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# Irlen Syndrome Incidence in Cuenca-Ecuador

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## Abstract

The objective of this study was to determine the prevalence of Irlen Syndrome (also known as Meares-Irlen Syndrome/Visual Stress (MISViS)/Scotopic Sensitivity Syndrome), and identify the most common physical and visual perceptual discomfort that affects reading in third-grade children of public and private Cuenca urban schools. Two hundred and sixty-seven third graders, as well as directors, parents and classroom teachers participated in this study. Children were assessed through observations, interviews and by applying five tests of the Irlen Reading Perceptual Scale (IRPS®). Prevalence of “severe” Irlen Syndrome in third graders of elementary schools in Cuenca is 25,84%, which may prevent the normal development of the reading process. The most common physical discomforts (PD) when reading were: i) moving closer to or further from the page (19,17%); ii) discomfort when reading under fluorescent lights (18,05%); iii) blinking very often (14,66%); iv) pain, burning of the eyes while reading (12,78%). Within the most common visual perceptual distortions (VPD) identified are: i) the need of using the finger or a marker while reading (37,59%); ii) choppy or slow reading (33,08%); iii) making effort to stay focused on the words, (28,95%); iv) avoiding reading or reading aloud (27,89%), v) having trouble remembering what was read (19,92%) among others. It was concluded that prevalence of “severe” Irlen Syndrome in Cuenca urban schools that would warrant possible intervention is 25,84%; the most common visual perceptual distortions and physical discomfort when reading were also identified in this study group.

**Keywords:** Visual perceptual distortions, reading discomfort, basic education, reading difficulties, Irlen Syndrome, Meares- Irlen/Visual Stress syndrome, Scotopic Sensitivity Syndrome.

## 1. Introduction

Among the main and most common learning difficulties which are of keen concern to pupils, classroom teachers, parents, psychologists, medical doctors and staff officials present worldwide, dyslexia, a term used interchangeably with reading difficulties, is considered the most important (Olitsky & Nelson, 2003). Orton (1925) states that dyslexia is the result of a malfunction of visual perception and visual memory caused by a delayed maturation. Olitsky (2003) defines dyslexia as the inability to develop the ability to read at reading level of what education expects of children despite having normal intellect. Dyslexia is a primary disorder of reading and must be separated from secondary forms of reading difficulties which include mental retardation, educational and environmental constraints, and/or diseases. Because there is no standardized test for dyslexia, the diagnosis is performed by comparisons of reading skills with intelligence and reading standards. Health and education professionals in our Ecuadorian school environment face with children who have learning problems especially reading difficulties, and besides being diagnosed as dyslexic, can also be classified into groups of individuals with attention deficit, hyperactive, and in general with some specific learning disorder (SLD). According to DSM-5 (Kupfer & Regier 2003), attention deficit/hyperactivity disorder (ADHD) is characterized by a pattern of behavior, present in multiple settings (eg, school and/or home) that can result in performance issues at social, educational or occupational level. Symptoms are divided into two categories of

inattention, hyperactivity and impulsivity behaviors including lack of attention to details, difficulty organizing tasks and activities, excessive conversation, restlessness, and/or inability to remain seated in appropriate situations. Many of them can actually manifest these singularities when evaluated by the application of reading tests, or other traditional tests, but there is the possibility that these individuals are misdiagnosed and rather present other symptomology and need different instruments for evaluations. Similarly, classroom teachers require certain psychopedagogic interventions that allow them to objectivize the problem and its intervention. Reading tests such as the Gates-MacGinitie Reading Tests® (MacGinitie et al., 2000), the Iowa Tests of Basic Skills® (ITBS®) (Hoover et al., 2001), or reading techniques such as animation for reading, individual reading, group reading, reading aloud, silent reading (Andrade, 2011), and comprehension tests are exercises that the students must perform without taking into consideration initial reading ability. Furthermore, these tests are administered regardless of what children see or do not normally see of what is printed, or whether these individuals have juxtaposition problems of letters, grapheme confusion, visual fatigue, physical discomfort – characteristic, signs and symptoms of dyslexia and/or may be confused with Irlen Syndrome, which can alter reading performance affecting results of traditional school, psychological and medical tests.

Irlen & Lass (1989) defines Irlen Syndrome or MISViS as a perceptual dysfunction which is related to reading difficulties due to different light sources, brightness, intensity, waves of light, color and contrast. Individuals suffering from Irlen Syndrome put more effort into perceiving visual information (including text on the page) and often experience strain and/or fatigue as a result of the extra stress put on the brain. They can be slow and inefficient readers, have low reading comprehension, inability to read continuously, suffer from fatigue or malaise, headaches, and have writing and depth perception problems. Within the physical manifestations of Irlen Syndrome are headaches, sore eyes, sleepiness, fatigue, and difficulty concentrating on and understanding what is being read. There have been extreme cases of children unable to sit still while reading, others protest and reject categorically to read because they can not tolerate the pain or discomfort that this activity causes on them. The existence of Irlen Syndrome has been corroborated by research conducted by Miller (1985), and Adler & Atwood (1987). Other studies report similar distortions to those seen in the inefficient readers. Jordan (1972) found that weak readers experienced double images, the separation of words or letters and duplication of words. Participants in the studies of Stein & Fowler (1985) and Lovegrove (1984) noticed distortions and movements in print. Studies of Irlen Syndrome prevalence in different populations have been performed worldwide. Miller (1985) found that 74% of adults with learning disabilities and 15% of the normal adult population or with reading skills above normal presented Irlen Syndrome symptoms themselves. Robinson & Miles (1987), Whithing (1986), Adler & Atwood (1987), and Irlen (1983) all reported that 46 to 50% of the weak readers who participated in their studies have symptoms of Irlen Syndrome. The treatment involves the intervention with color filters as standard glasses or contact lenses or with the use of color transparencies. Several studies such as Evans & Joseph (2002), Wilkins et al., (1999), Jeanes et al (1997) have reported that the use of color transparencies or lenses enhances printing, eliminates background distortions, increases reading time, decreases fatigue and pain, and improves reading comprehension among others. Irlen Syndrome cannot be diagnosed totally and efficiently through educational and psychological evaluations or other traditional school tests. This syndrome can coexist with other learning problems and does not eliminate the need for intervention and remediation programs to correct learning problems.

The prevalence of Irlen Syndrome worldwide in the general population is 12-15%, and 40-50% in people with learning disabilities. The present study provides data on Irlen Syndrome prevalence and identification of the most common physical and perceptual distortions that affect reading in Cuenca schools. It is the second nationwide study conducted with a sample of 267 participants from 15 schools. Bernal (2011) reveals the presence of visual perceptual distortions (VPD), 36%, and physical reading difficulties (PR), 21% in a group of 14 participants with learning difficulties reported to the Centro de Diagnostico y Orientacion Psicopedagógica (CEDOPS) in Cuenca. In general, professionals of general basic education in our environment are unaware of the pathologies of Irlen Syndrome; they claim to know something about dyslexia, hyperactivity and attention deficit, however, in their daily practice they are unable to assist students in their reading assignments. The objective of this research was to determine the prevalence of “severe” Irlen Syndrome in third graders and identify the most common VPD and PD. This will generate new knowledge in this area, and enable us to present new proposals for the correction and remediation of reading problems. The

results of this study will serve as reference material for multidisciplinary professional teams, schools, research centers, classrooms, support and remedial education programs. They can have new and different inputs to avoid confusing symptoms and signs that result from Irlen Syndrome or MISViS and not from dyslexia, attention deficit, hyperactivity, among others. By determining the prevalence of this syndrome in our environment, we are able to take appropriate measures to eliminate barriers that may be responsible for reading difficulties or other learning problems, since difficulty reading on these tests may be affecting the overall academic results. We will be also capable of making appropriate assessments to indicate what activities or recommendations to remedy in part the reading problems. From a public health point of view, the research results serve to tackle reading problems scientifically. Reading problems have a direct correlation with mental health and family, education and social welfare. Likewise, these research results enable us to further research on Irlen Syndrome, its treatment and its implementation at local, regional and national level, and contribute in general to the improvement of education in our country.

## **2. Materials and methods**

### ***2.1 Study Population and type of study***

Two hundred sixty-seven third-grade schoolchildren of basic general education (BGE) of fifteen (15) urban schools of Cuenca, Ecuador, during the second half of the school year, February-July and early September 2013-2014 participated in this study. It is a basic descriptive study that aimed to determine the incidence of Irlen Syndrome, and identify the most common VPD and PD present in this student population. According to the research approach, it is quantitative that describes the prevalence of a disease that affects reading performance in urban schools of Cuenca.

### ***2.2. Population, sampling and sample.***

According to the Excel files of education establishments, 1st district, provided by the Ministry of Education of Ecuador, the canton Cuenca, Azuay Province, Zone 6, in December 2013, the **population** of students in the third grade of BEG schools was 6,638 children. For **sampling**, we used the iOS Software *My sample v. 1.0* and determined that the sample with a confidence level (CL) of 99% and a margin of error (ME) 4.36% was 262; international reference of Irlen Syndrome is 12%. The selection of children was made by randomization through a mobile application "Random Number", and manually selected from the third-grade rosters delivered by the educational establishments.

The research focused on working with children who had no physical symptoms, whose vision was normal, were using lenses or not when taking the tests, and did not suffer from any visual disorder that demands constant attention. However, participants who had visual physical problems such as cataracts, blindness in one eye, etc., or any kind of emotional or psychological disorder or those with visual impairment and were not wearing glasses at the time of the application of the Irlen® Reading Perceptual Scale (IRPS®) were excluded.

### ***2. 3. Instrument for data collection***

The Irlen® Reading Perceptual Scale (IRPS)® was used to collect the data. The IRPS® contains 4 sections. Section 1 provides data on reading difficulties and discomfort on a qualitative scale: *not applicable*, quantitative range (qr) 0, *slight*, 1-3 *moderate*, 4-7 and *severe*, 8-17. Section 2, collects observations of Box A, Box B and Pumpkin(s) to confirm the statements of Section 1. This section also records the physical symptoms and visual distortions of the Pinguin, Musical Lines exercises and the physical symptoms of Span of Recognition and Pointing Task on scales 0 to 17. Section 3 records the subject's reactions when reading on a white sheet, and the degree of improvement when color transparencies are used. The ranges of the amount of improvement with overlays are on the scales of *not applicable N/A*, *slight*, *moderate*, and *considerable*. Section 4 gives information about distortion pages, as well as relevant comments. The IRPS® data sheet comes with the corresponding reference scales of each section for quantitative data. To determine the prevalence of Irlen Syndrome in our research, the section 1, (17 questions on the presence of VPD, and 17 on PD) with the corresponding quantitative assessments *always* (1) , *sometimes* (0.5) and *never* (0) was used. Section 2: Box A, Box B, Pumpkin (s), Span of Recognition, and the corresponding observations and

responses to structured interviews about the symptoms and signs of Irlen Syndrome were used to corroborate what was indicated in section 1.

#### 2.4. Data collection process

Prior to the application of methodologies and research techniques, training of the research team was carried out through 3 training workshops on application techniques of the IRPS®. The corresponding recommendations for the collection of information were raised, and two pilot tests were run, the first one with eight (8) volunteer students, and the other with thirty-one (31) at the Educational Unit "Sagrados Corazones". Informative workshops about Irlen Syndrome and Method involving a neurologist, a neuropsychologist, and participants of the research team were also conducted. Each child from the participating schools was interviewed by the evaluator who at first collected personal data of the student, then proceeded with the 17 questions in Section 1 and 2 of the IRSP®, and marked the corresponding scales: *No Irlen* (0), *slight* (1-3), *moderate* (4-7), and *severe* (8-17). Box A, Box B, Pumpkin (s), and Span of Recognition tests were also applied in order to corroborate what the children expressed in Section 1. To ensure the validity of the evidence, some children were requested to read a third-grade reading text either before or after the application of the previous tests which helped the research team to observe the presence of some of the Irlen Syndrome symptomology.

#### 2.5. Data analysis procedure

Registration information and additional observations were recorded directly in the IRPS®. In responding to the questionnaire 1 and 2 of Section 1, the researcher wrote the answers given by the participant. In case of detecting the signs and symptoms of Irlen Syndrome, s/he counted the number of responses, and marked on the first page of the IRPS® the score obtained from the 17 questions both for VPD and PD in the respective ranges, from 0 to 17. For purposes of data processing, consideration was given to 4 categories for assessing the presence of Irlen Syndrome: *No Irlen* (0), *slight* (1-3), *moderate* (4-7), and *severe* (8-17). The data recorded in the IRPS®, were uploaded to SPSS 21 program. A database was created to be analyzed according to the different variables corresponding to each item of IRPS® Section 1, questionnaire on PD and VPD. Sandra Tosta, PhD, the research director of the Irlen Institute in Long Beach, California, US, stated that for Irlen Syndrome prevalence studies the following parameters should be taken into account: Because Irlen Syndrome can present itself with either distortions or physical symptoms (it does not require both), incidence must be reported as follows:

- i) It needs to show the breakdown of how many have only physical symptoms, only distortions, or both;
- ii) Within each category, the percent having slight, moderate, or severe symptoms needs to be identified.

To report the data this way, as recommended above, we had to look at individual data taking into consideration the following combinations and resulting Irlen severity categorization:

**Table 1. Possible Combinations of Reading Difficulties and Discomfort**

Reading Difficulties/Discomfort	N	Categorization
no/no	4	No Irlen
no/slight	1	No Irlen
slight/no	9	No Irlen
slight/slight	44	No Irlen
slight/moderate	8	Slight Irlen
moderate/slight	63	Slight Irlen
slight/severe	2	Slight Irlen
severe/slight	11	Slight Irlen
moderate/moderate	50	Moderate Irlen
moderate/severe	13	Severe Irlen
severe/moderate	36	Severe Irlen
severe/severe	20	Severe Irlen

To determine a single percentage of individuals suffering from Irlen Syndrome moderate to severe relative frequency measures (percentage) was used.

### 3. Results

**Table 2.** Incidence of Irlen Syndrome in Urban Schools of Cuenca.

Irlen Syndrome	N (%)
No Irlen	58 (21,72)
Slight	84 (31,46)
Moderate	50 (18,72)
Severe	69 (25,84)
Lost Cases	6 (2,25)
<b>Total</b>	<b>267 (100)</b>

Irlen Syndrome prevalence in Urban Schools of Cuenca in the severe range (25.84%), and moderate (18.72%), combined values of the presence of the VPD and PR, is shown in Table 2.

**Table 3.** Most common Physical Discomfort

	Most Common Physical Discomfort	N (%)
1	move closer or further from the page	51 (19.17)
2	reading discomfort under fluorescent lights	48 (18.05)
3	open eyes wide	39 (14.66)
4	frequently blinking	39 (14.66)
5	dry, sandy, scratchy, or itchy eyes	34 (12.78)
6	eyes hurt, ache, or burn	34 (12.78)
7	rub eyes or around them when reading	33 (12.41)
8	active, nervous when reading	30 (11.28)
9	frown or squint	28 (10.53)

Out of the 17 Reading Difficulties or Physical Discomfort when reading (PD) on Section 1 of the IRPS®, the most common ones present in the research subjects of both sexes on a scale of *always* are detailed in Table 3. From high to low percentages are the following: i) children need to move closer or further from the material they read or the IRPS® tests (19.17%); ii) reading discomfort under fluorescent lights (18.05%); iii) open their eyes excessively when reading or performing Irlen tests (14.66%); iv) frequently blinking (14.66%); v) dry, sandy, scratchy or itchy eyes (12.78%); vi) eyes hurt, ache, or burn (12.78%); vii) 12.41% of schoolchildren rub their eyes or around them during testing; viii) (11.28%) are active, nervous to read; and ix) frown or squint (10.53%).

**Table 4.** Most common Visual Perceptual Distortions.

	Most Common Visual Perceptual Distortions	N (%)
1	use finger or a marker to read	100 (37.59)
2	slow and choppy reading	88 (33.08)
3	effort to stay focused on the words they read	77 (28.95)
4	avoid reading aloud	74 (27.89)
5	have problem remembering what they read	53 (19.22)
6	distracted, took repeated breaks while reading	46 (17.29)
7	restless, fidgety, easily distracted when reading	44 (16.54)
8	have problem understanding what they read	39 (14.66)
9	misread words from lines below or above	39 (14.66)
10	lose place when reading	27 (10.15)

Out of the 17 Reading Difficulties or Visual Perceptual Distortions (VPD), the most common are seen in detail in Table 4. They are as follows: i) children used their finger or a marker to read (37.59%); ii) slow and choppy reading (33.08%); iii) made effort to stay focused on the words they read (28.95%); iv) (27.89%)

avoided reading aloud; v) had trouble remembering what they read (19.92%); vi) (17.29%) got distracted, took repeated breaks while performing reading tasks; vii) (16.54%) of these students got restless, fidgety, and easily distracted when reading; viii) had trouble understanding what they read (14.66%); ix) (14.66%) misread words from lines below or above, and x) lost place when reading (10.15%).

#### 4. Discussion

Irlen (2005-2010) states that Meares-Irlen Syndrome/Visual Stress Irlen Syndrome (MISViS) in several studies on worldwide prevalence is 12 to 14%, and that for people who suffer from dyslexia, attention deficits, hyperactivity and other learning difficulties is from 46% to 50%. Irlen (in personal communications), usually indicates that the incidence is 26% for the world population in general in the moderate to severe range. Alder & Atwood (1987) studied 333 young students at San Gabriel East High School in the US in 1987, and found that 137 (42%) had symptoms of Irlen Syndrome. In this group, 45 (13.5%) were diagnosed in the scales of moderate to severe in the IRPS®. Johnson *et al.* (2000) studied Irlen Syndrome (IS) in 172 fourth grade schoolchildren in Massachusetts and found that 47 (27%) were diagnosed positive, and 30 (17.4%) were diagnosed with Irlen Syndrome symptoms on the scales moderate to severe. Robinson *et al.* (1995) in a sub-study worked with 287 seventh-grade students in Australia, and 137 (48%) were diagnosed with IS in the ranks of "affected" and 71 (25%) "significantly affected". Another study in Australia by Robinson & Milles (1987) in which 70 pre-school students participated showed that the incidence of IS is 58%, of which 13 (20%) were classified in the range of "significantly affected". Kruck *et al.* (2008) in a group of 38 children who had reading difficulties, showed that almost half had MISViS symptoms. Scheiman *et al.* (1990), in a study entitled "Characteristics of vision in individuals identified for Irlen filters", which involved 39 subjects, aged 10-49, who underwent an optometric examination, 95% of these patients were identified as candidates for the study and showed significant visual abnormalities easier to identify; 57% had significant vision problems that were not corrected by the optometric examination. Irlen Syndrome and its treatment is controversial despite the many studies and research conducted internationally. Several studies indicate that the prevalence of this syndrome may be biased, and it is also criticized for the lack of solid scientific evidence, and that it has rather commercial and non-scientific purposes. Kurck *et al.* (2008) note that the results of their research are mixed, and they would like to believe that Irlen Syndrome (IS), does exist, but until evidence of improved scores in reading comprehension are observed, they remain skeptical. Ritchie *et al.* (2011) in his article *Irlen Colored Overlays do not alliviate Reading Difficulties* conclude indicating that the color transparencias have no immediate effect on reading skills in children with reading difficulties. When comparing the results of Irlen Syndrome in Cuenca research with the aforementioned studies, evidence matches with international results on the prevalence of Irlen Syndrome in our urban school environment, 25.09%, as far as visual perceptual distortions when reading corresponds and 13.11% in physical discomfort while reading, in severe ranges of the Irlen® Reading Perceptual Scale. When taking *moderate to severe* parameters of the different studies and international benchmarks, the impact on our school environment is the 25.84% of the significantly affected (severe) by combining the VPD with PR, and 18.72% of affected in a moderate scale. Based on these results, we urge in the first place, to local school authorities to be aware of the presence of Irlen Syndrome symptomatology in our school populations, which may be confused with signs and symptoms of other learning difficulties. Secondly, it is imperative to continue the investigation, phase II, application of Irlen Method on severe cases found in each school in order to pose the possible elimination of VPD and PR through the Irlen Method. Finally, we stress that the Irlen Method (IM) is not a reading method, and it's important to count on the contribution and involvement of multidisciplinary teams in the search for solutions to learning problems, especially reading problems. The IM could rather be considered a significant contribution on preliminary diagnosis that complements the rest of diagnoses and evaluations of the various disciplines such as education, medicine, psychology and others. Irlen Syndrome (25.84%, severe range) in urban schools of Cuenca has been determined, and a new proposal is to extend the study in rural schools where it is possible that Irlen Syndrome prevalence is also present. The execution of this research in secondary and university levels is feasible as well since Ecuadorian government plans on improving education at all levels for the coming years. Reading is considered as the neural axis of education we hope for, then it is important to investigate why reading is so low and left out in educational institutions nationwide. Is there anything that is related to Irlen Syndrome that makes it difficult or prevents the reading process to take place in children, adolescents and adults? What is it that schoolchildren really see on the pages of texts they

are reading, and what are the corrective measures to be taken to eliminate these reading distortions and discomforts? These and more questions could be solved with further research on the subject. Tackling and treating reading difficulties in the first years of school life can prevent to some extent the consequences that this issue brings in long-terms: high levels of repetition, functional illiteracy and loss of time for educational institutions, teachers, students and their families. Additionally to a certain scale, it would be avoided the misuse of national resources, classroom teachers; frustrated children, called lazy, not wanting to read, understand nothing of what they read, and be the target of mockery, and of great concern to society, educational institutions, medical and psychological fields and family. It would seek additionally somehow understand why the presence of rebellious teenagers in secondary classrooms and university adults that rather decide to abandon their studies because of the alleged learning difficulties, dyslexia, hyperactivity, attention deficit symptoms among others. Once the educational institutions get to know the Irlen Syndrome symptomology, they would be better able to detect learning problems, and not to be confused with similar conditions. They will be able to serve their students to detect these symptoms, perform the appropriate corrective tasks favoring the normal process of reading in their student populations.

## 5. Conclusions

The results of this study on incidence of Irlen Syndrome (also known as MISViS or Scotopic Sensitivity Syndrome) reveals that there is an incidence of 25.84% in the *severe* range and 18.72% in *moderate* cases on third-grade schoolchildren in urban Cuenca schools. The most common symptoms of Physical Discomfort found in this population are: i) the need to move away or further from the material they read; ii) discomfort under fluorescent lights found in almost all classrooms of the participating school; iii) the exaggerated opening of the eyes when reading; iv) frequent blinking; v) dry, sandy, scratchy, or itchy eyes; vi) hurt, ache, or burn eyes, frowning when reading and general eye discomfort. The most common Visual Difficulties or Visual Perceptual Distorsion were: i) consistent use of the finger or marker; ii) slow and choppy reading; iii) effort to stay focused on the words being read; iv) avoid reading aloud; v) trouble to remember and understand what was read; vi) restlessness, fidgetiness and nervousness, vii) distraction and repeated breaks while testing, viii) discomfort when reading in white paper or boards; and ix) repetition of lines below or above the text that is being read.

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