1st Annual MIT Science Olympiad Invitational Tournament

Disease Detectives

(EXAM)

Team number:

High school:

Names:

Time: 45 minutes

Event supervisor contact information:

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Additional considerations:

- No penalty for guessing
- Significant figures are not required
- Units and work are required for all calculation questions
- One 8.5x11" resource sheet is permitted per team
- 2 non-programmable, non-graphing calculators are permitted
- You may take the test packet apart to work on sections separately. Please make sure to get the exam in the correct order and stapled when the time ends

Disclaimer: The following articles from the United States Centers for Disease Control and Prevention *Morbidity and Mortality Weekly Report* (CDC MMWR) have been modified for educational, not-for-profit use:

1. Hopkins, D.R., et al., Progress Toward Global Eradication of Dracunculiasis — January 2013–June 2014. CDC Morbidity and Mortality Weekly Report, 2014. 63(46): p. 1050-1054. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6346a3.htm?s_cid=mm6346a3_w

2. Nyenswah, T.G., et al., Evidence for Declining Numbers of Ebola Cases — Montserrado County, Liberia, June–October 2014. CDC Morbidity and Mortality Weekly Report, 2014. 63(46): p. 1072-1076. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6346a8.htm?s_cid=mm6346a8_w

3. Arrazola, R.A., et al., Tobacco Use Among Middle and High School Students — United States, 2013. CDC Morbidity and Mortality Weekly Report, 2014. 63(45): p. 1021-1026. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6345a2.htm

Exam Questions:
Please remember to record all answers on your answer sheet

1. Identify and define the components of the traditional “epidemiological triad” – what does it represent?

2. Distinguish between the following terms: epidemic, pandemic, endemic, outbreak

3. Indicate whether the following statements are TRUE or FALSE. If you believe the statement to be false, provide corrections or an explanation to the statement.

    a. A case-only epidemiological study can provide information about the risk associated with specific exposures.

    b. Quarantine periods may be enforced in order to prevent further spread of infectious diseases.

    c. A disease vector in which the disease agent undergoes an essential stage of its life cycle is known as a fomite.

    d. Experimental bias introduces random error to epidemiological studies.

    e. The increased risk of lung cancer in smokers when compared to non-smokers is indicative of a dose-response gradient.

    f. The first case identified in an outbreak is considered the “index case.”

    g. Virulence refers to the severity of the disease caused by an agent.

    h. In a natural experiment, the researchers can choose which individuals or groups receive treatments and/or preventative measures.

4. Identify two (2) factors which may influence the threshold of vaccination required to ensure herd immunity in different infectious diseases.

5. Provide a definition for vertical transmission, and provide two (2) examples of diseases with this mode of transmission.

6. The following table indicates the number of cases that were reported each day during an outbreak of an unknown disease in a small community. No cases were reported before 8/7 or after 8/19.

Date	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19	8/20
# new cases	0	2	4	8	14	16	13	11	9	6	4	3	1	0

   a. Create a histogram based on the data above.

   b. What type of outbreak do these data most likely represent?

   c. Fill in the table with the <u>cumulative</u> number of reported cases each day for this outbreak.

   d. Create a cumulative distribution graph based on the data of this outbreak.

   e. The exposure is believed to have occurred on 8/1. What is the incubation period for this outbreak?

   f. What does this incubation period represent?

   g. Identify two (2) public health challenges that may be associated with a disease or condition with a long incubation period.

   h. What group of diseases tends to have short incubation periods of 6-48 hours?

7. Identify four (4) classes of agent and give two specific examples of each class.

8. Zoonoses represent a major potential source of emerging infectious diseases.

   a. Provide a definition for zoonosis

   b. Provide two (2) examples of zoonotic diseases.

   c. How does population growth impact the rate of occurrence of zoonoses? Please provide three (2) specific mechanisms for this change.

9. Reports from Boston of an outbreak of a newly-discovered disease have recently emerged. The following table indicates the efficacy of the newly-developed Diagnostic Test A for the disease that has been employed in Boston during the outbreak. Assume that the "disease" and "no disease" designations specify whether or not the patient truly has the disease being test for.

	Disease	**No disease**
Positive test A	90	60
Negative test A	40	150

   a. Calculate the following measures for the data given above:
      i. Sensitivity
      ii. Specificity
      iii. Positive Predictive Value (PPV)
      iv. Negative Predictive Value (NPV)

   b. What do the calculations from part (a) indicate about this diagnostic test?

   c. What are some costs associated with a low PPV?

   d. Which category of cases during an outbreak often require a definitive positive diagnostic result?

   e. Suppose a second diagnostic test, Diagnostic Test B, has been developed for this disease, with the relevant data from Boston given below. If results from the two tests are completely independent, what is the likelihood a patient with the disease will test positive for both tests?

	Disease	**No disease**
Positive test B	150	10
Negative test B	20	300

   f. Provide two (2) reasons why using Diagnostic Test A may be detrimental to the ongoing outbreak investigation in Boston.

10. Each year, there are 15 new cases of Panda Flu in a city with a population of 375,000. The average duration of this disease is reported to be 6 months.

   a. Can prevalence and/or incidence be calculated from the above information? Use definitions or formulae in your explanation.

   b. If possible, calculate incidence (per 10,000 people) and prevalence of Panda Flu in this population.

   c. If the information given is sufficient, calculate a single individual's average annual risk for contracting Panda Flu.

   d. Name one (1) type of epidemiological studies where incidence can be measured.

   e. Name one (1) type of epidemiological studies where prevalence can be measured.

11. Describe three (3) reasons for a sudden apparent increase in measured disease incidence if the true incidence of the disease has not changed.

12. A fictional multi-year cohort study reported the following data:

Exposure	**Inflammatory Bowel Syndrome (IBD)**	**No IBD**
Family history	25	30
Smoking	15	60
Prolonged NSAID use	9	50
None of the above factors present	12	302

a. Name and calculate the appropriate measure(s) of disease risk associated with each of the exposures specified in the table (inc. the “none of the above” category). Please show one sample calculation.

b. Please interpret your results.

c. If a specific exposure has value(s) for measure(s) of disease risk <1, what can be said about that exposure?

d. Suppose this cohort study had an unusually high level of attrition, or loss-to-followup. Name two (2) common reasons why this may occur.

e. How might a high level of attrition among high-risk individuals affect the results of this study?

f. In selecting a group of individuals to take part in a cohort study, what important condition should be attained?

13. You wish to conduct a retrospective cohort study. Describe generally how you would design this study and collect relevant data and/or records.

14. Please refer to Article A (“Progress Toward Global Eradication of Dracunculiasis”) to answer the following questions:

    a. Which major disease was successfully eradicated worldwide in 1980?

    b. What key feature of a disease is usually required for it to be a candidate for global eradication?

    c. Why is it extremely important for public health officials to implement active surveillance for *D.medinensis*-infected dogs in Chad?

    d. Why is a country required to have no reported indigenous cases of dracunculiasis for a full calendar year before it may enter the WHO precertification stage of eradication?

    e. Identify two (2) challenges associated with current dracuncliasis eradication efforts as described in the article.

    f. What measures of active surveillance have been implemented in countries with dracuncliasis? How does this differ from passive surveillance?

15. Please refer to Article B (“Evidence for Declining Numbers of Ebola Cases – Montserrado County, Liberia”) to answer the following questions:

    a. What two factors mentioned in the article in relation to surveillance of Ebola incidence in Montserrado County may have caused the number of cases to be <u>under-reported</u>?

    b. Which of the three datasets (ETU Admissions Data, Ebola Laboratory Test Data, Body Collection Data) described in this report was (or were) used as a proxy (or proxies) for Ebola incidence? Include a definition of “proxy measurement” in your answer.

16. Please refer to Article C (“Tobacco Use Among Middle and High School Students”) to answer the following questions:

    a. The data in this study were only collected from youths who attended either public or private schools. How might this impact the results of the study? If applicable, please name the type(s) of systematic bias(es) that may have resulted from this procedure.

    b. The data in this study were collected using a “self-administered, pencil-and-paper questionnaire.” How might this impact the results of the study? If applicable, please name the type(s) of systematic bias(es) that may have resulted from this procedure.

    c. While cigarette use has generally decreased among the youth population, overall tobacco use remains high. What developments in the tobacco industry as mentioned in the article may explain this trend?

ARTICLE A:

Progress Toward Global Eradication of Dracunculiasis — January 2013–June 2014

CDC Morbidity and Mortality Weekly Report
November 21, 2014 / 63(46);1050-1054

Donald R. Hopkins, MD[1], Ernesto Ruiz-Tiben, PhD[1], Mark L. Eberhard, PhD[2], Sharon L. Roy, MD[3]
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6346a3.htm?s_cid=mm6346a3_w

Dracunculiasis (Guinea worm disease) is caused by *Dracunculus medinensis*, a parasitic worm. Approximately 1 year after a person acquires infection from contaminated drinking water, the worm will emerge through the skin, usually on the lower limb. Pain and secondary bacterial infection can cause temporary or permanent disability that disrupts work and schooling. In 1986, the World Health Assembly called for dracunculiasis elimination (*1*). The global Guinea Worm Eradication Program, supported by The Carter Center, World Health Organization (WHO), UNICEF, CDC, and other partners, began assisting ministries of health of countries in which dracunculiasis is endemic in meeting this goal. At that time, an estimated 3.5 million cases occurred each year in 20 countries in Africa and Asia (*1,2*). A total of 148 cases were reported in 2013 from five countries (in order of prevalence: South Sudan, Chad, Mali, Ethiopia, and Sudan) compared with 542 cases in 2012 from four countries (South Sudan, Chad, Mali, and Ethiopia). The disease remains endemic in four countries in 2014 (South Sudan, Chad, Mali, and Ethiopia). Failures in surveillance and containment, lack of clean drinking water, insecurity in Mali and parts of South Sudan, and an unusual epidemiologic pattern in Chad (*6*) are the main remaining challenges to dracunculiasis eradication.

Because the lifecycle of *D. medinensis* is complex, its transmission can be interrupted using several strategies (*4*). Dracunculiasis can be prevented with four main interventions: 1) educating residents in communities where it is endemic, and particularly persons from whom worms are emerging, to avoid immersing affected body parts in sources of drinking water, 2) filtering potentially contaminated drinking water through a cloth filter, 3) treating potentially contaminated surface water with the insecticide temephos (Abate), and 4) providing safe drinking water from bore-hole or hand-dug wells (*7*). Containment of transmission,[*] is achieved through four complementary measures: 1) voluntary isolation of each patient to prevent contamination of drinking water sources, 2) provision of first aid, 3) manual extraction of the worm, and 4) application of occlusive bandages.

Countries enter the WHO precertification stage of eradication after completing 1 full year without reporting any indigenous[†] cases (*D. medinensis* has approximately a 1-year incubation period [range = 10–14 months]) (*7*). A case of dracunculiasis is defined as infection occurring in a person exhibiting a skin lesion or lesions with emergence of one or more Guinea worms. Each infection is counted as a case only once during a calendar year. An imported case is an infection resulting from ingestion of contaminated water from a source identified through patient interviews and epidemiologic investigation in a place (i.e., another country or village within the same country) other than in the community where the patient is detected and reported. Three countries where transmission of dracunculiasis was previously endemic (Ghana, Kenya, and Sudan) are in the precertification stage of eradication.

In each country affected by dracunculiasis, a national eradication program receives monthly reports of cases from each village that has endemic transmission. All villages with endemic dracunculiasis are kept under active surveillance, with daily searches of households for persons with signs and symptoms suggestive of dracunculiasis. These searches are conducted to ensure that detection occurs within 24 hours of worm emergence so that patient management can begin to prevent contamination of water sources. Villages in which endemic transmission of dracunculiasis is interrupted (i.e., zero cases reported for ≥12 consecutive months) also are kept under active surveillance for 3 consecutive years.

WHO certifies a country free from dracunculiasis after that country maintains adequate nationwide surveillance for ≥3 consecutive years and demonstrates that no cases of indigenous dracunculiasis occurred during that period.

Chad. After a decade with no reported cases, Chad reported 10 cases in 2010, and dracunculiasis was declared endemic in Chad in 2012 after indigenous cases of dracunculiasis were confirmed over 3 consecutive years (*9*). Since 2012, more dogs than humans have had emerging Guinea worms in Chad. This has not happened in any other country during the eradication campaign. Since April 2012, 49 worm specimens obtained from dogs were morphologically and or genetically confirmed to be *D. medinensis* at CDC (WHO Collaborating Center, unpublished data, 2014[§]). Moreover, genetic testing to compare whether the worms obtained from humans and those obtained from dogs were *D. medinensis* confirmed that they were undistinguishable (*6*). During November–December 2013, after five human cases (none contained) were discovered in Sarh district (Moyen Chari Region), an area under passive surveillance, The Carter Center expanded its assistance and began implementing active surveillance in that district. The working hypothesis, based on biologic, environmental, and epidemiologic investigations by CDC and The Carter Center is that the cases in humans and dogs are associated with an intense domestic and commercial fishing industry along the Chari River (where nearly all the cases have occurred) and involve a fish that serves as a paratenic host (an intermediate host in which no development of the parasite occurs). New cases occur when inadequately cooked fish are consumed by humans and when raw fish or fish entrails are consumed by dogs (*6*).

Chad's Guinea Worm Eradication Program and its partners continue to implement standard intervention practices in 72 priority villages at risk. In October 2013, the program began promoting new educational messages to educate residents about proper cooking of fish and about the need to prevent dogs from eating raw fish and fish entrails. Temephos usage is constrained by the extremely large lagoons and impoundments used for fishing and as sources of drinking water. Investigations are under way to try to develop methods to isolate and treat water entry points at the end of paths leading from communities to water sources, which are routinely used by residents, and which have been identified during epidemiologic investigations as contaminated by a patient with GWD or by a dog with Guinea worm.

ARTICLE B:

Evidence for Declining Numbers of Ebola Cases — Montserrado County, Liberia, June–October 2014

CDC Morbidity and Mortality Weekly Report
November 21, 2014 / 63(46);1072-1076

Tolbert G. Nyenswah, MPH[1], Matthew Westercamp, PhD[2,3], Amanda Ashraf Kamali, MD[3,4], Jin Qin, PhD[3,5], Emily Zielinski-Gutierrez, DrPH[6], Fred Amegashie, MD[1,7], Mosaka Fallah, PhD[1], Bernadette Gergonne, MD[8], Roselyn Nugba-Ballah, MPH[9], Gurudev Singh[10], John M. Aberle-Grasse, MPH[6], Fiona Havers, MD[2], Joel M. Montgomery, PhD[6], Luke Bawo, MPH[1], Susan A. Wang, MD[6], Ronald Rosenberg, ScD[11]

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6346a8.htm?s_cid=mm6346a8_w

The epidemic of Ebola virus disease (Ebola) in West Africa that began in March 2014 has caused approximately 13,200 suspected, probable, and confirmed cases, including approximately 6,500 in Liberia (*1,2*). About 50% of Liberia's reported cases have been in Montserrado County (population 1.5 million), the most populous county, which contains the capital city, Monrovia. To examine the course of the Ebola epidemic in Montserrado County, data on Ebola treatment unit (ETU) admissions, laboratory testing of patient blood samples, and collection of dead bodies were analyzed. Each of the three data sources indicated consistent declines of 53%–73% following a peak incidence in mid-September. The declines in ETU admissions, percentage of patients with reverse transcription–polymerase chain reaction (RT-PCR) test results positive for Ebola, and dead bodies are the first evidence of reduction in disease after implementation of multiple prevention and response measures. The possible contributions of these interventions to the decline is not yet fully understood or corroborated. A reduction in cases suggests some progress; however, eliminating Ebola transmission is the critical goal and will require greatly intensified efforts for complete, high-quality surveillance to direct and drive the rapid intervention, tracking, and response efforts that remain essential.

ETU Admission Data

ETU admission data include all admissions to the four Montserrado ETUs* as reported to the Ministry of Health and Social Welfare for the period June 13–October 26, 2014. Of 2,916 patients admitted, admission dates were available for 2,768 (95%). For purposes of this analysis and because ETU admission data do not contain information on symptoms or Ebola risks, classification of cases depended on ETU documentation of negative Ebola RT-PCR test results: 1) a non-Ebola case was defined as a case in which a patient was admitted to an ETU but released as Ebola-negative based on ETU documentation of a negative Ebola test result by RT-PCR and there was absence of any ETU-documented positive Ebola test result, and 2) an Ebola case was defined as a case in which a patient did not have an ETU-documented negative RT-PCR test result, even if laboratory results were not recorded (including confirmed cases [those with ETU documentation of a positive RT-PCR test result], as well as probable and suspected cases for which there were no ETU-documented negative RT-PCR test results).

Release as a non-Ebola patient was based on a patient having two consecutive negative Ebola RT-PCR tests at least 72 hours apart.

The number of admissions to ETUs rose to a maximum of 255 patients during epidemiologic week 39 (beginning September 22) and then declined by 67% to approximately 70 per week by week 43 (October 26). Ebola cases and noncases followed this trajectory. The number of beds available for Ebola patients rose substantially, from fewer than 100 to more than 500 beds during the study period, moving from an initial shortage to a surplus. Because patients were turned away from ETUs due to bed shortages during the period when the number of Ebola cases was rising, the number of ETU admissions was effectively capped during various weeks. Trends in ETU admissions are affected by changes in the number of available ETU beds and might be influenced by changes in migration of patients to and from other counties. However, availability of ETU beds was stable or increasing during the last 4 weeks analyzed, when there were also no large shifts in patient migration to account for the decline of ETU admissions observed.

Ebola Laboratory Test Data

The percentage of patients with Ebola-positive RT-PCR test results, excluding repeat tests for individual patients based on the unique identifier, declined gradually over the entire period, from a maximum of 79% positive at week 34 (August 18) to 51% positive by week 43 (October 20).

Body Collection Data

Since late July 2014, the International Federation of Red Cross and Red Crescent Societies (IFRC) has been responsible for the collection and cremation of all dead bodies from ETUs (except ELWA-3) and bodies from the community. For the period July 28–October 26, a total of 2,234 bodies were collected by the IFRC. The majority (1,179 [53%]) were collected from homes or other community settings, 744 (33%) from ETUs, 194 (9%) from non-ETU health facilities, and 117 (5%) from unknown locations. ELWA-3 operates its own crematorium. To examine the trend of the total number of bodies collected, ELWA-3 records (n = 578) were combined with the totals from IFRC. The number of bodies believed to be the result of an Ebola-related death rose to a maximum in week 38 (September 15), with 380 bodies collected, and then declined to 160 by week 43 (October 20). The pattern was similar for both IFRC and ELWA-3.

The completeness of records was further compromised by refusal of an unknown number of persons to report cases or burials (Montserrado County Contact Tracing Team, personal communication, 2014). The need to cremate Ebola-related dead bodies has encountered resistance from the local population, raising the possibility that bodies might have been hidden and independently buried. A rapid community assessment performed in October examining community perceptions and avoidance of cremation, however, suggests no increase in frequency of such secret burials during September and October to account for the recorded decrease in body collection (African Union and CDC, unpublished data, 2014).

ARTICLE C:

Tobacco Use Among Middle and High School Students — United States, 2013

CDC Morbidity and Mortality Weekly Report
November 14, 2014 / 63(45);1021-1026

René A. Arrazola, MPH[1], Linda J. Neff, PhD[1], Sara M. Kennedy, MPH[2], Enver Holder-Hayes, MPH[3], Christopher D. Jones, PhD[1]

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6345a2.htm

Tobacco use is the leading preventable cause of disease and death in the United States, and nearly all tobacco use begins during youth and young adulthood (*1,2*). Among U.S. youths, cigarette smoking has declined in recent years; however, the use of some other tobacco products has increased (3), and nearly half of tobacco users use two or more tobacco products (*4*). CDC analyzed data from the 2013 National Youth Tobacco Survey* to determine the prevalence of ever (at least once) and current (at least 1 day in the past 30 days) use of one or more of 10 tobacco products (cigarettes, cigars, hookahs, smokeless tobacco, electronic cigarettes [e-cigarettes], pipes, snus, bidis, kreteks, and dissolvable tobacco) among U.S. middle school (grades 6–8) and high school (grades 9–12) students. In 2013, 22.9% of high school students reported current use of any tobacco product, and 12.6% reported current use of two or more tobacco products; current use of combustible products (i.e., cigarettes, cigars, pipes, bidis, kreteks, and/or hookahs) was substantially greater (20.7%) than use of other types of tobacco. Also, 46.0% of high school students reported having ever tried a tobacco product, and 31.4% reported ever trying two or more tobacco products. Among middle school students, 3.1% reported current use of cigars, and 2.9% reported current use of cigarettes, with non-Hispanic black students more than twice as likely to report current use of cigars than cigarettes. Monitoring the prevalence of the use of all available tobacco products, including new and emerging products, is critical to support effective population-based interventions to prevent and reduce tobacco use among youths as part of comprehensive tobacco prevention and control programs.

The National Youth Tobacco Survey is a cross-sectional, school-based, self-administered, pencil-and-paper questionnaire administered to U.S. middle school (grades 6–8) and high school (grades 9–12) students. Information is collected on tobacco control outcome indicators to monitor the impact of comprehensive tobacco control policies and programs (*5*) and regulatory authorities of the Food and Drug Administration (FDA) (*6*). A three-stage cluster sampling procedure was used to generate a nationally representative sample of students in grades 6–12. Of 250 schools selected for the 2013 National Youth Tobacco Survey, 187 (74.8%) participated, with a sample of 18,406 (90.7%) among 20,301 eligible students[†]; the overall response rate was 67.8%. Participants were asked about ever and current use of cigarettes, cigars (defined as cigars, cigarillos, or little cigars), smokeless tobacco (defined as chewing tobacco, snuff, or dip), pipes, bidis, kreteks, hookah, snus, dissolvable tobacco, and e-cigarettes. Ever use was defined as ever trying a product, and current use was defined as using a product on 1 or more days during the past 30 days. For both ever use and current use, any tobacco use was defined as reporting the use of one or more tobacco products; use of two or more tobacco products was defined as reporting the use of two or more tobacco products in the specified time, current (in the past 30 days) or ever. Combustible tobacco was defined as cigarettes, cigars, pipes, bidis, kreteks, and/or hookahs. Noncombustible tobacco was defined as smokeless tobacco, snus, and/or dissolvable tobacco. A separate category was created for e-cigarette use. Data were adjusted for nonresponse and weighted to provide national prevalence estimates with 95% confidence intervals; statistically significant ($p<0.05$) differences between population subgroups were assessed using a t-test. Estimates for ever and current use are presented for each type of product, for any tobacco use, and for the use of two or more tobacco products by selected demographics for each school level (middle and high).

In 2013, 22.9% of high school students reported current use of a tobacco product, including 12.6% who reported current use of two or more tobacco products. Among all high school students, cigarettes (12.7%) and cigars (11.9%) were the most commonly reported tobacco products currently used, followed by smokeless tobacco (5.7%), hookahs (5.2%), e-cigarettes (4.5%), pipes (4.1%), snus (1.8%), kreteks (0.8%), bidis (0.6%), and dissolvable tobacco (0.4%). Among high school students who identified as non-Hispanic white or Hispanic, cigarettes were the product most commonly used, whereas cigar use was more common for all other race/ethnicities. Cigar use among non-Hispanic black students was nearly 50% higher than cigarette use. Younger children are less likely to try tobacco than older children with the proportions of current any tobacco users and current users of two or more tobacco products being lower among middle school students (6.5% and 2.9%, respectively) than high school students (22.9% and 12.6%, respectively). Cigars (3.1%) and cigarettes (2.9%) were the most commonly reported tobacco products currently used by middle school students, followed by pipes (1.9%); smokeless tobacco (1.4%); e-cigarettes and hookahs (1.1%); and bidis, kreteks, and snus (0.4%). The proportions of ever users of any tobacco product and ever users of two or more tobacco products were higher among high school (46.0% and 31.4%, respectively) than middle school (17.7% and 9.4%, respectively) students.

Combustible tobacco products were the most commonly used form of tobacco among both current and ever tobacco users. Among high school students, 20.7% currently used combustible products (13.5% combustible only; 3.4% combustible and noncombustible only; 2.7% combustible and e-cigarettes only; and 1.1% combustible, noncombustible, and e-cigarettes). Of all middle school students, 5.4% currently used combustible products (4.0% combustible only; 0.8% combustible and noncombustible only; 0.4% combustible and e-cigarettes only; and 0.2% combustible, noncombustible, and e-cigarettes). Current use of only e-cigarettes was 0.6% among high school students and 0.4% among middle school students.