

Disease Detectives Science Olympiad

Basics:

Research - (clinical approach is of individuals while public health approach is of public) clusters 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. **source** - physical object serves to transmit infection from persons (cont. & lice) **reservoir** - disease animal to human **surveillance** - system collect, analyze, interpret, & dissemination of health data, to gain knowledge of patterns to control & prevent **clinical hypothesis** - health care to treat & diagnose disease, improve prognosis. Ind. (lab.) & **chronic** (complex, sampling & state) **latent agent**: ill. caused by medication physician **Index Case-Patient Care** **Latent Period** - time between person coming into contact w/ path. & when they are infected (chronic diseases) **Fluque** - Bubo (nodes), Septicemic (blood), Pneumonic (lungs) **nosocomial Dis.** - infection from hospital **Case Fatality Rate** - # of deaths from dis. w/ disease **Mortality Rate** - # of deaths from disease w/ in pop.

I, P, D - **Incidence** - # new instances in pop. over given time **casey pop.** / time. INCLUDES **FDH**

Prevalence - # of affected persons in pop. at any given time **casey pop.** **Point Q?** snapshot of pop. & rate of certain dis. at point in time **Period** **P** - prev. over certain duration

Disease w/ longer duration has greater prev.

P x 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 # **Other fact.** in Play (better reporting, seasonal fluctuations, pop. change)

➤ **Verify Diagnosis**

Proper Diagnosis (verify procedures used to diagnose problem, check methods used to identify infections) **Local 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 & **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 may be used sampling of local problems, expand search

Line Listing (chart of specific cases) **Ident. Info.** **ID Case #**, **Left name initials** **Clinical info.** (diag., symp., lab result, hospital, death) **Describe** (time, person, place) **Risk Factor** (disease & outbreak place)

➤ **Describe & Orient data in terms of person, place, time** (descriptive ep.)

Time, Place, Person **Time** (Epi Curve, histogram shows course of disease to identify infection: X-Axis= time equal to Y-Y, incubation time; Y-Axis is case #) **Place** (geographic extent = spot map of cases to identify groups specific to location or environmental fact.) **Person** (identify affected pop. by type of person: expos + age & sex)

Types of Descriptive Studies - study distribution of problems by outcome, frequency in pop., expos., time, patterns, or environmental factor studies w/o control cases 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/ in 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/ perspective of expos. disease status)

➤ **Develop Hypo. (Agent, Host, Environment Triad) - Chain of Transmission**

Agent-host-vic. Age capable of causing disease & sources = host/person susceptible to it + env. allowing them to get together **Infectious groups** - viruses, bacteria, protozoans, fungi, worms) **Testable Hypo.** must be in testable form) **Current**

Knowledge & hypothesis (should be based on current knowledge & be updated/modified as new info uncovered)

➤ **Refine Hypo. - Analytical Studies**

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 illness, used w/ small, well defined pop. & moves forward from 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** (a 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 $[a(b)]/[c(d)]$

RR > 1.0 - incidence rates of disease in exposed incidence rates in unexposed, NO **INTERVENTION FOR ASSOC.** **RR < 1.0** - positive assoc. increased risk, increases in strength as magnitude of RR increases **RR < 1.0** - neg. assoc. decreased risk (possibly protective effect?)

Can't be neg. **Case Control** - look 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 expos. in cases** = a/c = **odds of odds of expos. in controls** = b/d = bc

a = # 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 **dim. of chain of agent-source-host** **dim. interrupt transmission exp.** **dim. reduce susceptibility**

➤ **Intensify surveillance**

Community feelings **Coord. Effort** (inform local health officials/other need-to-know groups as soon as info. available) **Written Report** (initially done in scientific format for future reference, legal issues, education)

Errors in Investigations **Falsely Relationships** **Random Error** - divergence due to chance alone, of observation on sample from pop. value, leading to lack of precision in measurement of assoc.

Basic systematic error in an epidemiologic study **Bias** - systematic error in an epidemiologic study **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 finding of study to population from which the study is taken

Types of Bias **describe problems in how study is conducted** **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 disease characteristics & 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 extraneous fact. May lead to overestimating/underestimating true assoc. between expos. & outcome. **Confounding variable** would be variable (pollution) that can cause disease under study (smoke)

It 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 concern 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 these data**

problem of interest **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/across areas. 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 periods 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 map & 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 patterns have something in common.

➤ **Provide these data & their interpretation to those responsible for controlling health problem**

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 pop.**

Stakeholders **Purpose, objectives, operations, Unfinished, 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

➤ **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** - conditions can be altered, either prevented/accelerated, by appropriate experimental process

➤ **Cohort exp.** - 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 **Incubatory** - when individual transmits pathogen immediately following infection but prior to developing symptoms **Chronic** - someone who can transmit disease for long period of time **Transient** - inherited disease but host shows no symptoms

Transient/Temporary - someone who can transmit infectious disease for short amt. of time **Chain of Transmission Triad** has external agent, vector/fomite that transmits disease, & susceptible

Disease Detectives Science Olympiad is a fascinating and educational competition that engages students in the field of epidemiology, which is the study of how diseases spread and can be controlled. This event challenges participants to think critically about public health issues, analyze data, and apply scientific principles to real-world scenarios. The Science Olympiad is designed to inspire young minds to explore the intricacies of disease transmission and the importance of disease prevention and control. This article will delve into the structure, significance, and preparation strategies for the Disease Detectives event in the Science Olympiad.

Overview of Disease Detectives

The Disease Detectives event is primarily focused on understanding the fundamental concepts of epidemiology and public health. Participants are

expected to investigate disease outbreaks, analyze data, and understand the factors that contribute to health issues in populations. The competition encourages teamwork, critical thinking, and the application of scientific methods to solve complex problems.

Objectives of the Event

The goals of the Disease Detectives event include:

1. **Understanding Epidemiology:** Participants learn the principles of epidemiology, including how diseases are transmitted and controlled.
2. **Data Analysis Skills:** Students develop skills in interpreting data, statistics, and trends related to health issues.
3. **Problem-Solving:** The event enhances critical thinking and problem-solving skills by challenging students to devise solutions to hypothetical disease outbreaks.
4. **Awareness of Public Health Issues:** Participants gain insight into current public health challenges, including infectious diseases, chronic illnesses, and environmental health concerns.

Structure of the Competition

The Disease Detectives competition typically consists of several components that assess participants' knowledge and skills in epidemiology.

Written Test

The competition usually begins with a written test that covers a range of topics, including:

- Basics of epidemiology
- Types of diseases (infectious vs. non-infectious)
- Disease transmission methods (airborne, vector-borne, etc.)
- Data interpretation (graphs, charts, and statistics)
- Public health policies and interventions

The written test may include multiple-choice questions, short answers, and case studies that require analytical thinking.

Hands-On Activities

In addition to the written test, the Disease Detectives event often includes hands-on activities or scenarios that simulate real-world epidemiological investigations. These activities can involve:

- **Field investigations:** Analyzing a fictional outbreak and determining its cause.
- **Data collection:** Evaluating health data from a given population.
- **Case studies:** Reviewing historical disease outbreaks and their impact on public health.

Students may work in teams to solve problems and present their findings to judges.

Scoring and Judging

Scoring in the Disease Detectives event typically combines results from the written test and the hands-on activities. Judges evaluate participants based on:

- Accuracy of answers
- Depth of analysis in case studies
- Effectiveness in presenting solutions
- Teamwork and collaboration

The scoring system is designed to encourage not only individual knowledge but also the ability to work collaboratively in a team setting.

Significance of the Disease Detectives Event

The Disease Detectives Science Olympiad plays a crucial role in promoting awareness and understanding of public health issues among young students. Its significance can be highlighted through several key points:

Promoting Public Health Knowledge

Through participation in the event, students gain valuable knowledge about public health that can influence their future academic and career choices. Understanding the principles of epidemiology is essential for those considering careers in healthcare, research, and public health policy.

Encouraging Critical Thinking and Inquiry

The hands-on and analytical nature of the event fosters critical thinking skills. Students learn to ask pertinent questions, analyze data, and derive conclusions based on evidence. This scientific inquiry is fundamental for future scientific endeavors and informed decision-making.

Building Future Scientists and Leaders

By engaging in the Disease Detectives event, students are equipped with the skills and knowledge required to become future scientists, healthcare professionals, and leaders in public health. They gain a greater appreciation for the importance of scientific research and its impact on society.

Preparation Strategies for Participants

To excel in the Disease Detectives event, participants must be well-prepared. Here are some effective strategies for preparation:

Study Resources

Utilize a variety of study resources, including:

- Textbooks: Look for textbooks that cover epidemiology and public health topics.
- Online Courses: Many universities offer free online courses in epidemiology and public health.
- CDC and WHO Resources: The Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) provide valuable information on disease outbreaks and public health guidelines.

Practice with Mock Tests

- Past Papers: Review past Disease Detectives tests to familiarize yourself with the format and types of questions.
- Group Study: Engage in group study sessions to discuss and solve practice problems collaboratively.

Hands-On Experience

- Simulations: Participate in simulations or workshops focused on epidemiological investigations.
- Field Research: If possible, engage in local public health initiatives to gain practical experience.

Team Collaboration

- Effective Communication: Work on communication and teamwork skills with your team members to ensure smooth collaboration during the event.
- Role Assignment: Assign roles based on individual strengths, such as data analysis, presentation, and research.

Conclusion

The Disease Detectives Science Olympiad is more than just a competition; it is an educational experience that equips students with essential knowledge and skills in epidemiology and public health. By participating in this event, students not only enhance their understanding of how diseases affect populations but also prepare themselves to become informed citizens and future leaders in health-related fields. With proper preparation and a passion for science, participants can uncover the mysteries of disease

transmission and contribute to a healthier world.

Frequently Asked Questions

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

The primary focus of the Disease Detectives event is to understand the principles of epidemiology, including how diseases spread, how outbreaks are investigated, and how public health measures are implemented.

What skills are essential for participants in the Disease Detectives event?

Participants should have strong analytical skills, a good understanding of statistics and data interpretation, and the ability to apply epidemiological concepts to real-world scenarios.

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

Participants may study a variety of infectious diseases, chronic diseases, and environmental health issues, often focusing on recent outbreaks or public health concerns.

How are teams evaluated in the Disease Detectives event?

Teams are evaluated based on their ability to analyze case studies, answer questions correctly, and demonstrate their understanding of epidemiological methods and public health responses.

What resources are recommended for students preparing for the Disease Detectives event?

Students are encouraged to read textbooks on epidemiology, review the CDC and WHO websites, and study previous Science Olympiad materials and sample tests.

Can students from different grade levels compete in the Disease Detectives event?

Yes, the Disease Detectives event is typically open to middle and high school students, allowing for a diverse range of competitors.

What recent global health issue might be relevant for the Disease Detectives event?

Recent global health issues such as the COVID-19 pandemic and its impact on public health practices, vaccination strategies, and outbreak investigations are highly relevant for the Disease Detectives event.

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