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The Effectiveness of Comprehensive Low Vision Services for Older Persons with Visual Impairments in New Zealand

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Abstract: This study evaluated the effects of providing comprehensive low vision services to elderly persons with visual impairments in New Zealand. The 93 participants were matched on age, gender, and visual function with 93 who did not have access to comprehensive low vision services. No significant differences were found between the groups at posttest and follow-up on the three primary dependent variables of visual function, instrumental activities of daily living, and quality of life.

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The population of New Zealand, as in many other parts

of the world, is aging, with the most significant growth in population occurring in the older age groups (Health Funding Authority, 1998). As the population ages, so does the incidence and prevalence of visual impairment (Brennan & Silverstone, 2000; Tielsch, 2000). In the 1996–97 New Zealand census, 74,000 persons out of a population of about 4 million indicated that they had difficulty seeing ordinary newsprint or faces from across the room, even when they wore corrective lenses, to the extent that they required some assistance in functioning (Health Funding Authority, 1998). Of these 74,000 persons, about 55% were aged 65 and older. The rate of occurrence of visual impairments increased from 7 per 1,000 for those younger than age 15 to 98 per 1,000 for those older than age 65 (Health Funding Authority, 1998).

As the population has continued to age, age-related visual impairments (visual impairments in persons aged 50 and older) have become the most common cause of visual impairments in New Zealand and refers to conditions resulting from both normal and pathological changes in the eye related to the aging process (Brennan & Silverstone, 2000; Rubin, 2000; Schwartz, 2000). Typical visual changes that are associated with aging include reductions in visual acuity, response time in adjusting to lowered levels of light, and color discrimination; the most common pathological conditions related to increasing age are cataracts, diabetic retinopathy, glaucoma, and macular degeneration (Brennan & Silverstone, 2000).

The onset of age-related visual impairments has been observed to affect the performance of instrumental activities of daily living (IADLs) and to decrease morale among those who are affected (Katz & Tielsch, 1996; La Forge, Spector, & Sternberg, 1992; Lindo & Nordholm, 1999; Rudberg, Furner, Dunn, & Cassel, 1993). People who have age-related visual impairments also report more hospital admissions, nursing home admissions, and contacts with physicians than do persons of the same age who are not visually impaired (Branch, Horowitz, & Carr, 1989). They primarily have low vision, and the incidence of total blindness is low. Thus, low vision services are particularly relevant to them. Comprehensive low vision services, which consist of a coordinated and integrated approach to the provision of interdisciplinary services, both clinical low vision services and traditional vision rehabilitation services, are thought to be even more essential (Goodrich & Bailey, 2000).

Although comprehensive low vision services are not generally available in New Zealand, a range of hospital-based, university-based, and private low vision clinics exist, as well as a range of functional low vision interventions and aids that are provided by field staff of the Royal New Zealand Foundation of the Blind (RNZFB) to enrolled members as part of RNZFB's overall rehabilitation program. Yet, these services are neither evenly distributed across New Zealand nor coordinated to provide for a cohesive interface among

them. While there is little doubt that specific optical and nonoptical interventions are effective in increasing visual function for specific tasks (Goodrich & Bailey, 2000), there is only limited evidence of improvement in independence and mixed results on measures of social interaction and health status for this age group from the provision of either type of service (Crews, 1991; Davis, Lovie-Kitchin, & Thompson, 1995; Elliott & Kuyk, 1994; Engel, Welsh, & Lewis, 2000; Fagerstrom, 1994; Horowitz, Leonard, & Reinhardt, 2000). However, the recipients of comprehensive low vision services, which integrate these services, have been more consistently credited with a greater ability to perform a variety of tasks for independent living with greater independence and self-esteem and fewer physical and mental health problems (Crews, 2000; Goodrich & Bailey, 2000; Stuen, 2000). As a result, it may be expected that the provision of a comprehensive low vision service would ameliorate many of the difficulties associated with the onset of significant visual impairments among this population.

A project group was formed by RNZFB to oversee this study. The group advised on the aims of the study and approved its design and method. A project manager oversaw all aspects of the study from recruitment of participants to presentation of results. The specific aims of this study, as approved by the advisory group, were to investigate the effectiveness of comprehensive low vision services on visual function, instrumental activities of daily living (IADLs), quality of life

(QOL), and the use of health care services in persons with age-related vision loss. In the analyses, comparisons were made across groups and over time. The across-group comparisons were made between comprehensive low vision services and services that are typically available to this population, since it was not the purpose of this study to ascertain whether low vision services are effective compared to no services. Rather, the purpose was to ascertain whether the provision of comprehensive low vision services offered a benefit over and above the mix of services that were already available to the participants. The currently available services included both clinical low vision services and field services available from the RNZFB. Field services included assessment and instruction in independent living skills (ILS), orientation and mobility (O&M), and communications, as well as recreational and leisure activities. They are generally provided in a person's place of residence by specialist staff and are available to all members of the RNZFB. Persons are eligible for membership in the RNZFB if they have a visual acuity of 6/24 (20/80) or worse in the better eye after the best-possible correction or a field of view that does not subtend an angle of 20 degrees.

Method

Comprehensive low vision services, as assessed in this study, were defined as integrated services provided by low vision clinics in four population centers in New

Zealand, in cooperation with RNZFB field services. The services included (1) assessment of ocular health, near and distance acuity, central and peripheral field, contrast sensitivity, and functional vision; (2) prescription of optical and nonoptical aids; (3) loaning of prescribed aids; (4) training in the use of these aids; and (5) follow-up. The RNZFB field staff supplemented the services of these clinics by providing preclinical assessments and follow-up instruction in the participants' homes. Instruction included the use of prescribed optical and nonoptical aids for fulfilling various IADLs.

The services were standardized across the four sites to the greatest extent possible. All four sites shared an operations manual; standard forms for referrals, making appointments, responding to referral sources, and establishing clients' histories and profiles; an assessment prompt form; a client's record sheet; a clinical record; and an equipment order form. The four sites were monitored throughout the study with the use of these standard forms to assess the degree to which the services appeared to be standardized across settings. Although some variation occurred across the sites in the average number of aids prescribed and hours of instruction provided, this variation seemed to be appropriate and was accounted for by differences in the participants' ages and levels of visual impairments across the sites.

Sample

Although the services of all the participating clinics were available to all persons who were referred to them, regardless of age, only those aged 65 and older who agreed to participate and were successfully administered a pretest questionnaire before any of the components of service were provided were included in the study. Of 139 persons who received services from the four clinics during the course of this study, 93 persons (64 women and 29 men) met the criteria for inclusion. These participants ranged in age from 65 to 95, with a mean age of 80.6. They were matched on age, gender, and visual function with 93 persons from a pool of 192 potential contrast-group participants, who ranged in age from 65 to 94, with a mean age of 80.3. Gender and responses to the screening question for visual function were identical across the groups as a result of the matching process.

Procedure

One reason for the mixed results of earlier studies on the effects of clinical services and traditional rehabilitation services with elderly persons with low vision (Crews, 1991; Davis et al., 1995; Elliott & Kuyk, 1994; Engel et al., 2000; Fagerstrom, 1994; Horowitz et al., 2000) may be that these studies have often been limited to a single-group design using pre- and posttest measures. Thus, the analysis of the findings have not always been able to identify the relative effect of these services on function over and

above the decline in health and function that has been observed to occur in this population over time. Furthermore, the researchers may not have been able to establish control over time as a confounding variable.

This study sought to address this problem with a contrast group, since I and the advisory group could not, in good conscience, randomly assign members to experimental and control groups and therefore systematically deny access to these services to half the participants. As a result, a contrast group was selected from a pool of 192 persons who were willing to participate in the study as members of a contrast group and who were recommended by ophthalmic and optometric practices and the RNZFB. All potential participants in the contrast group lived in areas of the country where comprehensive low vision services were not available. No existing or commonly available services were kept from them. As a result, the only planned difference between the groups was that one received comprehensive low vision services and the other did not.

To achieve as much equivalence between the groups as possible, samples were matched on age, sex, visual function (rated on a 5-point Likert scale in response to the question, “How much difficulty do you have reading ordinary print in newspapers?”), and ethnicity. Most members of the contrast group were randomly selected when possible from the pool of potential participants who matched the salient characteristics of

the participants in the experimental group. Other members of the contrast group were not randomly selected, however, because, in some cases, only one member in the pool was a match for a member of the experimental group.

All members of the experimental group received, at a minimum (1) a preclinical assessment before their appointment at the low vision clinic, (2) an initial low vision examination, (3) training with any aids or devices prescribed in the clinic, (4) the loan of these aids for the duration for which they were needed, and (5) a follow-up visit in their homes from the RNZFB field staff, with repeated visits for instruction if required.

Measures were taken at intake, before the provision of any services (pretest), and again at a six-month (posttest) and one-year interval (follow-up) after the provision of services to compare the groups over time, as suggested by Head, Babcock, Goodrich, and Boyless (2000). As a result, the design used in this study was classified as a separate-samples (nonequivalent groups) pretest–posttest design with follow-up (Campbell & Stanley, 1966).

Three primary and two secondary dependent variables were assessed. The primary dependent variables were visual function, independence in IADLs, and QOL. The secondary dependent variables were use of health care services (outpatient and inpatient care).

The National Eye Institute's 25-Item Visual Function Questionnaire (VFQ-25) (Mangione, 2000) was used to measure visual function. The VFQ-25 takes approximately 10 minutes to administer and consists of 25 vision-targeted questions representing 11 vision-related constructs, plus an additional single-item general health rating question. A composite score is available and is determined by averaging the scores on the 11 vision-related subscales (general vision, ocular pain, near activities, distance activities, vision-specific social functioning, vision-specific mental health, vision-specific role difficulties, vision-specific dependency, driving, color vision, and peripheral vision).

The VFQ-25 is available in the public domain, is normed, and has demonstrated reliability and validity (Mangione et al., 2001; Margolis et al., 2002). It also appears to be robust enough to use across multiple conditions of various degrees of severity (Mangione et al., 2001) for epidemiological studies and clinical trials (Klein, Moss, Klein, Gutierrez, & Mangione, 2001). The VFQ 25 also has tables of power calculations to determine the required sample sizes for finding significant differences of different magnitudes. For example, a sample of 40–161 pairs is needed to detect a point difference of 10 and 5, respectively, between two groups using a repeated-measures design. A mean difference between pairs of 7 on the composite score with a standard deviation of 20 is considered a

moderate but important difference between the groups (Mangione, 2000). As a result, this study had a power of just over 90% to yield a statistically significant result if a moderate difference was found between groups on the VFQ composite score when tested against a theoretical value of 0.00.

Elliott and Kuyk's (1994) Measure of Functional and Psycho-social Outcomes of Blind Rehabilitation was adapted for use in this study as a measure of independence in daily living. This measure may be best characterized as a measure of IADLs. It consists of 13 questions stated in the first person, with respondents asked to respond on a 4-point scale, from strongly agree to strongly disagree, to a series of statements starting with "In my daily life at home, I am.…" A sample question would be, "In my daily life at home, I am *capable of preparing my own meals.*" Domains include O&M, ILS, communications, and leisure pursuits. This measure was selected for use in this study because of its clear relevance to visual impairments; its brevity; and its demonstrated reliability, validity, and sensitivity as a measure with this population (Elliott & Kuyk, 1994).

A single-item QOL measure was also used. In this case, it was a measure of life satisfaction and consisted of the statement, "In the past six months, I would say my overall quality of life has been (a) excellent, (b) very good, (c) good, (d) fair, (e) poor." The participants indicated the response that fit best.

Responses from all three primary dependent measures were transformed so that positive responses had higher values. The response categories were weighted as 1 = 0, 2 = 25, 3 = 50, 4 = 75, and 5 = 100, as directed in the instruction manual for the VFQ-25 (Mangione, 2000).

An additional nine questions were asked about general health, falls, and the use of medical services (such as visits to physicians, visits from nurses, nights spent in a hospital, and nights spent in a residential care facility). These questions were based, in large part, on the physical health subscale used by Engel et al. (2000), who reported significant improvements on this measure following the provision of vision rehabilitation services to an aging population. Four of the questions were used to constitute the secondary dependent measures, outpatient and inpatient care. The variable outpatient care included the number of visits to physicians and the number of visits from nurses over the past two months that the participants remembered. The variable inpatient care included the number of nights spent in a hospital or a residential care facility in the past two months that the participants remembered. One question was used as a control for general health status. The other four questions, about health-related issues, were not used as dependent measures in this study.

In all, 58 questions were asked. These questions

covered the following areas: (1) visual function (*n* = 25), (2) independence in IADLs (*n* = 13), (3) QOL (*n* = 1), (4) physical health and the use of health care services (*n* = 9), and (5) demographic information (*n* = 10).

Although a good deal of clinical data were collected to monitor the equivalence of the programs across regions, all data used to assess the effectiveness of the services were collected through self-reports using the questionnaire described earlier, which was administered by telephone because of the potential problems with self-administration that could be expected with this population. The questionnaire took approximately 40 minutes to administer.

A pilot study with 15 volunteers was conducted before the start of data collection to gain feedback on the wording of the questionnaire, determine the mean time required for its administration, and assess its test–retest reliability. Because of this trial, six questions were reworded, and the direction of response categories (from positive to negative) was aligned across the subscales to correspond with those in the VFQ-25, which was the only standardized measure used. Test–retest reliability was assessed and found to be *r* = .98. A measure of internal consistency (Chronbach's alpha) was also determined and found to be alpha = .94.

All participants were followed up by a third party to assess the quality of the telephone administration and

to ensure that the telephone interviews had been conducted in the expected manner. Some problems were noted and corrected as a result of this process, and in one case, data were not included from a telephone interviewer who was considered to be inconsistent or unreliable in his practice.

Results

Comprehensive low vision services provided

As was mentioned earlier, 139 persons who met the criteria for selection were seen by the four participating low vision clinics during the study. Of the 139, 22% were classified as having mild visual impairment, 50% as having moderate visual impairment, and 28% as having severe visual impairment.

A total of 297 low vision aids (optical, nonoptical, and electromechanical) were prescribed for the 139 persons at the four centers for an average of 2.14 per client. Of these aids, 107 were classified as being optical aids, 92 of which were identified as being near-point or near-point and other aids, 1 as a distance aid only, and 14 as other. Of the 139 persons, 62% were prescribed at least 1 optical aid, 22% were prescribed 2, and 16% were prescribed 3 or more. In addition, 167 nonoptical aids were prescribed; 95 were classified as lighting or task lighting, 37 as contrast, 10 as reading stands, and 25 as other. Of the 139 clients, 46% were prescribed nonoptical aids. Of those, 60% were prescribed at least

one aid, 7% were prescribed 2, and 33% were prescribed 3 or more. In addition, 23 electromechanical devices (closed-circuit televisions [CCTVs] or computer-enhancement systems) were prescribed: 21 CCTVs and 2 computer-enhancement systems. Of the 139 clients, 16.5% were prescribed electromechanical devices; no person was prescribed more than 1 electromechanical device. Aids for IADLs were sometimes provided and instruction given in their use, but many were either not prescribed per se or were prescribed as nonoptical aids. Thus, the number of devices for IADLs that were prescribed is not indicated.

Training was provided for the use of optical aids, nonoptical aids, and electromechanical devices, and in various IADLs. All persons who had an optical device prescribed received some level of training, with 17% receiving a half hour or less, 27% receiving a half hour to 1 hour, 36% receiving between 1 and 2 hours, and the remaining 20% receiving more than 2 hours. In the case of training in nonoptical aids, 33% received less than a half hour, 48% received between a half hour and 1 hour, and the remaining 19% received an hour or more. Training with electromechanical devices was reported for all but one device that was prescribed. Of those who received training in these devices, 66% received less than a half hour, 5% received from a half hour to 1 hour, 10% received from 1 to 2 hours, and 19% received more than 2 hours. Some training was also provided in ILS skills and for the use of various aids for ILS that were not necessarily identified as low

vision aids. For those who received such training, 48% received less than a half hour, 33% received from a half hour to 1 hour, 17% received from 1 to 2 hours, and 2% received more than 2 hours.

Effectiveness of services provided

Of the 139 persons who were seen in the clinics, 93 who met the criteria for inclusion in the study agreed to participate and were able to complete the pretest measure in the manner and time prescribed. These 93 participants were matched with 93 members of the contrast group. The groups were compared at the pretest stage to determine if any differences on the primary dependent variables (VFQ, ILS, and QOL) were present using a one-way, between-groups multivariate analysis of variance. Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity with no serious violations noted. A statistically significant difference was found between the groups on the combined dependent variables: F (3, 182) = 6.17, p = .001; Wilke's lambda = .91; partial eta squared = .09). When the results for the three dependent variables were considered separately, both the IADL (F (1, 184) = 3.94, p = .049) and QOL (F (1, 184) = 12.26, p = .001) were found to differ significantly across the groups. An inspection of the means indicated that the contrast group had a higher mean score (IADL M = 48.8, QOL M = 59.8) on

both measures than did the experimental group (IADL *M* = 46.2, QOL *M* = 46.2).

As a result, the pretest scores on all three primary dependent variables and both secondary dependent variables were used as baseline measures for subsequent comparisons, with change in scores computed and compared across groups at the posttest and follow-up. As can be seen in Table 1, no significant differences were found between the groups at the posttest or follow-up on the three primary dependent variables, VFQ, IADL, and QOL. The most obvious difference between the groups was the difference in the group mean on QOL that persisted across time, with the contrast group's mean remaining significantly higher than the experimental group's at all three times.

The secondary dependent variables of use of health-related services, which included the number of visits to physicians and visits from nurses (outpatient care) during the past two months and the number of nights spent in a hospital or residential care facility (inpatient care) in the same period were also analyzed. In this case, the participants' responses to a general health question were used as a covariate to adjust for current state of health. As can be seen in Table 2, there were some differences between the groups and over time on both variables, and a significant difference was noted on the change score from the pretest to the posttest for mean frequency of outpatient care.

As Tables 1 and 2 indicate, the experimental group's scores were relatively stable over time on the primary dependent variables (VFQ, IADL, and QOL), as were the contrast group's, and both improved somewhat on the secondary dependent variables by showing a decrease in the use of outpatient and inpatient services. As noted earlier, there was a significant difference in the frequency of outpatient visits at the posttest even though both groups had decreased their mean number of visits from the pretest. A slight increase in both variables occurred from the posttest to the follow-up for both groups but remained below that seen at the baseline in all but one case (the contrast group's mean rate of outpatient visits increased slightly, from 1.8 to 2.0). Only minor differences were found between the groups, with no clear evidence of improvement from the pretest to the posttest for either group.

One explanation for this apparent lack of effect may be that a control group (a no-treatment group) was not established. Thus, the comprehensive clinical low vision service was being compared with existing services, including those of the RNZFB. On investigation of the composition of the groups, it was found that 91% of those in the contrast group were members of the RNZFB. However, it was also found that 45% of the experimental groups were members of the RNZFB at the pretest. To complicate this finding further, the proportion of those in the experimental group who reported that they were members of the

RNZFB increased over time to 70% at the posttest and 79% at the follow-up. Thus, it was clear that one set of services was being compared with the other.

To determine if the difference in QOL could be due to RNZFB membership status, a follow-up analysis was conducted using membership as the independent variable across the two groups. RNZFB members were found to have significantly higher (F (1, 183) = 1.55, p = .029) QOL scores (M = 56.0, SD = 27.3) than nonmembers (M = 26.6, SD = 25.8). It was also clear that the comprehensive low vision intervention increasingly included RNZFB services, especially in light of the finding that the proportion of RNZFB members in the experimental group increased from 45% to 79% over the course of the study. As a result, a follow-up analysis was conducted with the experimental group using RNZFB membership as a grouping variable as reported at the time of assessment (the pretest, posttest, and follow-up). As before, the pretest scores were used as a baseline, with change scores used to determine if a significant difference occurred between the groups over time.

As can be seen in Table 3, there was a significant difference between the groups on VFQ (F (1, 91) = 10.53, p = .05) and IADL (F (1, 91) = 5.07, p = .03) at the pretest, but no difference on QOL (F (1, 91) = .007, p = .94). There was an increase in scores from the pretest to the posttest across both groups in general, but none of the changes was significant. There was also

some deterioration in the scores from the posttest to the follow-up for both groups, but more so for those who were not RNZFB members than for those who were, except for QOL, where the deterioration resulted in a return to the pretest levels for both groups but was greater for those who were RNZFB members than for those who were not. Although this change proved to be significant (F (1, 68) =8.50, p = .005), it was not in the direction that was predicted.

A similar pattern emerged in the use of the secondary dependent variables of the use of health-related services. As can be seen in Table 4, while the RNZFB members used both outpatient and inpatient services more at the pretest than did the nonmembers, they used them less often at both the posttest and the follow-up than they did at the pretest, whereas the nonmembers used both services somewhat more. The only differences noted between the RNZFB members and nonmembers was on the mean frequency of inpatient care at the posttest, with members reducing the frequency of use of inpatient care from a mean of 13.1 nights in the past two months at the pretest to 2.0 at the posttest. Those who were not members increased their mean frequency of nights in inpatient care from 3.9 to 9.0 over the same period. Thus, there was a significant difference in the change score across time between the groups (F (1, 77) = 4.56, p = .04).

Discussion

This study sought to investigate the effectiveness of the provision of comprehensive low vision services to an older population in New Zealand. Its purpose was to ascertain whether the provision of comprehensive low vision services offered a benefit over and above the mix of services that were already available to the participants. Of the 139 persons who were provided services over a two-year period from four participating low vision clinics, 93 agreed to participate and were able to be administered a pretest prior to beginning service. A contrast group, matched on age, gender, ethnicity, and perceived visual difficulty, was used for comparison. The participants in the contrast group received the services that were normally available to them, including field services from the RNZFB and services from their regular optometrists or ophthalmologists. Thus, the study compared the provision of comprehensive low vision services to existing services and found little or no difference in the three primary dependent variables: VFQ, IADL, and QOL. The only difference noted was on the secondary dependent variable of the mean frequency of visits to or from physicians or nurses at the posttest. The experimental group reported a significantly greater change in the number of visits from the pretest to the posttest (a decrease in visits) than did those in the contrast group. No difference was found on the other secondary dependent variable of mean frequency of nights spent in a hospital or residential care facility.

The most obvious difference between the groups on

any of the dependent variables was in QOL. The contrast group had higher mean QOL scores at all three times. One explanation for this finding may have been the disproportionate representation of RNZFB members in the contrast group. A follow-up test across all the participants, regardless of group affiliation, found that membership in the RNZFB resulted in a significant difference on QOL, with members scoring higher than nonmembers. It was also found that the difference in membership status across groups was significant. As a result, a follow-up analysis was conducted on the experimental group while controlling for membership status. This analysis only partly supported this explanation. RNZFB members in the experimental group scored lower on all three primary dependent measures than did the contrast group and lower than nonmembers on VFQ and IADL but not on QOL at the pretest. They used more inpatient and outpatient services than either the contrast group or the nonmembers in the experimental group. As a result, this group appeared to be different from both the contrast group, which was dominated by RNZFB members, and the nonmembers in the experimental group. The scores on the secondary dependent variables may indicate that the RNZFB members in the experimental groups were likely to have had more health problems than were those to whom they were compared. However, they also appeared to make greater improvements on all measures than did the nonmembers and the contrast group from the pretest to the posttest and maintained these gains, compared to

the nonmembers, in VFQ and IADL, but not in QOL. Therefore, it appears that the RNZFB members in the experimental group benefited more than did the nonmembers.

The increase in the percentage of RNZFB members in the experimental group from the pretest to the follow-up (from about 45% at the pretest to 70% at the posttest and 79% at the follow-up) complicates these assumptions. Thus, the increasing proportion of RNZFB members in this group may have masked some of the benefits that could have been attributed to the combination of membership and receipt of comprehensive low vision services over time. It was hypothesized that those who received comprehensive low vision services would improve in function in terms of VFQ and IADL and perception of QOL from the pretest in comparison to the contrast group, or would maintain their VFQ and IADL functioning and perception of QOL over time while the contrast group deteriorated in both VFQ and IADL function and perception of QOL over time. Neither of these scenarios occurred. Nor did either group deteriorate to any great extent over time. Rather, both groups maintained their levels of VFQ and IADL function and perception of QOL. Two explanations seem logical: (1) the comprehensive low vision services had no effect, or (2) they had an effect that was roughly equal to that of membership in the RNZFB, which includes access to vision rehabilitation services from field service staff. The latter seems more likely.

When the study was conceptualized, it was expected that comprehensive low vision services would be compared to a range of existing services, some of which would include RNZFB field services. As it turned out, the comparison was clearly between comprehensive low vision services and member services. It appears that in both cases, there was either no effect over time or both services had the effect of maintaining visual function and perception of the quality of life, despite the expectation that both would deteriorate over time. No significant differences were found when RNZFB members and nonmembers were compared in the experimental group. However, the expected pattern did emerge with members either improving in function or remaining stable and nonmembers remaining stable or declining somewhat in function. This finding could indicate an effect of adding comprehensive low vision services to existing services, with an overall improvement in four of the five dependent variables. It may provide some indication that the combination of RNZFB membership status and the provision of comprehensive low vision services was more effective than the provision of comprehensive low vision services alone. The former may be more representative of what was conceptualized than the latter when these services were defined and may therefore support the study's expectations to some degree.

There were a number of limitations to this study. First,

although a contrast group was used to counter the problems of a single-group pretest–posttest design, it appears that the interventions across groups may have been too similar. The problem with single-group designs is that it is difficult to identify the relative effect that the intervention may have over and above the decline in function that may be expected in this population over time. However, in this case, the contrast group and the experimental group may have been equally effective in countering this decline. Yet, we were not able to ascertain that possibility.

The other explanation is that neither set of interventions had any effect over time, perhaps because neither was effective or because the self-report measures used in the study were not sensitive enough to detect changes that may have occurred. However, differences on all three primary dependent variables and both secondary dependent variables reached significance at some point during the study, so the self-report measures were sensitive enough to denote differences between the groups with the sample size that was used. Yet, they still may have lacked the necessary sensitivity to denote changes that may have occurred. Finally, the variable that denoted the most difference across the groups was QOL. Although this variable was drawn from a single question and may therefore be suspect, it proved to be remarkably consistent across time and across groups. A standardized measure of life satisfaction may be desirable for further study, and a different design may

also be of value. A no-treatment control group would be an ideal foil to the problems encountered in this study. Ethically, we were unwilling to assign persons randomly to a no-treatment group. Practically, we were unsuccessful in recruiting persons with visual impairments who were not already members of the RNZFB. As a result, we were limited to an experimental–contrast group design that appeared to compare relatively similar services. In the end, we must conclude that no significant or obvious differences were found between providing comprehensive low vision services, as defined here, to the participants in this study and providing the mix of services that were currently available to them.

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