As consumers search for an increasing amount of health information online, it is important for the information that they find to not only be accurate, but written in an appropriate and accessible level of readability. Eight consumer health information websites were selected and a portion of text from each on the topic of macular degeneration, an eye disease that affects many older Americans and can result in the loss of central vision, was evaluated. The readability of the text was calculated using two tests: the Flesch-Kincaid Grade Level Index and the Flesch Reading Ease test. These calculations confirmed expectations that online consumer health information for macular degeneration is incomprehensible for a sizeable segment of the American population. According to the results, this information is written on average at a reading level of nearly the eleventh grade.

Headings:

Readability - Evaluation

Consumer health information

Macular degeneration
EVALUATING THE READABILITY OF ONLINE CONSUMER HEALTH INFORMATION REGARDING MACULAR DEGENERATION

by
Kelsey E Bartiss

A Master’s paper submitted to the faculty of the School of Information and Library Science of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Science in Information Science.

Chapel Hill, North Carolina
April 2013

Approved by

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Claudia Gollop
Table of Contents

I. Introduction...........................................................................................................................................2
II. Literature Review.................................................................................................................................4
III. Methods................................................................................................................................................10
IV. Website Information ..........................................................................................................................14
V. Results..................................................................................................................................................17
VI. Limitations..........................................................................................................................................20
VII. Conclusion .........................................................................................................................................21
Bibliography.............................................................................................................................................23
Appendix I ..................................................................................................................................................26
Appendix II ................................................................................................................................................27
I. Introduction

As consumers search for an increasing amount of health information online, it is important for the information that they find to not only be accurate, but written in an appropriate and accessible level of readability. According to the National Adult Literacy Survey, the average American adult reads at the seventh grade level, but more than half of the population of the country reads below the sixth grade level (DuBay 1). Experts have recommended that information about health should be written at a fifth grade level (DuBay 1). But is this the case with online consumer health information?

For this study, eight consumer health information websites were selected and a portion of text from each on the topic of macular degeneration, an eye disease that affects many older Americans, was evaluated. The readability of the text was calculated using two tests: the Flesch-Kincaid Grade Level Index and the Flesch Reading Ease test. The Flesch-Kincaid Grade Level Index test calculates the American grade level of written material (DuBay 26). It is one of the most popular reading ability calculators used today and is currently used by the Department of Defense, the Social Services Administration, and the Internal Revenue Service to calculate the readability of their published materials (DuBay 31, 54). The Flesch Reading Ease Score calculates the difficulty of reading material on a scale of one to one hundred, with a score of one hundred indicating a very easy level of readability, scores between sixty and seventy to be a “standard” reading
level, and scores between zero and thirty to be at a college graduate level (DuBay 21-22).

The goal of this research was to find answers to the following research questions:

1. What is the recommended reading level for consumer health information?

2. Is the reading level for macular degeneration information above, at, or below this level?

3. If the reading level of this information is above the recommended level, by how much is it above?

The objective of this study was to answer these questions in order to gain a better understanding of the accessibility of consumer health information online and see what changes would perhaps need to be made in regards to ease of understanding of the material.
II. Literature Review

Macular degeneration is a condition of the eyes, which results in a partial or complete loss of central vision. This area of vision is damaged as significant amounts of drusen develop under the retinal pigment epithelium and neurosensory retina within the eye (Coleman et al. 1835). Drusen are composites consisting of protein, lipids, and cells (Stone 479). Age-related macular degeneration, or macular degeneration, is an umbrella term that actually consists of different forms of the disease that can be attributed to several different causes (Stone 478).

![Figure 1 – Anatomy of the Human Eye](unknown)

In the past, it was believed that one single root cause of macular degeneration could be determined. However, this is not the case (Stone 479). Macular degeneration can be attributed to a number of various causes, or in some cases, a combination of them. Patients can live for years without adverse symptoms as the disease develops (Coleman et al. 1835).
One cause of macular degeneration for which there is no prevention is simply aging (Coleman et al. 1835). For some patients, genetics play a role in developing macular degeneration (Coleman et al. 1835). Genetics have the potential to be a contributing factor to increased risk of macular degeneration, and like aging, cannot be helped. Twin and family studies have been conducted to explore the role of genetics in the development of macular degeneration (Querques et al. 594). Medical science first discovered the link between heredity and macular degeneration in the late nineteenth century, before the term “genetics” was even widely used, as it was found that macular degeneration occurred within families (Stone 480-481). However, there isn’t one single gene in particular that increases an individual’s risk of developing macular degeneration (Stone 481). Instead, “high-risk alleles” occur across several locations within an individual’s DNA (Stone 481). While these genetic combinations do not inherently cause the development of macular degeneration, they do contribute to the likelihood of an individual developing the disease during their lifetime (Stone 481). Overall, genetics are the primary cause of approximately 23% of the cases of advanced macular degeneration (Coleman et al. 1838).

Some causes of macular degeneration are entirely preventable, the most prominent of which is smoking (Coleman et al. 1835). There is a proven direct correlation between the quantity of cigarettes a patient smokes and the likelihood of suffering from advanced macular degeneration (Coleman et al. 1836). For smoker patients who have yet to develop macular degeneration, studies have shown that ceasing smoking can decrease the risk of macular degeneration (Stone 483).
A number of previous studies have supported an association between sun exposure and an increased risk of developing macular degeneration, but other studies have not supported this conclusion (Coleman et al. 1838). The degree to which sun exposure influences the development of macular degeneration remains inconclusive and needs to be explored in further research (Coleman et al. 1838).

The effects of macular degeneration on a patient’s vision may vary depending on the type and severity of macular degeneration the patient has developed. Individuals can go years without symptoms, until they begin to complain of a combination of general vision loss, central vision loss, changes in color perception, and seeing grids of straight lines that appear wavy (Querques et al. 593). There are three stages of macular degeneration: early, intermediate, and advanced (Coleman et al. 1836).

With early macular degeneration, drusen that have developed within the eye are small to medium sized, and the patient most likely has no noticeable symptoms (Coleman et al. 1836). Once macular degeneration advances to the intermediate level, drusen have become medium to large in size, and it is still possible that the patient hasn’t noticed any adverse symptoms of macular degeneration, such as vision loss (Coleman et al. 1836).

During the advanced stages of macular degeneration, the condition can be characterized as one of two forms of the disease: as geographic, called “dry,” macular degeneration, or as neovascular, called “wet,” macular degeneration (Coleman et al. 1836). With dry macular degeneration, areas of the retina have slowly lost their pigmentation and small blood vessels, resulting in the loss of central vision (Coleman et al. 1836). When a patient suffers from wet macular degeneration, fluids and blood leak as the sensory retina or retinal pigment epithelium detach (Coleman et al. 1836).
Macular degeneration is the most common form of macular degeneration (Coleman et al. 1836).

Figure 2 – Macular Degeneration (ADAM )

Macular degeneration is currently the most common cause of blindness in the developed world for individuals over fifty-five years of age of European descent (Coleman et al. 1835). Members of other racial and ethnic groups who are older than fifty-five do develop drusen in their lifetimes, but these individuals have a smaller chance of developing macular degeneration than Caucasians (Coleman et al. 1836). Wet, or neovascular, macular degeneration is the most common cause of severe central vision loss among adults of this age group (Coleman et al. 1836). Smokers in general have a higher risk of developing macular degeneration than non-smokers regardless of race or ethnicity (Stone 478). In total, 10 – 15% of people with macular degeneration experience severe central vision loss (Querques et al. 593).

Unfortunately, a cure for macular degeneration has yet to be discovered. This being the case, prevention and patient education are key to lessening the impact of macular degeneration on the adult population (Coleman et al. 1840). It is important to
empower patients to control what factors they can in lessening their risk of developing the disease, such as keeping a healthy body mass index and smoking cessation (Coleman et al. 1840). Previous studies have shown that these preventative measures taken by patients could reduce their chances of developing macular degeneration by half (Coleman et al. 1840).

However, once a patient has developed macular degeneration, there are some treatments currently available to lessen the impact and progression of the disease. For patients at moderate risk of developing macular degeneration and who already have drusen developed within their eyes, taking regular supplements of zinc and antioxidant vitamins can reduce their risk of progressing into advanced macular degeneration by around 25% (Coleman et al. 1835). Taking supplements will not help all patients reduce their risk of developing advanced macular degeneration. It is important to note that this treatment should not be recommended to patients that smoke, as it will increase their risk of lung cancer (Coleman et al. 1840).

Another form of treatment for macular degeneration involves a series of ranibizumab injections into the affected eyes to slow and stop further vision loss (Coleman et al. 1835). For this treatment, the patient has injections on a monthly basis over a period of three months (Querques et al. 595). Ranibizumab injections prevent further blood vessel growth as well as blood vessel leaks within the eye ("Ranibizumab Injection."). Because these injections work to counteract the leaking of blood vessels, they can only be used to treat wet macular degeneration and not dry macular degeneration. Current studies with this form of treatment suggest that it is a safe and effective way to improve and stabilize the vision of the patient (Querques et al. 594-595).
Patients undergoing this treatment will need to continue to visit their doctor for follow-up visits after they finish the series of ranibizumab injections to ensure their vision is remaining stable and not worsening (Querques et al. 595). These injections are intended to stop further vision loss once a patient has already developed wet macular degeneration and are not a preventative treatment.

An additional treatment for patients who have yet to develop advanced macular degeneration involves removing drusen within the eye with a special laser (Coleman et al. 1841). Like ranibizumab injections, this laser treatment is a management, not preventative, strategy for macular degeneration. Not all treatments are effective on all patients. Further research into treatments and cures for macular degeneration are currently underway.
III. Methods

For this research, eight consumer health information websites were chosen. These websites were selected based on a Google search and meeting a basic set of criteria. The Google search was for the term “macular degeneration.” Google was chosen as the search engine because it was the most frequently used search engine available (S. Kalarani and G. V. Uma 135). The search was performed and the list of results returned by Google was reviewed. The websites were required to meet three basic criteria: the owners of the websites must be based in the United States, the website’s primary audience was intended to be consumers, and the website must be credible.

For the purposes of this research, a website would be deemed credible based on Metzger’s basic definition of credibility: “credibility is a multifaceted concept with two primary dimensions: expertise and trustworthiness” (Metzger 2079). Each website within the study group of eight websites was required to be credible and display a high degree of expertise and trustworthiness.

After scrolling through the Google search results, exploring the websites it presented, and evaluating their credibility, eight websites were selected for this study. These websites were:

• AARP’s Health page
• BrightFocus Foundation
• American Academy of Ophthalmology (eyeSmart)
Several of these websites are HONcode certified.

The HONcode is a certification system run by the HON Foundation for online consumer health information. It was the first established ethical evaluation system for websites providing health information to the public through the Internet ("HONcode: the commitment to reliable health and medical information on the internet."). Websites apply for certification and are evaluated based on a rigorous set of criteria outlined in eight principles: describing the credentials of content authors, a commitment to adding to instead of replacing visits to a qualified healthcare practitioner, confidentiality of website users, accurate citations, objectivity, transparency, financial disclosure, and clear advertising policies ("HONcode: the commitment to reliable health and medical information on the internet."). Once a website is certified to be HONcode compliant, it is periodically reviewed to ensure continued adherence to these eight principles ("HONcode: the commitment to reliable health and medical information on the internet.").
For the purposes of this study, the text defining the condition of macular
degeneration, the description of the disease, and treatment information were all analyzed.
Text was taken during late January of 2013. The level of readability was determined
using the Flesch-Kincaid Grade Level Index and the Flesch Reading Ease Score. The
Flesch-Kincaid Grade Level Index test calculates the American grade level of written
material (DuBay 26). It is one of the most popular reading ability calculators used today
and is currently used by the Department of Defense, the Social Services Administration,
and the Internal Revenue Service to calculate the readability of their published materials
(DuBay 31, 54). The formula for calculating the grade level is: (0.39 x average sentence
length) + (11.8 x average number of syllables per word) - 15.59, or GL = (0.39 x ASL) +
(11.8 x ASW) - 15.59 (DuBay 54).

The Flesch Reading Ease Score calculates the difficulty of reading material on a
scale of one to one hundred, with a score of one hundred indicating a very easy level of
readability, scores between sixty and seventy to be a “standard” reading level, and scores
between zero and thirty to be at a college graduate level (DuBay 21-22). How the Flesch
Reading Ease is calculated has changed since the test was invented, as the formula has
been refined. The Flesch Reading Ease is currently calculated as: (1.599 x number of

<table>
<thead>
<tr>
<th>WEBSITE</th>
<th>HONcode Certified</th>
<th>Government Sponsored</th>
<th>Professional Association</th>
<th>Hospital/ Clinic</th>
</tr>
</thead>
<tbody>
<tr>
<td>AARP Health Page</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BrightFocus Foundation</td>
<td></td>
<td></td>
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<tr>
<td>eyeSmart</td>
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<tr>
<td>John Hopkins</td>
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<td>x</td>
</tr>
<tr>
<td>Mayo Clinic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medline Plus</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>National Eye Institute</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>WebMD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 1 – Website Credibility**
one-syllable words per 100 words) – (1.015 x average sentence length in words) – 31.517
(DuBay 22).

The Flesch-Kincaid Grade Level Index and the Flesch Reading Ease Score were used to analyze the text from the eight websites by pasting the text into Microsoft Word for Mac 2011 and running the tests within the word processing program. Due to the limitations within Microsoft Word, the maximum grade level calculated for the Flesch-Kincaid Grade Level Index is 12.0.

_____________________
NOTES
1 See Appendix I for website urls and Appendix II for website screenshots.
IV. Website Information

Each of the eight websites used for this study was reviewed for their consumer health information, specifically regarding macular degeneration definitions and treatment options. The information regarding each website, such as the owner and purpose behind the website, was obtained from the website itself. Some websites contained more of this background information than others.

The Health page of the American Association of Retired Persons, or AARP, is owned and managed by AARP, which is a large nonprofit organization with over thirty-seven million members ("About AARP."). Dr. Ethel Percy Andrus founded AARP in 1958 with the goal to “enhance the quality of life for older persons,” a goal to which the Health page contributes ("AARP History."). The health encyclopedia featured on the Health page is powered by Healthline, which is also a HONcode compliant website and is owned by Healthline Networks. Healthline exists to provide consumers with reliable health information for education and also so that patients may better communicate with their doctors ("Healthline.com's Mission Statement.").

The BrightFocus Foundation, which was until very recently known as the American Health Assistance Foundation, was founded in 1973 ("About the BrightFocus Foundation."). As a nonprofit organization, the BrightFocus Foundation promotes research and public education for eye and brain diseases as they work “to save mind and sight” ("About the BrightFocus Foundation."). It is also a HONcode certified website.
eyeSmart is owned and maintained by the American Academy of Ophthalmology (AAO) and is geared towards everyday consumers of health information and promotes general public awareness of eye health and its importance ("About eyeSmart."). The American Academy of Ophthalmology is the largest national association of eye doctors and surgeons in the world ("About eyeSmart."). Through eyeSmart, the AAO educates patients about their personal risk factors for various eye diseases as well as other vision ailments and provides information about prevention, diagnosis, and treatment ("About eyeSmart."). eyeSmart has not been HONcode certified.

Johns Hopkins Medicine is a nonprofit organization and is a system consisting of a hospital, clinics, and a medical school ("About Johns Hopkins Medicine."). Based in Baltimore, Maryland, Johns Hopkins continues to be one of the best hospitals in the country ("Johns Hopkins Medicine Fast Facts."). Their website is not HONcode certified.

The Mayo Clinic is also a nonprofit organization and comprises a network of clinics located in Minnesota, Florida, and Arizona ("About Mayo Clinic."). The Mayo Clinic began as the practice of one physician, Dr. William Mayo, in 1863 and expanded as his two sons joined him ("History of Mayo Clinic."). Dr. William Mayo then took what was then a revolutionary step of asking researchers and other doctors to join them and thus created the first “private integrated group practice,” forever changing the practice of modern medicine ("History of Mayo Clinic."). The Mayo Clinic website is HONcode certified.

MedlinePlus is a government website owned by the US National Institute of Health and produced by the US National Library of Medicine ("About MedlinePlus."). This website exists to provide reliable health information to patients and consumers and
is updated on a daily basis by the National Library of Medicine ("About MedlinePlus."). MedlinePlus is not HONcode certified.

The National Eye Institute is also a government entity and is part of the National Institute of Health ("National Eye Institute Mission Statement."). The National Eye Institute was founded by the government in 1968 with the main purpose of conducting and advancing research of eye diseases and conditions in the United States ("National Eye Institute Mission Statement."). The National Eye Institute website is not HONcode certified.

WebMD is a website owned by an organization of the same name. The goal of WebMD is to provide consumers accurate health information and reference materials as well as access to online health communities ("What We Do For Our Users."). It provides the general public in addition to healthcare professionals with current medical reference material that is accessible without a paid subscription("What We Do For Our Users."). WebMD has been designed to help people find current information on healthy living, diseases and conditions, and personal support("What We Do For Our Users."). The website is HONcode certified.
V. Results

After completing the analysis of the selected text of each website and calculating the Flesch-Kincaid Grade Level Index of each section of every website, the following results were discovered. The formula for calculating the grade level is: (0.39 x average sentence length) + (11.8 x average number of syllables per word) - 15.59 (DuBay 54).

<table>
<thead>
<tr>
<th>WEBSITE</th>
<th>DEFINITION SECTION SCORE</th>
<th>TREATMENT SECTION SCORE</th>
<th>SCORE OF SECTIONS TAKEN TOGETHER</th>
<th>TOTAL WORDS</th>
</tr>
</thead>
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<tr>
<td>AARP's Health Page</td>
<td>11.9</td>
<td>11.1</td>
<td>11.5</td>
<td>107</td>
</tr>
<tr>
<td>BrightFocus Foundation</td>
<td>12.0</td>
<td>12.0</td>
<td>12.0</td>
<td>350</td>
</tr>
<tr>
<td>eyeSmart</td>
<td>12.0</td>
<td>12.0</td>
<td>12.0</td>
<td>1872</td>
</tr>
<tr>
<td>Johns Hopkins</td>
<td>9.9</td>
<td>10.2</td>
<td>10.0</td>
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<tr>
<td>Mayo Clinic</td>
<td>11.5</td>
<td>12.0</td>
<td>11.7</td>
<td>1092</td>
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<tr>
<td>MedlinePlus</td>
<td>8.1</td>
<td>9.4</td>
<td>9.0</td>
<td>470</td>
</tr>
<tr>
<td>National Eye Institute</td>
<td>6.9</td>
<td>7.8</td>
<td>7.5</td>
<td>450</td>
</tr>
<tr>
<td>WebMD</td>
<td>10.9</td>
<td>11.6</td>
<td>11.2</td>
<td>735</td>
</tr>
</tbody>
</table>

Table 2 – Flesch-Kincaid Grade Level Index Analysis Results

It was very clear that none of the information on the definition and treatments for macular degeneration for any of these websites was written at or below the recommended fifth grade level for health information or even the commonly recommended seventh grade level for general public information (DuBay 1). The information found on the National Eye Institute’s website came the closest to the recommended reading level for health information with a Flesch-Kincaid Grade Level Index of 7.5. The website with the next lowest grade level index was MedlinePlus, whose content scored a 9.0, followed by Johns Hopkins at 10.0. WebMD came next with a score of 11.2, closely followed by AARP’s Health page at 11.5 and Mayo Clinic’s score of 11.7. The final two websites,
BrightFocus Foundation and eyeSmart, both scored a 12.0 on the Flesch-Kincaid Grade Level Index. Taken as a group, the average Flesch-Kincaid Grade Level Index score for these websites is 10.6, nearly six grade levels above the recommended reading level for the health related material. Word count averaged at 680 words.

In order to gain further understanding of the readability of the material, the Flesch Reading Ease level of the text gathered from each website was also calculated. The Flesch Reading Ease is calculated as: \[(1.599 \times \text{number of one-syllable words per 100 words}) - (1.015 \times \text{average sentence length in words}) - 31.517\] (DuBay 22).

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<th>WEBSITE</th>
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<td>eyeSmart</td>
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<td>Johns Hopkins</td>
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<td>Mayo Clinic</td>
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<td>MedlinePlus</td>
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<tr>
<td>National Eye Institute</td>
<td>63.2</td>
</tr>
<tr>
<td>WebMD</td>
<td>41.4</td>
</tr>
</tbody>
</table>

Table 3 – Flesch Reading Ease Score Analysis Results

For the chosen websites and selected text on macular degeneration, the calculated range of Flesch Reading Ease scores varied from a low of 19.5 to a high of 63.2. The calculated average Flesch Reading ease score between all of the websites was 46.0. The website with the lowest Flesch Reading Ease score, indicating the most difficult text, was BrightFocus Foundation with a score of 19.5. The National Eye Institute had the simplest text and a score of 63.2. This was the only website that fell within the “standard” reading ease range of between sixty and seventy (DuBay 22). Below is a table which compares the Flesch-Kincaid Grade Level Index score, Flesch Reading Ease score, and total word count for each website.
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<th>FLESCH READING EASE SCORE</th>
<th>TOTAL WORDS</th>
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<td>AARP's Health Page</td>
<td>11.5</td>
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<td>eyeSmart</td>
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<td>1872</td>
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<td>Johns Hopkins</td>
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<tr>
<td>Mayo Clinic</td>
<td>11.7</td>
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<td>450</td>
</tr>
<tr>
<td>WebMD</td>
<td>11.2</td>
<td>41.4</td>
<td>735</td>
</tr>
</tbody>
</table>

Table 4 – Flesch-Kincaid Grade Level Index and Flesch Reading Ease Score Results

As may be seen in the table above, websites with higher Flesch-Kincaid Grade Level scores have lower Flesch Reading Ease scores, indicating a lower level of readability due to more difficult text. Websites with lower Flesch-Kincaid Grade Level scores have higher Flesch Reading ease scores, indicating that the text is easier to read. It is interesting to note that both the BrightFocus Foundation and eyeSmart earned a score of 12.0 on the Flesch-Kincaid Grade Level index, but their Flesch Reading Ease scores differed by 21.1 points. eyeSmart had a much higher word count, but still earned a higher Flesch Reading Ease score, this indicating that eyeSmart’s information on macular degeneration is more difficult for readers to understand than BrightFocus Foundation’s text. Taking this information into account, it is very likely that both BrightFocus Foundation and eyeSmart scored the same 12.0 on the Flesch-Kincaid Grade Level Index and earned vastly different Flesch Reading Ease scores because the maximum score calculated for the Flesch-Kincaid Grade Level Index within Microsoft Word is 12.0.
VI. Limitations

This study was conducted under a limited timeframe and without any additional monetary resources. All information was collected and analyzed within a three-month period due to the one semester length of the master’s paper course for which this paper was written. Had more time been allotted, the study could have included more websites for analysis.

The Flesch-Kincaid Grade Level Index and the Flesch Reading Ease tests were chosen to evaluate the readability of the selected health information not only because they are widely used, but because they come included as a tool within Microsoft Word for Mac 2011 which had already been purchased. Free online readability calculators are available for a select few other tests, but the validity of the tools could not be determined. Software packages that can calculate the readability of text are commercially available but were deemed too costly.
VII. Conclusion

Calculations using both the Flesch-Kincaid Grade Level Index and the Flesch Reading Ease confirmed expectations that online consumer health information for macular degeneration is written at a reading level that makes it incomprehensible for a sizeable portion of the American population. According to the National Adult Literacy Survey, nearly half of Americans have a reading comprehension level below the sixth grade (DuBay 1). It is recommended that consumer health information maintain a reading level at or below the fifth grade, yet the lowest calculated Flesch-Kincaid Grade Level Index score for these eight websites’ information on macular degeneration was 7.5, a full two and a half grades above the recommended level for the material.

Websites and their owners need to be made aware that their consumer health information is difficult for many of their users to understand. It is recommended that content be rewritten in order to reach a broader audience. As an increasing number of Americans phase into the age demographic most affected by macular degeneration, it is critically important to ensure that as many people as possible can easily read and understand the information they find about the disease on reliable Internet websites.

Further research on this topic employing a larger sample of websites and analyzing the content written for diseases other than macular degeneration may be a useful addition to the consumer health information literature. Additional research could also use other readability evaluations in addition to the Flesch-Kincaid Grade Level Index
and the Flesch Reading Ease Score in order to compare the results of different readability evaluation methods.
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Metzger, Miriam J. "Making Sense of Credibility on the Web: Models for Evaluating Online Information and Recommendations for Future Research." Journal of the


**Appendix I**

**Website Links**

<table>
<thead>
<tr>
<th>Organization</th>
<th>URL</th>
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<tbody>
<tr>
<td>AARP's Health Page</td>
<td><a href="http://www.aarp.org/health">www.aarp.org/health</a></td>
</tr>
<tr>
<td>BrightFocus Foundation</td>
<td><a href="http://www.brightfocus.org">www.brightfocus.org</a></td>
</tr>
<tr>
<td>eyeSmart</td>
<td><a href="http://www.geteyesmart.org">www.geteyesmart.org</a></td>
</tr>
<tr>
<td>JohnsHopkins</td>
<td><a href="http://www.hopkinsmedicine.org/">www.hopkinsmedicine.org/</a></td>
</tr>
<tr>
<td>Mayo Clinic</td>
<td><a href="http://www.mayoclinic.com">www.mayoclinic.com</a></td>
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<td>MedlinePlus</td>
<td><a href="http://www.nlm.nih.gov/medlineplus">www.nlm.nih.gov/medlineplus</a></td>
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<td>National Eye Institute</td>
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<td>WebMD</td>
<td><a href="http://www.webmd.com">http://www.webmd.com</a></td>
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Appendix II

Website Screenshots

AARP’s Health page
About Macular Degeneration

Macular Degeneration Research (MDR), a program of the BrightFocus Foundation funds research on and informs the public about macular degeneration. Since the program’s inception, MDR has granted over $12.5 million supporting basic research into the causes and potential treatments of this incurable disease.

Macular degeneration causes deterioration of the macula, the central area of the retina. The retina is a paper-thin tissue at the back of the eye where light-sensitive cells send visual signals to the brain. Sharp, clear, straight-ahead vision is processed by the macula, and damage to it results in blind spots and blurred or distorted vision. Those affected by macular degeneration find many daily activities such as driving and reading, increasingly difficult. Macular degeneration usually affects individuals older than 50 years of age, and scientific evidence shows that genes may play a role in the development of nearly three out of four cases of this devastating eye disease.

Macular degeneration is a major cause of visual impairment in the United States. As many as 11 million Americans have some form of macular degeneration, including both early and later stages of the wet and dry forms. This number is expected to double to nearly 22 million by 2050.

In this section you can find information on:

- Understanding Macular Degeneration
  Get comprehensive information about macular degeneration, current statistics, symptoms and stages, as well as easily-understood medical illustrations on how the disease impairs vision.

- Symptoms
  Blurred central vision and wavy lines on an Amsler grid are potential signs of macular degeneration. Learn more about these symptoms.

Risk Factors & Prevention

Scientists are unsure of the cause of macular degeneration, but some factors appear to increase the risk of developing the disease. Some ways to protect your eyes and lower your risk include:

- Quit smoking
- Eat a healthy diet rich in fruits and vegetables
- Exercise regularly
- Protect your eyes from the sun
- Get your eyes checked regularly
- Be aware of family history

What Is Age-Related Macular Degeneration?

Age-related macular degeneration (AMD) is a deterioration or thinning of the outer retina. The retina is a layer of tissue that lines the back of the eye. The macula is the central part of the retina that is responsible for your central vision, allowing you to see fine details clearly.

The macula makes up only a small part of the retina, yet it is much more sensitive to detail than the rest of the retina (called the peripheral retina). The macula is what allows you to thread a needle, read small print, and read street signs. The peripheral retina gives you side vision if someone is standing off to one side of your vision. Your peripheral retina helps you know that person is there by allowing you to see their general shape.

Many older people develop macular degeneration as part of the body’s natural aging process. There are different kinds of macular problems, but the most common is age-related macular degeneration.

With macular degeneration, you may have symptoms such as blurriness, dark areas or distortion in your central vision, and perhaps permanent loss of your central vision. It usually does not affect your side, or peripheral vision. For example, with advanced macular degeneration, you could see the outline of a dress, yet may not be able to see the hands of the clock or tell what time it is.

Causes of macular degeneration include the formation of deposits in the area.

Related Resources

- Related Topics
  Explore comprehensive source material on AMD, including an overview of macular degeneration and its symptoms, as well as information on treatment options.
- Related Answers
  Get answers to frequently asked questions about macular degeneration, including risk factors, diagnosis, and treatment options.

Featured Video

Bright Focu5 Foundation
Dry macular degeneration

Definition

Dry macular degeneration is a chronic eye disease that causes vision loss in the center of your field of vision. Dry macular degeneration is marked by degeneration of the macula (MMH-cells), which is in the center of the retina. The layer of tissue on the inside back wall of your eyeball.

Dry macular degeneration is one of two types of age-related macular degeneration. The other type — wet macular degeneration — is characterized by blood vessels that grow under the retina in the back of the eye, leaking blood and fluid. Dry macular degeneration is the more common form of the disease.

Dry macular degeneration may worsen your quality of life by causing blurred central vision or a blind spot in your central vision. You need clear central vision for many tasks, such as reading, driving, and recognizing faces.

Mayo Clinic products and services

- Macular degeneration treatment at Mayo Clinic
  - Newsletter: "Mayo Clinic Health Letter"

Mayo Clinic Store
- Check out these best sellers and special offers on books and newsletters from Mayo Clinic.
  - Try Mayo Clinic Health Letter FREE!
  - Control high blood pressure with a heart-healthy diet
  - Living with chronic pain? Mayo Clinic can help
  - Prepare for your small surgery and receive a FREE gift

Improve heart health in just 10 minutes a day

The Mayo Clinic Diet
- Read more about the Mayo Clinic diet and its benefits.
- Learn how to eat healthfully and maintain a healthy weight.
- Get tips for eating out and managing your diet.
- Discover the latest research on the Mayo Clinic diet.

- Advertising and sponsorship policy
  - Advertising and sponsorship policy

Johns Hopkins

Age-Related Macular Degeneration (AMD)

What is age-related macular degeneration (AMD)?

Age-related macular degeneration (AMD) is a disease that affects an individual's central vision. AMD is the most common cause of severe vision loss among people over 50. Because the center of the eye is the most sensitive to damage, AMD can result in significant loss of vision.

AMD occurs when the macula, which is located in the center of the retina and provides vision with significant danger to the user's field of vision, begins to degenerate. With AMD, the macula, which is the central vision, begins to degenerate. With AMD, the macula, which is the central vision, begins to degenerate.

What are the different types of AMD?

There are two primary types of AMD:

- Dry AMD
  - This type of AMD is the most common. While it is the least common, it can cause significant damage to the macula.

- Wet AMD
  - This type of AMD is the least common. It involves the growth of abnormal blood vessels under the retina.

Related Clinical Services

- Macular Degeneration Center
- Ophthalmology (Detmer Eye Institute)
- Winter Eye Institute

Find a Doctor

- Specialties:
  - Macular Degeneration
  - Macula Disorders
  - Macula Issues
  - Macula Problems
  - Retinal Problems

Surgical and Medical Treatments of the Eye

- Vitreoretinal Disease and Surgery

More

- Articles
- Drugs
- Diet
- Overview of Autonomic Nervous System
Mayo Clinic – Wet Macular Degeneration

Definition
Wet macular degeneration is a chronic eye disease that causes vision loss in the center of your field of vision. Wet macular degeneration is generally caused by abnormal blood vessels that leak fluid or bleed into the retina, the layer of tissue on the inside back wall of your eye.

Wet macular degeneration is one of two types of age-related macular degeneration. The other type — dry macular degeneration — is more common and less severe. Wet macular degeneration almost always begins as dry macular degeneration. It’s not clear what causes wet macular degeneration.

Early detection and treatment of wet macular degeneration may help preserve vision and, in some instances, improve vision.

MedlinePlus

Macular Degeneration
Also called: Age-related macular degeneration, AMD

Macular degeneration, or age-related macular degeneration (AMD) is a leading cause of vision loss in Americans 60 and older. It is a disease that destroys your sharp, central vision. You need central vision to see objects clearly and to do tasks such as reading and driving.

AMD affects the macula, the part of the eye that allows you to see fine detail. It does not hurt, but it causes cells in the macula to die. In some cases, AMD advances so slowly that people notice little change in their vision. In others, the disease progresses faster and may lead to a loss of vision in both eyes.

Regular comprehensive eye exams can detect macular degeneration before the disease causes vision loss. Treatment can slow vision loss. It does not restore vision.

NIH: National Eye Institute

Get Macular Degeneration updates by email

Start Here
• Age-Related Macular Degeneration NIA AgeinHealth (National Eye Institute)
• Facts About Age-Related Macular Degeneration NIH (National Eye Institute)

Also available in Spanish
• Macular Degeneration Interactive Tutorial (Patient Education Insiutol)

Related Topics
• Eye Diseases
• Vision impairment and blindness
• Tests and Vision SENSING

Medical Encyclopedia

Transplantation in anaplastic lymphoma kinase-positive

Relatedness of vision impairment and blindness

NIH: National Institutes of Health
**Facts About Age-Related Macular Degeneration**

This information was developed by the National Eye Institute to help patients and their families search for general information about age-related macular degeneration. An eye care professional who has examined the patient's eyes and is familiar with his or her medical history is the best person to answer specific questions.

**Table of Contents**

- What you should know about age-related macular degeneration
  - What is AMD?
  - What is dry AMD?
  - What are the symptoms?
  - What is wet AMD?
  - What are the treatment options for wet AMD?
  - Advanced AMD
  - Additional risk factors
  - Age-Related Eye Disease Study
  - How does the AREDS formulation work?
  - A note about the AREDS2 formulation

**Loss of Vision**

- What is low vision rehabilitation?
- Where to go for treatment?
- How to find a specialist
- What are some low vision devices?
- Computer aids and other technologies