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# A comparison of entering vs. exiting visual acuities of a humanitarian eye glass mission to Mexico

## Abstract

**Background:** The purpose of this study was to determine the amount of improvement in visual acuity (VA) of persons helped through humanitarian optometry.

**Methods:** A humanitarian clinic was established for 3 days in San Bias, Nayarit, Mexico. During the 3 days, 890 people were evaluated for refractive error, binocularity, and ocular health. Visual acuity was taken at the beginning of the evaluation and at the end when spectacle correction was dispensed.

**Results:** Significant improvement was seen in visual acuities at both distance and nearing the vast majority of patients seen. Data showed that of 731 people who received glasses for near (either as single vision or bifocal), the average exiting VA was between 20/20 and 20/30. The data also showed that of 413 people that received glasses for distance (single vision or bifocal), the average exiting VA was 20/32. An improvement in near acuity for cataract patients was evident, while improvement in distance acuity for these patients was minimal.

**Conclusion:** The people of third world countries are at a significant disadvantage in the realm of eye care. By simply providing spectacle corrections, a large portion of the population seen was able to improve their acuity status and be removed from the categories of visually impaired or legally blind.

## Degree Type

Thesis

## Degree Name

Master of Science in Vision Science

## Committee Chair

J.P. Lowery

## Keywords

visually impaired, legal blindness, world health organization, lions club organization

## Subject Categories

Optometry

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A Comparison Of Entering vs. Exiting Visual Acuities Of A Humanitarian Eye Glass

Mission To Mexico

By

Dale A. Schell

Reed T. Gibb

A thesis submitted to the faculty of the

College of Optometry

Pacific University

Forest Grove, Oregon

for the degree of

Doctor of Optometry

September 2002

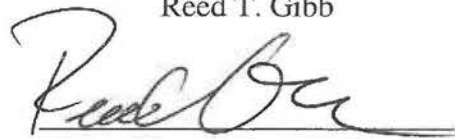
Advisor:

J.P. Lowery

Dale A. Schell

A handwritten signature in cursive script that reads "Dale Schell". The signature is written in black ink and is positioned below the printed name.

Reed T. Gibb

A handwritten signature in cursive script that reads "Reed Gibb". The signature is written in black ink and is positioned below the printed name.

Advisor: J.P. Lowery

A handwritten signature in cursive script that reads "J.P. Lowery". The signature is written in black ink and is positioned below the printed name.

## Acknowledgments

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## Abstract

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**Key Words:** Visually impaired, legal blindness, World Health Organization, Lions Club Organization.

# A Comparison of Entering vs. Exiting Visual Acuities of a Humanitarian Eye Glass Mission to Mexico

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*Pacific University, College of Optometry, Forest Grove, Oregon*

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**Results:** Significant improvement was seen in visual acuities at both distance and near in the vast majority of patients seen. Data showed that of the 731 people who received glasses for near (either as single vision or bifocal), the average exiting VA was 20/26. The data also showed that of 413 people that received glasses for distance (single vision or bifocal), the average exiting VA was 20/30. An improvement in near acuity for cataract patients was evident, while improvement in distance acuity for these patients was minimal.

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An estimated 180 million people are visually impaired worldwide.<sup>1</sup> While the etiologies that contribute to this problem are somewhat confounding, one major element stands out. This element is the relatively low concentration of eye care practitioners (all professions, including ophthalmologists, optometrists, and opticians) in many countries. For example, in Asia there is only 12 per million, while Africa has a meager 3 per million. Other countries have slightly better ratios, including the Middle East (47), South America (88) and Eastern Europe (108). In more developed countries, the ratios are much higher; ranging from 151 (Western Europe) to 262 (North America) and 444 (Japan).<sup>2</sup> These statistics demonstrate the need for humanitarian eyeglass missions. Pacific University College of Optometry has had a long history of humanitarian missions in effort to improve vision in third world countries. The Pacific University organization called the Amigos club has been going on such trips since 1975 and has traveled to Mexico 12 times in the past decade.<sup>3</sup> While humanitarian effort is not a new concept, data collection, interpretation of that data, and publication has been



minimal in terms of measuring outcomes. Occasionally such travels have been under scrutiny regarding the relative usefulness of their efforts. It was our desire to analyze the efforts of such missions, in order to better understand their effectiveness. Specifically, we wanted to quantify the acuity improvement in the individuals who received glasses. This is a key piece in measuring the value of these missions, since it is estimated that 80% of blindness that is reported in developing countries is considered avoidable or curable.<sup>4</sup>

In January of 2002, the Pacific University Amigos program organized a humanitarian trip with the Oregon Lions Club to San Blas, Nayarit, Mexico. Persons participating on the trip included 9 Pacific University optometry students, and three optometrists, one of which was a Pacific University College of Optometry faculty, and approximately 35 Lions Club members.

The trip consisted of five days of patient care - three of which were in the town of San Blas. The first two days in San Blas consisted mostly of adult patients, which are analyzed in this study. The final day of clinic was designated for children. Exiting acuities were not taken on the pediatric population due to time constraints. Individuals were seen on a first come first serve basis, although the local Lions Club chapter had dispensed admittance tickets to the most underprivileged members of the local community.

Clinic services were provided at the San Blas Lions Club facility located in the central part of town.

## Methods

The exam sequence was essentially the same for all individuals, except for those with significant ocular disease, which called for further evaluation. The sequence began with a case history consisting of the patient's name, age, chief complaint, occupation, medical history, current medication profile, and known allergies. Entering visual acuities were taken followed by auto refraction. It has been shown that single auto refraction readings are reliable compared to repeated results, therefore single readings were taken unless circumstances dictated otherwise.<sup>5</sup> Patients were then directed to a disease screening station consisting of direct ophthalmoscopy, extra-ocular muscle testing, and pupil evaluation. Persons that were suspected to have significant posterior segment disease were then dilated for further posterior pole examination. Subjects were then given glasses based on auto refractor results and/or retinoscopy. All prescriptions were finalized by one of the optometrists present to determine best correction. At the final station, glasses were dispensed to best match the patient's prescription. The glasses were donated eyewear that was made available for the mission through a collaborated effort of the Amigos club and Oregon Lions Club. Each individual would try on one or two pairs of glasses for best fit and acuity, as prescription matches were made through the closest prescription available. This station also included cleaning or adjusting of the frames. The time that this sequenced took was approximately 30 min per person, once entering VA's were started.

## Measurement

### Entering Acuity

After case history, entering acuities were taken at the first station, and emphasis was placed on efficiency. It should be noted that lighting was not ideal, but sufficient, as windows or skylights were the main sources of illumination. Three chairs were placed such that a seated patient's corneal plane was 20ft from Snellen acuity charts. Tumbling E charts were present for illiterate individuals. Optometry students, Lions Club members, and a translator for lingual assistance, conducted the acuity stations. All acuity measurements, whether at far or near, were taken through any habitual lenses the patient may have been wearing. Acuity measurements were taken for distance OD, OS, and OU in turn. With time being a factor, distance acuities were ended at best acuity, or 20/20. Due to the largest distance acuity measurement being 20/200, patients were recorded as >20/200 if 20/200 was unachievable.

Near acuities followed with only OU measurements. These charts were numerical, with lines from 20/100 to 20/25. Near measurements were taken at the standard 40cm testing distance.

Exiting acuity measurements were taken in the same manner as entering, however in a different location. It is important to note that lighting in this area was less ideal than that at the entering VA station, which possibly underestimates the exiting acuities recorded.

### Criteria

Because of the nature of our data, it is important to establish criteria by which we can categorize the individuals that were seen. In efforts to establish a

standard that could be used to compare data across nations, the World Health Organization (WHO) defined the international standard of visual blindness and visual impairment in 1977.<sup>6</sup> Legal blindness as defined by the WHO is any person whose visual acuity is 20/400 or worse in the better eye with best correction, or with a visual field of 10 degrees or less.<sup>6</sup> The U.S. definition of legal blindness differs slightly with the bar set at 20/200 or worse in the better eye with best correction or 20 degrees or less of visual field. Visual impairment in the U.S. and WHO are the same with the definition set as acuities of 20/70 to 20/160 in the better eye. Because of the difficulty of obtaining an accurate, comparable, and timely visual field data on humanitarian trips, these data were not obtained. The U.S. standard for acuity was used in this study.

All patient data was broken down into refractive error categories in order to demonstrate visual acuity improvements. The categories include near prescription patients, distance prescription patients, and cataract patients. The near prescription patients are further divided to separate out those who received a near prescription for asthenopic complaints. Also, patients who received bifocals are divided into separate near and distance categories for the analysis of this study. Specifics of who were included in each category are summarized in the respective section of this article.

Many ocular conditions could lead to reduce acuity in this population. Of the population in San Blas, conditions seen during the mission include, but are not limited to: nystagmus(2), diabetic retinopathy(6), macular degeneration(3), toxoplasmosis(1), posterior synecia(2),

chorioretinal atrophy(3), end stage glaucoma(3), corneal scars(2), macular hole(1), Marfan's syndrome(1), optic atrophy(1), and pterygiums(numerous). Most pterygiums did not involve the visual axis but many created corneal distortion that precluded accurate refractive correction.

### **Population Profile**

Of the 890 subjects seen, 304 (34.5%) were males and 578 (65.5%) were females. The average age of all individuals was 49. The number of persons over the age of 40 was 638 accounting for 72.3% of all patients. The age range of persons seen was from 8 years to 89. The distribution of all ages is illustrated in fig 1.

Of the population, 38 (4.3%) were wearing spectacles. Of these, 28 were used for dist correction, and 9 were reading glasses.

The total number of patients that had diagnosable cataracts was 86.

Of the 890 patients seen, there were 865 in which refractive error was recorded. Of the 865, there were 45 (5.2%) cases of emmetropia, 32 (3.7%) of myopia, 40 (4.6%) of astigmatism, 106 (12.3%) myopic astigmatism, 147 (17%) hyperopia, and 495 (57.2%) hyperopic astigmats. This distribution of refractive errors is illustrated in fig 2. The relatively high amount of hyperopia is consistent with past studies revealing a higher prevalence of hyperopia than myopia in persons over 40.<sup>7</sup> These refractive errors were based upon auto refraction. At least a 0.50D sphere was needed to categorize a person as myopic or hyperopic and at least a 0.50D of

cylinder for astigmatism. This is to compensate for human and/or auto refractor error.

## **Results**

### **Near Prescription Profile**

A total of 465 distance and 731 near point correction spectacles were dispensed. Of the 731 near point glasses given, 314 were readers alone, while 417 were in the form of bifocals.

The persons who received a near point correction were sorted into three categories in order to properly reflect the acuity improvement.

Individuals that entered complaining of near point asthenopia were separated into their own group. These individuals entered with near acuities of 20/25 or better, but were given near lenses despite good near acuity. These persons would obviously show no significant acuity improvement per say, only asthenopic relief. Persons diagnosed with cataracts were also separated due to the reduced ability to improve acuity with spectacle lenses alone. These two groups will be discussed separately.

There was also one 3x magnifier dispensed to a Marfan's syndrome patient improving near acuities from 20/200 to 20/50.

### **Acuity Improvement**

#### **Near Point Asthenopia**

Of those patients that received a near prescription, whether it is in the form of single vision reading glasses or bifocals, 82 demonstrated near point deficiencies other than acuity. As stated previously,

these were individuals who demonstrated an entering near acuity of at least 20/25, and complained of near point asthenopia.

Of these 82, 20(24.4%) were male, and 62(75.6%) female. The age distribution of this population is illustrated in fig. 1. The vast majority (87.7%) of the reading powers given were between 0.75D and 1.5D. The complete distribution of near point lenses given is illustrated in fig 4.

### **Cataracts**

Eighty-six patients were diagnosed with cataracts. These patients consisted entirely of persons over the age of 40, 83.7% of them being over the age of 60. A more detailed description of age distribution is included in fig.1. While it is difficult to significantly improve acuities with a cataract present, we were able to make visual improvement for many of these patients. This is critical since cataracts account for approximately 43% of vision loss in developing nations where cataract surgeons are unavailable or unaffordable.<sup>4</sup> Of the 86 cataract patients, 74 were able to complete distance and near entering and exiting acuities. The average entering near point acuity was 20/115.7, while the average near exiting acuity improved to 20/46.6. Distance entering acuities averaged 20/127.4, and exiting averaged 20/87.3.

### **Other Near Point Improvements**

The final near point group includes the remainder of the population that received near point correction. This population numbered 514. They consisted of 171(33.3%) males and 343(66.7%) females. The average age was 51.9, with 87.6% being over the age

of 40. This demonstrates the need for presbyopic correction for these people. See fig. 1 for complete age distribution.

Acuities were broken into three groups. They include patients demonstrating >20/100 entering near acuities, those with 20/60 to 20/100, and those with 20/30 to 20/50. The >20/100 group averaged an exiting near acuity of 20/28. The 20/60 to 20/100 group average entering near acuity was 20/78.8, while exiting acuity improved to an average of 20/26.4. The 20/30 to 20/50 group started with an average acuity of 20/36.2 and ended with 20/25.3. Overall acuity change was an entering acuity average of 20/83.9 to and exiting acuity of 20/26.5. These acuity improvements are illustrated in fig.3.

### **Distance Prescription Profile**

Of the original 890 patients seen, 822 had both entering and exiting acuities taken. Individuals entering with distance acuity of 20/20 or better, or who did not receive distance spectacles were removed from the distance acuity improvement group. Persons who did not receive spectacles include those who entered with excellent acuities, those who were referred for cataract removal, or who had other ocular conditions that prevented optical correction.

### **Distance Acuity Improvement**

The number of persons receiving a distance prescription was 413. The average entering acuity was 20/55.4, while the average exiting acuity was 20/29.9. Of this same population, 94 entered the clinic with a visual impairment by definition, while the number of people that were considered legally blind under the U.S. definition was 47. Exiting persons with a visual

impairment was reduced to 21 while legal blindness was eliminated from this group. It should be noted that the strict definition of visual impairment and legal blindness is applied only after best correction is in place. We are using this definition for the patients seen before correction because of their otherwise inability to obtain spectacles.

Acuities were again broken down into three groups according to U.S. definitions. These include legally blind ( $\geq 20/200$ ), visual impairment (20/70 to 20/160), and near normal vision (20/25 to 20/60). The  $\geq 20/200$  group averaged an exiting dist acuity of 20/42.4. The 20/70 to 20/160 group average entering dist acuity was 20/82.8, while their exiting acuity improved to an average of 20/35. The 20/25 to 20/60 group started with an average entering acuity of 20/36.6 and ended with 20/26.6. These acuity improvements are illustrated in fig.5. The change in frequency of legal blindness, visual impairment, as well as near normal vision is included in fig.6.

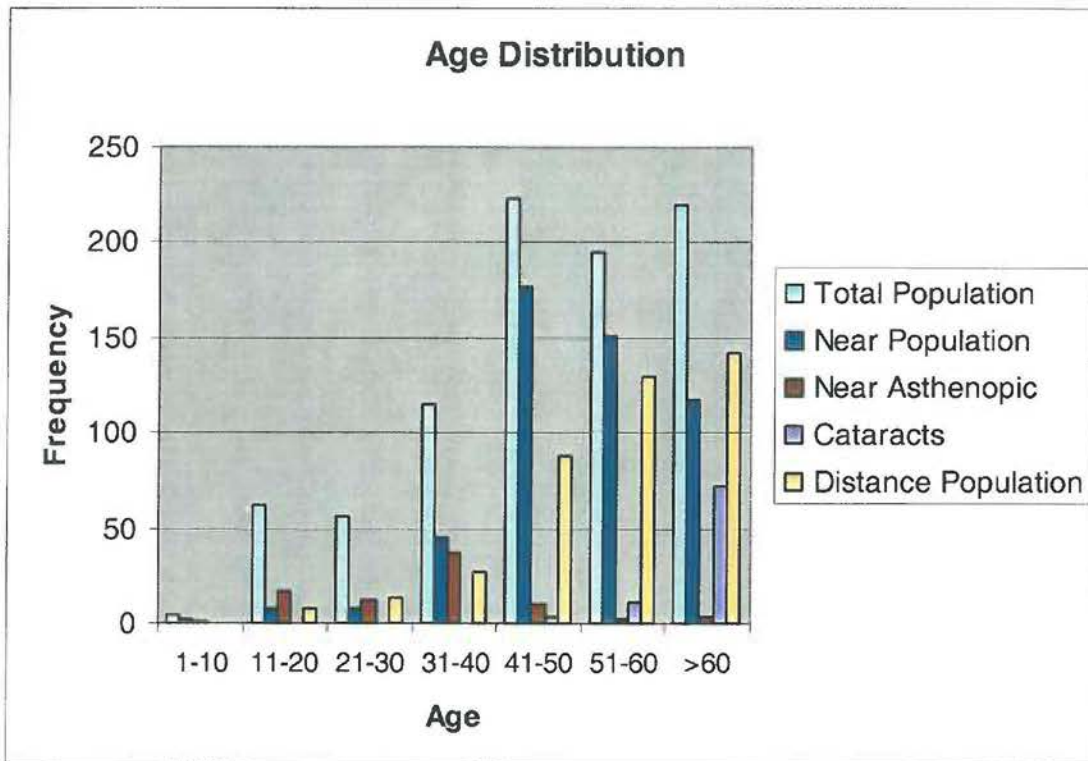
## Conclusion

Ametropia is an often-overlooked cause of visual impairment. The provision of spectacles may significantly impact the quality of life and economic productivity of millions who either have no access to or cannot afford them.<sup>4</sup> This idea is illustrated in figure 7. This figure plots individual acuity improvement. Those individuals who entered the clinic with both poor distance and near acuities, which received spectacles, had an incredible increase in acuities. While the degree to which this affected their everyday lives and quality of life is speculative, it is safe to say that the glasses made a difference on that day.

It is relatively easy to discuss the improvements in acuity on the day they received their new glasses, it is not so easy to discuss how receiving those glasses affect them days, weeks, or months later. Questions have been raised as to whether or not these spectacles actually become a useful tool, or simply thrown by the wayside. It is our intentions to revisit this location in attempt to further serve the community by providing eye care and spectacles, but to also make a determination as to whether or not they are keeping and using the glasses they have received in the past.

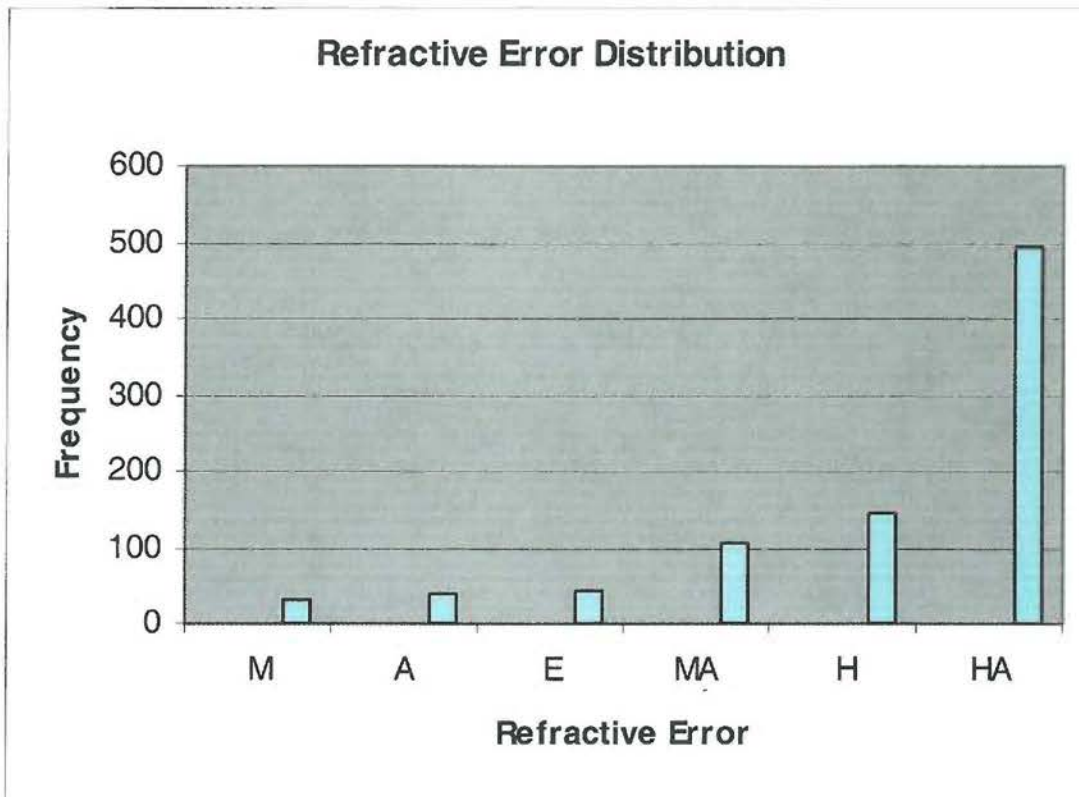
In future humanitarian trips an effort should be made to provide services for those whose schedules did not allow them to attend. The population profile of the patients was influenced by the lifestyles and schedules of the people. For instance, the unusually high prevalence of older or female persons in the study can be partially explained by the work schedule of younger, or male subjects.

Blindness is truly a devastating condition. It is the goal of all eye care practitioners to reduce the frequency of this condition. It is disheartening to see persons with such poor acuities that could otherwise see quite well with the aid of spectacles simply because the services are not available to them.



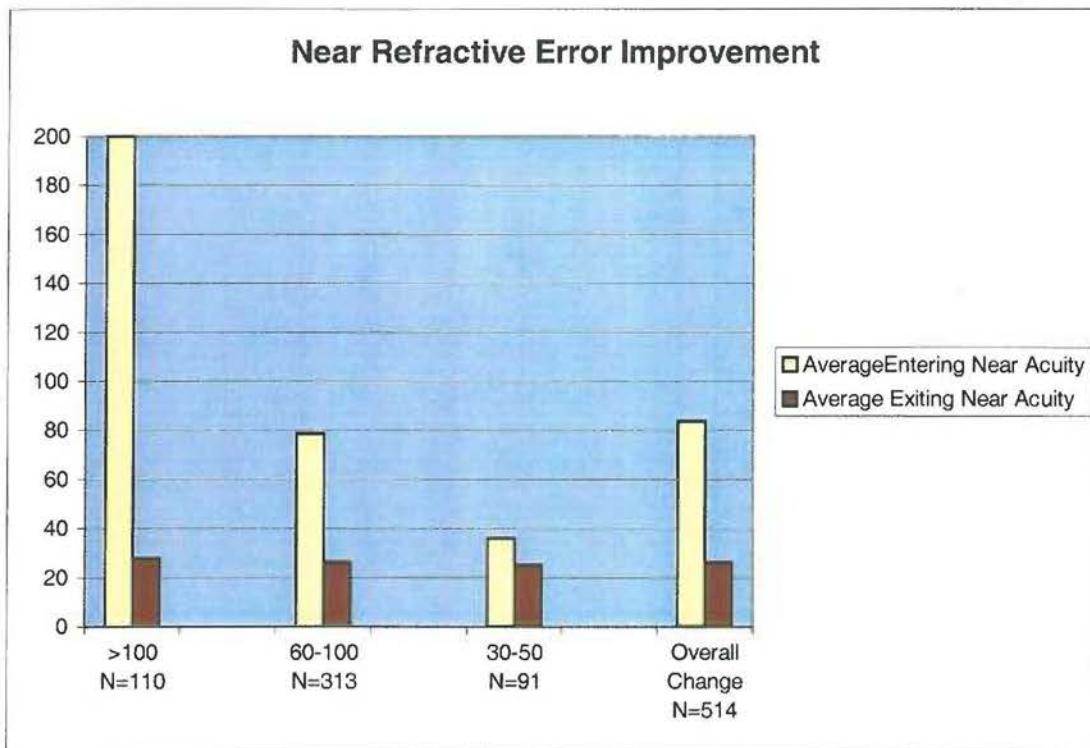
**Figure 1**

Distribution of age according to refractive classifications defined in the study. Total Population (N=890) consists of all persons who received an exam. Near Population (N=514) consists of all persons who received a near correction that do not fall into Near Asthenopic or Near Cataract categories. Near Asthenopic (N=82) consists of all individuals who required near correction despite entering acuity of 20/25 or better. Cataracts (N=86) consist of all cataract patients who received spectacle correction. Distance Population (N=413) consist of persons who received distance correction, and entering acuity of 20/25 or worse.



**Figure 2**

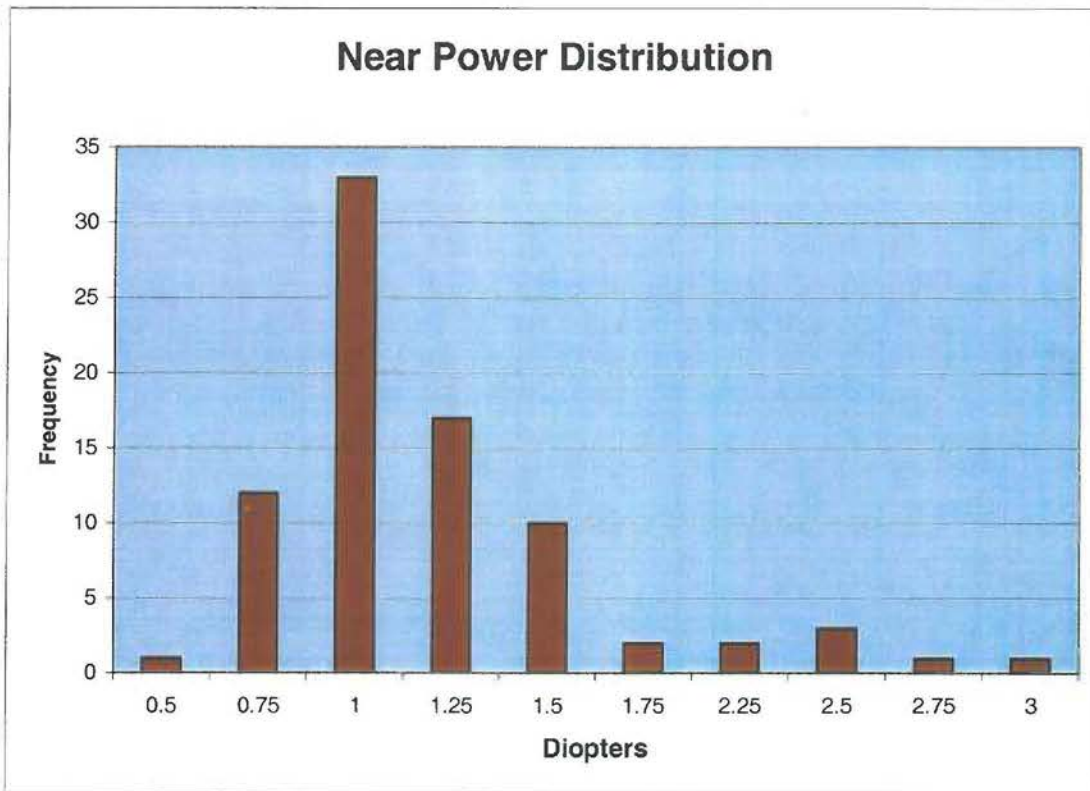
Refractive error distribution based on dispensed spectacles (N=865).  $\pm 0.25D$  refractive errors were classified as emmetropic to compensate for autorefractor/human error. M=Myopia, A=Astigmatism, E=Emmetropia, MA=Myopic Astigmatism, H=Hyperopia, HA=Hyperopic Astigmatism.



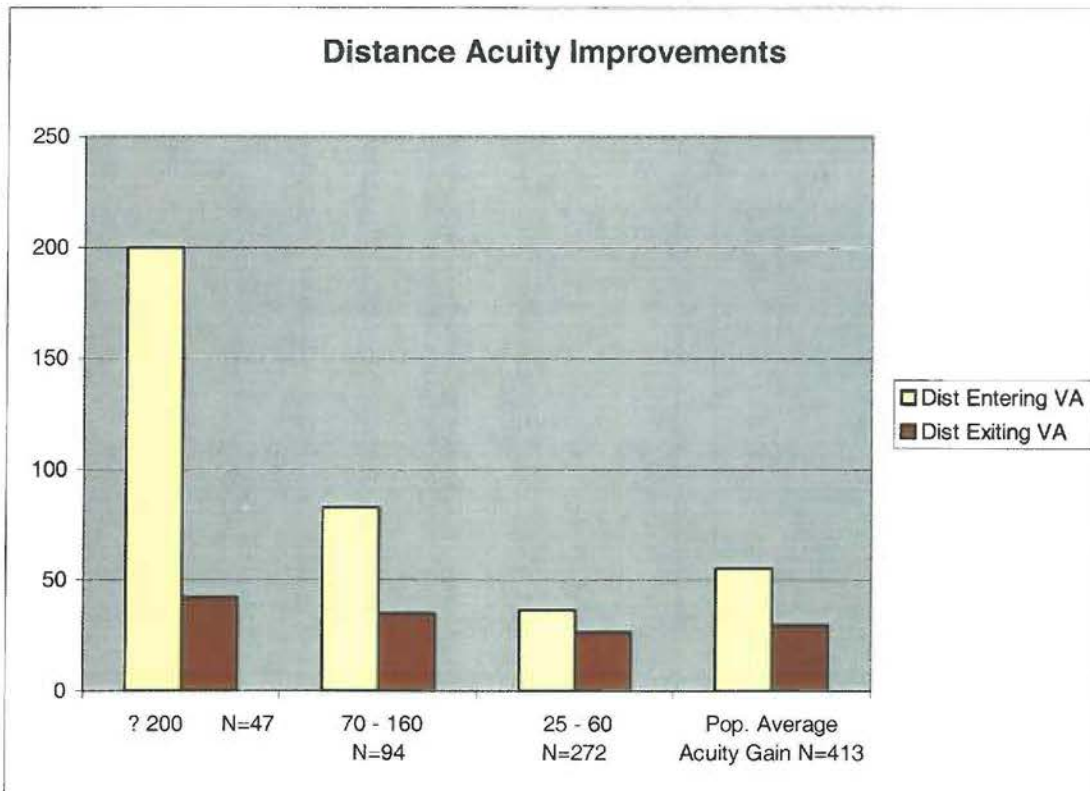
**Figure 3**

Near point acuity improvement for those persons (N=514) receiving near prescription with the absence of diagnosable cataract, or near point asthenopia (defined as those entering with 20/25 near acuity and near point discomfort).



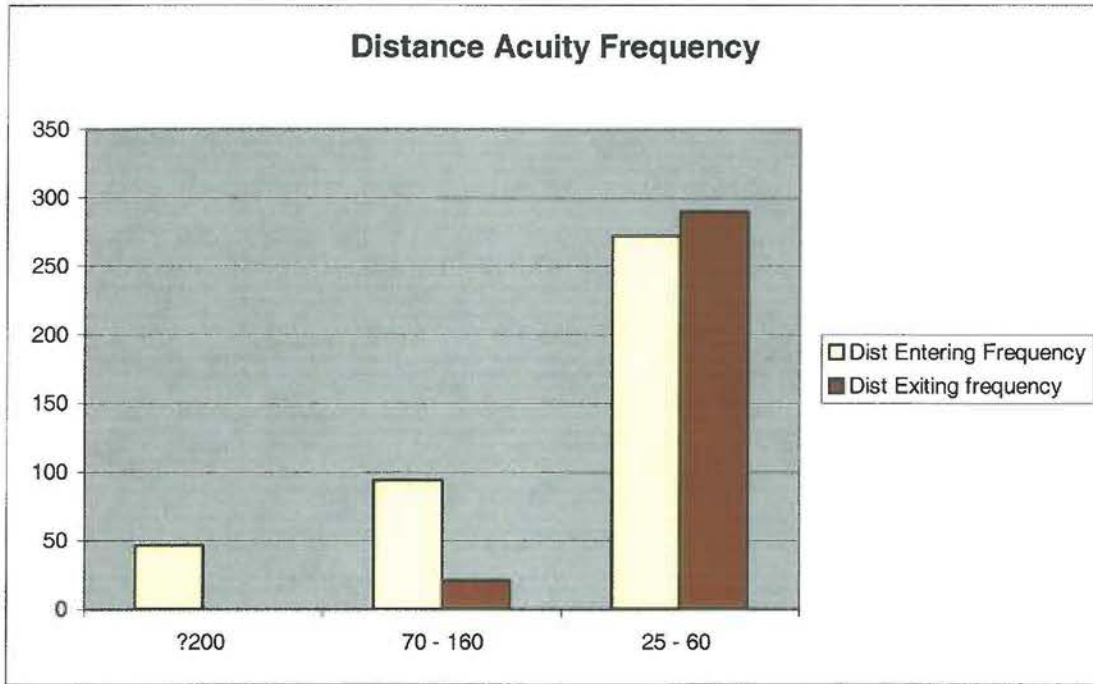


**Figure 4** Distribution of all reading powers dispensed, including net bifocal ADD and single vision spectacles.

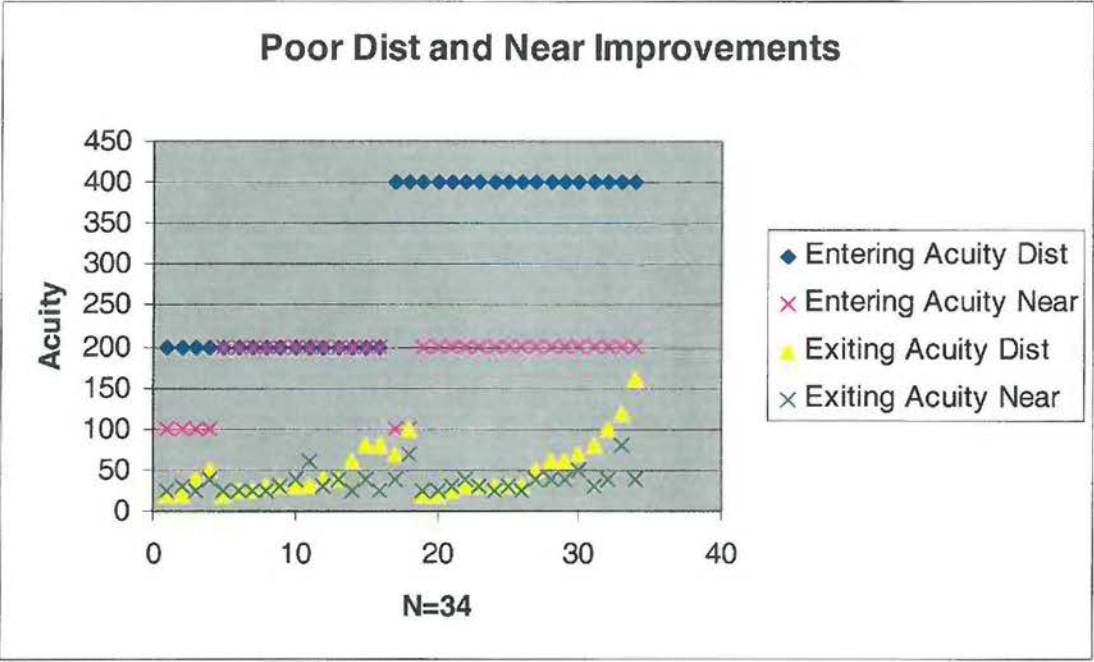


**Figure 5**

Distance acuity improvement for those persons (N=413) receiving distance prescription. Excluded subjects include those with entering acuities of 20/20, or were referred for pathology (cataracts).



**Figure 6** Comparing the frequency of entering legal blindness(N=47), visual impairment(N=94), near normal vision(N=272), and exiting legal blindness(N=0), visual impairment(N=21), and near normal vision(N=290).



**Figure 7**

Plot of patients entering with poor dist and near acuities who received spectacle correction (N=34). Persons entering with near acuities of 20/200 represent those who could not clear 20/100.

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