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Impact of Amblyopia on Self-Perception in Children

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B.S.
Georgia Institute of Technology
2015

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
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Abstract

Impact of Amblyopia on Self-Perception in Children
By Tuyet-Nhung Huynh

Background: Amblyopia, a common vision problem among children, is due to the abnormal development of the visual pathway. Children with amblyopia may have difficulty in various aspect of life such as school performance and social interaction, and if left unattended these negative impacts can contribute to negative self-perception.

Methods: Patients and visitors of the Emory Eye Center were asked to complete the Harter Self-Perception Profile for Children, an age-appropriate questionnaire assessing perceived competence on various domains. Amblyopes (n = 27), including those with strabismus, and controls with normal vision in both eyes (n=31) were included in the study. Parents/guardians of the children completed a different questionnaire and provided basic demographic information about the child in addition to other relevant variables.

Results: Children with amblyopia did not have significantly lower self-perception scores than control children among all domains. Although the mean global self-worth score for controls (3.38 ± 0.58) was 0.18 points higher than amblyopes (3.20 ± 0.70), the positive difference was not statistically significant ($p = 0.28$). Similarly, the mean difference in global self-worth score between strabismic amblyopes (3.27 ± 0.73) and controls (3.38 ± 0.58) was 0.12, with controls viewing themselves slightly more positively than cases, but the difference was not statistically significant ($p = 0.54$). Adjusting for relevant covariates did not alter these relationships.

Conclusion: Amblyopic children, even those with strabismus, between the ages of 8 and 12 do not perceive themselves differently than their peers with normal vision, which can be attributed to early diagnosis and treatment of their condition. Findings from this analysis should not deter further research into understanding the impact of amblyopia on self-perception especially with regards to those who are treated after the sensitive period of development.

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Table of Contents

Background

With a prevalence ranging from 1 to 4 percent in the U.S., amblyopia is one of the most common causes of vision problems experienced by children.[1] Amblyopia, commonly referred to as "lazy eye," is characterized by partial or complete loss of vision that is typically unilateral, but can affect both eyes, and leads to poor visual acuity due to the lack of development of the visual pathways at critical periods during child development.[2,14-15] Although amblyopia is well-researched, there are still uncertainties surrounding its diagnosis and screening process as there are various forms of the conditions and overlapping risk factors such as strabismus.[14] Strabismus, also known as crossed eyes, occurs when the eyes are misaligned leading to the line of vision being pointed different on the same object. If the imbalance in eye muscles continues without treatment, strabismus could lead to amblyopia.[20] Being that amblyopia is due to the inability of the visual pathway to converge images and develop normally, it is important to screen for and treat this condition before 6-8 years of age as this is the sensitive period where neuroplasticity is still present, allowing the visual pathways to still be corrected.[15] Furthermore, previous studies have shown that early screening for risk factors done prior to 37 months of age with check-ups at 4 to 6 month intervals results in better visual acuity in the amblyopic eye as opposed to screening at a later age in life, in turn resulting in a lower prevalence of amblyopia at during childhood age (about 7.5 years).[3] There is also little support in the effectiveness of screening for and treating amblyopia in adolescence and adulthood, further supporting the claim to treat amblyopia as early as possible in young children.[4,5]

Although defining amblyopia can prove to be a challenge task, its treatment has been consistently agreed upon throughout the ophthalmologic community. One of the most common treatments is through optical correction whether it be glasses, contact lenses, or both, and the decision is dependent on the severity of loss of visual acuity and refractive errors.[14] Another commonly used method to treat amblyopia is occlusion therapy where the better eye is inhibited forcing the patient to stimulate the weaker eye in turn leading to better visual development in the brain.[1,5-6] Using an eye-patch, occlusion therapy covers the unaffected eye for a few hours each day and the effectiveness of this treatment is dependent on compliance to treatment.[17] Atropine eye drops are also a common treatment used to treat amblyopia in children where drops used to dilate the non-amblyopic eye making it difficult to focus on near images, blurring the vision of the unaffected eye forcing the child to use the amblyopic eye.[18] The impact of early treatment is crucial to addressing the potential impact amblyopia could have on future employment, social interaction, and even permanent vision loss.[7-8,10]

Furthermore, visual loss itself is associated with a decrease in the quality of life for those who continue to suffer from visual impairment without being treated at an early stage in life.[8] Aside from the impacts amblyopia has on adults, children with amblyopia are at an increased risk of facing difficulties with regards to the psychosocial aspects of their life such as self-image, school, and relationships, which is possibly attributable to the impact amblyopia and the strabismus that is associated with it has on physical appearance as those with amblyopia look different from their peers with regards to the eye.[10-12] With an increased interest in examining the relationship between visual impairment and psychosocial factors, Webber et al. conducted a cross-sectional study

delving further into this association through the use of a questionnaire developed by Dr. Harter referred to as the Self-Perception Profile for Children, geared towards children between the ages of 8 and 14, focused on measuring how children would rate themselves on certain scales.[13] The results of this study, consisting of 47 children with a history of amblyopia treatment and 52 age-matched controls, found there was no statistically significant difference in self-perception between children with amblyopia as compared to those without amblyopia on all subscales except for social acceptance, with the children without amblyopia rating themselves as being more socially accepted than children with amblyopia.[12] Given this study was conducted in Australia, it would be of interest to examine whether or not this relationship would be observed in a similar population in order to confirm these findings and hope to increase the external validity of the existing literature. The research question at hand attempts to examine the association between amblyopia and self-perception in school-aged children between the ages of 8 and 12. In an attempt to answer this question, a cross-sectional study was conducted to examine whether or not children with amblyopia are more likely to perceive themselves negatively as compared to those without amblyopia.

Methods

Participants Through convenience sampling, patients and visitors of the Emory Eye Center between June 2015 and June 2017 were eligible to participate if they were between the ages of 8 and 12, had a diagnosis of amblyopia, or had normal bilateral vision. Of the 87 children that were eligible to participate in this study, only 58 were included in this analysis. Children were excluded from the analysis if they had incomplete questionnaires (n=10) and were not included as controls if they were strabismic but not amblyopic (n=19). Participation in the study required completion of a questionnaire, for both the child and parent/guardian, and a series of reading exercises where eye movement was tracked through the ReadAlyzer system.

Amblyopia Assessment Amblyopia status was determined via medical records obtained from the Emory Eye Clinic. Being that a child can have amblyopia without strabismus, amblyopia cases were included in the analysis as long as the medical record was both available for review and had amblyopia status clearly marked (n=27). Along with amblyopia diagnosis confirmed on the medical record, strabismus was also noted and used to define cases of amblyopes who also had strabismus (n=19). All cases in this sample had a history of treatment as evidenced by the medical record and are continuing patients of the clinic. Those included as controls has to be free of both amblyopia and strabismus as well as have normal bilateral vision (n=31).

Self-Perception Assessment The outcome of interest, self-perception, was measured using the Harter Self-Perception Profile for Children which is a 36-question survey aimed at addressing the multidimensional aspect of self-perception specifically among children between the ages of 8 and 14. Administration of this survey should

follow the guidelines outlined by Dr. Harter in order to increase validity of the measure

as eliminating certain questions or administering the questions by subscale can yield

incorrect results.[13] Each participant was asked to complete the survey on his own while

the researcher sat close by monitoring the responses to ensure that each child only

checked one box per row. Based on this requirement, 8 participants (1 amblyope, 7

controls) were completely excluded from analysis due to marking the boxes incorrectly,

i.e. checking off more than one box per row, or skipping multiple pages of the

questionnaire. In order to address the complexities of self-perception, scoring of the

questionnaire was divided into six subscales: scholastic competence, social competence,

athletic competence, physical appearance, behavioral conduct, and global self-worth

(reliability = 0.80). Listed below is a brief description of each domain:

- Scholastic Competence: Addresses a child's perception of their
  performance in school.

- Social Competence: General attributes of social success such as ease of
  making friends and knowing how to make others like you.

- Athletic Competence: Ability to perform well in sports or other physical
  activities.

- Physical Appearance: How a child feels about his looks.

- Behavioral Conduct: Understanding how well behaved a child feels and
  knowing when to do the right thing ad act appropriately.

- Global Self-Worth: General perception of the self.

Each of the six domains consisted of six questions presented in a structured alternative

format to avoid a child giving socially desirable responses. Self-perception scores were

calculated as a mean of each subscale, ranging from 1 to 4 with 1 representing the poorest self-perception and 4 representing the best.[13]

Covariates Other variables of interest included in this analysis were sex, age, grade, IEP plan, and various disabilities such as dyslexia, ADHD, and intellectual disability. Although age and grade tell a similar story, it is still noteworthy to examine both variables instead of excluding one or the other arbitrarily. IEP plan is important to control for in this analysis as those who are eligible to receive special education services are typically noted by receipt of an IEP plan, which can be expected for children with vision problems that can contribute to slower reading speed, imbalanced hand-eye coordination, etc.[4,8,12] Both age and grade were self-reported by the child while sex was determined by the interviewer. Information on the history or current use of an IEP plan as well as any disability the child has was reported by the parents during the completion of their questionnaire. Although SES was not measured directly, parents were asked how far they would expect their child to go in school which was used as a proxy given education has been used to define SES in other research.[19]

Statistical Analysis Differences in mean scores of each subscale were compared using independent samples t-test (SAS 9.4) with 0.05 set as the criterion for statistical significance. Following analysis of mean differences, ANOVA regression was conducted to examine if there were statistically significant differences between mean self-perception scores both unadjusted and adjusted for sex and history of/currently has IEP plan. The same analyses conducted between all amblyopes and controls was also done for the comparison between amblyopes with strabismus and controls.

Results

With regards to the descriptive characteristics of the study population, the amblyopia and control groups were not significantly different with respect to sex, age, grade, and SES as described by how far a child is expected to go in school (Table 1). However, children with amblyopia (n = 9 (47.4%)) were more likely than comparison children (n = 5 (16.1%)) to currently have, or had a history of, an IEP plan.

Overall, amblyopic children do not perceive themselves more negatively than non-amblyopic children across all domains (Table 2). The mean global self-worth score for all amblyopes was 3.20 ± 0.70 as compared to a score of 3.38 ± 0.58 for controls with controls having a slightly higher general perception of the self by 0.18 ($CI_{95\%}$: -0.15, 0.52) as observed in Figure 1. The greatest mean difference was observed in the athletic competence scale with controls viewing themselves more positively (2.94 ± 0.69) than amblyopic children (2.71 ± 0.71) by 0.23, but this difference in mean scores is not statistically significant ($CI_{95\%}$: -0.14, 0.60).

Even among those children with both amblyopia and strabismus there was no evidence that amblyopic children perceived themselves differently than their peers (Table 3). Although those with amblyopia and strabismus have a lower global self-worth mean score (3.27 ± 0.73) as compared to the controls (3.38 ± 0.58), the difference was not statistically significant ($p = 0.54$). The largest differences in mean scores among subscales were observed in the athletic competence domain with controls perceiving themselves as being more athletically competence than all amblyopes and strabismic amblyopes by 0.23 and 0.21, respectively, although neither of these differences are significant ($p = 0.22$, $p = 0.31$). With regards to the physical appearance domain,

amblyopic children, even those with strabismus, perceived themselves more positively than controls by 0.08 (CI$_{95\%}$: -0.15, 0.32) but this difference was not statistically significant.

After using ANOVA to adjust for potential confounding by potential confounders, the adjusted models used for the analysis included sex and history of/current use of an IEP plan. Although there was a statistically significant difference between amblyopes and controls with regards to IEP plan ($p = 0.02$) as referenced in Table 1, adjusting for IEP in ANOVA did not result in a statistically significant difference in self-perception scores between both amblyope groups and controls in all subscales (Tables 2 and 3).

Discussion

Through the use of an age-standardized survey, these data do not provide evidence to suggest that children with amblyopia have lower self-perception than similarly aged children without vision problems. There is no evidence that these children perceive themselves differently than their non-amblyopic counterparts when it comes to scholastic, social, and athletic competencies, as well as physical appearance and behavioral self-perception even after adjusting for relevant covariates such as sex and IEP plan, even among those with strabismus. The findings from this study are important as they do not confirm the finding of a similarly study conducted by Webber where a significant difference was observed between amblyopes and non-amblyopes with respect to the social competence domain. However, the results obtained in this analysis do support previous work done by Webber in that self-perception scores do not differ among the remaining subscales. Although the results display a null association between amblyopia and self-perception, it is important to use these results as a learning tool to better understand the complexity not only of self-perception and its assessment, but also understanding the complex nature of amblyopia and its definition.

Strengths and Limitations When determining cases in this analysis, it is important to understand the various ways strabismus is related to amblyopia. Historically, strabismus has been screened as a risk factor for amblyopia; however, if left untreated amblyopia itself can lead to strabismus. Development of strabismus leads to a change in physical appearance with the affected eye turning in a certain direction (e.g. inward turning (esotropia) vs. outward turning (exotropia))[21], which in turn can impact the child's self-esteem and fear of social acceptance. Although directionality between

amblyopia and strabismus was not able to be determined in this analysis, i.e. was strabismus a risk factor for amblyopia or a result of untreated amblyopia, interpretation of the results can still be made in terms of strabismus. The observed null association between the presence of amblyopia and self-perception while considering strabismus further supports the claim that even when controlling for relevant risk factors, amblyopia does not contribute to a child's self-perception. Another strength of the study can be attributed to the validity of the case definition of amblyopia as this information was gathered from medical records completed by an experienced ophthalmic technician as opposed to self-reporting, allowing for control of potential misclassification bias of the exposure. Data collection of the study was also a strength as researchers were thoroughly trained on the process of collecting data, interacting with children and parents, and understanding the questionnaire being administered to ensure correct completion of the study.

There were also several limitations in this analysis most notably with the sample size being small, as visualized in Figure 2 with regards to sex, underpowering the statistical tests conducted for analysis. The relatively small sample size, in comparison to Webber's sample of 99 children, contributes to issues with imprecision and the inability to detect true difference. Additionally, the small sample size itself made it difficult to stratify on the potential confounders of interest such as grade and age as this created smaller sub-samples and imprecise statistical testing, contributing to issues with residual confounding. Nevertheless, we had adequate power to detect approximately a 1 standard deviation difference in reported self-perception between children with amblyopia and their peers. Recruitment of the sample population was also a limitation as convenience

sampling was conducted, which brings up an issue of selection bias as this group is likely to be inherently different in many ways from the target population of children in the U.S. between the ages of 8 and 14 with and without amblyopia. Lack of information on other possibly important confounding variables, such as race and socioeconomic status, could have provided more depth to the analysis and would be a point to address for future studies as seeking health care and health care access are related to the aforementioned variables.

 Future Directions Being that the sample population had already been treated for amblyopia and were continuing their care at the Emory Eye Center, it would be of interest to observe self-perception differences among those who were treated for amblyopia after the sensitive period of visual pathway development as compared to those treated for amblyopia during the critical period in an attempt to provide more support for treatment of amblyopia early in life.

 In conclusion, we found no evidence that amblyopia impacts self-perception in school-aged children. This is good news for families who may be worried about the impact that amblyopia may have on their children's quality of life and self-confidence. However, it would be important to continue to look at such questions, particularly related to scholastic competence and social confidence during adolescence.

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Tables

Table 1. Characteristics of SEEK Study Population (N=58).

Mean±SD	Amblyopia (n=27)	Controls (n=31)	p
Age (years)	9.6±1.2	10.0±1.3	0.18
Grade[a]	3.9±1.3	4.2±1.4	0.28
Sex[b] (% female)	12 (48.0)	18 (58.1)	0.45
IEP Plan[c] (%)	9 (47.4)	5 (16.1)	**0.02**
How far child will go in school [d] (%)			
4 years of college or more	24 (92.3)	25 (86.2)	0.47
Disability (%)			
ADHD	6 (25.0)	2 (6.7)	0.06
Dyslexia	3 (13.0)	0 (0.0)	xx
Intellectual Disability	1 (4.2)	1 (3.3)	0.87
Speech/Language Problem	7 (29.2)	3 (10.0)	0.07
Hearing Problem	1 (4.6)	1 (3.3)	0.82
Other Learning Disability	4 (17.4)	0 (0.0)	xx

a. Range: (2,7). Missing two values

b. Female is the referent group. Missing one value

c. History of or currently have an IEP Plan. Missing one value

d. Reference group is less than 4 years of college. Missing three values

*Bolded values signify a statistically significant difference between amblyopes and controls ($p < 0.05$)

Table 2. Mean scores±SD for each subscale in the Self-Perception Profile for Children

	Amblyopia (n=27)	Controls (n=31)	Mean Difference (95% CI)[a]	Crude		Adjusted*	
				$t_{(df=56)}$	p	$F_{(3,52)}$	p
Scholastic Competence[b]	2.78±0.82	2.96±0.70	0.18 (-0.23, 0.58)	0.88	0.38	0.50	0.69
Social Competence	2.96±0.72	3.04±0.67	0.09 (-0.28, 0.45)	0.47	0.64	0.23	0.88
Athletic Competence	2.71±0.71	2.94±0.69	0.23 (-0.14, 0.60)	1.23	0.22	0.58	0.63
Physical Appearance	2.51±0.42	2.38±0.38	-0.13 (-0.34, 0.08)	-1.24	0.22	0.89	0.45
Behavioral Conduct	2.34±0.34	2.30±0.29	-0.05 (-0.21, 0.12)	-0.56	0.58	0.95	0.42
Global Self-Worth[b]	3.20±0.70	3.38±0.58	0.18 (-0.15, 0.52)	1.09	0.28	0.33	0.81

a. Mean Difference = Controls – Amblyopia
b. There are 26 amblyopes in these subscales ($t_{(df=55)}$)
*Adjusted for sex and history of/currently has IEP plan

Table 3. Mean scores±SD for each subscale in the Self-Perception Profile for Children: Strabismus and Amblyopia

|	Amblyopia and Strabismus (n=19)	Controls (n=31)	Mean Difference (95% CI)[a]	Crude		Adjusted*	
				$t_{(df=48)}$	p	$F_{(3,45)}$	p
Scholastic Competence[b]	2.83±0.89	2.96±0.70	0.13 (-0.33, 0.59)	0.55	0.58	0.71	0.55
Social Competence	3.15±0.67	3.04±0.67	-0.11 (-0.50, 0.29)	-0.54	0.60	0.38	0.77
Athletic Competence	2.73±0.72	2.94±0.69	0.21 (-0.20, 0.62)	1.02	0.31	0.46	0.71
Physical Appearance	2.46±0.43	2.38±0.38	-0.08 (-0.32, 0.15)	-0.71	0.48	0.56	0.65
Behavioral Conduct	2.33±0.33	2.30±0.29	-0.04 (-0.22, 0.14)	-0.41	0.69	0.91	0.45
Global Self-Worth[b]	3.27±0.73	3.38±0.58	0.12 (-0.26, 0.50)	0.62	0.54	0.25	0.86

a. Mean Difference = Controls – Amblyopia and Strabismus
b. There are 18 amblyopes in these subscales ($t_{(df=47)}$)
*Adjusted for sex and history of/currently has IEP plan
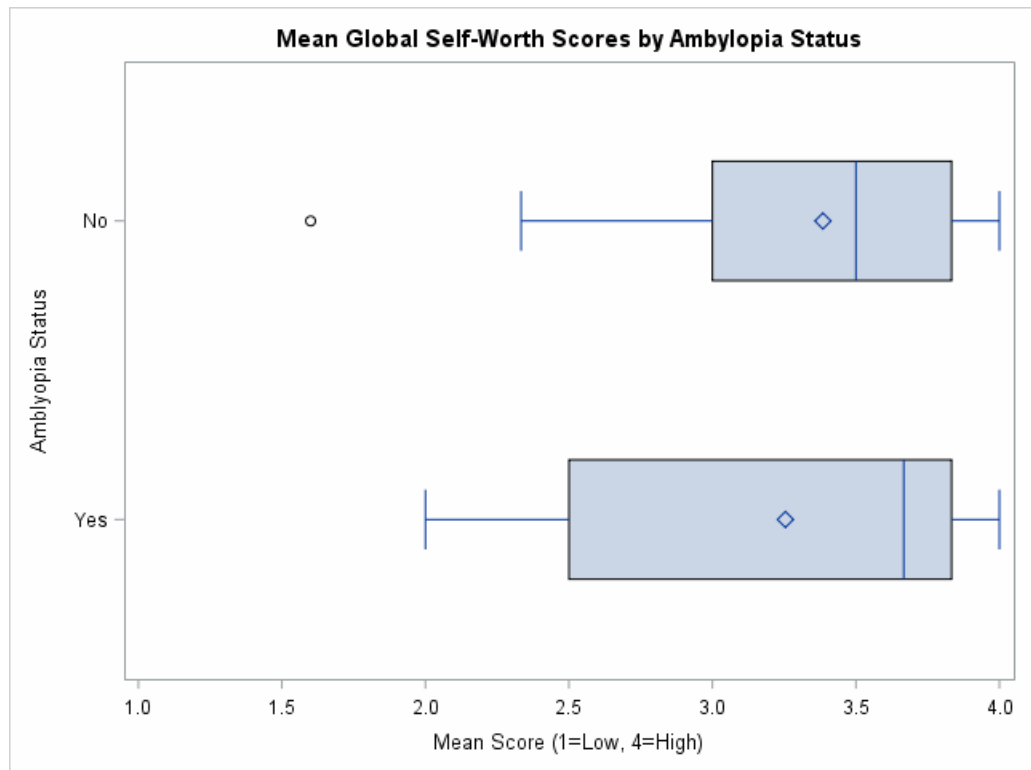
Figure 1. Distribution of Mean Scores for the Global Self-Worth subscale by Amblyopia Status. Although the controls, on average, have higher mean scores of global self-worth (3.38) as compared to those with amblyopia (3.20), there was no statistically significant difference in mean scores between the groups ($t_{(df=55)} = 1.09$, $p = 0.28$).
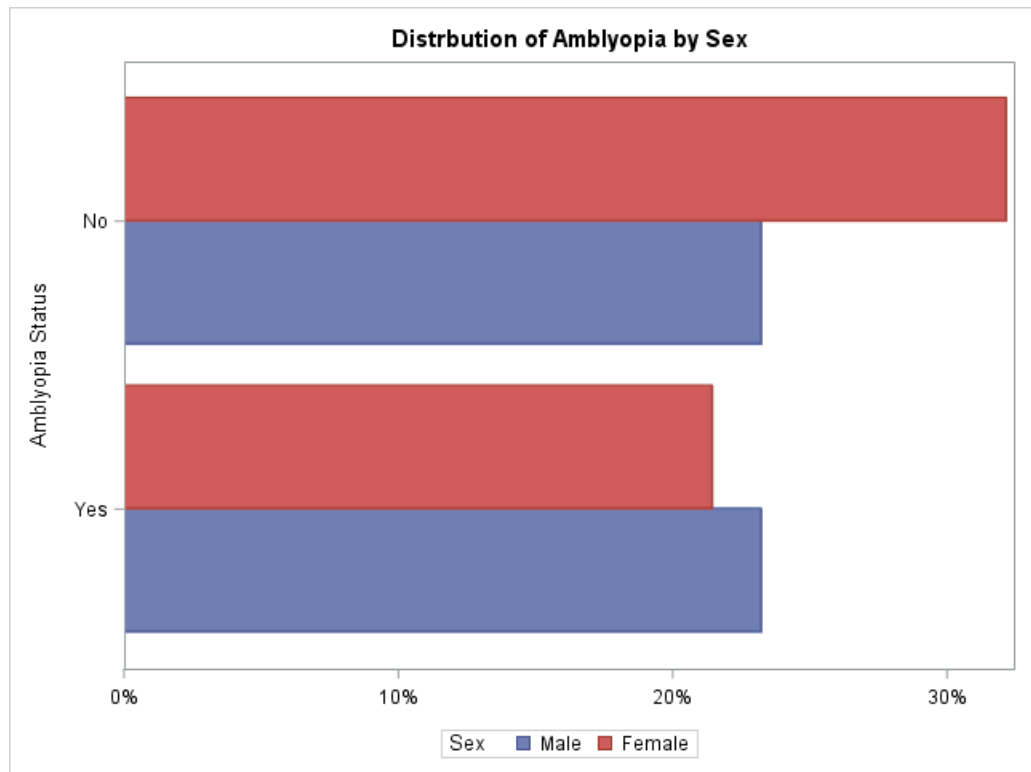
Figure 2. Distribution of Amblyopia by Sex. Males appear to be equally represented in each of the groups regardless of amblyopia status (23%), whereas females are more prevalent in the control group (33%) as opposed to the amblyopic group (21%).