

Science Olympiad Disease Detectives Cheat Sheet

Basics:
"Terms: (clinical approach is of individuals while public health approach is of public) **cluster**: aggregation of cases over particular period close grouped in time & space regardless of whether it is more than exp. **endemic disease**: Present at continuous level throughout population/geographic area, refers to the usual prevalence of an agent/condition. **zoonotic**: physical object serves to transmit infection from persons (zoonotic & vice versa). **zoonotic**: disease animal to human **surveillance**: system collect, analyze, interpret, & dissemination of health data to gain knowledge of patterns to control & prevent. **clinical info**: health care to treat & diagnose diseases. **epidemiologic info**: (lab.) & **chronic** (complex sampling & state) **lab info**: ill. caused by medication/physician. **Index Case**: Patient **Zero** **Latent Per.**: time between person coming into contact w/ pathogen & when they are infected (chronic diseases) **Plague**: Bubonic (nodes), Septicemic (blood), Pneumonic (lungs) **Novel/contagious** **Du**: infection from hospital **Case Fatality Rate**: # of deaths from dis. w/ disease **Mortality Rate**: # deaths from disease w/ new instances in pop. over time **Prevalence**: # of affected persons in pop. at any given time **Casey pop.** **Point** **DT**: snapshot of pop. & rate of certain agent in time **Period** **DT**: prev. over certain duration **Disease w/ longer duration has greater prev.** **P-I-X-D**
Steps for Investigating Outbreak
➤ **Prepare for field work**
➤ **Research, supplies & equipment** **Administrative arrangements** (make official administrative & personal travel arrangements) **Local Contacts** (follow protocol & contact all parties to determine roles & local contacts)
➤ **Establish existence of Outbreak** (severity, spread potential, public concern, available resources)
➤ **Expected # of cases** for area from local sources to determine expected **Order** **Fact** in **Plan** (better reporting, seasonal fluctuations, pop. change)
➤ **Verify Diagnosis**
➤ **Proper Diagnosis** (verify procedures used to diagnose problem, check methods to identify infectious/toxic agents) **Not Lab Error**
➤ **Commonality** (interview those who got ill, determine possible cause, source, spread or problem)
➤ **Construct working case definition** (establish how it is determined who has disease)
➤ **Case Definition**: **Clinical info** (about disease/condition) **Characteristic** (of those affected) **Location/Place** (specific as possible) **Time Sequence** (specific time when it occurred) **Identification** of specific cases including kind & **DT** **Confirmed** (diagnosis w/ case def. - lab verify) **Probable** (many fact. point to diag. but lack lab verify) **Possible** (some fact. point to diag.) **Some initial reports must be used** (number of total problems, exposed search)
➤ **Line Listing**: chart of specific cases **Ident. Info** **ID** **Case #**, **last name initials** **Clinical info** **diag.**, **sympt.**, **lab result**, **hospital death?** **Describe** (time, person, place) **Risk Factor** (disease & outbreak place)
➤ **Describe & Orient date in terms of person, place, time** (descriptive epi)
➤ **Time, Place, Person** **Time** (Epi Curve: histogram shows course of disease to identify source) **X-Axis**: time equivalent to **Y-axis** (incubation time) **Y-Axis** is **#** **Place** (geographic extent - spot map of cases to identify groups specific to location or environmental fact.) **Person** (identify affected pop. by type of person exposed as age & sex)
➤ **Types of Descriptive Studies**: study distribution of problems by outcome, frequency in pop., exposure, time, pattern, or environmental factor studies w/o control can be used for descriptive purposes **Case Report/Case Series** (case report: detail report of single patient from 1+ docs, **case series**: characteristics of several patients) **Correlative Studies** (correlates general characteristics of the pop. w/ health problem frequency w/ sev. groups during same time period, case series analysis: correlate w/ same pop. @ diff. points in time, ecological relations: correlate relative to specific ecologic fact. like diet) **Cross Sectional** (survey of a pop. where participants are selected w/ respect to exposure/disease status)
➤ **Develop Hypo. (Agent, Host, Environment Triad)** **Chain of Transmission**
➤ **Agent-Host-Env.** (age, capable of causing disease & sources = host/persons susceptible to it + env. allowing them to get together) **Infectious groups**: viruses, bacteria, protozoa, fungi, worms) **Resistant** (hypo. must be in testable form) **Current**

Knowledge & background (should be based on current knowledge & be updated/modified as new info uncovered)
➤ **Evaluate Hypo. - Analytical Studies** **MUST HAVE CONTROL**
➤ **Compare w/ established fact** (used when evidence strong & clear cut) **Must have lab verify to validate hypo.** **Two Types of Studies** (study determinants of health problems- why & how)
➤ **Cohort**: based upon expos. status (whether not they have disease, used w/ small, well defined pop. & moves forward in time expos. Both groups have known expos. & are checked for future illness. **retrospective**: starts @ expos. in past & moves forward to outcome **prospective**: starts @ present expos. & moves forward in time to outcome. **Calculation rate & relative risk** **attack rate**: rate that group experiences outcome illness **High attack rate in exposed & low in unexposed** **Relative risk** (total in group) **EXPOSED** = a (exp. & yes) **a/b** (exp. & no) **UNEXPOSED** = c (exp. & yes) **c/d** (exp. & no) **Relative risk**: estimates extent of assoc. between expos. & disease, estimates likelihood of developing disease in exposed v. unexposed **Relative risk** = $\frac{a(b+c)}{c(b+d)}$ **Relative risk**: incidence rates of disease in exposed v. unexposed rates in unexposed. **NO** **EVINCED** **FOR ASSOC.** **Relative risk** = 1.0: positive assoc. increased risk; increases in strength as magnitude of RR increases **Relative risk** = 0.5: neg. assoc. decreased risk (possibly protective effect); can't be neg. **Case Control**: works backward from effect/illness to suspected cause. Control is selected w/ similar characteristics to sick, then checked for similar expos. **Odds Ratio**: calculated to evaluate possible agents & vehicles of transmission **Odds of exposure in cases** = $\frac{a}{b}$ **Odds of exposure in controls** = $\frac{c}{d}$ **OR** = $\frac{a/b}{c/d}$ **OR** = 1: case exposed, b = # control exposed, c = # case patients unexposed, d = # control unexposed
➤ **Refine Hypo. if necessary**
➤ **No conf. of hypo.** (analytical studies do not confirm hypo.) **More specific** (in make up of case patients & controls) **Verify w/ other lab studies** (lab verify needed to validate hypo.)
➤ **Compare & reconcile w/ Lab. &/ or Env. studies**
➤ **Implement Control & Prev. measures ASAP**
➤ **As soon as source known** **Also @ chain of agent-source-host** **Min interrupt transmission exp.** **Min reduce susceptibility**
➤ **Implement surveillance**
➤ **Communicate findings**
➤ **Oral Briefing** (inform local health officials/other needed-to-know groups as soon as info. available) **Written Report** (usually done in scientific format for future reference, legal issues, education)
Errors in Investigations
➤ **"False Relationships"** **Random Error** - divergence due to chance alone, of observation on sample from pop. value, leading to lack of precision in measurement of assoc. **Bias systematic error** in an epidemiologic study results in incorrect estimation of assoc. between expos. & health-related event **Random Error** result of fluctuations around true value due to sampling variability, can occur w/ data collection, coding, transfer, analysis of data, affects measurement in inconsistent manner **Ways to reduce include: increasing the sample size & reduce variability in measurements** **Systematic Error** occurs when there is difference between true value (pop.) & observed value (sample) error is in system used for measurement so it occurs in each occasion. Conclusions drawn on this data will be inaccurate - too great or too little. Validity of study depends upon degree of systematic error - less error equals more validity. **Internal validity** - amt. of error in measurements including those for expos. disease, & assoc. between these variables. **External validity** - relates to process of generalizing findings of study to population from which the study is taken **Types of Bias**: describe problems in how study is organized **Selection bias** occurs when study subjects are selected for study as result of third unmeasured variable which is assoc. w/ both expos. & outcome. There may be assoc. between diseases characteristic & disease related to admission to a hospital for those w/ disease, w/o disease but w/ symptoms, & those w/ only characteristics of disease. **Information bias** - occurs from systematic error in the assessment of a variable. Examples are information bias, response bias, interviewer bias, recall bias **Confounding**: co-occurrence mixing of effects of confounding factor. May lead to overestimation/underestimating true assoc. between expos. & outcome. Confounding variable would be variable (pollution) that can cause disease under study (smoking)

& is also assoc. w/ expos. (smoking).
Five Steps For Surveillance
➤ **Identify, define, & measure health problem of interest**
selection based on criteria developed for prioritizing diseases, review of available morbidity & mortality data, knowledge of diseases & geographic-temporal patterns, & impressions of public/political concerns through surveys
➤ **Collect & compile data about problem** (if possible the factors influencing it)
available reports & other relevant data should be located to conduct surveillance, should be gathered by multiple sources. Characteristics & natural history of disease (if it can be easily diagnosed) is crucial. Data collected usually comes from individual persons, env., & health-care providers/facilities. Data collected for non-health purposes can be used as surveillance. Data can also be collected from env. monitoring, surveys, & notifications by local health authorities.
➤ **Analyze & interpret data**
diff. types of data might require diff. analyses; descriptive methods usually appropriate for majority. To determine whether incidence/prevalence of health problem has increased, data must be compared either over time/area. Selection of data for comparison depends on health problems under surveillance & what is known about its typical temporal/geographical patterns of occurrence. Basic analysis of surveillance data by time usually conducted to characterize trends & detect changes in disease incidence. First analysis usually is comparison of # of case reports received for current week w/ the # received in preceding weeks. Another common analysis is comparison of # of cases during current period to # reported during same period for last 2-10 years. Analysis of long term (secular) trends involves graphing occurrence of disease by year. Analysis by place is usually displayed in tabular form & rates often calculated by adjusting for differences in size of pop. of diff. geo. areas. Analyzing by time in place can also be used. When analyzing by person, calculate age, other people, & related risk factors. When incidence of disease increases its pattern among specific pop. @ particular time place varies from expected pattern, further investigation increased emphasis on prevention/control measures usually indicated. # of increase/variation required for action usually determined locally. Suspicion might be aroused from finding patients have something in common
➤ **Provide these data & their interpretation to those responsible for controlling health risk**
timely, regular dissemination of basic data & interpretations crucial, should be sent to those who provided reports & those to manage/control it
➤ **Monitor & periodically evaluate usefulness & quality of surveillance to improve it for future use. Does not include actions to control prob.**
Stakeholders: Purpose, objectives, operations, usefulness, resource requirements, Recommendations
Hill's Criteria for Causation
➤ **Strength of Assoc.** - relationship clear & risk estimate high
➤ **Consistency** - observation of assoc. must be repeatable in diff. pop. at diff. times
➤ **Specificity** - single cause produces single effect
➤ **Alternative Explan.** - consideration of multiple hypo. before making conclusions abt. whether association causal/not
➤ **Temporality** - cause/exposure must precede effect/outcome
➤ **Dose-Response Relationship** - increasing amt. of exposure increases risk
➤ **Biological Plausibility** - assoc. agrees w/ currently accepted understanding of biological & pathological processes
➤ **Experimental Evidence** - causation can be altered, either prevented/accelerated, by appropriate experimental process
➤ **Coherence** - assoc. should be compatible w/ existing theory & knowledge, including knowledge of past cases & epidemiological studies
Types of Carrier/Vectors
Convalescent: Humans capable of spreading disease following period of illness, typically thinking themselves cured of disease **Infectious**: when individual transmits pathogen immediately following infection but prior to developing symptoms **Chronic**: someone who can transmit disease for long period of time **Contaminated**: inherited disease but not does no symptoms **Transient/Temporary**: someone who can transmit infectious disease for short amt. of time. **Chain of Transmission** **Triad** has external agent, vector, source that transmits disease, & susceptible

Science Olympiad Disease Detectives Cheat Sheet: The Science Olympiad is a prestigious competition that challenges students in various scientific disciplines. One of the events, Disease Detectives, focuses on epidemiology and the study of diseases, their causes, and their effects on populations. This cheat sheet serves as a comprehensive guide to help students prepare for the event, covering essential concepts, terminology, and practical applications.

Understanding Epidemiology

Epidemiology is the study of how diseases affect the health and illness of populations. It involves the analysis of various factors, including the distribution, patterns, and determinants of health and

disease conditions.

Key Terms in Epidemiology

Familiarizing yourself with essential terminology is crucial for success in the Disease Detectives event. Here are some key terms:

1. Epidemic: A sudden increase in the number of cases of a disease above what is normally expected in a given area.
2. Pandemic: An epidemic that has spread across a large region, such as multiple continents or worldwide.
3. Endemic: A disease or condition regularly found among particular people or in a certain area.
4. Incidence: The number of new cases of a disease in a specific period.
5. Prevalence: The total number of cases of a disease in a population at a given time.
6. Mortality Rate: The number of deaths caused by a disease in a given population during a specified time period.
7. Morbidity Rate: The incidence of a disease or the measure of how many people are affected by it.
8. Outbreak: A sudden rise in the incidence of a disease.
9. Vector: An organism that transmits a disease from one host to another (e.g., mosquitoes for malaria).

Types of Diseases

A solid understanding of different diseases and their transmission methods is vital for Disease Detectives participants. Here are the primary types:

Infectious Diseases

Infectious diseases are caused by pathogens such as bacteria, viruses, fungi, or parasites. Key examples include:

- Influenza: A contagious respiratory illness caused by influenza viruses.
- COVID-19: A disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).
- Malaria: A life-threatening disease caused by parasites transmitted through the bite of infected mosquitoes.

Non-Infectious Diseases

These are not caused by pathogens and include:

- Cancer: A group of diseases characterized by uncontrolled cell growth.
- Diabetes: A chronic condition that affects how the body processes blood sugar (glucose).
- Heart Disease: A range of conditions that affect the heart, including coronary artery disease.

Data Collection and Analysis

Data collection is a fundamental aspect of epidemiology, as it helps in understanding the spread and impact of diseases.

Types of Data

When analyzing disease outbreaks, various types of data are collected:

- Qualitative Data: Non-numerical information, such as symptoms reported by patients.
- Quantitative Data: Numerical data, such as the number of reported cases or mortality rates.

Sources of Data

- Public Health Agencies: The Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO) provide extensive data on health trends.
- Medical Records: Hospitals and clinics maintain records that can be analyzed for disease patterns.
- Surveys: Epidemiologists often conduct surveys to gather information about health behaviors and symptoms.

Data Analysis Techniques

1. Descriptive Statistics: Summarizes data from a sample without making conclusions about the larger population.
2. Inferential Statistics: Uses a random sample of data to make inferences about a larger population.
3. Epidemiological Modeling: Mathematical models are used to predict the spread of diseases and the impact of interventions.

Investigating an Outbreak

When an outbreak occurs, a systematic approach is necessary for investigation and control.

Steps in Outbreak Investigation

1. Identify the Outbreak: Determine whether an outbreak exists by comparing current data to historical data.
2. Define the Case: Establish a clear definition of who qualifies as a case based on symptoms and exposure.
3. Search for Cases: Actively look for cases by reviewing medical records and conducting interviews.
4. Establish a Line Listing: Create a table to organize collected data on cases, including identifiers

such as age, sex, and symptoms.

5. Perform Descriptive Epidemiology: Analyze who, what, when, and where regarding the outbreak.
6. Develop Hypotheses: Formulate potential explanations for the outbreak and how it spreads.
7. Test Hypotheses: Conduct analytical studies to test the validity of your hypotheses.
8. Implement Control Measures: Based on findings, recommend strategies to control the outbreak and prevent further cases.

Common Control Measures

- Vaccination: Immunizing the population against diseases to reduce incidence.
- Quarantine: Isolating individuals who may have been exposed to the disease.
- Public Health Campaigns: Educating the public on hygiene practices and preventive measures.

Practice Scenarios and Case Studies

Using practice scenarios can be invaluable for students preparing for the Disease Detectives event.

Sample Case Study Analysis

1. Scenario: An unusual spike in respiratory illness cases in a local school.
 - Data Collection: Gather information from health records, conduct student surveys, and interview parents.
 - Hypothesis Formation: Consider potential causes such as a viral outbreak, allergens, or environmental factors.
 - Testing Hypothesis: Compare the incidence of illness in students exposed to different environments (e.g., classrooms with different ventilation systems).
2. Scenario: A community reports increased gastrointestinal illness.
 - Data Collection: Review food history, employee health records at local restaurants, and interview affected individuals.
 - Hypothesis Formation: Investigate if the outbreak is linked to a particular food source.
 - Testing Hypothesis: Use analytical studies to identify the common food item consumed.

Conclusion

The Science Olympiad Disease Detectives Cheat Sheet serves as a foundational resource for students participating in this challenging event. By mastering the key concepts of epidemiology, familiarizing themselves with disease types, and practicing outbreak investigation techniques, students can enhance their understanding and performance in Disease Detectives. As they prepare, it's essential to combine theoretical knowledge with practical applications, enabling them to think critically and act decisively when faced with real-world health challenges. With dedication and practice, participants can excel in this event and develop skills that will be invaluable in their future scientific endeavors.

Frequently Asked Questions

What is the primary focus of the Science Olympiad Disease Detectives event?

The primary focus of the Science Olympiad Disease Detectives event is to understand and apply concepts related to epidemiology, disease investigation, and public health.

What types of diseases are typically covered in the Disease Detectives event?

The Disease Detectives event typically covers infectious diseases, chronic diseases, and environmental health issues, including their causes, effects, and control measures.

What skills are essential for success in the Disease Detectives competition?

Essential skills include critical thinking, data analysis, problem-solving, and understanding of statistical methods and epidemiological principles.

How can students prepare effectively for the Disease Detectives event?

Students can prepare effectively by studying epidemiology textbooks, reviewing case studies, practicing with sample data sets, and familiarizing themselves with disease investigation methods.

What role does teamwork play in the Disease Detectives event?

Teamwork is crucial in the Disease Detectives event as participants collaborate to analyze data, discuss findings, and develop solutions to hypothetical disease outbreaks.

Are there specific resources or cheat sheets recommended for the Disease Detectives event?

Yes, resources such as epidemiology textbooks, online databases, and cheat sheets summarizing key concepts, formulas, and case study examples are recommended for preparation.

What types of questions are typically asked in the Disease Detectives competition?

Questions in the Disease Detectives competition often include case studies, data interpretation, identification of disease outbreaks, and application of epidemiological concepts to real-world scenarios.

Find other PDF article:

Science Olympiad Disease Detectives Cheat Sheet

Science | AAAS

6 days ago · Science/AAAS peer-reviewed journals deliver impactful research, daily news, expert commentary, and career resources.

Targeted MYC2 stabilization confers citrus Huanglongbing

Apr 10, 2025 · Huanglongbing (HLB) is a devastating citrus disease. In this work, we report an HLB resistance regulatory circuit in Citrus composed of an E3 ubiquitin ligase, PUB21, and its substrate, the MYC2 transcription factor, which regulates jasmonate-mediated ...

In vivo CAR T cell generation to treat cancer and autoimmune

Jun 19, 2025 · Chimeric antigen receptor (CAR) T cell therapies have transformed treatment of B cell malignancies. However, their broader application is limited by complex manufacturing processes and the necessity for lymphodepleting chemotherapy, restricting patient ...

Tellurium nanowire retinal nanoprostheses improves vision in

Jun 5, 2025 · Present vision restoration technologies have substantial constraints that limit their application in the clinical setting. In this work, we fabricated a subretinal nanoprostheses using tellurium nanowire networks (TeNWNs) that converts light of both the ...

Reactivation of mammalian regeneration by turning on an

Mammals display prominent diversity in the ability to regenerate damaged ear pinna, but the genetic changes underlying the failure of regeneration remain elusive. We performed comparative single-cell and spatial transcriptomic analyses of rabbits and ...

Programmable gene insertion in human cells with a laboratory

Programmable gene integration in human cells has the potential to enable mutation-agnostic treatments for loss-of-function genetic diseases and facilitate many applications in the life sciences. CRISPR-associated transposases (CASTs) catalyze RNA-guided ...

A symbiotic filamentous gut fungus ameliorates MASH via a

May 1, 2025 · The gut microbiota is known to be associated with a variety of human metabolic diseases, including metabolic dysfunction-associated steatohepatitis (MASH). Fungi are increasingly recognized as important members of this community; however, the role of ...

Deep learning-guided design of dynamic proteins | Science

May 22, 2025 · Deep learning has advanced the design of static protein structures, but the controlled conformational changes that are hallmarks of natural signaling proteins have remained inaccessible to de novo design. Here, we describe a general deep learning-guided ...

Acid-humidified CO₂ gas input for stable electrochemical CO₂

Jun 12, 2025 · (Bi)carbonate salt formation has been widely recognized as a primary factor in poor operational stability of the electrochemical carbon dioxide reduction reaction (CO₂RR). We

demonstrate that flowing CO₂ gas into an acid bubbler—which carries trace ...

Rapid in silico directed evolution by a protein language ... - Science

Nov 21, 2024 · Directed protein evolution is central to biomedical applications but faces challenges such as experimental complexity, inefficient multiproperty optimization, and local maxima traps. Although in silico methods that use protein language models (PLMs) can ...

[Science | AAAS](#)

6 days ago · Science/AAAS peer-reviewed journals deliver impactful research, daily news, expert commentary, and career resources.

Targeted MYC2 stabilization confers citrus Huanglongbing

Apr 10, 2025 · Huanglongbing (HLB) is a devastating citrus disease. In this work, we report an HLB resistance regulatory circuit in Citrus composed of an E3 ubiquitin ligase, PUB21, and its substrate, the MYC2 transcription factor, which regulates jasmonate-mediated ...

In vivo CAR T cell generation to treat cancer and autoimmune

Jun 19, 2025 · Chimeric antigen receptor (CAR) T cell therapies have transformed treatment of B cell malignancies. However, their broader application is limited by complex manufacturing processes and the necessity for lymphodepleting chemotherapy, restricting patient ...

Tellurium nanowire retinal nanoprostheses improves vision in

Jun 5, 2025 · Present vision restoration technologies have substantial constraints that limit their application in the clinical setting. In this work, we fabricated a subretinal nanoprostheses using tellurium nanowire networks (TeNWs) that converts light of both the ...

Reactivation of mammalian regeneration by turning on an

Mammals display prominent diversity in the ability to regenerate damaged ear pinna, but the genetic changes underlying the failure of regeneration remain elusive. We performed comparative single-cell and spatial transcriptomic analyses of rabbits and ...

Programmable gene insertion in human cells with a laboratory

Programmable gene integration in human cells has the potential to enable mutation-agnostic treatments for loss-of-function genetic diseases and facilitate many applications in the life sciences. CRISPR-associated transposases (CASTs) catalyze RNA-guided ...

A symbiotic filamentous gut fungus ameliorates MASH via a

May 1, 2025 · The gut microbiota is known to be associated with a variety of human metabolic diseases, including metabolic dysfunction-associated steatohepatitis (MASH). Fungi are increasingly recognized as important members of this community; however, the role of ...

Deep learning-guided design of dynamic proteins | Science

May 22, 2025 · Deep learning has advanced the design of static protein structures, but the controlled conformational changes that are hallmarks of natural signaling proteins have remained inaccessible to de novo design. Here, we describe a general deep learning-guided ...

Acid-humidified CO₂ gas input for stable electrochemical CO₂

Jun 12, 2025 · (Bi)carbonate salt formation has been widely recognized as a primary factor in poor operational stability of the electrochemical carbon dioxide reduction reaction (CO₂RR). We demonstrate that flowing CO₂ gas into an acid bubbler—which carries trace ...

Rapid in silico directed evolution by a protein language ... - Science

Nov 21, 2024 · Directed protein evolution is central to biomedical applications but faces challenges such as experimental complexity, inefficient multiproperty optimization, and local maxima traps. Although in silico methods that use protein language models (PLMs) can ...

Unlock your potential with our Science Olympiad Disease Detectives cheat sheet! Discover key concepts

[Back to Home](#)