

Alzheimer's Disease

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Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

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Summary

This lesson is designed for the high school biology classroom and fits into the broader study of populations and disease demographics. The lesson teaches students about the symptoms, risk factors, and prevalence of Alzheimer's disease.

Learning Outcomes

- Students will be able to describe the symptoms, risk factors, prevention, and treatment of Alzheimer's disease.
- Students will be able to graph data on Alzheimer's cases in the United States—historically and predicted—using Microsoft Excel.
- Students will be able to identify trends in Alzheimer's case data and give possible explanations for those trends.

Materials

1. United Streaming video clip on Alzheimer's disease
2. Computers with Internet access and Microsoft Excel
3. Class set of Web Quest Handouts
4. Class set of "Alzheimer's Disease in the United States" worksheets

Total Duration

70 minutes

Procedures

Teacher Preparation

Download and prepare the United Streaming video clip. Make copies of the Web Quest Handout and "Estimated Alzheimer's Disease Cases in the United States" worksheet for the class. Gather and set out white paper and colored pencils or markers. If needed, visit the Centers for Disease Control and Prevention's (CDC) website for more information.

Web Resource

Title: Healthy Aging: Healthy Brain Initiative

URL: <http://www.cdc.gov/aging/healthybrain.htm>

Description: This CDC website has general information on research, program development, and communication for brain health.

Introduction

Duration: 25 minutes

Ask students to tell what they know about Alzheimer's disease. Show the video segment from United Streaming that outlines the history of the study of Alzheimer's disease and its symptoms. Talk with students about the video. What kinds of thoughts, feelings, and questions did the video raise in students' minds? *Note:* Many students might know someone or have a family

member who has Alzheimer's disease. Encourage students to be sensitive to classmates who might find it difficult to discuss the topic.

Web Resource

Title: United Streaming Video: Alzheimer's Disease: Losing the Past

URL:

www.unitedstreaming.com/search/assetDetail.cfm?guidAssetID/A7018601-E673-443F-A748-206F84F5207F

Description: This 10-minute video illustrates the latest findings in the fight against Alzheimer's disease. If you are not a current user of United Streaming, you can register for a free, 30-day trial.

Step 2

Duration: 20 minutes

After the video, divide students into groups of four. Assign each group one of the following aspects of Alzheimer's disease to research:

- General Information
- Symptoms
- Risk Factors
- Treatment Plan

Give each student a copy of the Web Quest Handout. Instruct students to search the websites listed to answer the questions for their research topic.

Once students have completed the Web Quest, divide them into new groups consisting of one member from each of the four research topics. Each student will teach the others in the group about his or her research topic.

Web Resources

Title: National Institute of Neurological Disorders and Stroke (NINDS)

URL: www.ninds.nih.gov/disorders/alzheimersdisease/alzheimersdisease.htm

Description: This National Institutes of Health (NIH) website has general information about Alzheimer's disease, along with links for more information.

Title: Alzheimer's Association

URL: www.alz.org

Description: This website has general information, resources, statistics, and links related to Alzheimer's disease.

Title: National Institute on Aging

URL: www.nia.nih.gov/Alzheimers/

Description: This NIH website has general information, resources, statistics, and links related to Alzheimer's disease.

Title: NIH Senior Health

URL: <http://nihseniorhealth.gov/alzheimersdisease/defined/01.html>

Description: The NIH senior health website has general information, resources, statistics, and links related to Alzheimer's disease.

Supplemental Documents

Title: Web Quest Handout

Description: This handout has the questions for the four research topics on Alzheimer's disease.

Title: Answer Key: Web Quest Handout

Description: Provides answers to the Web Quest handout.

Conclusion

Duration: 25 minutes

Distribute the "Estimated Alzheimer's Disease Cases in the United States" worksheet. Ask students to graph the data using Microsoft Excel. Have students analyze and interpret the data on the graph by writing a short summary paragraph. The paragraph should include information from the graph and at least three different facts from the Web Quest.

Supplemental Documents

Title: Estimated Alzheimer's Disease Cases in the United States

Description: This worksheet has data on the number of cases of Alzheimer's disease in the United States.

Title: Answer Key: Estimated Alzheimer's Disease Cases in the United States

Description: The answer key contains sample graphs and student explanations for the tasks in the "Estimated Alzheimer's Disease Cases in the United States" worksheet.

Assessment

Students are assessed in Step 2 through their "Web Quest Handout" and in the Conclusion in the worksheet, "Estimated Alzheimer's Disease Cases in the United States".

Modifications

Extension

Creative Writing

Have students imagine going through a typical day while having the symptoms of Alzheimer's disease. Have them describe how would their life be changed because of the limitations of the disease.

Anatomy of Alzheimer's Disease

Study how the brain anatomy's and neuron structure are affected by Alzheimer's disease.

Other Modifications

If computers do not have Microsoft Excel, give students graph paper for the Conclusion.

Education Standards

National Science Education Standards

SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES, CONTENT STANDARD F:

As a result of activities in grades 9–12, all students should develop understanding of

- **Personal and community health**
- Population growth
- Natural and human-induced hazards
- Science and technology in local, national, and global challenges

HISTORY AND NATURE OF SCIENCE, CONTENT STANDARD G:

As a result of activities in grades 9–12, all students should develop understanding of

- Science as a human endeavor
- Nature of scientific knowledge
- **Historical perspectives**

State of Ohio Content Standards

LIFE SCIENCES, Grade 11

Benchmark F: Explain how human choices today will affect the quality and quantity of life on earth.

Indicator 9: Give examples of how human activity can accelerate rates of natural change and can have unforeseen consequences.

SCIENTIFIC INQUIRY, Grade 10

Benchmark A: Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate, and communicate the results of these investigations.

Indicator 3: Use mathematical models to predict and analyze natural phenomena.

Indicator 4: Draw conclusions from inquiries based on scientific knowledge and principles, the use of logic and evidence (data) from investigations.

Web Quest Handout

Alzheimer's Disease
Jamie Valo and Sarah Wabler, CDC's 2006 Science Ambassador Program

Directions: Use the following websites to answer the questions for your group's assigned research topic.

National Institute of Neurological Disorders and Stroke:

www.ninds.nih.gov/disorders/alzheimersdisease/alzheimersdisease.htm

Alzheimer's Association: www.alz.org

National Institute on Aging: www.nia.nih.gov/Alzheimers/

Remember, you will be teaching your classmates about your topic.

General Information

1. What is Alzheimer's disease?
2. What changes occur in the brain of a person with Alzheimer's disease?
3. What is one interesting statistic you found about Alzheimer's disease, and where did you find it?

Symptoms

1. What are the symptoms of Alzheimer's disease during the early stages of onset?
2. What are the symptoms of Alzheimer's disease during the late stages of the disease?
3. When diagnosing Alzheimer's disease, doctors must rule out other conditions that have similar symptoms. What are some of these other conditions?

Risk Factors and Prevention

1. What risk factors might increase an individual's chance of getting Alzheimer's disease?

2. What risk factors associated with the development of Alzheimer's disease are unavoidable?
What risk factors are avoidable?
3. What are some things people can do to reduce their risk of developing Alzheimer's disease later in life?

Treatment

1. What medications are used to Alzheimer's patients?
2. What non-medicinal treatments are available for Alzheimer's patients?

Answer Key: Web Quest Handout

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General Information

1. What is Alzheimer's disease?

According to the National Institute of Neurological Disorders and Stroke (NINDS) website, Alzheimer's disease (AD) causes a gradual loss of cognitive functions including memory and reasoning abilities. (1)

2. What changes occur in the brain of a person with Alzheimer's disease?

AD causes microscopic changes in the brain involving abnormal clumps (amyloid plaques) and tangled bundles of nerve cell fibers (neurofibrillary tangles) made up of misplaced proteins. There is also widespread loss of nerve cells (neurons) in the cerebral cortex. This loss is somewhat greater in the frontal and temporal areas. This loss causes the brain to shrink (atrophy).

3. What is one interesting statistic you found about Alzheimer's disease, and where did you find it?

Answers will vary for statistics about Alzheimer's disease. See <http://www.alz.org/AboutAD/Statistics.asp>

Symptoms

1. What are the symptoms of Alzheimer's disease during the early stages of onset?

Mild forgetfulness (age-related memory change) is common among older persons but by itself does not indicate Alzheimer's disease and often does not progress. Alzheimer's disease starts with mild memory loss. It slowly gets worse and eventually affects other aspects of thinking. In the early stages of AD, people might have trouble remembering recent events, activities, or the names of familiar people or things. As symptoms get worse, they might forget to pay their bills or have a hard time making change at a store, balancing their check books, or making long-term plans. In the earlier stages of AD, these problems may be a bother but do not necessarily cause alarm. (2)

2. What are the symptoms of Alzheimer's disease during the late stages of the disease?

According to Alzheimer's Association website, very late in the disease, people lose the ability to respond to their environment, the ability to speak and, in the end, the ability to control movement. They need help with eating and going to the bathroom, and they may become incontinent. Individuals lose the ability to walk without help, then the ability to sit without support. Reflexes become abnormal and muscles grow rigid. They might lose the ability to swallow. (3)

3. When diagnosing Alzheimer's disease, doctors must rule out other conditions that have similar symptoms. What are some of these other conditions?

According to Alzheimer's Association website, depression, drug interactions, thyroid problems, excess use of alcohol, and certain vitamin deficiencies can have symptoms similar to Alzheimer's disease. (3)

Risk Factors and Prevention

1. What risk factors might increase an individual's chance of getting Alzheimer's disease?

According to Alzheimer's Association website, the risk of getting Alzheimer's disease appears to be increased by many conditions that damage the heart or blood vessels. These include high blood pressure, diabetes, and high cholesterol. There also appears to be an increased risk of AD in older people who had serious or repeated head injuries when they were younger. Genetics might affect the risk of AD in some people, depending on the presence of other risk factors. (3)

2. What risk factors associated with the development of Alzheimer's disease are unavoidable? What risk factors are avoidable?

Unavoidable: age and genetics

Avoidable, to a certain extent: high blood pressure, high LDL cholesterol, diabetes, hardened arteries, smoking, lack of exercise, and mental inactivity.

Note that any single risk factor by itself does not necessarily mean a person will or will not develop AD. The combination of risk factors determines overall risk. (2)

3. What are some things people can do to reduce their risk of developing Alzheimer's disease later in life?

Although we need to learn more about risk factors for AD, current information suggests that it may help to keep your weight, blood pressure, and cholesterol at healthy levels, to avoid tobacco and excess alcohol, to stay socially connected, and to exercise both your body and mind. (3)

Treatment

1. What medications can be used to treat Alzheimer patients?

According to the National Institute of Neurological Disorders and Stroke (NINDS) website, there is no cure for AD and no way to slow the progression of the disease. For some people in the early or middle stages of AD, medication such as tacrine (Cognex) might lessen some problems with thinking and memory. Donepezil (Aricept), rivastigmine (Exelon), and galantamine (Reminyl) might keep some symptoms from getting worse for a short time. A fifth drug, memantine (Namenda), was recently approved for use in the United States. Also, other medications might help control behavioral symptoms such as sleeplessness, agitation, wandering, anxiety, and depression. (1)

2. What non-medicinal treatments are available for Alzheimer patients?

According to Alzheimer's Association website, it is also helpful to simplify the environment, simplify tasks and routines, get adequate rest between stimulating events, use labels to cue or remind the person, put locks on doors and gates,

remove guns from the home, and use lighting to reduce confusion and restlessness at night. (3)

References

1. National Institute of Neurological Disorders and Stroke (NINDS) [online]. [cited 2006 Sep 19]. Available from URL: <http://www.ninds.nih.gov>.
2. National Institute on Aging [online]. [cited 2006 Sep 19]. Available for URL: <http://www.nia.nih.gov/Alzheimers/>.
3. Alzheimer's Association [online]. [cited 2006 Sep 19]. Available from URL: <http://www.alz.org>.

Estimated Alzheimer's Disease Cases in the United States

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Directions: Working on your own, graph the data using Microsoft Excel and answer the questions in complete sentences.

The following data show the prevalence of Alzheimer's disease in the United States in 2000.

Age Range	U.S. 2000 Population	U.S. Estimated Cases	Rate/1,000
55-64	24,274,684	0	0
65-74	18,390,986	300,000	16
75-84	12,361,180	2,400,000	194
85+	4,239,587	1,800,000	425

Source: Hebert LE, PA Scherr, JL Bienias, DA Bennett, DA Evans. Alzheimer's disease in the US Population. Arch Neurol 2003;60(8):1119-1122.

1. Construct a bar graph to show the relationship of age and Alzheimer's disease prevalence (rate/1,000). Properly label the x and y axis and give the chart a title. Staple this bar chart to your completed answers to the questions.
2. In complete sentences, write about your observations and give possible explanations of the trends shown in the bar graph. Use information from your Web Quest to help explain your observations.

The following data show the projection of Alzheimer's disease cases in the United States.

Year	Estimated Number of Cases
2000	4,600,353
2005	4,986,787
2010	5,435,827
2020	6,621,014
2030	9,325,542

Source: Hebert LE, PA Scherr, JL Bienias, DA Bennett, DA Evans. Alzheimer's disease in the US Population. Arch Neurol 2003;60(8):1119-1122.

3. Construct a line graph to show the relationship of year and estimated number of cases. Properly label the x and y axis and give the chart a title. Staple this line chart to your completed answers to the questions.

4. In complete sentences, write about your observations and give possible explanations of the trends shown in the line graph. Use information from your Web Quest to help explain your observations

Answer Key: Estimated Alzheimer's Disease Cases in the United States

Alzheimer's Disease

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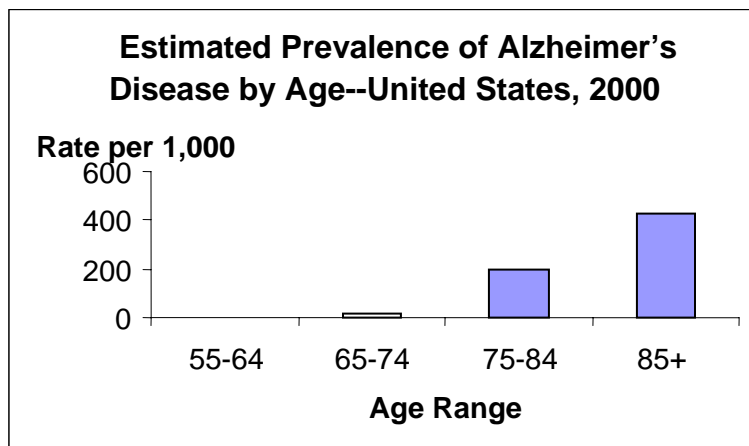
Directions: Working on your own, graph the following data using Microsoft Excel. Answer the following questions in complete sentences.

The following data show the prevalence of Alzheimer's disease in the United States in 2000.

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55-64	24,274,684	0	0
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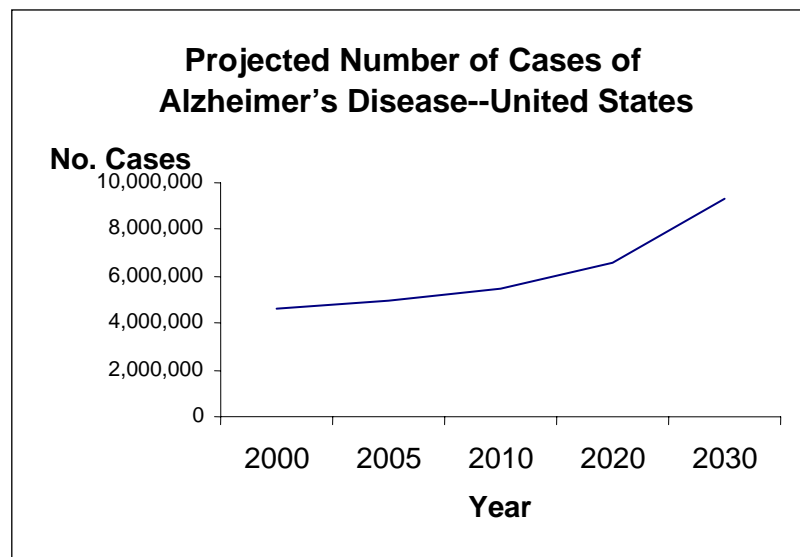
Answers will vary but should include that the prevalence for Alzheimer's disease increases as people age, especially after 75 years of age (as mentioned in Web Quest, one of the important risk factors for Alzheimer's disease is age). Several of the other apparent risk factors for AD and dementia, such as high blood pressure and diabetes, are more prevalent in older age groups. (1)

The following data show the projection of Alzheimer's disease in the United States.

Year	Estimated Number of Cases
2000	4,600,353
2005	4,986,787
2010	5,435,827
2020	6,621,014
2030	9,325,542

Source: Hebert LE, PA Scherr, JL Bienias, DA Bennett, DA Evans. Alzheimer's disease in the US Population. Arch Neurol 2003;60(8):1119-1122.

3. Construct a line graph to show the relationship of year and estimated number of cases. Properly label the x and y axis and give the chart a title. Staple this line chart to your completed answers to the questions.



Source: Hebert LE, PA Scherr, JL Bienias, DA Bennett, DA Evans. Alzheimer's disease in the US Population. Arch Neurol 2003;60(8):1119-1122.

4. In complete sentences, write about your observations and give possible explanations of the trends shown in the line graph. Use information from your Web Quest to help explain your observations.

Answers will vary but should include that the projected number of cases for Alzheimer's disease increases over the next 25 years. According to the Alzheimer's Association website, the number of Americans with Alzheimer's disease will continue to grow. By 2050, the number of individuals with Alzheimer's could range from 11.3 million to 16 million. (2) This is because Americans are living longer, thanks to advances in public health and medicine. Therefore, the size of the overall U.S. population is increasing. In particular, a large number of people who were born from 1946 to 1964 (baby boomers) are reaching older ages, where the risk of Alzheimer's disease increases.

References

1. National Institute of Neurological Disorders and Stroke (NINDS) [online]. [cited 2006 Sep 19]. Available from URL: <http://www.ninds.nih.gov>.
2. Alzheimer's Association [online]. [cited 2006 Sep 19]. Available from URL: <http://www.alz.org>.