted for the 2006 annual conference of the American Society on Aging show:

- Older drivers faced with vision problems are generally reluctant to discuss driving-related issues with others
- Only half talk with a family member, and only a quarter talk with a physician
- However, the majority said that their doctors, spouses, or children would be most likely to influence their driving decisions

Insights gained from this study can be used to inform the growing number of community-based, governmental and private programs that focus on assisting older drivers in making timely decisions that will protect both public safety and the individual's mental health. Rehabilitation and mental health professionals who work with older drivers can also use this information to facilitate the transition from driver to ex-driver in late adulthood.

Publication

Horowitz, A., Boerner, K., & Reinhardt, J. P. (2002). Psychosocial aspects of driving transitions in elders with low vision. *Gerontechnology, 1*, 262-273.

Investigators: Amy Horowitz, DSW/PhD, Principal Investigator
Joann P. Reinhardt, PhD, Co-Investigator
Kathrin Boerner, PhD, Co-Investigator
Tenko Raykov, PhD, Statistical Consultant
Kent Higgins, PhD, Vision Scientist
Bruce Rosenthal, OD, Low Vision Specialist
Stan Maes, PhD, Consultant
Steven E. Mock, PhD, Project Director
Tina Calia, MS, Research Assistant
Elizabeth Courtney, BS, Administrative/Research Assistant
Kim Macek, BA, PhD, Candidate, Research Intern
Lauren Grunseid, Research Intern

Funded by: National Institute on Aging (1 RO1 AG020579)

Project Period: 5/01/04 – 4/30/09

Updated: 9/2005

Dual Sensory Impairment Among the Elderly

Overview

Vision and hearing impairments are among the most common age-related conditions affecting the elderly. While there is an emerging literature regarding the profound functional, social, and physical and mental health consequences of either a vision or hearing impairment in later life, there is a dearth of existing knowledge regarding both short- and long-term consequences of dual sensory impairment for older persons. Yet, with the aging of the population, the numbers of older people experiencing a concurrent age-related loss in vision and hearing can be expected to grow substantially. Even current estimates of the prevalence of dual sensory impairments among the elderly range from 4% to 21%, depending upon used definitions and/or sources of data. However, our current body of knowledge on sensory loss is largely defined by a specific focus on either vision or hearing, with relatively little attention to the confounding effects of a concurrent age-related loss in both vision and hearing. While it has been suggested that "...the presence of two sensory losses increases the functional significance of each one..." (Luey, Belser, & Glass, 1989), little data exist to support or refute this hypothesis.

Thus, the primary purpose of this study is to identify the correlates and long-term consequences of dual sensory impairment among the elderly relative to functional ability; social support and social activities; use of formal community-based services; health and health care utilization; and mortality. Furthermore, this research is examining whether the short-term and long-term consequences of dual sensory impairment among the elderly are more consistent with the additive hypothesis (i.e., hearing + vision) versus the interactive hypothesis (hearing X vision) of the consequences of dual sensory impairment. Lastly, the study will test the generalizability of findings to major subgroups of the elderly in terms of race/ethnicity (i.e., African-Americans), gender (i.e., females), and age (i.e., the oldest-old 85 years or more).

Method

Secondary analyses were conducted utilizing the Longitudinal Study of Aging (LSOA) Version 5 dataset. The 1984 Supplement On Aging (SOA) study, comprised of a representative, national sample of persons 55 years of age and older, provides baseline data from the 1984 interview. In the LSOA, persons age 70 and older at baseline were reinterviewed every two years (i.e., 1986, 1988, and 1990). Cross-sectional and time-lagged hypothesized relationships addressing the research objectives have been examined through the use of binary/ordered/multinomial logistic, tobit, negative binomial and Cox regressions, depending upon the level of measurement of the outcome and type of analysis performed. Structural equation modeling is being employed to examine the effects of dual sensory loss on global outcome domains over time (i.e., PADL functioning from 1984 to 1990) and to further test the additive vs. interactive effects of this chronic condition.

Sensory impairment status was determined by the following two questions: "Which statement best describes your (vision or hearing) even when wearing (glasses/contact lenses or hearing aid, respectively): no trouble, a little trouble, or a lot of trouble?"

Respondents were classified as nonimpaired, singly vision or hearing impaired, or dual impaired based on these items.

Findings

The LSOA data clearly indicate a high prevalence of sensory impairments among elders age 70 and older; vision and hearing impairments were reported by 35% and 42% of respondents, respectively. Significantly, dual sensory impairment was found to affect more than one-fifth (21%) of the adults age 70 years and older in the United States. Findings also supported the supposition that minority populations

are at greater risk for both single and dual sensory impairments.

A major trend in the current findings was the consistent negative relationship between sensory impairment and the major outcome domains, with the exception of mortality. Significantly, a vision impairment alone or in combination with concurrent hearing impairment accounted for greater functional disability, dissatisfaction with social interaction, more informal help received with PADL/IADL tasks, difficulties with physical functioning, greater risk of falls, and greater levels of health service utilization compared to persons with no sensory impairment or moderate hearing loss alone. However, there were relatively few instances where dual sensory loss increased the risk of poor outcomes over a single impairment in vision. Thus, the impact of dual sensory impairment in the lives of older people appears to stem largely from the negative effects of vision loss and fits the additive model (i.e., vision + hearing). However, in some instances (e.g., IADL function, formal and informal help received with IADL tasks), the combined negative effects of vision and hearing loss were found to be significant, and interacted in a way that could not be explained by considering the two sensory impairment statuses separately, thus supporting the interactive model (i.e., vision X hearing).

Current findings underscore the need for expanded educational, rehabilitation and outreach programs for elders with concurrent vision and hearing impairments to support them in efforts to remain independent in their communities. The negative effects of sensory impairments also highlight the need to address sensory functioning as part of the regular clinical health assessment process for older adults. Education of both public and professional audiences is also needed to specifically address the effects of sensory loss, and emphasize that sensory loss should neither be ignored nor considered to be a normal part of aging.

Status

The final report on this project was submitted to the AARP Andrus Foundation in August 2001. Manuscripts based on the final report are in preparation for publication.

Publications

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Brennan, M., Horowitz, A., & Su, Y. (2005). Dual sensory loss and its impact on everyday competence. *The Gerontologist*, 45 (3), 337-346.

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Horowitz, A., Brennan, M., & Su, Y. (2001). *Dual sensory impairment among the elderly*. Final report submitted to the AARP Andrus Foundation. New York: Arlene R. Gordon Research Institute of Lighthouse International.

Presentations

Brennan, M., Horowitz, A., & Su, Y. (2002, November). The widespread consequences of dual sensory loss among older U. S. adults. In I. Lissman and K. Boerner (Chairs), *Consequences of sensory loss in old age*. Symposium conducted at the annual scientific meeting of The Gerontological Society of America, Boston, MA.

Brennan, M., Horowitz, A., & Su, Y. (2003, December). *Sensory impairment and risk of falling among older adults: The special case of dual impairment of vision and hearing*. Poster session presented at the International Conference on Aging, Disability and Independence, Arlington, VA.

Brennan, M., Su, Y., & Horowitz, A. (2001, August). *Dual sensory impairment and cognitive function in older adults*. Poster session presented at the annual convention of the American Psychological Association, San Francisco, CA.

Horowitz, A., Su, Y., & Brennan, M. (2000, November). *The impact of vision, hearing and dual sensory impairment on received informal support*. Poster session presented at the annual scientific meeting of The Gerontological Society of America, Washington, D.C.

Su, Y., & Brennan, M. (2001, November). Examining the effects of dual sensory loss on change in PADL and IADL function over time using latent growth curve analysis. In J. T. Newsom (Chair), *Growth curve approaches to longitudinal data in gerontology research*. Symposium conducted at the annual scientific meeting of The Gerontological Society of America, Chicago, IL.

Su, Y., Brennan, M., & Horowitz, A. (2000, October). *The effects of dual sensory impairment on living arrangements among older adults*. Poster session presented at the annual conference of the State Society on Aging of New York, Albany, NY.

Su, Y., Horowitz, A., & Brennan, M. (2000, November). *The effects of dual sensory impairment on functional ability among elderly adults*. Poster session presented at the annual scientific meeting of The Gerontological Society of America, Washington, D.C.

Su, Y., Brennan, M., & Horowitz, A. (2001, November). Dual sensory impairment and change in ADL function among elderly over time: A SEM latent growth curve approach. In J. Newsom (Chair), *Growth curve approaches to longitudinal data in gerontology research*. Symposium conducted at the annual scientific meeting of The Gerontological Society of America, Chicago, IL.

Su, Y., Brennan, M., & Horowitz, A. (2001, November). *Dual sensory impairment and health service use among elderly adults*. Poster session presented at the annual scientific meeting of The Gerontological Society of America, Chicago, IL.

Investigators: Amy Horowitz, DSW/PhD, Principal Investigator
Mark Brennan, PhD, Co-Investigator
Ya-Ping Su, PhD, Research Associate

Funded by: AARP Andrus Foundation

Project Period: 1/1/99 - 6/30/00 - 12/30/00

Updated: 9/2005

Employment of Individuals with Visual Impairments

Overview

Rates of employment among working-age persons who have a visual impairment are substantially lower than those in the general population as well as among other disability subgroups. National estimates indicate that only about 30% of working-age adults who have severe visual impairments are employed. This proportion is significantly lower than the estimated 84% of persons in this age group without any kind of disability who were employed (McNeil, 1997).

Lighthouse Placement Services address the employment needs of adults with visual impairments. The goal of Placement Services is to provide training in the skills necessary to obtain and retain employment independently. The Research Institute conducted a follow-up evaluation study of Lighthouse Placement Services. The objectives of this follow-up study were to determine the employment status of vocational placement referrals, determine factors associated with employment, and to determine the effectiveness of Lighthouse vocational placement services.

Method

Information related to employment history, service history, psychosocial status, and demographics has been gathered from two sources: (1) an evaluation questionnaire designed specifically for this study, and (2) case records from the Lighthouse Consumer Information System. The potential study participants included all individuals referred to the program of vocational placement between July 1, 1989 and June 30, 1994.

Findings

A total of 167 telephone interviews were conducted. Respondents ranged in age from 18 to 79 years with an average age of 41 years. Approximately 56% are male (n=93, 55.7%).

Results indicated that 42% of the sample were employed, 22% were engaged in some other activity (e.g., school, placement service), and 36% were not working at the time of the follow-up interviews. Findings revealed that employed respondents were more likely to have a college education, have attended an integrated school setting, and primarily read printed material. Employed respondents were also more likely to be users of computers and public transportation. A significantly higher level of self-efficacy was found among employed respondents, though no differences between groups were found for work-motivation or feelings of sadness or depression. Employed respondents were also more likely to report receiving encouragement from family in obtaining employment.

Results from logistic regression analyses revealed that among all factors significantly related to employment status on a bivariate level, the type of school attended (i.e., integrated or not integrated), receipt of technology training, and primary reading method used emerged as significant predictors of employment. Respondents who attended an integrated setting for most of their schooling were 74% more likely to be employed and individuals who read primarily printed material were 78% more likely to be employed. Respondents who received technology training were more than twice as likely to be employed than those who did not receive technology training.

Predictors of more positive employment characteristics (occupational position, salary range, and perceived match between abilities and job responsibilities) were also examined. Results from a hierarchical regression analysis indicated that being blind rather than partially sighted, receiving technology training, and receiving fewer hours of rehabilitation training were significant predictors of higher occupational positions. Results from a hierarchical regression analysis also indicated that a set of

covariates (education, having dependent children and computer and keyboarding skills) accounted for a significant proportion of variance in salary range, but that no individual variables emerged as significant predictors. Finally, receiving encouragement in looking for work from family or friends was the only significant predictor of greater perceived match between abilities and job responsibilities which emerged.

Experiences of Nonworking Respondents - Analyses were also conducted among a subsample of respondents who were not working (n=60). The purpose of these analyses was to describe the experiences of nonworking respondents, examine the barriers that prevent them from working, and to determine the predictors of job seeking. Vision impairment in general was the most frequently reported obstacle to employment with four respondents specifically expressing concern over telling employers about their vision loss. Results indicated that the majority of nonworking respondents were not looking for work (57%) at follow-up, primarily due to another health condition or disability. A logistic regression analysis was conducted to determine the predictors of job seeking. Results identified having another health/physical condition and length of time unemployed to be significant predictors of job seeking. Respondents who had no other health or physical conditions were nearly 8.5 times more likely to be looking for work than those with another condition. Respondents unemployed one year or less were 6.5 times more likely to be looking for work than those out of work for more than one year.

Results from this study have several implications. First, this type of information may be beneficial to a service provider in identifying potential risk factors associated with a poorer chance of employment. Second, findings have implications for early childhood education and the issues surrounding integrated versus self-contained classes for children with visual impairments. Findings also highlight the positive impact of technology training on employment among persons who have a visual impairment. Analyses found that among nonworking respondents, those unemployed one year or less were significantly more likely to seek employment. This suggests that early intervention following job loss is important in keeping persons with visual impairments in the workforce.

Publications

- Leonard, R. (2002). Predictors of job-seeking behavior among persons with a visual impairment. *Journal of Visual Impairment & Blindness*, 96 (9), 635-644.
- Leonard, R., & D'Allura, T. (2000). *Employment among persons with a vision impairment: A comparison of working and nonworking respondents*. In C. Stuenkel, A. Arditi, A. Horowitz, M. A. Lang, B. Rosenthal, & K. Seidman (Eds.), *Vision rehabilitation: Assessment, intervention and outcomes*. Amsterdam: Swets and Zeitlinger.
- Leonard, R., D'Allura, T., & Horowitz, A. (1999). Factors associated with employment among persons who have a vision impairment: A follow-up of vocational placement referrals. *Journal of Vocational Rehabilitation*, 12, 33-43.
- Leonard, R., D'Allura, T., & Horowitz, A. (1997). *Factors associated with employment: A follow-up of vocational placement referrals*. (Final Report). New York: Arlene R. Gordon Research Institute of Lighthouse Inc.

Presentations

- Leonard, R., & D'Allura, T. (1999, July). *Factors associated with employment: A follow-up of vocational placement referrals*. Poster session presented at Vision '99: International Conference on Low Vision, New York, NY.

Leonard, R., & D'Allura, T. (2000, July). *The experiences of nonworking persons who have a vision impairment: A follow-up of vocational placement referrals*. Poster session presented at the International Conference of the Association for the Education and Rehabilitation of the Blind and Visually Impaired, Denver, CO.

Investigators: Robin Leonard, MA
Tana D'Allura, PhD

Project Period: December 1994 - June 1997

Updated: 9/2005

Enhancing the Social Interaction Skills of Preschoolers with Visual Impairments

Overview

A critical finding in the fields of child development and early intervention is that the establishment of relationships with peers is an important process resulting in various developmental benefits. While many studies have indicated that children with disabilities exhibit deficits in social interaction skills, a relatively small number of studies have focused on the social interactions between preschool children with visual impairments and their sighted peers.

Method

A longitudinal, observational design was used to examine the effects of integration, in combination with a strategy to foster interaction, on the social interaction patterns of 3- and 4-year old children with and without visual impairments over a period of five months. Two classes of the Child Development Center [CDC] were involved in the study. Videotapes of each of the classes during free-play periods allowed comparisons among three groups of children [a] children with visual impairments in the integrated setting, [b] children with visual impairments in the self-contained setting, and [c] children with sight in the integrated setting.

Findings

A total of 26 hours of video data, across a 5-month period, were available for analysis. Observational data indicated that while children with visual impairments interacted with peers, a number of differences among the three groups of children are worth noting. Children with visual impairments in the self-contained class spent approximately three times as much time in solitary play as children with visual impairments or sighted children in the integrated class. Both groups of children in the integrated class, those with visual impairments and those with sight: [a] spent a greater proportion of time interacting with peers than with adults, [b] spent less time in solitary play, and [c] were more likely to initiate interactions with peers than with adults.

Differences were also noted across time. During month one, children with sight spent 22% of their time interacting as compared with 4% for children with visual impairments in the integrated class and 1% for children with visual impairments in the self-contained class. Following the implementation of the strategy to facilitate interaction in the integrated class, rates of interaction in the integrated class increased. Children with sight spent 29% of their time interacting as compared with 22% for children with visual impairments in the integrated class and 7% for children with visual impairments in the self-contained class.

Findings are interpreted cautiously in light of the number of children who participated in the study.

Publication

D'Allura, T. (2002). Enhancing the social interaction skills of preschoolers with visual impairments. *Journal of Visual Impairment & Blindness*, 98 (8), 576-584.

Presentation

D'Allura, T., & Lang, M. (1998, April). *Enhancing the social interaction skills of preschoolers with visual impairment*. Paper presented at the annual convention of the Council for Exceptional Children, Minneapolis, MN.

Investigators: Tana D'Allura, PhD, Principal Investigator
Susan Russello, MA, Research Assistant
Gina Cardinali, MA, Research Assistant

Funded By: Funded in part by the Eisman Foundation

Project Period: March 1995 through September 1998

Updated: 9/2005

Friendship Provisions and Adaptation in Disabled Elders

Overview

While the importance of family support in times of stress has been widely documented in the gerontological literature, in-depth studies of the importance of friendship support are lacking. The objective of this study was to follow a sample of recently, visually impaired, community-dwelling men and women over time to examine how they utilize friendship support, in addition to family support, in adapting to age-related, chronic vision impairment. Adaptation was measured with three scales: the domain-specific adaptation to vision loss scale, and two global measures of well-being, life satisfaction and depressive symptoms.

Method

A 5-year longitudinal study with three times of measurement was conducted. Initial contact with participants occurred at application for rehabilitation service. Respondents were interviewed 6 months later, after the receipt of service, for a short-term follow-up, and again, 12 months later (18 months after baseline), for a long-term follow-up.

Findings

The sample (N=570) was drawn from a population of English-speaking, community-dwelling persons aged 65 and above. Study participants (average age = 80; 51% female) were mostly White (85%), without a spouse (about 60%), and with an education of high school or beyond (69%). The Time-2 and Time-3 samples consisted of 470 and 356 older adults, respectively. Analyses comparing drop-outs with participants showed that drop-outs were significantly older with poorer self-rated health and greater functional disability compared to participants. This is not uncommon in longitudinal research on older adults. There were no significant differences in vision loss severity.

Selected findings are briefly summarized below. First, analyses from the final report (listwise sample; N=313) which examined adaptation over time are presented. Findings showed that higher initial disability and increased disability over time had a negative impact on visually impaired elders' adaptation to vision loss. Initial use of coping strategies (greater acceptance and less wishfulness) had a short- and long-term impact on adaptation, but was not associated with change in adaptation over time. While family support had an important impact on adaptation initially, friendship support was associated with increased adaptation over time. Thus, the utilization of friendship, in addition to family support, is an important issue to be addressed in vision rehabilitation.

Three papers examined support variables over time. Reinhardt and Boerner (2003) examined the degree of individual change in friendship and family networks and support received (affective, instrumental) over time as a function of demographic characteristics, disability, and rehabilitation use. All network and support variables decreased over time. In terms of predicting individual variation, age (younger) and education (higher) were associated with greater friendship support at baseline, rehabilitation was related to less decrease in friend network size, and disability was positively associated with instrumental family support at each time point. Results support the importance of examining individual change and factors associated with variability in multiple support components by relationship type.

Boerner and Reinhardt (2003) also studied the predictors of support provision over time among older adults with vision loss. Both affective and instrumental support provided to family and friends decreased over time. Age (younger), gender (women), and education (higher education) were associated with

higher support provision at baseline, but neither functional disability nor health emerged as significant predictors. Rehabilitation use predicted less decrease in the provision of instrumental friendship support. Support receipt was positively related to provision at each point, within and across support types, showing older adults were actively engaged in reciprocal relationships. Findings indicate that there may be feasible ways of providing support, even for older adults in need of support themselves.

Boerner, Reinhardt, Raykov, and Horowitz (2004) examined stability and change in social negativity and the link between social negativity and instrumental support over time in 570 older adults with vision loss using latent growth curve methodology. Findings demonstrated a decrease over time in social negativity received, while the level of social negativity initiated remained more stable. Links with instrumental support were positive, but stronger for received than initiated social negativity. These differential patterns for received and initiated social negativity suggest different origins for these support constructs.

Reinhardt, Boerner, and Horowitz (in press) focused on the differential effects of perceived and received support on well-being. Findings demonstrated that while higher perceived support (perception you have others to count on for help if needed) was associated with greater well-being, the actual receipt of instrumental support (e.g., help with cooking, shopping) was associated with poorer well-being. Findings underscore the importance of distinguishing the impact of multiple support components in order to fully understand how social support may buffer the effects of stressful events in later life.

Publications

- Boerner, K., & Reinhardt, J. P. (2003). Giving while in need: Support provided by disabled older adults. *Journal of Gerontology: Social Sciences, 58B* (5), S297-S304.
- Boerner, K., Reinhardt, J. P., Raykov, T., & Horowitz, A. (2004). Stability and change in social negativity in later life: Reducing received while maintaining initiated negativity. *Journal of Gerontology: Social Sciences, 59B* (4), S230-S237.
- Reinhardt, J. P. (2000). Effects of positive and negative support received and provided on adaptation to chronic impairment. *Applied Developmental Science, 5*, 76-85.
- Reinhardt, J. P., & Benn, D. (2000). The role of personal and social resources in elders' adaptation to chronic vision loss. In C. Stuenkel, A. Arditi, A. Horowitz, M.A. Lang, B. Rosenthal, & K. Seidman (Eds.). *Vision rehabilitation: Assessment, intervention, and outcomes* (p.650-654). Amsterdam: Swets & Zeitlinger.
- Reinhardt, J. P., Boerner, K., & Benn, D. (2003). Predicting individual change in support over time among chronically impaired adults. *Psychology and Aging, 4*, 770-779.
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- Reinhardt, J. P., Boerner, K., & Horowitz, A. (in press). Good to have but bad to use: Differential impact of perceived and received support on well-being. *Journal of Social and Personal Relationships*.

Selected Presentations

- Benn, D., & Reinhardt, J. P. (2000, November). *The effect of coping patterns on change in adaptation to vision loss*. Poster session presented at the annual scientific meeting of The Gerontological Society of America, Washington, DC.

Reinhardt, J. P. (2000, November). The variable role of informal support in promoting vision rehabilitation service use. In M. Cantor and M. Brennan (Chairs), *Is need enough? Additional pathways to service utilization*. Paper presented at the annual scientific meeting of The Gerontological Society of America, Washington, DC.

Reinhardt, J. P., Benn, D., Boerner, K., & Su, Y. (2001, November). *Impact of friendship and family support on change in adaptation to chronic impairment over time*. Poster session presented at the annual scientific meeting of The Gerontological Society of America, Chicago, Illinois.

Reinhardt, J. P. (2004, November). *Applying social support research findings to the development and evaluation of support interventions*. Informal Discussion Roundtable presented at the annual scientific meeting of the Gerontological Society of America, Washington D.C.

Investigators: Joann P. Reinhardt, PhD, Principal Investigator
Dolores Benn, PhD, Research Coordinator
Charla McKinzie, MA, Graduate Research Intern
Kathrin Boerner, PhD, Research Associate

Funded by: National Institute of Mental Health

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In Their Own Words: Strategies Developed by Visually Impaired Elders to Cope with the Emotional and Functional Consequences of Vision Loss

Overview

The goals of this qualitative study were: (1) To document and develop a typology of the coping strategies that older adults self-report in adapting to the emotional and functional consequences of vision impairment; (2) To identify emerging patterns and themes in the coping strategies reported by elders with vision impairment; and (3) To disseminate this information to both professionals and persons experiencing vision impairment. Additional analyses have examined the utilization of novel self-reported coping strategies in the process of adaptation to a chronic impairment among older adults.

Method

Three previous studies (n = 155, 95, and 343, respectively) were primarily designed as quantitative explorations of factors predicting more successful adaptation to vision impairment among older applicants for Lighthouse services. However, all three studies also included the collection of extensive qualitative data in the form of verbatim recordings of spontaneous comments or responses to open-ended questions concerning factors that may have helped or hindered adaptation to visual impairment. Using the "Grounded Theory" approach, self-reported coping strategies were organized into three major areas; behavioral (overt, observable actions), psychological (cognitions or emotions), and social (involving other individuals) means of coping (Glaser & Strauss, 1967). Because the grounded theory approach was employed, codes were not developed *a priori*, but instead were based on actual responses. In developing coping codes, the focus was on the function of a particular way of coping rather than its outcomes. A codebook was constructed for reference that provided definitions and examples for each code.

Findings

Older respondents reported a vast array of different coping strategies in behavioral, psychological and social domains in adapting to vision impairment; most individuals reported using multiple coping strategies. A major theme in the coping strategies reported by older people in the psychological domain is the difficulty in balancing cultural and personal norms of independence with the functional losses resulting from vision impairment. Many older adults with vision impairment, most of whom have struggled to be independent adults and have taken pride in their self-reliance, grapple with the realization that in some cases they may need to be dependent on others. Another theme was the importance of members of the informal social support network in helping the older person with vision loss to adapt. Many elderly reported they relied on specific persons, such as a spouse or child, to provide them with needed assistance. Additional analyses have supported the hypothesis that older adults utilize novel coping strategies in the process of adaptation to chronic vision impairment. Overall, the use of novel coping strategies was found to be associated with better adaptational outcomes, emphasizing the importance of novel coping in response to stressful life circumstances. Findings from the present qualitative study, along with inconsistency in prior quantitative work in coping with chronic health conditions, would suggest the need for future research on the underlying factors involved in coping with stressful life events, such as late-life vision loss, in order to better facilitate adaptation to vision impairment in later life as well as clarify our understanding of this important topic.

Demographic factors have been found to be related to the self-reported coping strategies of older adults with vision loss. For example, the old-old were less motivated to use rehabilitation training and withdrew socially. Women were more likely to utilize nonfamily social supports, while men relied on immediate

family. Compared to other groups, White respondents in the study seem to have better personal, social, and environmental resources, indicated by their self-report of having greater availability of their spouse and friends, greater access to optical as well as adaptive devices, and greater motivation to learn from others with vision loss. Latinos presented coping strategies of activating emotional support from informal sources. Elderly with African and Hispanic heritage appeared to be more flexible with the notion of interdependency, expressing their needs for support from family and sometimes close friends, which is a positive predictor of better adaptation. The high-level education group showed more frequent self-reports of seeking certain resources and services (e.g., low vision exam, information on eye condition, advice from doctors, and counseling), whereas they reported the least frequent use of rehabilitation services overall. These findings underscore the complexity of needs in the older visually impaired population.

Finally, we have used a mixed-methods approach to better understand the constellations of functional stressors and coping strategies used by older adults in adaptation to visual impairment. The analysis yielded five stress constellation groups: Stoic (n=83), Complainers (n=42), Taciturn (n=295), Sentimentalists (n=67), and Articulate (n=11). The analyses of self-reported stress constellations across the five clusters demonstrated a high frequency of expression of negative thoughts and feelings, occurrence of negative social interactions, and loss of functional ability to perform everyday tasks such as reading and housework. Clusters based on self-reported coping that emerged included Mavericks (n=12), Autonomous (n=76), Pragmatists (n=44), Hermits (n=41), and Nonchalant (n=325). The *Hermits* and *Nonchalant* placed the greatest reliance on personal resources, sometimes at the expense of social ties, with little use of either formal or informal social supports. Across groups, there was a pattern of limited efforts to obtain vision rehabilitation services for instrumental needs, along with low acceptance of vision loss or desire to strengthen personal resources.

Status

Further qualitative analyses are examining the relation of coping strategies to (1) adaptational outcomes, and (2) change in self-reported coping strategies over time. Findings from this study are also being used in the ongoing development of valid and reliable measures of coping and psychosocial outcomes to chart the course of adaptation to age-related vision loss.

Publications

Brennan, M. (1998). Don't bother me, I can cope! *Sharing Solutions, Spring 1998*, 1-2.

Brennan, M., & Cardinali, G. (2000). The use of preexisting and novel coping strategies in adapting to age-related vision loss. *The Gerontologist, 40* (3), 327-334.

Brennan, M., Horowitz, A., Reinhardt, J. P., Cimarolli, V., Benn, D., & Leonard, R. (2001) In their own words: Strategies developed by visually impaired elders to cope with vision loss. *Journal of Gerontological Social Work, 35* (1), 63-85.

Brennan, M., & Sussman-Skalka, C. J. (2003). Acceptance: Coming to terms with vision impairment. *Sharing Solutions, Fall 2003*, 1-4.

Horowitz, A., Brennan, M., Reinhardt, J. P., Leonard, R., Benn, D., & Cimarolli, V. (1998). *In their own words: Strategies developed by visually impaired elders to cope with the emotional and functional consequences of vision loss*. Final report submitted to the Macular Disease Foundation, Virginia Beach, VA. New York: Arlene R. Gordon Research Institute of The Lighthouse Inc.

- Lee, E. O., & Brennan, M. (2002). "I cannot see flowers but I can smell them:" The relation of age and gender to self-reported coping strategies among older adults with visual impairment. *Qualitative Social Work: Research and Practice*, 1 (4), 389-411.
- Lee, E. K., & Brennan, M. (2004). "I am the fighter until the last moment;" The relation of race/ethnicity and education to self-reported coping strategies among older adults with vision impairment. *Journal of Social Work in Disability and Rehabilitation*, 2 (4), 3-28.
- Lee, E. K., & Brennan, M. (2005). *Stress constellations and coping styles of older adults with age-related visual impairment: A mixed-methods approach*. Manuscript under review.

Presentations

- Brennan, M., & Cardinali, G. (1998, November). Maintaining and regaining well-being in later life: Use of preexisting and novel coping strategies in adapting to vision loss. In D. Mroczek and M. Brennan (Chairs), *The context of well-being in later life: Psychological and social perspectives*. Symposium conducted at the annual scientific meeting of The Gerontological Society of America, Philadelphia, PA.
- Brennan, M., Horowitz, A., Reinhardt, J. P., Leonard, R. L., Benn, D., & Cimarolli, V. (1998, November). *In their own words: Self-reported coping strategies of older adults with vision loss*. Poster session presented at the annual scientific meeting of The Gerontological Society of America, Philadelphia, PA.
- Lee, E. O. (1999, October). *I cannot see flowers but I can smell them: Coping strategies and adaptation among older adults with vision loss*. Poster session presented at the annual conference of the State Society on Aging of New York, Albany, NY.
- Lee, E. O. (2000, November). *Coping strategies and adaptation among older adults with vision loss*. Poster session presented at the annual scientific meeting of The Gerontological Society of America, Washington, DC.
- Lee, E. K., & Brennan, M. (2003, November). *The relation of race/ethnicity and education with self-reported coping strategies among older adults with visual impairment*. Poster session presented at the annual scientific meeting of the Gerontological Society of America, San Diego, CA.
- Lee, E. K., & Brennan, M. (2005, November). *A cluster analysis of self-reported contextual issues and coping strategies in adaptation to visual impairment in later life*. Poster session to be presented at the annual scientific meeting of the Gerontological Society of America, New Orleans, LA.

Investigators: Amy Horowitz, DSW/PhD, Principal Investigator
Mark Brennan, PhD, Project Coordinator/Analyst
Verena Cimarolli, MA, Research Assistant
Robin Leonard, MA, Consultant
Joann P. Reinhardt, PhD, Consultant
Dolores Benn, PhD, Consultant
E. Othelia Lee, Ph.D., Boston College.

Funded by: Funded in part by the Macular Disease Foundation of Virginia Beach, Virginia

Project Period: February 1997 - January 1998. Further qualitative analyses are ongoing.

Life goals, Disability, Rehabilitation, and Mental Health in Young and Middle-Aged Adults with Visual Impairment

Overview

As an important motivational force, life goals contribute to health and well-being (Emmons, 1986, 1989). Being confronted with a disability such as visual impairment is likely to lead to interference with a person's involvement in important life domains, which can mean a significant disruption and blockage of the individual's goal pursuits. The pursuit of life goals is particularly critical in young as well as middle adulthood. For example, during young adulthood, life goals may involve getting an education, finding an occupation, selecting a partner, and starting a family. Middle adulthood may involve maintaining a career, meeting the demands of parenthood, nurturing one's marriage/relationship, and managing a household (Nurmi, 1992).

Because life goals and the implications of experiencing a disruption of life goals are so critical in early and middle adulthood, insights regarding which life domains are most affected by disability can be helpful to better understand adaptation to a disability such as vision loss, and may also provide cues for intervention planning. Specifically, it has been suggested that the perceived correspondence of rehabilitation goals and life goals enhances a person's motivation to participate in rehabilitation and to make the intervention relevant to the person's life (Sivaraman Nair, 2003). Furthermore, a recent study on life goals of people with neurological disabilities found that great significance was attached to partner and family relationships, life domains that are not typically included in defined rehabilitation goals (Sivaraman Nair & Wade, 2003).

Life Goal Study Part I:

The objectives of this study were to explore the relative importance of different life goals among adults with vision impairment, the extent to which vision impairment interferes with each, as well as the extent to and ways in which rehabilitation addressed and affected these life goals. Finally, the relationships between importance of life goals, goal interference, and mental health outcomes were also examined.

Method

Participants were 86 working age adults (age 18-64 years) with vision impairment. Data were collected through telephone interviews that included structured assessments of life goal importance (0=no importance to 3=extreme importance), goal interference due to vision loss (0=not at all to 3=extremely), and mental health outcomes (depressive symptomatology and life satisfaction) as well as open-ended assessments of if and how rehabilitation programs addressed life goals. Descriptive analyses were conducted to explore participants' reports of goal importance and interference for the different life goals, as well as the ways in which these goals were addressed by rehabilitation. Correlational analyses were conducted to examine interrelationships between goal importance, interference, and mental health.

Findings

In addition to functional aspects of living, life goal importance ratings reflected that, relationships were a top priority for this study population. Functional compared to relationship goals were more commonly addressed in vision rehabilitation services. However, many participants felt that their vision impairment interfered with their relationships, and in the rare case that relationships were addressed in rehabilitation, it was never perceived as ineffective. In contrast, reports of a life goal being addressed in ineffective ways emerged for functional life goals.

All interference variables were significantly correlated with mental health outcomes. Those who reported higher levels of goal interference were also likely to report worse mental health. Of the three

goal importance variables, only relationship importance was significantly linked with mental health. Those who rated the relationship domain as more important were also likely to report better mental health. Taken together, the consistent links between goal interference and well-being across life domains demonstrate that, among people with vision impairment, the perception of lesser goal interference was generally associated with better mental health. Unlike goal interference, goal importance was not consistently linked to mental health. Only those who attached more importance to their relationships also reported better mental health. These findings suggest that, in addition to functional life domains, relationship-related life goals may need to receive more attention in the context of rehabilitation for people with disabilities.

Publications

Boerner, K., & Cimarolli, V. (2005). Optimizing rehabilitation for adults with visual impairment: attention to life goals and their links to well-being. *Clinical Rehabilitation*, 19 (7), 790-798.

Cimarolli, V. R., & Boerner, K. (2005). Social support and well being in adults with visual impairment. *Journal of Visual Impairment and Blindness*, 99(9), 521-534.

Life Goal Study Part II:

Although findings from the first phase of this pilot study using a structured goal assessment approach provided valuable insights, it is possible that this approach missed important individual differences in personal goals, which an open-ended approach may be more likely to capture. Also, since so little is known about the interrelationships among life goals, vision rehabilitation, and psychological well being in young and middle-aged adults, it may be particularly interesting to pose open questions about life goals most important to participants, rather than to have them rate pre-established dimensions.

Employing an assessment focusing on if and how each type of vision rehabilitation service used may have addressed these most important goals is likely to provide more concrete insights into the relationship between life goals and vision rehabilitation service use than the structured assessment used in the first phase of this pilot.

Finally, since adjustments in important life domains often occur during the adaptation process (Boerner, 2004), life goals may or may not change when a person deals with vision loss, and if they do, the use of vision rehabilitation services may actually play a role in this change. Although change is best assessed longitudinally, retrospective data on changes in major life domains, and on the role of rehabilitation in these changes can provide valuable pilot data on this issue, on which we then can build in future studies.

Thus, the objectives of this second part of the life goal project were: 1) To identify participants' three most important personal goals, and then assess how vision impairment interferes with each; 2) To explore if and how each type of rehabilitation service received has addressed these most important goals; and 3) To explore if and how vision impairment and the use of vision rehabilitation services has changed participants' life goal or priorities.

Method

The sample consists of 53 participants between the ages of 22 and 65 who had an age of onset of vision impairment 18 years of age or older. Data were collected through semi-structured telephone interviews. The interviews included questions about visual functioning and rehabilitation service history, an open-ended assessment of important life goals, and extent to/ways in which these were addressed in each of the specific types of rehabilitation received, as well as open-ended question on changes in life goals, sense of self, world views, and relationships to others resulting from vision impairment.

Findings

Results indicated that rehabilitation services that teach functional skills as well as psychosocial therapeutic-type services were instrumental in addressing life goals. Independence-related goals were most often addressed, whereas hobbies/leisure-related goals were least often addressed. When life goals were addressed, they were generally perceived as having been addressed effectively.

Results also demonstrated that positive, negative, and “in-between” types of change occurred across the four life domains to varying extents. Although negative changes seemed to be more prevalent than positive changes, the majority of changes were in-between changes. Links of occurrence and type of change with well-being were found for the self and world view domains. Regarding different facets of change, even though for most people change seemed to involve more of a gradual adjusting of individual aspects while retaining some degree of overall continuity, changes were certainly characterized as more drastic for some. Findings underscore the need to assess different types and aspects of life changes in order to better understand the impact of functional loss in young and middle adulthood.

Publications

Boerner, K., Wang, S., & Cimarolli, V. R. (2006). The impact of functional loss: Nature and implications of life goals. *Journal of Loss & Trauma, 11*, 265-287.

Cimarolli, V. R., Boerner, K., & Wang, S. (2006). Life goals in vision rehabilitation: Are they addressed and how? *Journal of Visual Impairment and Blindness, 100*(6), 343-352.

Project Team

Kathrin Boerner, PhD, Principal Investigator

Verena Cimarolli, PhD, Co-Investigator

Lauren Grunseid, Research Intern

Shu-wen Wang, Research Assistant

Funded by

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Project period

5/04 – 12/05

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The Lighthouse National Survey on Vision Loss: Experience, Attitudes, and Knowledge of Middle-Aged and Older Americans

Overview

In 1995, The Lighthouse Inc. commissioned Louis Harris and Associates to conduct a nationwide survey of adults 45 years and older, focusing specifically on aging and vision loss, to provide current data on the prevalence of self-reported vision impairment, public attitudes and knowledge about vision loss and use of vision rehabilitation services, and the impact of vision impairment on everyday life. Funding was received from the AARP Andrus Foundation in 1996 to conduct multivariate, secondary analyses among respondents aged 55 years and older in six areas with direct relevance to maintaining independence in later life: (1) factors associated with older Americans' attitudes, knowledge, and fears about vision loss and aging, (2) risk factors associated with self-reported vision impairment in later life, (3) the unique impact of vision impairment on the quality of life of older Americans, (4) factors associated with more positive psychosocial and functional status among older adults with a vision impairment, (5) factors associated with service knowledge and service utilization among older Americans with a vision impairment, and (6) the social, health and vision-related characteristics that differentiate older drivers and nondrivers who are visually impaired.

Method

A total of 1,219 telephone interviews were conducted nationwide including an oversample of persons age 75 and older. A two-stage weighting procedure was utilized to ensure that the sample parameters were representative of the population at large. Respondents were classified as visually impaired based on multiple indicators of vision problems including blind in one or both eyes, inability to read newspaper print or recognize a friend across the room, or self-rated poor or very poor vision, or any other reported trouble seeing even when wearing corrective lenses. Respondents were further classified as moderately or severely visually impaired. A subsample of 861 respondents aged 55 years and older was used for the secondary analyses funded by the AARP Andrus Foundation.

Findings

Results indicated that self-reported vision impairment is greater than estimated previously, with 15% of 45-64 year-olds, 17% of those aged 65-74 years, and more than one-fourth (26%) of elders 75 years and older classified as visually impaired, and half report that a vision problem interferes with their daily lives. Furthermore, there is pervasive fear of blindness among older adults and limited knowledge about age-related vision loss. Knowledge about the availability of vision rehabilitation is seriously lacking among those who may be the most in need: the elderly, the least educated, and those with severe visual impairments. Secondary analyses have suggested numerous implications including: (1) expand outreach to educate older people about age-related vision loss, basic eye care, and vision rehabilitation; (2) target outreach at those most at risk for late-life vision loss, namely those with greater age, lower education, and limited informal social support; (3) target vision rehabilitation at those with greatest risk to functional and psychosocial well-being (i.e., young elderly, non-Whites, those in poor health, persons with low education or income); (4) increase public education on the benefits of vision rehabilitation in terms of life quality, especially in minority and low-income communities, which include interactions between visually impaired and sighted persons to promote positive attitudes towards vision loss; (5) educate the public and eye care professionals about the benefits of low vision care and other adaptive devices; and (6) conduct future research on how older adults modify driving behaviors in response to vision impairment.

Since the completion of the AARP grant, two additional secondary analyses have been conducted with these data. The first project was designed to examine the impact of vision impairment among a subsample of retirees 55 years and older ($n = 558$) with regard to previously identified predictors of well-being in late adulthood. Findings indicated that retirees with visual impairments (20%) were significantly older, had lower education levels, were more likely to have poverty-level incomes, and were more likely to report poor health as compared with their peers. Retirees with vision impairment also reported a significantly greater number of problems in their lives compared to nonimpaired adults. Multivariate analysis revealed that severe visual impairment was a unique predictor of greater life problems among retirees, even after controlling for age, health, income, and minority status.

A second project examined the effects of visual impairment on employment status among respondents aged 45 to 69 years ($n = 702$), among whom 14% ($n = 97$) were visually impaired. There was no significant difference in the proportion of persons with visual impairments and nonimpaired adults who were employed (60% and 63%, respectively). Among respondents with visual impairments, only use of an optical device significantly predicted employment status; those using optical devices were 70% less likely to be currently employed as compared with nonusers. The use of an optical device may be considered a proxy for visual impairment severity, so these findings indicate that as severity increases, the prospects of employment for adults with vision loss is significantly diminished.

Publications

Brennan, M., Horowitz, A., & Reinhardt, J. P. (in press). Understanding older Americans' attitudes, knowledge, and fears about vision loss and aging. *Journal of Social Work in Disability and Rehabilitation*.

Horowitz, A., Reinhardt, J. P., & Brennan, M. (1997). *Aging and vision loss: Experiences, attitudes and knowledge of older Americans*. Final Report submitted to the AARP Andrus Foundation. New York: Arlene R. Gordon Research Institute of The Lighthouse Inc.

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Presentations

Brennan, M., Horowitz, A., & Reinhardt, J. P. (1997, November). *Factors associated with risk of self-reported vision impairment in later life*. Poster session presented at the annual scientific meeting of The Gerontological Society of America, Cincinnati, OH.

Horowitz, A., Brennan, M., & Reinhardt, J. P. (1997, November). *Prevalence and predictors of driving among older adults with self-reported vision impairment*. Poster session presented at the annual scientific meeting of The Gerontological Society of America, Cincinnati, OH.

Horowitz, A., Reinhardt, J. P., Brennan, M., Goodman, C. R., & Cantor, M. (1996, November). *The impact of age-related vision impairment on life quality: Findings from The Lighthouse national survey on vision loss*. Poster session presented at the annual scientific meeting of The Gerontological Society of America, Washington, D.C.

Leonard, R., D'Allura, T., & Brennan, M. (1997, October). *Chronic impairment and retirement status in older Americans*. Paper presented at the annual meeting of the State Society on Aging of New York, Albany, NY.

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Reinhardt, J. P., Horowitz, A., Brennan, M., Goodman, C. R., & Cantor, M. (1996, November). *Predictors of psychosocial and functional adaptation in visually impaired older Americans*. Poster session presented at the annual scientific meeting of The Gerontological Society of America, Washington, DC.

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Investigators: Amy Horowitz, DSW/PhD, Principal Investigator
Joann P. Reinhardt, PhD, Co-Principal Investigator
Mark Brennan, PhD, Research Associate
Barbara Silverstone, DSW, Consultant
Prof. Marjorie Cantor, Consultant

Project Period: Field work completed 1994; descriptive report issued in April 1995; secondary analyses for AARP Andrus completed April 1997, further analyses ongoing.

Updated: 9/2005

Perceived Overprotection and Age-Related Vision Loss

Overview

Research with older adults confronted with health-related stressors, such as stroke, has shown that overprotection, a form of negative support, not only leads to depression but also hinders successful rehabilitation outcomes leading to unnecessary disability. The impact of overprotection on adjustment to age-related vision loss, however, stands mostly unexplored. Moreover, very little is known about factors predicting perceived overprotection in this population. This is unfortunate because vision loss is often associated with falls and injuries, and therefore overprotection from significant others might be especially likely in visually impaired elders because of the safety issues involved. Secondary analyses were conducted for two purposes. The first was to investigate the impact of perceived overprotection and other social support variables, namely instrumental, affective, and negative support, on the adjustment to age-related vision loss and the other purpose was to identify longitudinal predictors of perceived overprotection.

Method

Study participants were 400 (58% female) elders with a recent vision loss, who were first time applicants to a vision rehabilitation service agency. Participants constituted a subsample of individuals involved in a large-scale longitudinal study on the interrelationships among depression, vision loss, and rehabilitation use (Dr. Amy Horowitz, PI; Dr. Joann P. Reinhardt, Co-PI). Perceived overprotection by family and friends/neighbors was measured using the 9-item short version of Overprotection Scale for Adults (OPSA; Thompson & Sobolew-Shubin, 1993a). In addition, the frequency of other types of support (instrumental, affective, and negative) received over the past month from family, friends, and neighbors was assessed employing items specifically designed for this study. The items were based on Morgan's and Rook's work. Optimal adjustment was operationalized as having high environmental mastery (an indicator of psychological well-being) and high scores on a vision-specific adaptation measure (AVL; Horowitz & Reinhardt, 1998). For 297 of these participants, data from a 6-month follow-up interview were available, including data on the use of vision rehabilitation services.

Findings

The Impact of Perceived Overprotection on Adjustment to Age-Related Vision Loss - The primary goal of these cross-sectional analyses was to investigate the impact of perceived overprotection, a negative social network variable, and other social support variables, namely instrumental, affective, and negative support, on the adjustment to age-related vision loss. Optimal adjustment was operationalized as having high environmental mastery (an indicator of psychological well-being) and high scores on a vision-specific adaptation measure. Path analysis results demonstrated that functional disability, stemming from vision loss and other comorbid health conditions, significantly, positively impacted social support variables (overprotection, affective support, and instrumental support) and significantly, negatively impacted the two indicators of adjustment. In addition, higher levels of overprotection led to decreased mastery and lower scores on the vision-specific adaptation measure. Both higher levels of instrumental support and higher levels of negative support predicted higher overprotection. All social support variables taken together mediated the impact of functional disability on the outcome variables, but individually they did not. Moreover, higher mastery was predicted by lower levels of both negative support and overprotection, but was unaffected by instrumental and affective support. In contrast, higher scores on the vision specific adaptation measure were predicted by lower levels of overprotection and affective support and by higher levels of instrumental support.

Predictors of Perceived Overprotection: A Longitudinal Analysis - The primary goal of this study was to investigate baseline predictors of perceived overprotection at a 6-month follow up in a sample of older adults (N=297) with visual impairment. Predictors included demographic variables (age, gender, race, and education), functional disability, self-rated health, and social support variables (instrumental, affective, and negative support) assessed at baseline. In addition, the use of vision rehabilitation services, specifically the number of programs in which the participants were engaged between baseline and 6-months later was also examined as a predictor of long-term perceived overprotection. Results from a hierarchical regression analysis demonstrated that higher levels of baseline functional disability, lower self-rated health, and higher levels of instrumental support as well as the greater number of service programs the participants were engaged in predicted higher levels of perceived overprotection at the 6-month follow-up.

Publications

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Cimarolli, V. R., Reinhardt, J. P., & Horowitz, A. (2006). Perceived overprotection: Support gone bad? *Journal of Gerontology: Social Sciences*, 61: S18-S23.

Presentations

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Cimarolli, V. R., Reinhardt, J. P., & Horowitz, A. (2002, November). *Predictors of perceived overprotection: A longitudinal analysis*. Paper presented at the annual meeting of The Gerontological Society of America, Boston, MA.

Investigators: Amy Horowitz, DSW/PhD, Principal Investigator
Joann P. Reinhardt, PhD, Co-Investigator
Mark Brennan, PhD, Data Analyst
Verena Cimarolli, MA, Research Coordinator (to 7/2001)
Thalia MacMillan, MSW, Research Coordinator (from 7/2001)

Funded by: National Eye Institute

Project Period: October 1999 - September 2004

Updated: 6/2007

Religiousness and Spirituality in Vision Impaired Adults

Overview

A rapidly growing literature shows that greater levels of religiousness and spirituality generally lead to better physical and mental health outcomes. The Lighthouse National Survey on Vision Loss (1995) indicates that 13.5 million Americans 45 years and older report significant vision loss, ranging from moderate impairment to total blindness. The current research has taken a broader approach to the study of adaptation to visual impairment by considering the roles played by religiousness and spirituality in terms of both domain-specific and more global psychosocial outcomes. Overall, it was hypothesized that individuals reporting greater religiousness or spirituality would experience less negative impact from vision impairment and other stressful events, and would have more positive rehabilitative outcomes in terms of adaptation to vision loss and psychosocial development. Specifically, two competing hypotheses were tested: 1) *social support* -- highly religious people, through contact with religious institutions, have increased social contact and exchanges of assistance; and 2) *religious consolation* -- religious beliefs promote perceptions that lessen suffering and distress. This research has also examined the extent to which religion and spirituality play differential roles among middle-aged adults compared to older individuals in adapting to vision loss.

Method

Participants were 99 middle-aged and 95 older adult applicants for services from Lighthouse International (a vision rehabilitation agency) and whose cases were recently closed (n = 195). Participants were screened on the following criteria: visually impaired; age (45 or older); living in the community; and fluency in English. After obtaining informed consent, respondents were interviewed by telephone for approximately 1 hour. Extrinsic and intrinsic religiousness were assessed with a modified Religiousness Orientation Scale (Allport, 1967). Spirituality was measured with the Spirituality Assessment Scale (Howden, 1992). Covariates included vision loss severity, and sociodemographic, health, life stress, and social support measures. Outcomes consisted of the Adaptation to Vision Loss Scale (AVL) (Horowitz & Reinhardt, 1998), the Inventory of Psychosocial Balance (Domino & Affonso, 1990), and two single-item measures; life satisfaction and depression.

Results and Discussion

After controlling for all other covariates using hierarchical multiple and logistic regression, spirituality emerged as a significant independent predictor of better adaptation, supporting the religious consolation hypothesis. Extrinsic religiousness was associated with lower AVL scores, while higher intrinsic religiousness was related to higher life satisfaction. Although religious involvement was associated with greater levels of social support, the only social support factor to predict better adaptation was the perception of emotional support adequacy. In addition, social support received directly from religious congregations was not significantly related to any outcome. Thus, the social support hypothesis was not supported. Furthermore, additional analyses have not supported the hypothesis that highly religious individuals are advantaged in terms of social support resources resulting from such religious activity. Current findings from this project, one of the few studies that has examined religiousness and spirituality concurrently, suggest that the beneficial effects of religiousness on physical and mental health outcomes have been to-date, somewhat misleading and overstated. Our current results suggest that one's underlying level of spirituality is the more important factor in adaptational outcomes, regardless of whether such spirituality is expressed formally through participation in a religious community. This is not to suggest that religiousness is not related to better outcomes, rather, it is that religiousness demonstrates its beneficial effects on these outcomes because it is a vehicle for the expression of a person's underlying spirituality.

The relation of religiousness and spirituality to psychosocial development was also examined as part of this study. Regression analyses on the effects of religiousness and spirituality on psychosocial development among middle-aged and older adults with vision impairment found that spirituality, but not religiousness, significantly predicted higher levels of development operationalized according to Erikson's theory. In addition, spirituality was found to significantly interact with life event impact and control domain ratings such that this coping resource exhibited a buffering effect on self-reported negative life experiences. These additional analyses allowed a comparison of the stress mediating roles of religiousness and spirituality on both vision impairment and more general life event stress. This comparison revealed that spirituality and religiousness variables exhibit similar mediating effects in terms of both adaptation to vision loss and the more global concept of psychosocial development. That is, higher levels of spirituality were related to both better adaptation and higher levels of development while religiousness, particularly an extrinsic orientation, tended to predict poorer outcomes. Additionally, further work has found evidence for developmental recapitulation in adaptation to visual impairment. Middle age and older adults appear to renegotiate earlier developmental stages during the adjustment process as a way of restoring equilibrium following the onset of visual impairment.

Increased social support availability has been hypothesized as one of the mechanisms responsible for the positive effects of religiousness. Thus, the 182 middle-aged and older adults who reported a denominational affiliation were asked about their experience with tangible social support received from their religious communities. Nearly one-quarter (23%) reported receipt of such help. Persons from Protestant denominations were significantly more likely to report receiving faith-based support (41%) compared to either Catholic or Jewish denominations (10% and 11%, respectively). Among those reporting the receipt of faith-based assistance, emotional support was the most frequently mentioned type of help (19% of responses), followed by getting a ride or escort (17%). Both help with food or meals and receiving a ride to religious services were the next most frequently reported types of help (13% and 13%, respectively). Examining broad categories of support (i.e., emotional, instrumental, religious, and transportation) revealed that all participants reporting faith-based help received instrumental assistance. Receipt of support was not associated with age, gender, race/ethnicity, denomination, or frequency of service attendance. Persons living alone were more likely to receive emotional support compared to peers, but living arrangement was not related to any other category of support. These findings suggest that faith-based social support is an important resource for many middle-aged and older adults, especially in meeting age-related challenges such as chronic disability resulting from vision loss.

Status

Multivariate analyses (i.e., regression analyses and structural equation modeling [SEM]) are continuing. Qualitative analysis of respondents' narrative data is ongoing. Funding is currently being sought to study the relationship of religiousness and spirituality to rehabilitation outcomes among visually impaired adults over time.

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Presentations

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- Brennan, M., & DePalo, R. (2004, November). Faith-based social support: Activation of resources in coping with vision loss. Poster session to be presented at the annual scientific meeting of The Gerontological Society of America, Washington, D.C.
- Brennan, M., & MacMillan, T. (2005, November). Spirituality and the achievement of vision rehabilitation goals. In A. Ai and K. Branco (Chairs), *Faith matters: Health and functioning of older persons*. Symposium to be conducted at the annual scientific meeting of The Gerontological Society of America, New Orleans, LA.
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- Brennan, M., & Shippy, R. A. (2000, November). *Vision impairment and psychosocial development: Adaptation to chronic stress*. Poster session presented at the annual scientific meeting of The Gerontological Society of America, Washington, D.C.
- Shippy, R. A., & Brennan, M. (2000, August). *The effects of vision impairment on psychosocial development in middle age and older adults*. Poster session presented at the annual convention of the American Psychological Association, Washington, D.C.

Investigators: Mark Brennan, PhD, Principal Investigator
Gina Cardinali, MSW, Research Coordinator
Thalia MacMillan, MSW, Data Analyst
R. Andrew Shippy, MA, Predoctoral Intern

Funded by: National Institute on Aging

Project Period: 12/1/97 - 11/30/99

Updated: 9/2005

Studies in Adaptation to Age-Related Vision Loss

Adaptation to Age-Related Vision Loss; Amy Horowitz, DSW/PhD, Principal Investigator; Joann Reinhardt, PhD, Co-Investigator; Robin McInerney Leonard, MA, Research Associate. Funded by the Community Trust of Greater New York. 1990-1991.

Age-Related Vision Loss: Factors Associated with Adaptation to Chronic Impairment Over Time; Amy Horowitz, DSW/PhD, Principal Investigator; Joann Reinhardt, PhD, Co-Investigator; Robin McInerney Leonard, MA, Project Director. Funded by the AARP Andrus Foundation. 1993-1995.

Friendship as a Resource in Age-Related Vision Loss; Joann P. Reinhardt, PhD, Principal Investigator; Robin McInerney Leonard, MA, Research Associate. Funded by the National Institute of Mental Health. 1991-1994.

Overview

For an older person who has been sighted until late life, the onset of vision impairment is a profound experience and one that requires considerable functional, emotional, and psychosocial adjustment. A series of three studies have examined the process and predictors of adaptation to age-related vision loss. These studies have focused on the effect of demographic characteristics, characteristics of the vision disability, concurrent health conditions, functional status, coping strategies and social support on adaptation outcomes. In addition, a major objective of the first study was the development and validation of a scale of adaptation to vision loss (AVL scale) specifically designed for elderly persons. The AVL scale has subsequently been used as an outcome measure in this series of studies, in addition to two other measures of global well-being: life satisfaction and depressive symptomatology.

The second study was a 2-year follow-up of the earlier participants in the first study (after service receipt), which permitted the examination of adaptation to age-related vision loss over time and the effect of varying levels of service on adaptation. The third study provided an in-depth examination of the quality of perceived support in visually impaired women and men, and specifically compared the effect of kin and nonkin support on adaptation to vision loss.

Findings

Multivariate analyses conducted in the first study suggested that several major conceptual domains contributed significantly to adaptation to age-related vision loss. Specifically, educational level, quality of family and friendship support, current type of coping strategies used to deal with the vision loss, and activity level emerged as the most significant domains in predicting adaptation.

Analyses of data in the two-year follow-up study focused on the identification of baseline predictors of Time-2 adaptation. Results demonstrated that less use of affective coping strategies, greater use of escape/compensatory coping strategies, better health at baseline and having one's service expectations met were significant predictors of each of the adaptation indicators. In addition, using a greater number of optical devices predicted more successful adaptation to the vision loss and lower levels of depression; receiving counseling predicted higher life satisfaction, and receiving low vision services predicted lower depression. Greater ADL disability at follow-up was predicted by poorer initial health status, more severe functional vision problems at both baseline and follow-up, lower perceived income adequacy and a decrease in contact with friends.

Results for the third study demonstrated that the majority (70%) of the sample of elder, visually impaired women and men had both a close friend and a close family member. Multivariate procedures

demonstrated that after accounting for demographic, vision and health variables, and family support, friendship support predicted unique variance in adaptation variables. This was true even though descriptive data showed that most individual support components were significantly higher for family than friendship support. Selected significant differences by gender in perceived friend and family support components emerged, yet overall, females and males appeared to receive similar levels and types of support from kin and nonkin support providers. Thus, both kin and nonkin support is important for adaptation to vision loss.

Analyses of these data continue with a focus on the dual sensory impaired elderly, the effect of vision loss on specific functional tasks, coping strategies and adaptation, and the prevalence and predictors of depression among visually impaired elders.

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Reinhardt, J. P., & Horowitz, A. (1992, November). *Differential use of coping strategies in adaptation to chronic impairment*. Poster session presented at the annual scientific meeting of The Gerontological Society of America, Washington, D.C.

Updated: 9/2005

Validation of a Functional Vision Screening Questionnaire (FVSQ) for Older People

Overview

Vision loss is too often accepted as a “normal” part of the aging process by both professionals and the aged themselves. As a result, older people tend not to actively seek or be referred to vision rehabilitation services. Aggressive outreach efforts are required to break down these barriers which impede early identification of emerging vision disabilities. Screening instruments, which can be easily and quickly administered, are critically needed to implement such a strategy.

The Functional Vision Screening Questionnaire (FVSQ) was developed several years ago as part of an educational and outreach project for older people in the community. The objective was to develop an instrument that could facilitate early identification of vision problems and referral for comprehensive clinical evaluations. The questionnaire consists of 15 items which focus on functional, rather than clinical, indicators of vision problems.

Method

The FVSQ was administered to the patient population (n=265) of an ophthalmologist whose practice includes low vision patients. Clinical data on the patients' visual acuities, eye diseases, visual fields, contrast and glare problems, and need for low vision devices were collected. Patients are defined as visually impaired based on best corrected distance acuity of 20/70 or worse or best corrected near acuity of greater than 1.25. Using these criteria, 18% were classified as visually impaired. The primary analytic method for evaluating the FVSQ is an expectancy table analysis in order to identify the scale value (i.e., cut-score) most appropriate for defining the probability that an individual is visually impaired.

Findings

Results indicated that a cut-score of 9 (i.e., respondents reporting problems in at least 9 of the 15 items) was most appropriate for screening purposes. At this value, 90.6% of all 265 cases were correctly classified. Furthermore, at a cut of 9: the sensitivity was .72 (i.e., 72% of all the truly impaired were identified by the screen); the specificity was .94 (i.e., 94% of the truly not impaired were identified as not impaired by the screen); the positive predictive value was .74 (i.e., of all those identified by the screen as impaired, 74% were truly impaired); and the negative predictive value was .94 (i.e., of all those identified by the screen as not impaired, 94% were truly not impaired). Both higher and lower cut scores were rejected because they tended to increase negative qualities of the screening questionnaire without sufficient gains in other aspects.

The data provide support for the index's efficiency and effectiveness as a vision screening tool which can be used in community outreach programs to identify visually impaired older people who should be referred for clinical follow-up. With funding from the National Institute on Disability and Rehabilitation Research, the FVSQ is available in German, French, Spanish, Creole-French, Chinese, Russian, and Hindi.

Publications

Horowitz, A., Teresi, J., & Cassels, L. A. (1991). Development of a vision screening questionnaire for older people. *Journal of Gerontological Social Work*, 17, (3/4), 37-56.

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Investigators: Amy Horowitz, DSW/PhD, Principal Investigator
Eleanor E. Faye, MD, Co-Investigator
Robin McInerney Leonard, MA, Research Associate.

Updated: 9/2005

Vision Loss, Coping Tendencies, and Mental Health

Overview

The purpose of this study is to better understand the relationships among vision impairment severity, functional disability, coping tendencies, and mental health among middle-aged and older adults who are confronted with chronic vision impairment. Age-related vision loss is the second most prevalent disability among older adults (NCHS, 1993). Its major impact on functional ability and interaction with others has been shown to put individuals at risk for depression and poorer perceived life quality (Horowitz & Reinhardt, 2000). While preliminary evidence shows that coping is a key factor in adaptation to vision loss, this work has contributed more to the understanding of coping patterns that are maladaptive than to learning what may be adaptive. However, optimal interventions depend as much on knowing what is adaptive as on understanding the factors that increase risk for poor mental health. Furthermore, prior research has not included a developmental perspective, and has been limited to the study of older adults. The present study seeks to fill this gap by comparing middle-aged and older adults, and by utilizing a theoretical framework that incorporates a developmental component, and specifies modes of coping that mitigate depression and enable a person to stay resilient in the face of major decline: the model of assimilative and accommodative coping (Brandtstädter, 1999). The insights gained from this study will guide subsequent research that will serve to identify those who are at risk for mental health problems, and to optimize interventions that help individuals adapt to vision impairment as well as to other disabilities.

Method

Participants were 55 middle-aged (40-64) and 52 older adults (65+) experiencing a recent vision impairment. Data were collected through telephone interviews. Multivariate analyses were conducted to explore the interrelationships between vision impairment severity, functional disability, assimilative and accommodative modes of coping, and mental health outcomes among middle-aged and older adults, and to examine if these relationships vary by age. The effect of functional disability on mental health depending on age was also investigated.

Findings

Data collection and analyses have been completed. Study findings support the importance of accommodative and assimilative modes of coping for mental health outcome among middle-aged and older adults with a chronic impairment. The two coping modes accounted for a significant proportion of the variance in mental health outcome, even after controlling for sociodemographics and impairment status. Furthermore, the negative direction of the individual effects indicates that the more participants used either of the coping modes, the less mental health problems they reported. The effect of accommodative coping on mental health outcome did not seem to vary depending on age, as had been predicted. However, the role of accommodative coping varied depending on a person's level of disability. Thus, findings demonstrated a critical role of accommodative coping for adaptation, with beneficial effects on mental health that were more pronounced in the case of high disability. Findings also showed that mental health problems were most likely under the condition of younger age and high levels of disability, which suggests that having to deal with disability may pose more of a mental health risk in middle than in late adulthood.

Publications

Boerner, K. (2002). *Vision Loss, Coping Tendencies, and Mental Health*. Final Report to the National Institute of Mental Health. New York: Arlene R. Gordon Research Institute of Lighthouse International.

Boerner, K. (2004). Adaptation to disability among middle-aged and older adults: The role of assimilative and accommodative coping. *Journal of Gerontology: Psychological Sciences*, 59(1), P35-P42.

Presentation

Boerner, K. (November, 2003). *Disability and depression in mid- versus late adulthood: The benefits of assimilative and accommodative coping*. Poster to be presented at the annual scientific meeting of The Gerontological Society of America, San Diego, CA.

Investigators: Kathrin Boerner, PhD, Principal Investigator
Christopher Meehan, MA, Research Assistant

Funded by: NIMH

Project Period: 11/1/01 - 10/31/02

Updated: 9/2005

Psychosocial Research: Completed Research Projects (see publication list for study papers)

1. **Rehabilitation of visually impaired older adults.** Cynthia Stuen, DSW, Principal Investigator; Amy Horowitz, DSW/PhD, Co-Principal Investigator; Betty Bird, EdD, Co-Principal Investigator; Ruth Fangmeier DSW, Co-Principal Investigator/Project Director. Funded by the National Institute of Disability and Rehabilitation Research. 1992 – 1996.
2. **The national vision rehabilitation cooperative on behalf of older Americans: Technical assistance and evaluation initiative.** Amy Horowitz, DSW/PhD, Principal Investigator, Arlen Sue Fox, MA, Evaluation Specialist. Funded by the Community Trust of Greater New York. 1993 – 1995.
3. **Vision rehabilitation and family services: Maximizing functional and psychosocial status for both older visually impaired adults and their families.** Amy Horowitz, DSW/PhD & Betty Bird, EdD, Co-Project Directors; Joann P. Reinhardt, PhD, Senior Research Associate; Caryn R. Goodman, PhD, Research Associate. Funded by AARP Andrus Foundation. 1994 – 1997.
4. **Older spouses and adjustment to age-related vision loss.** Caryn Goodman, PhD, Principal Investigator, R. Andrew Shippy, MA, Research Assistant, Amy Horowitz, DSW/PhD, Consultant, Mary Ann Parris Stephens, PhD, Consultant, Funded by National Institute of Mental Health, February 1999 – January 2001.
5. **Personality, rehabilitation, and health in impaired elders.** Dolores Benn Inzerillo, PhD, Principal Investigator, Christopher D. Meehan, Research Assistant, Funded by National Institute on Aging, April 2001 – March, 2002.

Updated: 9/2005

“Access for Elders” - An Evaluation

Overview

“Access for Elders” is an educational, outreach project designed and implemented by Lighthouse International. The outreach project employed three approaches that enabled staff to reach the largest number of older adults with vision loss. These included working with nonprofit and government organizations that serve the elderly, collaborating with comprehensive senior care facilities, and outreach to physicians. Staff conducted a series of presentations to raise awareness about the issue of vision loss among older adults, to identify those in need of vision rehabilitation services, and to provide needed services. The goals of the evaluation were [1] a description of the populations reached, [2] the documentation of the number of presentations made at various settings, the number of staff who received training, the number of individuals who attended presentations, and the number of individuals referred for and receiving vision rehabilitation services, [3] an assessment of staff and presentation attendee satisfaction with the program and recommendations for program improvement, and [4] the documentation of the types and outcomes of vision rehabilitation services received.

Method

Various methods were used to achieve evaluation goals including the design and administration of two questionnaires to assess attendee and staff satisfaction with the program; the design of a database to simplify the collection of project-specific information, and the utilization of an existing database to assess services provided, outcomes, and county of residence of those served.

Findings

A total of 725 older adults completed an evaluation survey. Results from surveys with 643 older adults show that when asked to rate the informative value of the presentations on a scale from 1 to 5, where 1 meant ‘not at all informative’ and 5 meant ‘very informative’ the vast majority of older adults (85%) gave a rating of 5. Moreover, 122 (83%) older adults rated the quality of the presentation as ‘very high.’

Three hundred and eighty-two staff members completed an evaluation survey. Results from surveys with 379 staff members show that when asked to rate the informative value of the presentations on a scale from 1 to 5, where 1 meant ‘not at all informative’ and 5 meant ‘very informative’ the vast majority of staff (88%) gave a rating of 5. Moreover, 182 (78%) staff members rated the quality of the presentation as ‘very high.’

Investigators: Janet Weinstein, Project Director
Tana D’Allura, PhD, Evaluation Advisor (to 8/2006)
Verena R. Cimarolli, PhD, Evaluation Advisor (from 8/2006)
Margarita M. Posada, PhD, Evaluation Associate (from 10/2006)

Funded by: Lavelle Fund for the Blind

Project Period: 8/04 – 12/06

Updated: 6/2007

An Assessment of Lighthouse International Volunteer Resources

Overview

Lighthouse International relies on volunteers to support facilitating its numerous programs. One of the service programs that Lighthouse International is offering are reading services which are coordinated by the Volunteer Resource Department. The purpose of this study was to conduct an assessment of volunteer resources at Lighthouse International and to gain knowledge on how volunteer resources at Lighthouse International can be improved. For this purpose, two groups of people were interviewed for this study: Lighthouse Volunteers and Lighthouse Reading Service Clients (RSC).

The main objectives of interviewing volunteers were the following:

- To assess volunteer's work habits and motivations to volunteer.
- To assess satisfaction with volunteering.
- To obtain feedback on how the volunteer experience can be improved.

The main objectives of interviewing reading service clients (RSC) were the following:

- To assess RSC satisfaction with reading services and their perceived impact on functioning.
- To assess the reading client's view of their volunteer readers.
- To obtain feedback on how reading services can be improved.

Method

All Lighthouse International volunteers (1,035) were invited to participate in the study and a total of 323 volunteers participated by completing a survey. Moreover, all Lighthouse International RSC (a total of 176) were contacted by phone and asked to participate in the study. Ninety RSC participated in the survey by completing a phone survey.

Findings

Volunteers' Work Habits and Motivations:

The majority of participants volunteers in Manhattan onsite (n=283; 88%). Participants reported having volunteered at Lighthouse International for an average of about seven years, with times ranging between one month and 45 years. When asked about how much time participants spend volunteering at Lighthouse International in an average month, 60% (n=148) reported volunteering 10 hours or less of their time to the Lighthouse. Participants were also asked to indicate all areas in which they currently volunteer. Results show that approximately half of the volunteers who completed the survey provide reading services. The most prominent motivations for volunteering included: wanting to help people, seeing volunteering as the opportunity to make a difference, and wanting to work with people

Satisfaction with Volunteering:

When asked about their overall satisfaction with their volunteer experience, the vast majority of volunteers (n=289; 91%) reported being either very satisfied (n=218; 69%) or somewhat satisfied (n=71; 22%) with their volunteer experience at Lighthouse International. Moreover, 95% of volunteers either strongly (n=224; 73%) or somewhat (n=67; 22%) agreed with the statement: "The Lighthouse is an excellent place to volunteer." Plus, 95% of volunteers either strongly (n=239; 76%) or somewhat (n=61; 19%) agreed with the statement: "I would recommend the Lighthouse to a friend as a place to volunteer."

Feedback on Improvement of Volunteer Experience:

Volunteers were asked to describe what the Lighthouse could have done differently to make volunteering easier to accomplish, if it was difficult at times. Volunteers provided 53 suggestions on how services can be improved. The two most frequent suggestions were that communication between volunteers and staff

as well as departments should be improved (n=20) and that there should be more flexibility in scheduling (n=18).

RSC Satisfaction with Reading Services and Perceived Impact on Functioning:

When asked about their overall satisfaction with reading services, the vast majority of RSC (n=86; 96%) reported being either very satisfied (n=68; 76%) or somewhat satisfied (n=18; 20%) with reading services at Lighthouse International. Participants were also asked to indicate how much receiving reading services has helped them function better in their everyday life. Eighty-three percent (n=73) reported that receiving reading services has helped them function "very much better."

RSC view of Volunteer Readers:

The vast majority of readers (n=139; 91%) were rated as being very reliable. Participants indicated that 95% (n=146) of readers always treated them with respect. In terms of readers' reading skills, 90% (n=138) of readers were rated as their reading skills matching very well.

Feedback on Improvement of Reading Services:

The most prominent suggestions made were that more readers should be recruited (n=17), e.g. through advertising or providing stipends, in order to have more readers available and on call, and that readers should be screened in regards to their qualifications (n=6).

Investigators: Rowena Saunders, MSOL, Project Co-Director
Verena R. Cimarolli, PhD, Project Co-Director
Margarita M. Posada, PhD, Evaluation Associate
Suela Tinaj, Research interviewer, Intern
Esther Yekutieli, Research interviewer, Intern

Project Period: November 2006 - May 2007

Updated: 6/2007

Client Satisfaction Study

Overview

The purpose of this evaluation study is to conduct an assessment of clients' satisfaction with services to gather information on how to improve our intake and service process. Specifically, the evaluation has three major goals: [1] to assess client satisfaction and suggestions for improvement of our intake process, [2] to assess client satisfaction with the various services and suggestions on how the various services can be improved, and [3] to assess the perceived impact of various services on functioning and if services met clients' needs

Method

Adult clients (21 years and older) are being randomly selected from the pool of Lighthouse clients who received services and had their cases closed. These clients are being contacted by telephone and asked for their participation in the study. It is projected that about 100 clients will be interviewed for this study.

Status

Recruitment and interviewing of participants is in progress. To date, 90 telephone interviews with clients have been completed.

Investigators: Verena R. Cimarolli, PhD, Project Director
Margarita M. Posada, PhD, Evaluation Associate
Suela Tinaj, BA, Research interviewer, Intern
Esther Yekutieli, BA, Research interviewer, Intern
Amy Langdon, MA, Research interviewer, Intern

Project Period: March 2007 – August 2007

Updated: 6/2007

Creating an Evidence Base for Vision Rehabilitation

Overview

The 3-year project, "Creating an Evidence Base for Vision Rehabilitation", involves the implementation of the newly developed Electronic Vision Rehabilitation Record (EVRR®). EVRR is a multifaceted record designed to improve the quality of care and the efficiency with which care is provided to people who are visually impaired. EVRR provides the infrastructure of information technology software and connectivity designed to bridge the communication gap among the three, key, provider groups involved in vision rehabilitation – state agencies for those with visual impairments; private, primary-care physicians who refer patients for vision rehabilitation; and the private agencies that actually provide large portions of vision rehabilitation in most states.

This project is the beginning of an effort to use information technology, in the field of vision rehabilitation, to assure the use of evidence in the modification and refinement of best practice. EVRR will provide the detailed record of patient needs, treatments, outcomes, and functional improvements. The average functional improvement for all individuals who received services in a particular intervention will also be provided so an individual's improvement can be viewed in relation to the average improvement of other individuals in her/his group or other groups.

The lead agency on this project, Lighthouse International, built this software and the model upon which it is based. The project involves the installation and implementation of EVRR at Lighthouse International, The Iris Network in Maine, and the Central Association for the Blind and Visually Impaired (CABVI) in Utica, New York. EVRR will use functional ability scores that will clearly reflect the individual's progress over time and will also allow comparisons with other individuals.

The six objectives of the project include:

1. Training of all appropriate staff in the use of the best-practice protocols;
2. Installing the complete EVRR software at three nonprofit vision rehabilitation agencies and conducting the related staff training for their central-office staff and their network of field-based providers;
3. Information technology gap analyses to determine, build, and pilot the electronic interface between government provider agencies, private rehabilitation agencies, and primary care providers – all three of which jointly contribute to the vision rehabilitation of mutual patients;
4. Refinement of the EVRR software as indicated through feedback from the diverse pilot sites;
5. Validation of the system's logic and predictive ability; and
6. Construction and population of a national, benchmarking database with outcome-measurement data from pilot sites, thereby, developing the first vision rehabilitation evidence base for best-practice.

Status

Due to major technical difficulties encountered with the original design of the system, the system was entirely re-designed as a web based application. This re-design also included the streamlining of the various assessment instruments used to determine clients pre and post-service functional ability.

Staff at Lighthouse International and the two partner agencies was trained in the use of the newly designed system and its applications and has been "live" since April 2007. Hence, data collection on clients' pre and post service functioning is currently in progress.

Investigators: Cynthia Stuen, PhD, Principal Investigator
Verena Cimarolli, PhD, Co-Investigator

Funded by: Agency for Healthcare Research and Quality

Project Period: September 2004 – August 2007

Updated: 6/2007

Evaluation of a Psycho-Educational Support Group Intervention for Depressed Caregivers

Overview

Research has demonstrated that because of the chronic stress stemming from caring for an impaired relative (Dura, Stukenberg, & Kiecolt-Glaser, 1991), caregivers are at risk for mental health problems (e.g. depression and anxiety), poorer self-reported physical health and increased mortality (e.g. Schulz & Beach, 1999; Schulz, O'Brien, Bookwala, & Fleissner, 1995). In line with this literature, support providers of adults with vision impairment have been found to be at risk for mental health problems with about 16% reporting significant depressive symptomatology (Goodman & Shippy, 2002; Horowitz et al, 1998). Although caregivers of people with vision impairments are at risk for mental health problems, interventions to alleviate these problems are sparse. The vast majority of intervention studies have focused on caregivers of dementia patients.

The main purpose of this pilot intervention study was to implement and evaluate the effectiveness of a multi-component, psycho-educational telephone intervention (psycho-educational support group in combination with one individual session) in reducing depressive symptomatology in a sample of informal support providers of older adults with vision impairment. In addition, the study aimed to assess participants' satisfaction with the intervention and perceived impact on functioning as a caregiver.

Method

The telephone intervention consisted of eight weekly group sessions lasting 60 minutes and one individual session that was also conducted via telephone. The meetings were facilitated by a master's level counselor with experience facilitating family caregiver groups. Group meetings focused on both the practical and the emotional issues involved in caring for an older person with vision impairment, including problem-solving and thought modification techniques. The individual session was for any topics a participant wanted to discuss further or any relevant issues not covered during the group sessions.

To examine the impact of the intervention on depression a simple pretest- posttest design was utilized. Hence, the 20-item CES-D scale (Radloff, 1977) was administered pre and post intervention. In addition, as part of the post interview participants were asked to rate their satisfaction with the program on a scale from 1 to 4 (1 = not at all satisfied; 4 = very satisfied). Participants were also asked to rate how much they felt the support group program helped them to function better in their everyday life as a caregiver on a scale from 1 to 4 (1 = not at all; 4 = very much).

Findings

Ten caregivers with significant depressive symptoms (determined by a score of 16 or higher on the Center for Epidemiological Study Depression Scale; CES-D, Radloff, 1977) participated in the intervention program. Eight of the caregivers were female and two were male. Participants were between the ages of 38 and 80 ($M = 54.50$, $SD = 13.16$). Six participants were providing care to a parent, three were providing care to a spouse, and one participant was providing care to his/her mother-in-law.

Results showed a significant decrease in depressive symptomatology from pre- to post-program ($z = -2.14$; $p = .03$). At the time of the pre-interview, the mean CES-D score was 26.90 ($SD = 14.66$). After the intervention, the mean CES-D score decreased to 16.60 ($SD = 16.04$).

Data regarding satisfaction with the program and its impact on functioning was available from nine participants. Regarding the overall satisfaction with the program, seven of the participants reported being very satisfied and two reported being somewhat satisfied. Six of the participants indicated that the

program helped them "very much" in functioning better in their everyday lives as a caregiver, and three participants reported that the program helped "somewhat" in functioning better.

Results from this pilot study demonstrate that depression decreased among participants who took part in the psycho-educational support group. In addition, all participants reported high levels of overall satisfaction with the program and felt the program helped them function better in their everyday lives as caregivers. Hence, these results not only offer some evidence that psycho-educational support group interventions can be effective in reducing depression in caregivers, but also support the potential effectiveness of such groups as perceived by caregivers.

Presentation

Marty, M., Cimarolli, V. R., & Posada, M. M. (2007). *Evaluation of a Psycho-Educational Support Group Intervention for Depressed Caregivers*. Poster accepted for presentation at the Annual Conference of the 115th American Psychological Association, August 2007.

Investigators: Verena R. Cimarolli, PhD, Principal Investigator
Meghan Marty, MA, EdM, Group Facilitator
Margarita M. Posada, PhD, Evaluation Associate

Funded by: Mr. Edward Ferris

Project Period: November 2005 - February 2007

Updated: 6/2007

An Evaluation of Lighthouse International's Mental Health Services Center

Overview

The purpose of this evaluation study is to test the effectiveness of psychotherapeutic treatment delivered by Lighthouse International's Mental Health Clinic providers in reducing symptoms of depression and anxiety in adult clients/patients.

Method

Participants in the evaluation of the Mental Health Services Center (MHSC) will be adult Lighthouse clients or others who are referred to the MHSC for services. Following referral to the MHC, the client will complete intake and registration information with MHC staff who will enter these data into the Electronic Vision Rehabilitation Record (EVRR®) system. Following intake/registration, the staff psychiatrist will provide a clinical assessment of the client and determine if a diagnosis can be made according to DSM-IV criteria. Following this evaluation, the psychiatrist will determine if the MHSC can serve the client and develop a treatment plan based on this clinical assessment.

If the client is retained for treatment at the MHSC, a psychotherapist will conduct a psychosocial assessment, including administration of the Beck Depression and/or Anxiety scales dependent upon presenting diagnosis(es). These data will be entered in to the EVRR system by the psychotherapist. The psychotherapist will implement the treatment plan developed by the psychiatrist, and will provide 10 sessions of psychotherapy. The treatment plan and client progress will be reviewed after 30 days, regardless of the number of psychotherapy sessions received, in order to determine if further services are warranted, if the client can be discharged from the MHSC, or if the client should be referred elsewhere.

In order to evaluate the MHSC, the program evaluation staff will receive a weekly report on new referrals/cases enrolled in the MHC who meet evaluation inclusion criteria. Program evaluators will then download the client record from the EVRR system and transfer this information into a statistical database package. In addition, client charts will also be reviewed for other relevant information as needed for the evaluation, such as DSM-IV diagnosis of the psychiatrist and notes.

This evaluation will use a single-group pre-test/post-test noncontrol group design of clients in the MHC. Repeated Measures Analysis of Variance will be used to examine significant change in depression, anxiety and mental health measures following treatment at the MHSC.

Status

Evaluation data collection is ongoing.

Investigators: Mark Brennan, PhD, Co-Investigator
Verena Cimarolli, PhD, Co-Investigator

Project Period: June 2007- May 2009

Updated: 6/2007

An Evaluation of the Geriatric Home-based Low Vision Partnership Program

Overview

The Geriatric Home-based Low Vision Partnership Program (GHLVPP) will implement and evaluate an innovative, multi-disciplinary, home-based health care model on behalf of underserved, homebound older adults with vision impairment residing in Manhattan. This new model will utilize a Geriatric Nurse Practitioner (GNP) to conduct home health assessments that include visual functioning in order to identify service needs and implement home-based low vision care, necessary vision rehabilitation services, and other allied health care services. This program will enable Lighthouse International to reach homebound individuals who have been unable to access community based low vision and vision rehabilitation services. The main goal of the evaluation effort of this project is to test effectiveness of the program in improving functional disability, psycho-social adaptation and psychological well-being (life satisfaction and depression) of homebound older adults with vision impairment.

Method

It is estimated that about 740 homebound older adults will receive services under this program. As part of the visits to conduct the pre and post service health assessments, the GNP will invite clients to participate in the study. Hence, clients will be interviewed by the GNP before they receive services and after service completion. Both the pre and post interviews will assess psycho-social adaptation to vision loss and psychological well-being, specifically depression and life satisfaction. In addition, sociodemographic (e.g. age) information, vision-related information (e.g., eye diagnosis), service-related information (e.g., types of services received), and clients' levels of functional disability pre and post service will be obtained from the clients' electronic case records (EVRR®).

This evaluation will use a single-group pre-test/post-test noncontrol group design. Paired t-tests will be conducted to determine significant changes on the above indicators of quality of life from pre to post service delivery.

Status

The Geriatric Nurse Practitioner (GNP) is currently being trained to conduct home health assessments.

Investigators: Kathy Smock, GNP, Project Co-Director
Tara Easter, GNP, Project Co-Director
Verena Cimarolli, PhD, Evaluation Associate

Funded by: The Fan Fox and Leslie R. Samuels Foundation, Inc.

Project Period: February 2007- January 2009

Updated: 6/2007

An Evaluation of VRA-NET: Developing a Network of Trained Paraprofessionals to Address Personnel Shortages in Vision Rehabilitation

Overview

This project pilot tests a state-of-the art, accessible, online, and mentored training program with students and mentors in state and private agencies for the blind and those with visual impairments around the nation. Lighthouse International's VRA-Net development initiative is based on the successes of previous projects involving the development of both comprehensive curricula and an accessible online training program for Vision Rehabilitation Assistants. The overall goal is to address a severe shortage of trained vision rehabilitation personnel, while increasing the availability of specialized vision rehabilitation services to meet the burgeoning population of adults with visual impairment in the U.S. The major objectives of the evaluation effort of the project are [1] to assess the effectiveness of the training program in terms of students' knowledge and competencies as well as students' and mentors' perceived benefits and disadvantages [2] to gather information on how to refine the online training modules in terms of ease of use, user-friendliness, and clarity of content, and [3] to test the impact of VRAs on service provision.

Method

Students and mentors of the training program are being interviewed before, during (mid-point surveys), and after the completion of the training program to gather above outlined evaluation related information.

Status

Pre, mid, and post-interviews with Group I students and mentors and pre-interviews with Group II students and mentors have been completed.

Investigators: Karen Seidman, MPA, Principal Investigator
Carol Sussman-Skalka, LMSW, MBA, Project Director
Verena Cimarolli, PhD, Evaluation Associate

Funded by: National Institute on Disability and Rehabilitation Research

Project Period: October 2005- September 2008

Updated: 6/2007

Evaluation Research: Completed Research Projects (See Publication List for study papers)

1. **The Consumer Feedback Survey: Consumer Perceptions of Vision Rehabilitation Services.** Tana D'Allura, PhD, Principal Investigator; Susan Russello, MA, Project Coordinator; Verena Cimarolli, MA, Research Assistant. 1997 – 1998.
2. **Evaluation of an Education and Outreach Project for Reaching Older Minority Adults with Vision Impairments.** Susan Russello, MA, & Tana D'Allura, PhD, Project Evaluators. Funded by The New York Community Trust. 1995 – 1997.
3. **Evaluation of the Community Vision Education Program - Project InSights.** Susan Russello, MA, & Tana D'Allura, PhD, Project Evaluators. Funded by The InSights project is grateful to the following funders: The Altman Foundation, The Ascher Foundation, Con Edison, The John A. Hartford Foundation, The Hearst Foundation, Inc., The McGraw-Hill Foundation, The Alma Haas Milham Trust, and GreenPoint Bank. 1994 – 1997.
4. **An Evaluation of the Innovative Employment Training Initiative.** Janice O'Connor, Project Director; Verena R. Cimarolli, PhD, Evaluation Associate; Tana D'Allura, PhD, Evaluation Advisor. Funded by Commission for the Blind and Visually Handicapped (CBVH). 8/2002 – 9/2003.
5. **An Evaluation of The Lighthouse Youth Transition Pilot Program.** Robin Leonard, MA, & Tana D'Allura, PhD, Project Evaluators. 1994 – 1996.
6. **An Evaluation of the New York State Commission for the Blind and Visually Handicapped (CBVH) Integrated Rehabilitation Services for the Elderly.** Amy Horowitz, DSW/PhD; Robin Leonard, MA; Joann P. Reinhardt, PhD; Co-Investigators. Funded by the New York State Commission for the Blind and Visually Handicapped. 1995 – 1998.
7. **An Evaluation of the New York State Commission for the Blind and Visually Handicapped (CBVH) Rural Adaptive Skills Program for Older Adults.** Amy Horowitz, DSW/PhD; Robin Leonard, MA; Joann P. Reinhardt, PhD; Co-Investigators. Funded by The New York State Commission for the Blind and Visually Handicapped. 1995 – 1998.
8. **An Evaluation of the Talking Signs System.** Robin McInerney Leonard, MA, & Tana D'Allura, PhD, Investigators. 1994 – 1995.
9. **Field-Initiated Research to Evaluate Methods for the Identification and Treatment of Visually Impaired Nursing Home Residents.** Amy Horowitz, DSW/PhD, Principal Investigator; Cynthia Stuen, DSW, Co-Principal Investigator; Ruth Fangmeier, DSW, Co-Principal Investigator/Project Director; Elizabeth Balistreri, PhD, Research Associate. Funded by the National Institute for Disability and Rehabilitation Research. 1990 – 1994.
10. **A Follow-up of Rural Adaptive Skills Training Program Participants:** Robin Leonard, MA, Co-Investigator; Amy Horowitz, DSW/PhD, Co-Investigator; Joann P. Reinhardt, PhD, Co-Investigator.
11. **“Living Better with Vision Loss” - An Evaluation.** Judith Millman, Project Co-Director; Janet Weinstein, Project Co-Director; Linda Schulz, MSW, Project Coordinator; Verena R. Cimarolli,

PhD, Evaluation Associate; Tana D'Allura, PhD, Evaluation Advisor. Funded by Lavelle Fund for the Blind. 11/2002 – 10/2004.

12. **Low Vision Services: A Follow-up Study.** Tana D'Allura, PhD; Robin McInerney Leonard, MA, Amy Horowitz, DSW/PhD. 1992 – 1993.
13. **Macular Disease and the Failure to Use the Full Range of Vision Rehabilitation Services.** Tana D'Allura, PhD, Principal Investigator; Thalia MacMillan, MSW, Project Coordinator; Verena Cimarolli, PhD, Research Associate. Funded by The Macular Disease Foundation and Lighthouse International. 07/01/03 – 06/30/04.
14. **Vision Rehabilitation Services: A Post-Service Follow-Up.** Tana D'Allura, PhD, Principal Investigator; Verena Cimarolli, PhD, Co-Investigator; Robin Leonard, MA, Co-Investigator. Funded by Lighthouse International. 10/01/01 – 11/31/03.

Updated: 9/2005

Assessment of a New Letter Contrast Sensitivity Test

The Mars Letter Contrast Sensitivity Test (MLCST) is a simple portable set of contrast-calibrated letter charts for testing contrast sensitivity that was developed by The Mars Perceptrix Corporation. Its design is similar to, but improves upon that of the well-known Pelli-Robson chart. The Mars test follows many of the same design principles; it uses the identical Sloan letter forms used in that test, and presents these letters declining in contrast from across and down the chart. However, the Mars test uses much smaller contrast decrements (0.04 log unit) than the Pelli-Robson, which uses 0.15 log unit decrement between triplets of letters. Studies performed in the Lighthouse Vision Laboratory show that it yields results that are entirely comparable to those of the Pelli-Robson; in fact, using both analytic and Monte Carlo simulations and a model of visual performance identical to that used in the design of the Pelli-Robson the test yields scores almost identical to the Pelli-Robson, yet has 28% better accuracy (i.e. 28% smaller score standard deviations; Arditi, 2005).

The only substantial differences between the proximal stimuli of the two tests (at the retina) are the particular sequence of Sloan letters chosen, and the finer gradations of contrast. Because of the high degree of similarity between the stimuli of the MLCST with those of the Pelli-Robson chart and the equivalence of its scores, all of the normative data that applies to the P-R chart can be applied to the MLCST (Arditi, 2005). The reduced size and format of the test makes it far easier to illuminate evenly, and more convenient to administer than the P-R test. In addition to testing of the MLCST in a clinical setting (Arditi & Faye, 2004), reliability and validity have also been favorably assessed by independent studies at Ohio State University (Dougherty et al., 2005), Dalhousie University's Medical School (Haymes et al., 2006), and Moorfield's Eye Hospital in London (Thayaparan et al., in press).

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Updated: 6/2007

Computer Graphic Representations of Visual Space

Dr. Aries Arditi and former Lighthouse computer scientist Steven Azueta developed a computer graphic program for modeling geometric relationships among visual imagery, retinotopic maps describing visual capabilities and visual space. The program, which is called VP for Volume Perimetry, is an interactive tool which is used to elucidate the geometric aspects of visual perception of a hypothetical observer.

VP uses two types of windows on the computer screen. A WORLD window is used to represent the three-dimensional environment and visual space of the hypothetical observer, while a RETINA window illustrates retinal imagery and retinal function. These windows are yoked so that a change in the geometry of the observer's environment can be illustrated on the observer's retina. This yoking also allows the user to see the three-dimensional manifestations (in visual space) of two-dimensional retinal function.

VP incorporates a modeling system which allows the user to construct the observer's environment in a WORLD window. The hypothetical subject can be placed in an office environment which includes a desk, chair and lamp, for example. With use of the computer's mouse, the observer's gaze can then be interactively adjusted to look around the environment. As the observer's fixation is changing, the changing retinal imagery is displayed in the RETINA window.

The user can map areas of specific retinal function in the RETINA window. The areas can represent either dysfunction or acuity, depending on the user's task. These two-dimensional retinal characteristics can be retrojected into visual space; that is, their three-dimensional manifestations can be constructed in the hypothetical observer's environment. VP can also construct the three-dimensional intersections of the two-dimensional retinal characteristics. These reconstructions provide a valuable means for visualizing the impact of field defects on binocular performance of visual tasks. Development of this program was supported by a grant from the National Aeronautics and Space Administration.

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Updated: 6/2007

Driving and Mobility

It is frequently stated that 90% of the sensory information required for driving is “visual.” The fact that virtually all countries, including most states in the United States, require some form of vision test as a prerequisite for driver licensure is certainly consistent with this viewpoint. Currently, the most prevalent vision standard for an unrestricted driver's license is 20/40 visual acuity. Unfortunately, it remains the case that there is little empirical evidence that could be used to justify this standard. The traditional research paradigm, which consists of correlating traffic accident records and vision characteristics of licensed drivers, has failed to provide the empirical evidence that would justify any of the existing vision standards for driver licensure.

Former Lighthouse Research Investigator Dr. Kent Higgins attributes the failure of the traditional research paradigm to its almost exclusive reliance on real-world traffic accidents as a measure of driver performance. Nearly all of the previous studies that have correlated visual acuity and accidents in samples of licensed drivers have found that less than 1% of the variance in the accident database can be explained by acuity variations. Traffic accidents are statistically rare events and, consequently, do not provide for a fine-grained discrimination of differences in driving performance. The rarity of traffic accidents was recently underscored by estimates that “a U. S. driver can expect to travel for 102 years before experiencing a disabling-injury accident, and one is not likely to fall victim to a fatal accident for 3,738 years” (Owens, Helmers, & Sivak, 1993, p. 363). Reviews of the earlier research on vision and driving appeared in two chapters (Higgins, 1996a; Higgins & Bailey, 2000).

Dr. Higgins proposed new methodologies for determining the minimal visual requirements (e.g., visual acuity, visual fields) for the different components of the overall driving task such as steering, reading signs, and recognizing road hazards. In one approach, normally sighted subjects with artificially degraded vision performed driving tasks on a special closed-road test track which allowed the measurement of different aspects of their driving performance. During the summer of 1995, Dr. Higgins was awarded a Visiting Research Fellowship by the School of Optometry of the Queensland University of Technology (QUT) in Brisbane, Australia. This fellowship allowed him to conduct a 2-month collaborative study with Dr. Joanne Wood of QUT in which this approach was used to determine the effect of degraded visual acuity on the driving performance of otherwise normally-sighted subjects.

Using this approach, each subject drove a full-size vehicle on a closed-road test track that was specially designed to measure different components of overall driving performance. Twenty-four subjects were tested on the series of driving tasks (e.g., sign recognition, steering accuracy, maneuvering, road hazard recognition and avoidance, etc.) while their visual acuity was degraded to each of five levels. One level was produced by normal viewing (20/20); three by optical blur (20/40, 20/100, 20/200); and the fifth was produced by special filters which simulated mild cataracts (this method produced only a minor loss in acuity). This latter condition was termed 20/40g to indicate that the level of acuity was the same as that of the 20/40 optical blur condition. In addition, subjects were administered a battery of vision tests (including measurements of glare and contrast sensitivity) under the same visually degraded conditions.

One objective of this project was to determine whether the different components of closed-track driving performance were selectively or uniformly degraded by reductions in visual acuity. A second objective of this research was to determine, for those tasks affected by acuity reduction, the precise form of the relationship between visual acuity degradation and driving performance. A preliminary report on this project was published in *Vision Science and Its Applications* (Higgins, Wood, & Tait, 1996a). Additional findings describing the quantitative relationship between acuity loss and driving performance were presented at the Association for Research in Vision and Ophthalmology and summarized in *Investigative Ophthalmology & Visual Science* (Higgins, Wood, & Tait, 1996b).

Overall, the results indicated that acuity degradation produced selective losses in some aspects of driving performance (e.g., decreased ability to recognize high contrast signs and to avoid large, low contrast road hazards; slower driving times). However, other aspects of driving performance (perception

of lateral clearance, maneuvering or “slaloming” through a series of traffic cones) were largely unaffected.

Further, when acuity degradation was produced solely by optical blur, the driving tasks that were affected evidenced a linear relationship between acuity degradation and performance. For example, in the case of the sign recognition and road hazard avoidance measures, 50% of the variance in performance was explained by variations in visual acuity. This stands in marked contrast to previous research indicating that variations in acuity account for less than 1% of the variance in accident statistics and serves to underscore the important role of vision in driving. These results were described in the journal *Human Factors* (Higgins, Wood, & Tait, 1998). When, however, the results of the 20/40g condition (cataract simulation) were included in the analysis, the limitations of high contrast visual acuity as a predictor of driving performance became evident. Although acuity in the 20/40g condition was the same as that in the 20/40 condition produced by optical blur, driving performance was markedly degraded in the 20/40g condition. Overall driving performance in the 20/40g condition was as poor as that for individuals driving with an amount of optical blur sufficient to reduce acuity to 20/200. These results appeared in the proceedings of the International Vision in Vehicles VII conference (Wood & Higgins, 1999).

A third objective was to determine which measure(s) of visual function, alone or in combination, was most predictive of changes in driving performance. As already noted, visual acuity was an excellent predictor when the sole source of the acuity reduction was optical blur, accounting for as much as 50% of the variance in some driving tasks. When the effect of cataract-like changes was included in such analyses, the percentage of variance explained by visual acuity alone dropped to a maximum of about 15-18%. When, however, the results of a visual acuity test (a test that is more sensitive to blur than glare) were supplemented by results of vision tests that were more sensitive to glare than blur, the percentage of variance explained by the combined vision tests was increased to about 45-50%. Drs. Higgins and Wood found that there are a number of tests that are particularly sensitive to glare while being relatively independent of optical blur and could, therefore, be used to supplement acuity testing. These results were described in *Investigative Ophthalmology & Visual Science* (1997). More recently, Drs. Higgins and Wood have been working on a multiple regression model to describe the efficacy of different combinations of vision tests for predicting changes in driving performance produced by glare as well as optical blur. A preliminary version of this model appeared in *Vision Science and Its Applications* (Higgins & Wood, 1998). The complete model was recently published in a feature issue of the journal *Optometry and Vision Science* (Higgins & Wood, 2005) dedicated to the subject of vision and driving. Also, Drs. Higgins and Wood have shown, using an approach based on signal detection theory, that traditional vision tests are indeed important for predicting certain aspects of closed road driving performance (Higgins & Wood, in press).

The second method that Dr. Higgins proposed for determining the minimal visual requirements for driving involved the development of a driving simulator with high-resolution visual graphics sufficient to simulate the resolution of the human visual system. The intent was to use the simulator to study the visual requirements for driving using paradigms similar to those already used by Dr. Gordon Legge (1991), who studied the visual requirements for reading. Using the simulator, each individual's vision could be progressively degraded to determine the level at which different components of driver performance began to deteriorate, just as in the case of the closed track approach described previously. In addition, the simulator would permit the testing and training of driving performance in an increasing number of individuals with visual loss due to age and/or ocular disorder who may have lost their license for failure to meet existing vision standards (Horowitz & Higgins, 2000; Higgins, 2003).

Dr. Higgins also collaborated on a multiyear research project that employed both on-road and simulator tests of driving performance in normally sighted and visually-impaired individuals. The Department of Veterans Affairs provided funds for the purchase of a driving simulator and, to conduct the research, the National Eye Institute awarded a five-year Bioengineering Research Partnerships Grant. The Principal Investigator on this multidisciplinary grant is Dr. Eli Peli of the Schepens Eye Research Institute, Harvard Medical School. The objectives of this proposal are to a) develop optical and electronic devices aimed at

restoring the interplay of central (high-resolution) and peripheral (wide-field) vision for persons with different types and amounts of vision loss and b) test the efficacy of the proposed devices through laboratory (virtual-world) and field (real-world) tests of pedestrian and driving mobility. Dr. Higgins' role in this research was to assist in the design of the on-road testing protocols and oversee the design and conduct of the driving simulator evaluation of normally sighted subjects and of persons with different types and amounts of vision loss. Two manuscripts have been accepted for publication; they describe important methodological considerations underlying the design of the on-road (Sodhi et al., in press) and simulator (Peli et al., in press) driving evaluations. This research will provide important evidence concerning the relationship between vision loss and driving performance and, in addition, the efficacy of the proposed low vision devices for improving driving related mobility.

On-road testing of patients with vision loss commenced in late 2002 and is being conducted in The Netherlands and in Alabama. The simulator was delivered and installed in March of 2003. A initial series of driving scenarios was created and preliminary testing with the simulator began in June of 2003. Additional scenarios have been developed and refined over that past year, and the first major study is scheduled to begin in the Fall of 2004 and conclude by the end of 2005.

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Investigations of Color Vision in Low Vision

Many eye conditions that result in low vision also result in color vision deficiencies. While the most common congenital color defects produce little in the way of performance limitations in and of themselves, the additional loss of sensory information that arises from a color defect for an already compromised visual system could have greater consequences. Conversely, the residual color discrimination that some low vision observers show could provide a viable avenue along which information could be presented to enhance performance on certain tasks dependent upon visual input. This line of reasoning suggested that a useful approach would be: a) to evaluate what residual color discrimination low vision observers display and b) to evaluate what influence the introduction of chromatic contrast might have on specific tasks for normal and low vision observers.

In the evaluation of residual color discrimination, the answers to two complementary questions are sought: 1) What color contrasts does an individual discriminate most poorly, and 2) what color contrasts does an individual discriminate best. To assess the color discrimination of low vision observers, former Lighthouse research investigator Dr. Kenneth Knoblauch and his colleagues at the Institute, modified standard color tests by increasing the size of test elements to make them easier to see by low vision observers. In addition, they developed specialized computer-controlled testing equipment for measuring the color discrimination of low vision observers for stimuli of a variety of sizes. Results to date from ongoing studies using these approaches indicate that many low vision observers do show improvements in color discrimination when tested with larger objects. In addition, results indicate that standard approaches to testing color vision would not have been adequate to indicate the degree of color vision actually present in low vision observers. Future studies will concentrate on modeling the color vision losses experienced by individuals with low vision to provide tools for predicting what color contrasts will be most visible to such individuals. More recently, Drs. Knoblauch and Arditi have produced practical guidelines making color choices that are likely to have good effective contrast for those with low vision (Knoblauch and Arditi, 1993; Arditi and Knoblauch, 1994).

With knowledge of the color contrasts that an individual discriminates best, the degree to which color cues influence performance on specific tasks can be evaluated. An initial study performed by Dr. Knoblauch and his colleagues concentrated on the effect of color contrast on reading performance in normal and low vision observers. Under most practical situations, color contrast was found not to enhance reading performance and in some low vision observers, color, as opposed to luminance or brightness, contrast interfered with reading performance. The reasons why some low vision observers perform more poorly with reading material defined by color contrast are not well understood and will be the subject of future investigations. Other tasks under study for which color might provide a useful cue are visual search and object recognition. Some of these studies were funded by a grant from the National Eye Institute.

A major goal of our color contrast work is the dissemination of simple, comprehensible guidelines for choosing colors that work effectively for all, including those with the acquired color deficiencies that almost always accompany low vision, and those with congenital color deficiencies. We have developed a brochure (Arditi, 1999/2002), that is now in its third edition, that we hope accomplishes this goal. The most recent version of these guidelines is accessible on the internet (<http://www.lighthouse.org/colorcontrast.htm>).

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Methods of Text Display for Low Vision Reading

People with severe low vision typically can read only with large letter sizes achievable on computer screens, or on closed-circuit television video magnifier reading aids (CCTVs). Even with magnified text, reading rates are usually substantially slower than those of normally sighted readers. A computer text presentation mode that has shown promise in enhancing low vision reading performance is rapid serial visual presentation (RSVP). In RSVP, words are presented sequentially, one at a time, on a computer monitor, at a uniform rate of presentation. RSVP makes more modest demands on eye movements than normal reading, and this is why it seems so promising for low vision. Unfortunately, RSVP studies with low vision have not borne out this promise, in that low vision readers reap only modest benefits (if any), whereas ironically, normally sighted readers gain significant benefits.

Drs. Aries Arditi, Bruce Rosenthal, Kent Higgins, and Lei Liu, with the assistance of Katherine Lee have evaluated a method of text display for low vision reading developed by Dr. Arditi, called elicited sequential text presentation (ESP). ESP is a variant of RSVP in which the reader elicits presentation of single words via a button press, allowing the user to control presentation rate on a word-by-word basis. Putting the presentation of each word literally into the hands of the reader allows her or him to allocate more or less time to each individual word, depending on how difficult that word is to read.

Initially, they compared maximum reading speeds using the three methods (RSVP, ESP, and CCTV) in 15 subjects with low vision who were customary CCTV users but previously unexposed to RSVP and ESP. Text was fifth grade level and presented using the same font (TrueType Arial) in all conditions at the subject's preferred font size or magnification. Reading speed for RSVP was determined by increasing or decreasing speed in coarse (20%) or fine (10%) steps until errors were made, while for ESP and CCTV, subjects were instructed simply to read as fast as possible without error. While ESP and CCTV yielded essentially the same speeds (78-79 wpm, geometric averages), reading was on average 31-32% faster with them than with RSVP. Since all subjects were highly practiced on CCTV reading, these results probably underestimate the true benefit of ESP.

Subsequently, they tested the role of two other manipulations on ESP reading: presence or absence of a fixation cross, and justification mode within the text field (i.e. centered or left justified). Both of these manipulations were designed to make ESP reading even faster; however, neither had any measurable impact.

Another way to increase the efficiency of low vision reading is by optimizing usage of the intact retinal area. In the traditional RSVP method, the duration of each display cycle is determined by the length of the longest word in the text, which in turn is determined by the size of each subject's intact retinal area. Thus, when a small word is displayed alone in a display cycle, both retinal resources and time are wasted. Dr. Liu has devised a computer program that analyzes text and divides it into chunks of equal size. Each chunk is displayed in a single RSVP cycle, and each chunk may contain a single long word or two or three short words. A study is being conducted to determine whether low vision readers can benefit from this display method. Preliminary data was presented at Vision 2002, the 7th International Conference on Low Vision (Liu, 2002).

A method of presentation that combines the virtues of ESP and chunk RSVP has also been incorporated into a prototype web browser (Arditi, 2003; also see abstract entitled "Studies in Web Accessibility").

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Predicting Vision Problems in Everyday Activities from Vision Tests

Several lines of evidence indicate that traditional vision tests (e.g., visual acuity) do not adequately predict elderly individuals' complaints about their vision when they are engaged in common everyday activities. Reading letters on the doctor's eye chart is not, for example, a good predictor of one's ability to read everyday printed material (e.g., newspapers, prescription labels). In other words, there appears to be a discrepancy between how well an elderly individual sees in the doctor's office and how well that same individual sees when going about their everyday activities (i.e., outside of the doctor's office).

Former Lighthouse researcher, Dr. Kent Higgins, with the help of graduate students Rita Conway Ximenez (New York University) and Dan Patanella (Fordham University), undertook research designed to investigate this apparent failure of conventional vision tests to predict visual complaints that elderly individuals have in their everyday visual activities. The basic premise of the research is that the failure of conventional vision tests to predict everyday visual problems is due to a discrepancy between light levels typically used in the clinic and those typically encountered in the outside world. Specifically, most conventional tests used by the eye doctor are "standardized" in the sense that they use daytime levels designed to reveal the "best vision" of which an individual is capable. It is well-known that human visual capabilities decline selectively and rapidly as light level decreases from the daytime levels used in the doctor's office to those likely to be encountered in the home and while driving or riding in a car at twilight or nighttime. During the course of a normal day, the outdoor light level can vary by factors as great as 10^8 or 10^{10} . Thus the overall objective of this research is to evaluate the contribution of average light level to the failure of conventional vision tests to predict visual problems experienced by the elderly in their everyday activities.

A pilot study began in the fall of 1995. In this pilot study, a battery of vision tests (visual acuity, visual fields, letter contrast sensitivity, and a steady-state glare sensitivity test) was administered to each of 17 elderly volunteers at two different average light levels. The first was similar to conventional clinical testing light levels; the second was 2 log units (100 times) lower and was similar to the level of outdoor illumination on a clear day about 30-40 minutes after sunset. This lower level also approximated the level of illumination when driving at night by automotive headlights. Preliminary results of the vision tests revealed significant losses in vision from the higher to the lower light level. Further, whereas there was little evidence of any visual loss due to glare when this test was administered at the higher light level, there were significant losses due to glare when the same test was administered at the lower light level.

Volunteers for this project were also administered the Activities of Daily Vision Scale (ADVS) questionnaire to assess subjective complaints about their everyday vision. This questionnaire was previously validated by other investigators for use with a specific population of elderly individuals (i.e., individuals scheduled for cataract surgery). Briefly, the questionnaire identifies 20 visual activities which are categorized into five subscales dealing with distance vision, near vision, glare disability, night driving and daytime driving. The objective was to determine the general utility of this questionnaire as an instrument for assessing self-reported visual problems; if the utility of the questionnaire was confirmed, then the results could be related to the results of the vision tests obtained at the different light levels. In this phase of the pilot research, over 300 young and elderly volunteers completed the questionnaire and preliminary statistical analyses confirmed the general utility of this instrument for assessing self-reported vision problems in the elderly.

Unfortunately, the number of elderly individuals that completed both the visual activities questionnaire and the vision tests at the two light levels was too small (N=17) to permit a definitive assessment of the relationship between the two measures. Nonetheless, the preliminary results were encouraging and were used in support of a grant application to the Department of Veterans Affairs. This application, which

represented a collaborative effort between Dr. Higgins of Lighthouse International and Dr. Janis White of the Department of Veterans Affairs (East Orange, NJ), was funded for three years beginning in April of 1997.

This project incorporated four changes from the original pilot study. First, since there were two test sites, Lighthouse International and the VA Medical Center, some of the testing systems, such as that for testing disability glare, had to be duplicated so that equivalent test batteries were available at both sites. Second, the original ADVS questionnaire was replaced by a new and improved instrument, the National Eye Institute Visual Function Questionnaire. Third, the Smith-Kettlewell Institute Low Luminance (SKILL) Card was added to the test battery to provide an assessment of low-contrast, low-luminance visual acuity. Fourth, the commercially available glare test used in the pilot study was replaced by a more sensitive, specially designed system developed at Lighthouse International. The latter was a computerized test that provided estimates of losses in vision due not only to continuous glare sources but also to transient, brief-duration glare sources like the headlights of an oncoming vehicle at night.

Over the three-year period, testing was completed on 97 elderly volunteers and 20 young control subjects. Analyses of the data suggested a number of important trends. First, elderly individuals, when compared to younger individuals, appeared to experience greater losses in vision, when measured with conventional tests, as light level was reduced. Importantly, however, there were also marked variations from one elderly individual to the next. While some elderly individuals showed marked losses in vision as light levels were reduced, some showed relatively small losses that were generally more characteristic of much younger individuals. A critical question was whether variations in vision loss within the elderly sample provided important clues concerning the difficulties that some, but not all, elderly individuals have when performing their everyday visual tasks. A preliminary report of the effects of reduced light level on conventional vision tests was presented at the International Low Vision Conference, Vision '99 and at the Vision Science and Its Applications 2000 conference.

Second, results obtained with the specially constructed glare testing system also revealed two important trends. First, when exposed to continuous glare, older individuals tended to experience somewhat greater losses in visibility than did younger individuals. This may, in part, explain why older individuals complain about visibility problems when driving at night. It seems likely, however, that there may be another important reason underlying such complaints. More specifically, our results indicated that when the glare source was transient (e.g., when it simulated the headlights of an approaching vehicle), the visibility losses in the elderly were more complex than was previously thought. Specifically, previous research suggested that the visibility losses associated with the initial onset of a glare source were smaller in elderly when compared to younger individuals. Results of our research, in contrast, indicated that the visibility loss in the elderly was as great, and possibly greater, than that in the younger subjects. Moreover, elderly individuals evidenced a markedly slower time course in the recovery of sensitivity following the initial onset of a glare source when compared to younger individuals. In other words, the headlights of an approaching vehicle would be expected to produce a more prolonged period of vision loss in an older individual than in a younger individual. At present, it is unclear whether older individuals evidence a delay in the recovery of sensitivity following the offset of a brief duration glare source. Preliminary reports summarizing our findings obtained with the glare testing system have been presented at a number of scientific conferences, including the Association for Research in Vision and Ophthalmology (1998, 2003, 2004), the Fourth International Lighting Research Symposium: Vision at Low Light Levels (1999), Vision Science and Its Applications (1999), Vision '99 (1999), the Conference on Aging Retina and Early Degeneration (2001), the American Academy of Optometry (2001, 2004), the International Conference on Low Vision (2002), the international Eye and The Auto conference (2003), and the National Highway Safety Administration's Workshop on Headlamp Safety Metrics: Balancing Visibility and Glare (2004).

Dr. Higgins and his collaborators also concluded a three-year study of transient glare adaptation and recovery. This study is funded by a three-year grant from the Department of Veterans Affairs. For this research, Dr. Higgins and his collaborators constructed a new optical system, one that permits a more precise determination of possible differences in the time course of transient glare adaptation in young and elderly individuals. Such differences, if they are large, have important implications for the design of environmental lighting systems. For example, existing American National Standards Institutes (ANSI) guidelines used by illuminating engineers in, for example, in the design of tunnel lighting systems, incorporate a transient adaptation factor that is intended to make allowance for visibility losses that accompany large, abrupt changes in light level. Unfortunately, virtually all of the test subjects used to derive this factor were under the age of 40 years. In effect, the guidelines are based on the assumption the magnitude of vision loss due to transient change in light level is the same in young and elderly individuals. In contrast, our research suggests that a transient adaptation factor based on younger individuals may underestimate the visibility loss experienced by older individuals. It would also suggest that elderly individuals' complaints about oncoming headlights when driving at night are justified.

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Spatial Vision Deficits and Retinal Neural Loss

Retinal neural cells sample images of the external world, convert light energy into neural signals, and transmit neural signals to the brain. The integrity of the retinal neural cells is crucial to normal spatial vision. Many retinal diseases, such as age related macular degeneration, diabetic retinopathy and retinitis pigmentosa, are known to cause degeneration of retinal neural cells. Former Vision Research Investigator Dr. Lei Liu and Senior Fellow in Vision Science Aries Arditi started a series of psychophysical experiments which aim to reveal the relationship between the integrity of retinal neural cells and spatial vision performance (visual acuity, contrast sensitivity and texture discrimination).

In these studies, a computer graphics technique is used to generate degraded visual stimuli that mimic images sampled by retinas that suffer from neural loss. These stimuli are then used to test both normal subjects and patients with known retinal diseases. The performance of the normal subjects serves as the reference baseline for assessing tolerance to image degradation. It is expected that the patients with retinal diseases will show poorer tolerance to image degradation because the defects of their retinas will compound the defects of the image. By comparing the performance of normal subjects with that of patients, the magnitude of a patient's retinal neural loss may be estimated.

The first experiment of this project measured normal subjects' tolerance to sample noise, luminance noise and positional uncertainty in texture discrimination tasks. Specially designed texture pairs were used in this study. Subjects with normal vision could easily discriminate intact texture pairs. When more pixels of the texture patches were blanked out or more luminance noise was added to the texture patches, the discrimination became more difficult; thus, a threshold tolerance to missing pixels or luminance noise could be measured. Drs. Liu and Arditi found that normal subjects needed only 40% of the pixels in the texture patch to achieve 82% correct texture discrimination. This result indicated that normal subjects could tolerate a large amount of luminance noise. Discrimination performance for normal subjects remained high as long as the contrast polarities of the majority of the pixels remained unaltered. In contrast, they found that if the remaining pixels in a sampled texture patch were allowed to move into vacancies made by their deleted neighbors (positional uncertainty), then normal subjects' texture discrimination performance was greatly impaired. Under this condition, normal subjects required about 80% of pixels to reach 82% correct texture discrimination. These findings appeared in the proceedings of an Optical Society of America topical meeting (Liu, 1999b) and in abstract form (Liu & Arditi, 1998; Liu, 1999a).

The degraded texture discrimination test (DTDT) has been applied to two retinal diseases, AMD and diabetic retinopathy to evaluate its value as a tool to detect and quantify neural loss associated with early retinal diseases. With the support of the Juvenile Diabetes Research Foundation and the Helen Hoffritz Charitable Trust, and in collaboration with Dr. Janis White of the VA hospital in East Orange, NJ, Dr. Liu conducted DTDT on young and old normal controls, diabetic patients without retinopathy, diabetic patients with early retinopathy, and patients with early AMD. These experiments have demonstrated that DTDT can differentiate patients with and without retinal diseases. Specifically, in DTDT, diabetic patients with early retinopathy showed inferior performance to diabetic patients without retinopathy, and patients with early AMD showed inferior performance to age-matched normal controls. The fact that all normal controls and patients had normal visual acuity indicates that DTDT can provide information that cannot be provided by conventional vision test. Therefore, DTDT can be a useful tool in detecting and quantifying early retinal diseases. These findings were presented in several conferences.

A second experiment compared normal subjects' and patients' performances in detecting degraded visual stimuli. In this study, the minimum contrast levels required to detect intact and degraded visual stimuli (the contrast thresholds) were measured. Based on theoretical analyses, Dr. Liu predicted that contrast sensitivity (the reciprocal of contrast detection threshold) should decrease linearly with increasing proportion of stimulus pixel deletion. However, if one could imagine a line graph depicting this

relationship, the line would be predicted to have a smaller slope if a fixed proportion of stimulus energy were lost when the textures were imaged on a diseased retina. Dr. Liu measured contrast detection thresholds at several levels of stimulus pixel deletions. Indeed, he observed the predicted linear reduction of contrast sensitivity with increasing proportion of pixel deletion. In addition, when the contrast sensitivity data from the eyes of a patient with advanced retinitis pigmentosa was plotted on a line graph, the slopes of the lines were smaller than the lines depicting the data from normal subjects. The slope differences suggested a 25% and a 35% loss of retinal samples in the 20/20 eye and the 20/30 eye of the patient, respectively. These findings appeared in abstract form (Liu, 1999a).

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Studies in Reading and Text Legibility

The Arlene R. Gordon Research Institute of Lighthouse International has carried out a set of studies examining the role of several factors in reading and text legibility.

Senior Fellow in Vision Science, Dr. Aries Arditi, former Lighthouse researcher, Dr. Kenneth Knoblauch, and former Lighthouse research assistant, Ilana Grunwald began by comparing reading performance (speed) with fixed and variable (proportional) character widths. What they found was that for small characters approaching the acuity limit in central vision, and for somewhat larger characters in peripheral vision, fixed spacing is clearly easier to read. On the other hand, for medium and large characters, where acuity is not the limiting factor, they found that variable character widths (such as those used in proportionally spaced text fonts) are easier to read than variable spacing. Further research has shown that it is the greater horizontal compression, and consequently the reduced eye-movement requirements of variable pitch, that are responsible for its superiority at medium and large character sizes (Knoblauch, Arditi, & Szlyk, 1991).

Reading performance was also measured with text that was defined by differing amounts of color and luminance contrast, in order to determine the influence of color information on reading. Results indicated that when luminance contrast was well above threshold, varying the chromatic (color) contrast had little effect on reading performance. However, when luminance contrast was very low, near – threshold, chromatic contrast sustained reading rates of nearly 300 words per minute, almost as high as those found with high luminance contrasts. On the other hand, for some low vision observers, text defined by color contrast interfered with reading performance. Further investigations are planned to determine why the reading of some low vision observers is adversely affected by color contrast that is not accompanied by sufficient luminance contrast.

Institute studies have also examined the role of other font parameters in legibility, in addition to the studies of inter-letter spacing, font proportionality and color described above. Letter stroke width (Arditi, Cagenello & Jacobs, 1995a), letter aspect ratio (Arditi, Cagenello & Jacobs, 1995b), outline vs. filled letterforms (Arditi, Liu & Lynn, 1997a, 1997b), the presence or absence of letter serifs (Arditi & Cho, 2000a; Arditi & Cho, 2005) and letter case (Arditi & Cho, 2000b; Arditi and Cho, in press) were all found to affect legibility to some degree. The results from the earlier of these studies are summarized in a review article (Arditi, 1996).

Since many different typographic parameters may affect legibility, the Institute also undertook a two-year collaboration, funded by the National Institute on Aging, with Mars Perceptrix Inc., to develop adjustable font software for users with low vision. The software allows adjustment of many font parameters in real-time, so that the user can see the impact of parameter adjustments on legibility as it happens. The prototype software works, but evaluation using participants with low vision suggested that font legibility could not be significantly improved above and beyond that provided by highly evolved and readily available fonts such as TrueType Arial and TrueType Times New Roman (Arditi, 2004).

A second thread of the Institute's reading and text legibility research program to elucidate the factors common to both reading and acuity. Despite the elemental relationship of letters to written words, letter acuity is well known to be a poor predictor of several indices of reading performance. In one paper, Arditi (1994) provided a general discussion of differences between reading and letter acuity stimuli and cognitive demands in the two acuity tasks that may account for the poor power of single letter acuity to predict reading performance. He also outlined a sensor model of text processing that can account for text and optotype crowding phenomena (crowding refers to the observation that closely-spaced contours tend to interfere with letter recognition). Two subsequent reports (Arditi & Cagenello, 1993; Arditi, Cagenello, & Jacobs, 1995) were devoted to examining some of the implications and merits of the proposed sensor model.

In addition, Drs. Liu and Arditi have completed a study of letter confusion under conditions of close letter spacing. This study was intended to reveal the neural mechanisms responsible for the crowding effect. By comparing the letter confusions observed under wide and narrow inter-letter spacing, they were able to determine that a large portion of the deterioration of legibility under narrow spacing condition could be attributed to unique letter confusions which did not occur when inter-letter spacing was wider. The cause of these unique letter confusions was lateral interference (inhibition) from neighboring letters. A preliminary report of these findings appeared in abstract form (Liu & Arditi, 1996) and a full report was published in the journal *Optometry and Vision Science* (Liu & Arditi, 2001).

Drs. Liu and Arditi have also completed a study that concerned the number of letters read from a closely packed letter string. They found that human observers not only made mistakes in identifying closely packed small letters, but they also misjudged the number of letters in the string. Using interlaced four-letter and five-letter strings, Drs. Arditi and Liu demonstrated that human observers tended to mistake more five-letter strings for four-letter strings when the inter-letter spacing was narrowed. Typically, the observers would either omit one of the three letters in the middle of the five-letter string, or combine two neighboring letters into a new letter. The researchers used a computer simulation to demonstrate that optical blur of the eye might have played an important role in this new aspect of the "crowding effect". A preliminary report of these findings appeared in abstract form (Liu & Arditi, 1997a) and a full report was published in the journal *Vision Research* (Liu & Arditi, 2000).

In two recent studies, Dr. Liu further explored the contour interactions exhibited in a now classic experiment paradigm. In experiments that follow this paradigm, a visual acuity target, usually a Landolt C, is presented with four flanking bars. Visual acuity is measured as a function of the separation between the Landolt C and the flanking bars. The inhibitory effect of the flanking bars is demonstrated as reductions of visual acuity at certain separations. Drs. Liu and Arditi studied the effects of contrast polarity by measuring contour interaction between a black C with four white bars, and between a white C with four black bars. They found that features of different contrast polarities were still engaged in inhibitory interaction, although the interaction appeared to be weaker than that observed with features of the same contrast polarity. Therefore, a simple linear receptive field model was not applicable to suprathreshold contour interaction. A preliminary report of these findings appeared in abstract form (Liu & Arditi, 1997b).

Dr. Liu and research assistant Katherine Lee also investigated the contour interactions between features of different orientations. They measured contour interaction curves for pairs of flanking bars that were either parallel or orthogonal to the gap of the Landolt C. They found that flanking bars that were parallel exerted the strongest inhibition at the narrowest separation between the Landolt C and the bars. At separations narrower than two gap widths, the inhibition caused by a pair of parallel bars was stronger than that observed when all four bars were present. The orthogonal bars only exerted moderate inhibition at wider separations. It appeared that when four flanking bars were present, the orthogonal bars alleviated the inhibitory effect of the parallel bars at narrower separations and enhanced it at wider separations. The preliminary results of this study appeared in abstract form (Liu & Lee, 1999). A full report was published in the journal *Vision Research* (Liu, 2001b). In a theoretical study of the Landolt C/flanking bar stimulus configuration, Dr. Liu analyzed spatial frequency components at various ring/bar separations, and concluded that the foveal crowding effect could not be accounted for by the physical characteristics of the stimulus. These findings appeared in abstract form (Liu, 2001a) and a full report appeared in the journal *Vision Research* (Liu, 2001c).

In a third thread of this research, Drs. Kent Higgins, Aries Arditi, and former Lighthouse researcher, Dr. Kenneth Knoblauch, completed an initial investigation which is part of a larger program aimed at understanding why reading performance is poorer in the peripheral retina than in the central retina. The initial study was prompted by the work of other researchers which suggested that the peripheral retina was, in comparison to the central retina, deficient with respect to spatial phase discrimination. Such a

deficit could affect reading performance by interfering with the discriminability of letters having the same spatial frequency content but different spatial phase spectra (i.e., mirror image letters like “b” vs. “d”). However, they found that when letters were size-scaled to compensate for differences in contrast sensitivity, the relationship between detection and identification performance was the same in both the central and peripheral retinas (Higgins, Arditi, & Knoblauch, 1992, 1996a, 1996b). These results thus argue against the hypothesis that the poorer reading performance outside the fovea is, somehow, due to reduced letter discriminability that might occur secondarily to a loss of peripheral-retina phase sensitivity. These results were summarized in paper that appeared in *Vision Research* (1996a). This paper was also selected for inclusion in *Human Symmetry Perception and Its Computational Analysis* (1996b), which was edited by Christopher Tyler of the Smith-Kettlewell Institute.

The next phase of this project will involve an evaluation of the effect of contour interaction on the mechanisms that mediate detection and discrimination of mirror-image letters in the central and peripheral retina. Several studies have suggested that the magnitude of the crowding effect may be greater in peripheral vision than in central vision. If this is true, it might imply that the optimal letter spacing for legibility is different for central vision as opposed to peripheral vision, a finding that would have important implications for the type of magnification device prescribed for low vision reading (optical vs. electronic).

A major goal of our legibility work is the dissemination of simple, comprehensible guidelines for selecting typography that works effectively for all, including those with low vision. We have developed a brochure (Arditi, 1999/2002), that we hope constitutes one important step toward accomplishing this goal.

A new line of research concerns how contrast affects letter legibility. It is well known that it takes more contrast to recognize a letter than to detect it. There is, however, no study on why detectable letters may not be recognizable. Dr. Liu and research assistant Hillary Gauthier created 12 letter-like figures, and measured normal subjects' detection and recognition performance at different contrast and different stimulus durations. They found that low contrast letters elicit less stable percepts than high contrast letters. When one looks at a low contrast letters, the appearance of letter spontaneously changes to a different one. The lower the letter contrast is, the more likely that the letter appearance changes. If the task is not just to see the letter but to correctly name the letter, the subject is more likely to make an error with a low contrast letter, because she may see several letters over time, and cannot decide which one is the correct one. Such perceptual instability occurs when letters become detectable. At two or three time detection contrast threshold, the letter appearance may change every 2 or 3 seconds. Increasing letter contrast reduces the perceptual instability and thus reduces the chance to make recognition errors. Therefore, to recognize a letter, one not only has to have enough contrast to see it, but also has to have additional contrast to see it stable. The results have been presented in two conferences, and a manuscript has been submitted to the journal of *Vision Research*.

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Studies in Visual Acuity

Visual acuity has been a research focus at Arlene R. Gordon Research Institute of Lighthouse International for several years. For research purposes, Drs. Aries Arditi and Lei Liu use a computer-based acuity test system specifically designed to overcome problems inherent in using printed letter charts.

In an early study, Arditi and Cagenello (1993a) determined boundary values of test-retest reliability and sensitivity to acuity change that are unlikely to be exceeded in any clinical study using a popular visual acuity chart (Lighthouse/ETDRS). The results showed that, using this chart with the recommended letter-by-letter scoring, visual acuity may, with 95% confidence, be ascertained only within +0.1 log unit. In order to detect a significant change in visual acuity, about +0.14 log unit was required to achieve the same degree of confidence. These measurements may be usefully viewed as approaching the upper limit of reliability of this letter chart, and provide guidelines to clinicians who use the test as an aid to refraction and to monitor the progression of eye disease.

In a second study, Cagenello et al. (1993) determined the conditions under which binocular acuity is better than monocular acuity. They compared binocular and monocular acuity in one or both eyes under a variety of conditions of contrast differences. When the same contrast level was presented to each eye, binocular acuity was found to be better than the best monocular acuity by an average of 0.045 log MAR, which is nearly half a line on a standard acuity chart, or 11%. When the contrast level presented to each eye differed, binocular acuity remained better in most cases than the monocular acuity of the eye receiving the higher contrast. These results are likely explained by the contrast sensitivity enhancements of high spatial frequency, or "fine detail" components of the retinal image. These results alert clinicians to the possibility that letters viewed with two eyes may be more legible than letters viewed with one, even when the eyes differ from one another in acuity or effective contrast.

A few years ago, Drs. Arditi, Liu, visiting colleague Darren Albert, M.D. and research assistant William Lynn evaluated the efficiency of adaptive computerized methods of acuity testing, in which the letter size presented depended on both the size previously presented, and the observer's (or patient's) response. Their data indicated that a computer can obtain, in just minutes, visual acuity estimates that are twice as accurate as those obtained with a traditional eye chart.

Lighthouse work on acuity testing is closely related to our work on typography and legibility. Most of the Lighthouse legibility studies use acuity as a criterion; the most legible text can be seen at the smallest retinal sizes.

Dr. Liu recently studied how the contours of a square C contributed to the acuity in identifying the position of the gap. The interactions between the gap and the contours were determined by measuring acuity to a rectangular C of various aspect ratios. It was found that larger aspect ratios generally produced more correct responses than smaller aspect ratios. At the same aspect ratio, acuity was higher when the gap was on the longer side of the rectangular ring than when it was on the shorter side. A preliminary report of these findings appeared in abstract form (Liu, 2000).

In recent years, many studies of visual acuity have been conducted using computers and CRT displays. Software for computerized clinical tests has also become increasingly available. However, it is known that there are significant differences between the actual image shown on a CRT and the nominal image. One cause of the discrepancy is the anisotropy of pixel interaction along and across raster lines. Pixels appear more blurred along the horizontal raster line than across. Dr. Liu, with the help of Research Assistant Jianna Cho, evaluated the effect of this anisotropy on a computerized visual acuity test. Their results indicated that left and right gaps of a Landolt C produced better acuity than up and down gaps. Although the difference was not large, it was sufficient to introduce uncertainty in the computerized test

results. These results were presented at the 2001 annual meeting of the American Academy of Optometry. A full report appeared in the journal of Optometry and Vision Science (Liu & Cho, 2002).

Most recently, Arditi (in press) performed a study that validates the letter identification task as one that is particularly resistant to lapses, which are errors that are independent of stimulus visibility, for use in letter acuity testing and letter contrast sensitivity testing.

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Studies in Web Accessibility

The widespread use of the term *accessibility* dates back only to the early 1990s, coincident with the Americans with Disabilities Act and the growth of the disability rights movement. However, as a research topic, accessibility has been a focus of study at the Arlene R. Gordon Research Institute virtually since its founding. Indeed, much of our work on reading, legibility, color, wayfinding, and even driving, can be viewed as accessibility research, since all of these studies seek to enhance access to things that have been designed primarily with the able-sighted person in mind.

In recent years, the importance of the World Wide Web in human communication has grown vastly in areas as diverse as staying in touch with friends and relatives, commerce, information and entertainment. Because it has become so pervasive in everyday life, Web accessibility to those with disabilities, and to older people who so often are visually impaired, the importance of this issue is now widely acknowledged.

How does one make web sites more accessible to visually impaired persons? Most solutions, which are intended to enhance accessibility for users with hearing and motor as well as visual impairments, encourage good practices that make things more usable for people who may be accessing the site using assistive technology such as a screen reader, which speaks the screen text to the user. For example, they recommend that text alternatives (such as “alt” and “longdesc” html tags) be provided for images, image maps and descriptions for video, so that important information is not lost to blind persons who may be accessing the site. They also recommend logical and consistent presentation structure, and the use of style sheets (which facilitate global changes in presentation style), and alternative provisions for users who may have only simple browser capabilities (e.g., with java, scripts, or frames lacking or disabled). Finally, they make recommendations about typography, color and contrast that are intended to help people with low vision (see (see Arditi, 1999/2002a; Arditi, 1999/2002b). Many of these practices have the beneficial side effect of making things more usable for people who have no vision (or other) disability, as well.

Making a site accessible to a blind person who will be accessing the site without vision, is generally a matter of designing it so that the user can access all the important information efficiently using his or her own assistive technology (usually a screen reader). This is not always easy, but at least all blind users access the site using similar technology: some kind of speech synthesis, converting text to speech.

Accessibility for low vision users, on the other hand, can be quite different. Low vision encompasses an enormous range of visual capabilities, sometimes requiring little or no screen magnification, and sometimes magnification of 20 or 30 times or more, in which only a few letters of text may fill the entire screen. Some low vision users can get away with simple enhancements such as enlarging fonts and/or changing color schemes, accessibility features that are available through the most popular browsers (including Internet Explorer, Netscape, and Opera). But users who require high levels of magnification face special problems: For example, moving a mouse or other scrolling device to navigate a line of text while reading is difficult, and even more difficult is using it to find the beginning of the next line. Also, when the page is highly enlarged, it is extremely difficult to integrate successive views of the page into a “big picture” that can be used for searching, skimming, and other kinds of nonsequential reading. Screen magnification software helps but does not solve these difficulties. Low vision users may benefit from a wide range of page style changes in color, typography, animation rate, background images, and more. Accessible Web designs for low vision, then, must take into account a wide range of access methods, and provide many more features, corresponding to the wide range of visual capabilities of the low vision population. Paradoxically, then, providing access to blind users, who do not see at all, may be easier than doing so for those who see but with low vision.

The Institute’s research program in web accessibility focuses on this more challenging low vision aspect

of Web accessibility, and seeks to develop improved methods of presenting global (e.g., page layout) and local (e.g., text) information in a manner that allows for easier page navigation and accomplishment of nonsequential reading tasks so important in hypertext processing, like searching for information or skimming a document. A prototype web browser for low vision has been constructed for experimental purposes (Arditi, 2003), and currently we are seeking funds for further development.

Recently, efforts to develop the web browser technology and to develop more general methods for studying web accessibility have focused on the open source Mozilla browser suite, and in particular in the XML based eXtensible User interface Language (XUL) and related technologies. The hope is that in the coming years, Dr. Arditi and Associate Vision Scientist Jianwe Lu can make available a web browser for low vision at no cost, and as open source software, both to increase accessibility for low vision and as a tool for open and collaborative studies of web accessibility.

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Wayfinding and Universal Design

This project seeks to test the feasibility of commercial development of a computer-controlled, interactive tactile map and wayfinding system to enhance the accessibility for visually impaired individuals, of office buildings and other public accommodations. The original scope of the project as a system to indicate the locations of and safe routes to a small set of building features, such as exits restrooms and telephones, has expanded. The system will now allow the user to plan a route to any room or utility feature in a building. Although the system being tested will primarily be for use by persons who are blind or partially sighted, it will also provide useful wayfinding information for the normally-sighted population.

Finding one's way about in an unfamiliar environment can be a difficult task. It can be especially difficult for a person who is blind or partially sighted traveling independently, and increasingly so in an unfamiliar environment. The first-time visitor to a building may want to find information about what is available in the building and information about how to get to a chosen goal. Able-sighted people can get this information from visual maps and building directories. For blind or partially sighted people, this information needs both to be presented in an accessible form and also be relevant to the particular needs of the traveler. Currently there are no such systems. The current project, funded first by a \$100,000 Small Business Technology Transfer Research grant and more recently by a \$675,000 regular (RO1) project grant from the National Eye Institute, is performing research to meet this need.

Wayfinding may be defined as the ability, both cognitive and behavioral, to find the way to a destination. It is a form of spatial problem solving that involves identifying a current location, then following a route, and finally reaching and identifying a goal. Wayfinding is a complex task for able-sighted people, and poses additional challenges for people who are blind or partially sighted.

A particularly difficult task for the blind or partially sighted traveler is wayfinding in a new or unfamiliar environment. This is both because of wayfinding challenges while following a route and also because of the lack of access to information for route planning. There is a cultural and educational tradition of maps and signs for able-sighted travelers, but the vast majority of building spaces in the world have not made these accessible to blind or partially sighted travelers.

The project has recently conducted a study to compare two designs of tactile maps installed as part of the Lighthouse renovations. The study has generated several results: it has lead to the development of prerecorded teaching instructions to use the current maps, which can be applied to the evolving map interface; derived feedback for the design of the tactile component of the system; served as a spring board for ideas from blind participants about the information desired for wayfinding and format for displaying this information; and it has tested objective and subjective measures for future wayfinding interface evaluation methodology.

Most recently, a study was completed to test the effectiveness of the interactive map system for totally blind individuals (Arditi et al., in press). An experiment was conducted in which wayfinding performed of blind participants was compared after planning routes with either the interactive tactile map or mock "bystander" directions. A questionnaire assessing the perceived usefulness of such a system was also administered. The results indicated great promise for the interactive map system in that there were significantly fewer wayfinding errors, and significantly more errorless wayfinding trials in the interactive map condition than in the bystander condition. Also participant ratings of usefulness and ease of use of the interactive map average 5.59 on a 1-7 Likert scale. The study indicates that interactive tactile maps may provide an effective intervention for increasing access of blind persons in building interiors.

Our research in wayfinding is now taking a new direction. We are setting aside our plans to develop a commercial wayfinding system, and are focusing instead on more basic issues underlying wayfinding performance. For example, what are the sensory requirements for developing a "cognitive map" of an environment? How much vision is required to learn the location of landmarks? Does accuracy suffer

when visual images are degraded, and if so, which visual parameters are important for accurate location? What is the role of eye movements in visual wayfinding?

One recently completed study (Hall and Ardit, 2000) investigated the potential use of full-field flicker as a means of coding information about the environment to people who are blind to pattern but can still sense light levels in one or both eyes. The results were promising, but enormous practical obstacles still remain before such a device could become a reality.

We are also exploring the possible development of a Radio Frequency Identification Device (RFID) based wayfinding aid, in collaboration with Prof. Klaus Mueller (State University of New York Department of Computer Science).

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