

Autism Spectrum Disorders: The New Rainbow

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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 use in a 9th- or 10th-grade biology class to introduce students to autism spectrum disorders (ASDs). The lesson gives a basic overview of ASDs through literature, lecture, and group discussion. It concludes with a creative-writing activity where students demonstrate what they have learned about ASDs.

Learning Outcomes

- Students will develop a basic understanding of ASDs by researching and presenting basic information about ASDs.
- Students will be able to describe clinical features relating to ASDs by writing a new chapter in a book featuring someone with an ASD.

Materials

1. One copy of the book *The Curious Incident of the Dog in the Night-time* by Mark Haddon
2. Overhead projector
3. Access to the Internet (one computer per group of students)

Total Duration

1 hour and 40 minutes

Procedures

Teacher Preparation

Understanding the array of symptoms that accompany autism spectrum disorders (ASDs) is necessary to teach this lesson adequately. To familiarize yourself with ASDs, gather background information from the Centers for Disease Control and Prevention's (CDC) autism page, CDC's "Learn the Signs. Act Early." Campaign webpage, and the autism webpage from the National Institute of Health's National Institute of Neurological Disorders and Stroke. Note that statistics and information about this disease are updated periodically. Be sure to check these websites to make sure answers provided on the worksheet answer keys reflect the most current data.

Before the lesson, obtain a copy of the book *The Curious Incident of the Dog in the Night-time* by Mark Haddon. Read and be familiar with specific sections of the text used in step 2 (pgs. 6–11) before using it in the lesson.

Make an overhead of "Some Behaviors and Issues Associated with ASDs Checklist," found in the Introduction. If an overhead is not available, make one photocopy for each

group of four students. Also make two copies for each student of the “Autism Spectrum Disorder Pre/Posttest,” to be used in the Introduction and Conclusion steps.

Note: ASDs can be a very sensitive subject. Students in the classroom might either have an ASD or might have family members or friends who have ASDs. Remind students at the beginning of the lesson about being kind and sensitive to others, and stress throughout the lesson that people with ASDs are not always going to act in a similar manner.

Web Resources

Title: Autism

URL: www.cdc.gov/ncbddd/autism/index.htm

Description: CDC’s website on autism provides an overview of the disorder.

Title: Learn the Signs. Act Early.

URL: www.cdc.gov/ncbddd/autism/ActEarly/default.htm

Description: This CDC website provides new guidelines for marking a child’s developmental milestones. This site also includes an autism fact sheet.

Title: Autism Fact Sheet

URL: www.ninds.nih.gov/disorders/autism/detail_autism.htm

Description: This webpage from the National Institute of Health’s (NIH) National Institute of Neurological Disorders and Stroke provides information on autism.

Supplemental Documents

Title: Autism Spectrum Disorder Pre/post test

Description: This document will be used to test the students’ previous knowledge of ASDs.

Title: Autism Spectrum Disorder Pre/post test Answer Key

Description: This document provides possible answers to the “Autism Spectrum Disorder Pre/post test.”

Title: *The Curious Incident of the Dog in the Night-time*

Description: This fiction book illustrates the life of a 15-year-old autistic savant. The book allows students to relate to the character and better understand autism through a literature-based point of view.

Title: Some Behaviors and Issues Associated with ASDs Checklist

Description: This document lists several characteristics and common behaviors associated with people with ASDs.

Step 1: Introduction

Duration: 35 minutes

At the start of the lesson, assess students’ prior knowledge of ASDs by giving an “Autism Spectrum Disorder Pre/Posttest” to each student. After the pretest, introduce the topic of ASDs by reading pages 6–11 from the book *The Curious Incident of the Dog in the Night-time* by Mark Haddon. The book should engage students in the topic of ASDs and pique their interest in finding out more about ASDs in subsequent steps. As you read, have students make a list of behaviors that they would consider outside the “norm.”

Then, divide students into groups of four to six students to compare their individual lists and consolidate their ideas into one group list. Place “Some Behaviors and Issues Associated with ASDs Checklist” on an overhead (or hand out one photocopy to each group). Have students share some of the behaviors from their group lists and check them off the list projected on the screen. Discuss the results as a class. Advise students that the characteristics exhibited by the main character in the book are not the only characteristics someone with an ASD might have. ASDs encompass a wide range of symptoms, and every person is different.

Supplemental Documents

Title: Autism Spectrum Disorder Pre/Posttest

Description: This document will be used to test students’ prior knowledge of ASDs.

Title: Autism Spectrum Disorder Pre/Posttest – Pretest Answer Key

Description: This document provides possible pretest answers to the “Autism Spectrum Disorder Pre/Posttest.”

Title: *The Curious Incident of the Dog in the Night-time*

Description: This fiction book illustrates the life of a 15-year-old autistic savant. The book allows students to relate to the character and better understand autism through a literature-based point of view.

Title: Some Behaviors and Issues Associated with ASDs Checklist

Description: This document lists several characteristics and common behaviors associated with ASDs.

Step 2

Duration: 30 minutes

The class discussion on various behaviors of people with ASDs should illicit multiple questions from students about ASDs, including basic information about what it is, who has it, etc. With the students in the same groups from the Introduction, have each group research a particular topic about ASDs and share that information with the class. Research will be conducted via the Internet. Topics are listed on the “ASDs Internet Search” worksheet.

Web Resources

Title: Autism

URL: www.cdc.gov/ncbddd/autism/index.htm

Description: CDC’s website on autism provides an overview of the disorder.

Title: Learn the Signs. Act Early.

URL: www.cdc.gov/ncbddd/autism/ActEarly/default.htm

Description: This CDC website provides new guidelines for marking a child’s developmental milestones. This site also includes an autism fact sheet.

Title: Autism Fact Sheet

URL: www.ninds.nih.gov/disorders/autism/detail_autism.htm

Description: This webpage from the National Institute of Health’s (NIH) National Institute of Neurological Disorders and Stroke provides information on autism.

Supplemental Documents

Title: ASDs Internet Search

Description: This worksheet lists the research topics for students as well as the websites to use during the research.

Title: ASDs Internet Search Answer Key

Description: This worksheet has answers for each research topic.

Step 3

Duration: 35 minutes

Once students have completed their research, bring the class back together to listen to student presentations. Presentations should be about 5 minutes per group with some extra time for questions and answers. Each group of students is responsible for teaching the class about their particular topic. Instruct students to fill in the missing sections of their “ASDs Internet Search” worksheet based on the presentations from the other groups. Assess students using the “ASDs Internet Search – Presentation Grading Rubric.”

Supplemental Document

Title: ASDs Internet Search

Description: This worksheet lists the research topics for students as well as the websites to use during the research.

Title: ASDs Internet Search Answer Key

Description: This worksheet has answers for each research topic.

Title: ASDs Internet Search – Presentation Grading Rubric

Description: This is the rubric to assess student presentations.

Step 4

Duration: 20 minutes

Following the presentations, students should have a completed worksheet with some basic information, providing them with an introductory understanding of ASDs. Refer back to the book *The Curious Incident of the Dog in the Night-time* and remind students of the characteristics of ASDs they discussed. Have students write a new chapter for the book in which the main character faces a new situation. Students should describe this situation and the character’s response to it. Students can choose to introduce a new character who also has an ASD. They should describe the new character in detail and show how he or she might (or might not) interact with the other characters.

Supplemental Document

Title: *The Curious Incident of the Dog in the Night-time*

Description: This fiction book illustrates the life of a 15-year-old autistic savant. The book allows students to relate to the character and better understand autism through a literature-based point of view.

Conclusion

Duration: 15 minutes

To see what students have learned, give students the “Autism Spectrum Disorder Pre/Posttest.” The same questions given in the pretest are asked of the students to

evaluate their final understanding of the topics and to gauge how much they have learned from the lesson.

Supplementary Documents

Title: Autism Spectrum Disorders Pre/Posttest

Description: This document is the posttest to assess how much students have learned about ASDs from the lesson.

Title: Autism Spectrum Disorders Pre/Posttest – Posttest Answer Key

Description: This document provides possible posttest answers to the “Autism Spectrum Disorders Pre/Posttest.”

Assessment

Assessment of students’ understanding of ASDs can be measured by comparing answers to the pretest with those of the posttest. Students will also be assessed on their “ASDs Internet Search” worksheet and on the presentations based on their research.

Modifications

Extensions

ASDs in the Medical Literature

Encourage students to research further questions they might have about ASDs by referring them to online medical journal databases, such as PubMed.

Web Resource

Title: PubMed

URL: www.ncbi.nlm.nih.gov/entrez/query.fcgi?CMD=File&DB=pubmed

Description: PubMed is an online database of all published and publicly accessible journal articles. This resource will help students search for the answers to their questions about ASDs.

ASDs, the Brain, and Neurotransmitters

To add another component to the lesson plan, students can work in groups to research the structure of the brain and neurotransmitters. Each group will choose one part of the brain and one neurotransmitter to explore. Students will then use online resources to research whether the structure of their specific part of the brain, and/or specific neurotransmitter, could possibly play a role in ASDs.

Web Resources

Title: Name that Brain Part!

URL: www.kidshealth.org/kid/misc/name_that_brain_part.html

Description: This Kids Health website provides a general overview of the parts of the brain.

Title: Neuroscience for Kids

URL: <http://faculty.washington.edu/chudler/chnt1.html#type>

Description: This University of Washington website provides general information on neurotransmitters. It might be more appropriate for students in more advanced science classes.

Title: The Brain: Understanding Neurobiology Through the Study of Addiction

URL: www.nida.nih.gov/Curriculum/HSCurriculum.html

Description: This website from the National Institute of Health's National Institute on Drug Abuse provides an introduction to neurotransmitters.

Title: The Whole Brain Atlas

URL: www.med.harvard.edu/AANLIB/home.html

Description: This interactive website from Harvard University allows students to view magnetic resonance images of the top 100 structures of the brain.

Epidemiology of ASDs

Students can conduct simple epidemiological analyses using existing data on ASDs. Prior knowledge of epidemiology and some of the methods used in the field are helpful to complete this extension. Use the "Excellence in Curriculum Integration through Teaching Epidemiology (EXCITE)" website and the "Epidemiology for the Uninitiated" article from the *British Medical Journal* to help introduce basic concepts of epidemiology. You can also have students read about current topics in epidemiology from CDC's *Morbidity Mortality Weekly Report* (MMWR), a weekly online publication containing articles on the latest public health issues.

After students are more familiar with epidemiology, guide them through the "Using Epidemiology to Evaluate Autism Spectrum Disorders" activity. This activity allows students to see how epidemiology is used to assess the risk for a disease or other health-related condition. Be sure to mention that these epidemiological methods can apply to many other diseases and health related conditions.

Web Resources

Title: Excellence in Curriculum Integration through Teaching Epidemiology (EXCITE)

URL: www.cdc.gov/excite/

Description: This CDC website contains a collection of teaching materials to introduce students to public health and epidemiology. This can be used by the teacher or the students to gain a basic understanding of the concepts of epidemiology.

Title: "Epidemiology for the Uninitiated"

URL: <http://bmj.bmjournals.com/collections/epidem/epid.shtml>

Description: This article in the *British Medical Journal* offers a thorough introduction to epidemiology.

Title: Morbidity and Mortality Weekly Report

URL: www.cdc.gov/mmwr

Description: CDC's weekly publication containing articles on the latest public health issues.

Supplemental Documents

Title: Using Epidemiology to Evaluate Autism Spectrum Disorders

Description: This activity allows students to see how epidemiology is used to assess the risk for a disease or other health-related condition.

Title: Using Epidemiology to Evaluate Autism Spectrum Disorders Answer Key
Description: This document provides the answers to the “Using Epidemiology to Evaluate Autism Spectrum Disorders” worksheet.

Education Standards

National Science Education Standards

LIFE SCIENCE, CONTENT STANDARD C:

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

- The cell
- Molecular basis of heredity
- Biological evolution
- Interdependence of organisms
- Matter, energy, and organization in living systems
- **Behavior of organisms**

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 resources
- Environmental quality
- Natural and human-induced hazards
- **Science and technology in local, national, and global challenges**

Washington State Standards

2. Inquiry: The student knows and applies the scientific ideas, skills, processes of investigation, and the nature of science.

Inquiry describes the skills necessary to investigate systems and asks students to understand the nature of science, which gives integrity to scientific investigations. Inquiry represents the application of science concepts and principles to the scientific investigative processes that aims to answer scientific questions about the natural world. These concepts, principles, and processes are expressed in two components:

2.1 Investigating Systems: Develop the knowledge and skills necessary to do scientific inquiry.

2.2 Nature of Science: Understand the nature of scientific inquiry.

3. Application: The student knows and applies science ideas and inquiry to design and analyze solutions to human problems in societal contexts.

Scientific design process skills are used to develop and evaluate scientific solutions to problems in real world contexts. The application of an understanding of systems and inquiry is comprised of two components:

3.1 Designing Solutions: Apply knowledge and skills of science and technology to design solutions to human problems or meet challenges.

3.2 Science, Technology and Society: Analyze how science and technology are human endeavors, interrelated to each other, to society, and to the workplace and the environment.

Autism Spectrum Disorders Pre/Posttest

Autism Spectrum Disorders: The New Rainbow
Tamara Caraballo and Scott Braswell, CDC's 2006 Science Ambassador Program

Directions

Read the following words to the students. As each word is read, instruct students to write down the first word that comes to mind.

1. **Developmental disorder**
2. **Social skills**
3. **Repeated behaviors**
4. **Rainman**
5. **Dan Marino**
6. **Prevalence**
7. **Autism**

Autism Spectrum Disorders Pre/Posttest – Pretest Answer Key

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Directions

Read the following words to the students. As each word is read, instruct students to write down the first word that comes to mind.

Answers will vary. There is no correct answer for this activity. Possible student answers for each term might include the following:

1. Developmental disorder- **mental impairment**
2. Social skills- **interacting nicely with others**
3. Repeated behaviors- **action done over and over again**
4. Rainman- **the movie**
5. Dan Marino- **football**
6. Prevalence- **frequency**
7. Autism- **Rainman**

Some Behaviors and Issues Associated with ASDs Checklist

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Behaviors

- Very organized
- Rigid about routines
- Adamant about object placement
- Upset by changes
- Eats few foods
- Eats only certain textures
- Smells food
- Insensitive to pain
- Unaware of danger (e.g., hot things)
- Has obsessive interests
- Likes spinning objects
- Likes to spin him/herself
- Special areas of talent or expertise
- Perseveration
- Unknowingly walks over objects
- Hand flapping
- Finger flicking
- Toe walking
- Likes parts of objects (e.g., wheels)

Communication

- Repeats words/phrases of others (Echolalia)
- Uses own language (jargoning)
- Repeats a word or phrase
- Reverses pronouns "I" and "you"
- Refers to self by name
- Does not respond to conversational initiation
- Makes comments unrelated to conversation topic
- Uses few or no gestures
- Talks in monotone or "robot-like"
- Does not respond to own name
- Does not understand jokes, sarcasm
- Does not understand idioms, teasing, or similes

Social

- Avoids eye contact (actively or passively)
- Looks away
- Turns away
- Not interested in having friends
- Not interested in the activities of others
- Not sharing/showing objects or interests with others
- Lives in a world of their own
- Seems unaware of others
- Flat or inappropriate affect or facial expressions
- Odd posture (e.g., looks sideways at person)
- Does not understand personal space boundaries
- Avoids or resists physical contact
- Not comforted by others during distress

Disclaimer: ASDs are complex disorders that can only be diagnosed by a health professional. Any number of above behaviors should not be considered conclusive evidence of ASDs.

Reference:

Whitney J. Autism Spectrum Disorders Presentation. Science Ambassador Program. July 2006.

3. Prevalence of ASDs

a. What is the prevalence of ASDs in the United States?

b. Who is affected by ASDs?

4. ASDs Research

a. What research is being conducted on ASDs? By whom?

b. What other questions about ASDs do you think we need to have answered?

ASDs Internet Search Answer Key

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Directions

Your group has been assigned one of the following topics. Conduct an Internet search to find the answers to the questions. After you have answered the questions, you will present the information to the class. You are responsible for filling in the rest of the worksheet as you listen to the other groups' presentations. The following web resources are to be used:

- www.cdc.gov/ncbddd/autism/index.htm
- www.cdc.gov/ncbddd/autism/ActEarly/default.htm
- www.ninds.nih.gov/disorders/autism/detail_autism.htm

Topics:

1. ASDs in General

a. What is the definition of ASDs?

According to CDC, autism spectrum disorders (ASDs) are a group of developmental disabilities defined by significant impairments in social interaction and communication and the presence of unusual behaviors and interests. (1)

According to CDC's "Learn the Signs. Act Early." Website, ASDs are a group of developmental disabilities caused by a problem with the brain. (2)

b. What are some symptoms of ASDs?

According to the "Learn the Signs. Act Early." website, individuals with ASDs may:

- not play "pretend" games (pretend to "feed" a doll)
- not point at objects to show interest (point at an airplane flying over)
- not look at objects when another person points at them
- have trouble relating to others or not have an interest in other people at all
- avoid eye contact and want to be alone
- have trouble understanding other people's feelings or talking about their own feelings
- prefer not to be held or cuddled or might cuddle only when they want to
- appear to be unaware when other people talk to them but respond to other sounds
- be very interested in people, but not know how to talk, play, or relate to them
- repeat or echo words or phrases said to them, or repeat words or phrases in place of normal language (echolalia)
- have trouble expressing their needs using typical words or motions
- repeat actions over and over again
- have trouble adapting when a routine changes
- have unusual reactions to the way things smell, taste, look, feel, or sound

- lose skills they once had (for instance, stop saying words they were once using) (2)

c. What causes ASDs?

According to the National Institute of Health (NIH) and the National Institute of Neurological Disorders and Stroke, scientists are not certain what causes autism, but it is likely that both genetics and environment play a role. Researchers have identified a number of genes associated with the disorder. Studies of people with autism have found irregularities in several regions of the brain. Other studies suggest that people with autism have abnormal levels of serotonin or other neurotransmitters in the brain. These abnormalities suggest that autism could result from the disruption of normal brain development early in fetal development caused by defects in genes that control brain growth and that regulate how neurons communicate with each other. While these findings are intriguing, they are preliminary and require further study. The theory that parental practices are responsible for autism has now been disproved. (3)

2. Autism as 'spectrum' disorder

a. Why is autism considered a spectrum disorder?

According to CDC, it is because autism represents a wide range of behaviors and abilities. People who have ASDs, like all people, differ greatly in the way they act and what they can do. No two people with ASDs will have all the same symptoms. A symptom might be mild in one person and severe in another person. (1)

b. How are ASDs treated?

The National Institute of Health (NIH) and the National Institute of Neurological Disorders and Stroke present the following:

There is no cure for autism. Therapies and behavioral interventions are designed to remedy specific symptoms and can bring about substantial improvement. The ideal treatment plan coordinates therapies and interventions that target the core symptoms of autism: impaired social interaction, problems with verbal and nonverbal communication, and obsessive or repetitive routines and interests. Most professionals agree that the earlier the intervention, the better.

- **Educational/behavioral interventions:** Therapists use highly structured and intensive skill-oriented training sessions to help children develop social and language skills. Family counseling for the parents and siblings of children with autism often helps families cope with the particular challenges of living with an autistic child.
- **Medications:** Doctors often prescribe an antidepressant medication to handle symptoms of anxiety, depression, or obsessive-compulsive disorder. Anti-psychotic medications are used to treat severe behavioral problems. Seizures can be treated with one or more of the anticonvulsant drugs. Stimulant drugs, such as those used for children with attention deficit disorder (ADD), are sometimes used effectively to help decrease impulsivity and hyperactivity.

- **Other therapies:** There are a number of controversial therapies or interventions available for autistic children, but few, if any, are supported by scientific studies. Parents should use caution before adopting any of these treatments. (3)

3. Prevalence of ASDs

- a. What is the prevalence of ASDs in the U.S.?

According to CDC, ASDs affect 2–6 in 1,000 children. ASDs are also four times more common in boys than in girls. (1)

- b. Who is affected by ASDs?

According to CDC, assuming the prevalence rate has been constant over the past two decades, we can estimate that up to 500,000 individuals between the ages of 0 to 21 have an ASD. However, many of these individuals may not be classified as having an ASD until school age or later. ASDs are found in all cultures and economic groups. (1)

4. ASDs Research

- a. What research is being conducted on ASDs? By whom?

According to CDC, ongoing ASDs projects include those listed below.

***Metropolitan Atlanta Developmental Disabilities Surveillance Program (MADDSP):* CDC tracks the number of children with autism spectrum disorders (ASDs) and four other disabilities in a five-county area in metropolitan Atlanta (Georgia).**

***Brick Autism Project:* In late 1997, a citizen’s group in Brick Township, New Jersey, told the New Jersey Department of Health and Senior Services (DHSS) of their concerns about what seemed to be a larger-than-expected number of children with autism in Brick Township. Because of the complexity of the disorder and the citizens’ concern that environmental factors might play a role, the New Jersey DHSS contacted CDC and the Agency for Toxic Substances and Disease Registry (ATSDR) for help. CDC and ATSDR worked together on a project to find out how common ASDs were in Brick Township and to study the possible relationship of environmental factors to ASDs in the community.**

***Funded Projects including ADDM and CADDRE Networks:* CDC funds ASD-related projects in several states. These state projects look at how common ASDs are in children. Some of the projects also study what factors make it more likely that a child will have an ASD. CDC provides technical support to all of the state projects to help them conduct their studies. (1)**

According to NIH’s National Institute of Neurological Disorders and Stroke, as part of the Children’s Health Act of 2000, the NINDS and three sister institutes have formed the NIH Autism Coordinating Committee to expand, intensify, and coordinate NIH’s autism research. Eight dedicated research centers across the country have been established as “Centers of Excellence in Autism Research” to bring together researchers and the resources they need. The centers are conducting basic and clinical

research, including investigations into causes, diagnosis, early detection, prevention, and treatment, such as the studies highlighted below:

- Investigators are using animal models to study how the neurotransmitter serotonin establishes connections between neurons in hopes of discovering why these connections are impaired in autism.
- Researchers are testing a computer-assisted program that would help autistic children interpret facial expressions.
- A brain imaging study is investigating areas of the brain that are active during obsessive/repetitive behaviors in adults and very young children with autism.
- Other imaging studies are searching for brain abnormalities that could cause impaired social communication in children with autism.
- Clinical studies are testing the effectiveness of a program that combines parent training and medication to reduce the disruptive behavior of children with autism and other ASDs. (3)

b. What other questions about ASDs do you think we need to have answered?
Answers will vary.

1. Centers for Disease Control and Prevention. Autism. 2006 [cited 2006 Aug 25]. Available from URL: <http://www.cdc.gov/ncbddd/autism/index.htm>.

2. Centers for Disease Control and Prevention. Learn the Signs. Act Early. 2006 [cited 2006 Aug 25]. Available from URL: <http://www.cdc.gov/ncbddd/autism/ActEarly/default.htm>.

3. National Institute of Neurological Disorders and Stroke. Autism Fact Sheet. 2006 [cited 2006 Aug 25]. Available from URL: http://www.ninds.nih.gov/disorders/autism/detail_autism.htm.

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Directions

Read the following words to the students. As each word is read, instruct students to write down the first word that comes to mind.

- 1. Developmental disorder**
- 2. Social skills**
- 3. Repeated behaviors**
- 4. Rainman**
- 5. Dan Marino**
- 6. Prevalence**
- 7. Autism**

Autism Spectrum Disorders Pre/Posttest – Posttest Answer Key

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Directions

Read the following words to the students. As each word is read, instruct students to write down the first word that comes to mind.

Answers will vary. There is no correct answer for this activity. Possible student answers for each term might include the following:

1. Developmental disorder- **impairment**
2. Social skills- **making eye contact and feeling comfortable around others**
3. Repeated behaviors- **actions done over and over again; routines**
4. Rainman- **a movie with a character who is an autistic savant**
5. Dan Marino- **football player who has a child with autism**
6. Prevalence- **frequency**
7. Autism- **developmental disabilities where people have poor social skills and might have a hard time communicating with others**

Using Epidemiology to Evaluate Autism Spectrum Disorders

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1. List three possible research questions about ASDs in terms of “who,” “when,” and “where.”

-
-
-

2. Using the table below, please describe what this table is telling you.
Autism Cases of Children Ages 3–10 Years in Atlanta, Georgia, 1996 (1)

| Exposure status | Number of White cases | Number of Black cases | Number of Other cases |
|-----------------|-----------------------|-----------------------|-----------------------|
| Male | 457 | 305 | 25 |
| Female | 120 | 70 | 7 |
| Total | 577 | 375 | 32 |

Determine the total number of boys with autism: _____

Determine the total number of girls with autism: _____

Determine the total number of boys and girls with autism: _____

3. Using the data that you compiled, construct a 2x2 table to determine the risk ratio.

| Exposure Status | Outcome | | Total |
|-----------------|---------|-----------|----------|
| | Autism | No Autism | |
| Male | | | 147,623* |
| Female | | | 141,833* |
| Total | | | 289,456* |

*Based on U.S. Census data 51% male and 49% female

Risk in males = _____
 (the number of male autism cases / the total male population at risk)

Risk in females = _____
 (the number of female autism cases / the total female population at risk)

Risk Ratio (Risk in male group / Risk in female group) = _____

What does your risk ratio show?

Reference:

1. Yeargin-Allsopp MD, Rice C, Karapurkar MPR, Doernberg N, Boyle C, Murphy C. Prevalence of autism in a US metropolitan area. JAMA 2003;289(1):49–55.

Using Epidemiology to Evaluate Autism Spectrum Disorders Answer Key

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- List three possible research questions about ASDs in terms of "who," "when," and "where."
 - Who has autism (e.g., do more boys or girls have autism)?
 - Is the rate increasing? Decreasing? Or stable? When are people finding out they have autism (e.g., are older or younger people diagnosed with autism)?
 - Where do people live who have autism?

2. Using the table below, please describe what this table is telling you.

Autism Cases of Children 3–10 Years in Atlanta, Georgia, 1996 (1)

| | White | Black | Other |
|--------------|-----------------|-----------------|-----------------|
| Sex | Number of cases | Number of cases | Number of cases |
| Male | 457 | 305 | 25 |
| Female | 120 | 70 | 7 |
| Total | 577 | 375 | 32 |

Determine the total number of boys with autism: 787
 Determine the total number of girls with autism: 197
 Determine the total number of boys and girls with autism: 984

3. Using the data that you compiled, construct a 2x2 chart to determine risk ratio.

| | Autism | No Autism | Total |
|--------------|------------|----------------|-----------------|
| Male | 787 | 146,836 | 147,623* |
| Female | 197 | 141,636 | 141,833* |
| Total | 984 | 288,472 | 289,456* |

*Based on U.S. Census data 51% male and 49% female

Risk in males: $\frac{787}{147,623} = .0053$
 (the number of male autism cases / the total male population at risk)

Risk in females: $\frac{197}{141,833} = .0014$
 (the number of female autism cases / the total female population at risk)

Risk Ratio: $\frac{0.0053}{0.0014} = 3.8$
 (Risk in male group / Risk in female group)

What does your risk ratio show? **Males are almost 4 times more likely than females to have ASD.**

Reference:

- Yeargin-Allsopp MD, Rice C, Karapurkar MPR, Doernberg N, Boyle C, Murphy C. Prevalence of autism in a US metropolitan area. JAMA 2003;289(1):49–55.

ASDs Internet Search – Presentation Grading Rubric

Autism Spectrum Disorders: The New Rainbow
Tamara Caraballo and Scott Braswell, CDC's 2006 Science Ambassador Program

Your presentation will be graded based on the following:

| CATEGORY | 4 | 3 | 2 | 1 |
|--|---|--|---|--|
| Content - Accuracy | All facts in the presentation are accurate. | The majority of the facts in the presentation are accurate. | Some of the facts in the presentation are accurate. | Almost none of the facts in the presentation are accurate. |
| Attractiveness & Organization | The presentation has exceptionally attractive formatting and well-organized information. | The presentation has attractive formatting and well-organized information. | The presentation has well-organized information. | The presentation formatting and organization of material are confusing to the audience. |
| Sources | Careful and accurate records are kept to document the source of all of the facts and graphics in the presentation. | Careful and accurate records are kept to document the source of the majority of the facts and graphics in the presentation. | Careful and accurate records are kept to document the source of some of the facts and graphics in the presentation. | Sources are not documented accurately or are not kept on many facts and graphics. |
| Knowledge Gained | All students in the group (or individuals if not working in groups) can accurately answer all questions related to facts in the presentation. | All students in the group (or individuals if not working in groups) can accurately answer most questions related to facts in the presentation. | Most students in the group (or individuals if not working in groups) can accurately answer most questions related to facts in the presentation. | Several students in the group (or individuals if not working in groups) appear to have little knowledge about the facts in the presentation. |

A portion of the above rubric was created using Rubistar, available at <http://rubistar.4teachers.org/index.php>