

# NEET-PG Social & Preventive Medicine Sample Paper-1

Duration: 20 Minutes

Maximum Marks: 100

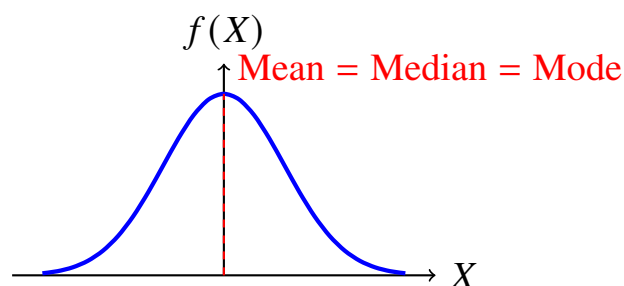
## Instructions

- This paper contains **25** Multiple Choice Questions.
- Each correct answer carries **+4** mark. Incorrect answer: **-1** marks. Only **one** correct option.
- Unattempted questions carry **0** marks.
- Use of mobile phones, smartwatches, or any electronic gadgets is strictly prohibited.

**Q1.** In a community with a population of 100,000, a new screening test for a chronic disease is introduced. Out of 1,000 individuals who actually have the disease, 900 test positive. Out of 99,000 individuals who do not have the disease, 9,900 test positive. What is the positive predictive value (PPV) of this screening test in this population?

- (A) 90.0%
- (B) 50.0%
- (C) 8.33%
- (D) 9.09%

**Q2.** A researcher measures the serum cholesterol levels of 150 post-menopausal women. To determine if the data follows a normal distribution, which of the following statistical parameters would be most useful to check if the mean, median, and mode are identical?



- (A) Standard deviation
- (B) Skewness
- (C) Variance
- (D) Interquartile range

**Q3.** Under the National Tuberculosis Elimination Program (NTEP), a 45-year-old newly diagnosed pulmonary tuberculosis patient is started on the standard treatment regimen. According to current guidelines, what is the duration of the continuation phase and the frequency of drug administration?

- (A) 4 months, thrice weekly
- (B) 4 months, daily
- (C) 2 months, daily
- (D) 6 months, thrice weekly

**Q4.** During an outbreak investigation of a gastrointestinal illness at a university hostel, 45 out of 90 students who ate a specific chicken salad became ill. Among 60 students who did not eat the salad, 10 became ill. What is the Relative Risk (RR) of developing the illness associated with eating the chicken salad?

	Ill (+)	Ill (-)
Salad (+)	45	45
Salad (-)	10	50

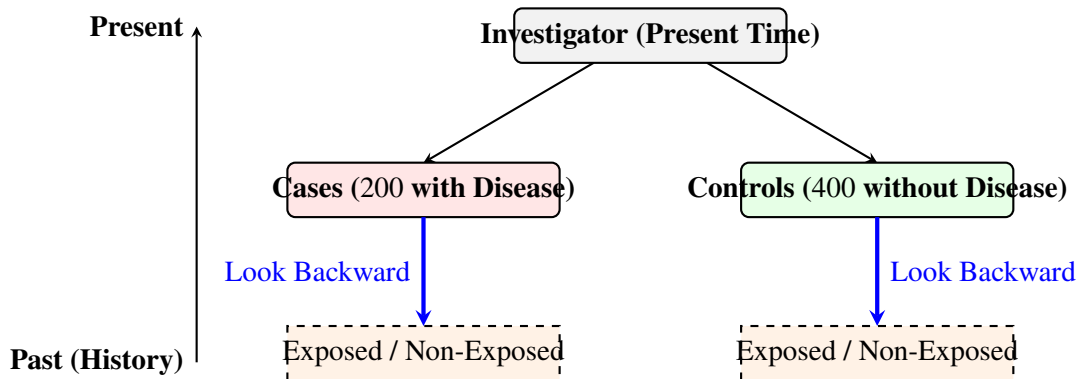
- (A) 3.0
- (B) 4.5
- (C) 2.5
- (D) 1.5

**Q5.** A 12-month-old infant is brought to the primary health center for missed vaccinations. According to the National Immunization Schedule (NIS) in India, which of the following combinations of vaccines can be safely administered to this child during this visit?



- (A) MR 1st dose, JE 1st dose, Vitamin A 1st dose
- (B) MR 1st dose, JE 1st dose, Vitamin A 2nd dose
- (C) MR 2nd dose, DPT Booster, OPV Booster
- (D) BCG, Rotavirus 3rd dose, PCV Booster

**Q6.** A study was conducted to evaluate the association between oral contraceptive use and the risk of thromboembolism. The investigators selected 200 women diagnosed with thromboembolism and 400 age-matched women without thromboembolism. History of oral contraceptive use was then ascertained in both groups. This study design is an example of a:



- (A) Prospective Cohort Study
- (B) Case-Control Study
- (C) Cross-sectional Study
- (D) Randomized Controlled Trial

**Q7.** In an urban slum, a public health worker notes a high prevalence of dental fluorosis among children. According to the World Health Organization (WHO) standards, what is the optimum permissible limit of fluoride in drinking water?

- (A) 0.1 to 0.3 mg/L
- (B) 0.5 to 0.8 mg/L
- (C) 1.5 to 2.0 mg/L
- (D) 2.5 to 3.5 mg/L



- Q8.** A clinical trial compares a new antihypertensive drug with a standard drug. The primary outcome is the mean reduction in systolic blood pressure (measured in mmHg). If the data in both groups are independent and normally distributed, which statistical test should be used to compare the mean reductions between the two groups?
- (A) Paired t-test  
(B) Chi-square test  
(C) Unpaired (Independent) t-test  
(D) One-way ANOVA
- Q9.** Under the National Reproductive, Maternal, Newborn, Child, and Adolescent Health (RMNCH+A) strategy, which of the following interventions is specifically designated to target the “Adolescent” component to reduce the burden of nutritional anemia?
- (A) Weekly Iron and Folic Acid Supplementation (WIFS)  
(B) Daily Iron and Folic Acid Supplementation  
(C) Bi-weekly Iron syrup distribution  
(D) Quarterly deworming only
- Q10.** A randomized controlled trial is conducted to test a new vaccine against a respiratory virus. In the vaccine group, the incidence of infection is 2%, while in the placebo group, the incidence is 10%. What is the Vaccine Efficacy in this trial?
- (A) 20%  
(B) 80%  
(C) 50%  
(D) 90%
- Q11.** A health worker wants to assess the socio-economic status of an urban family using the Modified Kuppuswamy Scale. Which three variables must the health worker evaluate to calculate the score?



- (A) Occupation of head, Education of head, Total family income
- (B) Occupation of head, Type of housing, Per capita income
- (C) Education of head, Material possessions, Total family income
- (D) Occupation of head, Education of head, Per capita income

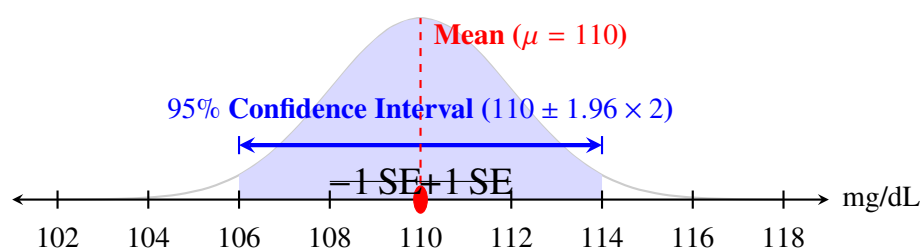
**Q12.** The National Vector Borne Disease Control Programme (NVBDCP) aims to eliminate Lymphatic Filariasis. What is the primary strategy implemented annually in endemic districts to achieve this goal?

- (A) Mass Drug Administration (MDA) of Diethylcarbamazine (DEC) and Albendazole
- (B) Indoor Residual Spraying (IRS) with DDT twice a year
- (C) Distribution of Long-Lasting Insecticidal Nets (LLINs) to all households
- (D) Early case detection and radical treatment with Primaquine

**Q13.** In a cohort study tracking 5,000 smokers over 10 years, 150 developed lung cancer. Out of 5,000 non-smokers tracked over the same period, 30 developed lung cancer. What is the Attributable Risk (AR) of lung cancer due to smoking in this study?

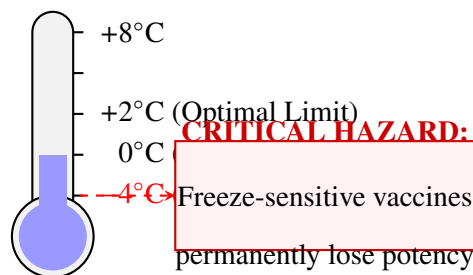
- (A) 80%
- (B) 2.4%
- (C) 3.0%
- (D) 1.2%

**Q14.** A public health researcher samples 400 adult males from a city to estimate the prevalence of diabetes mellitus. The sample mean glucose level is found to be 110 mg/dL with a standard error of 2 mg/dL. What is the 95% Confidence Interval for the population mean glucose level?



- (A) 108 to 112 mg/dL
- (B) 106 to 114 mg/dL
- (C) 104 to 116 mg/dL
- (D) 100 to 120 mg/dL

**Q15.** A cold chain technician notices that the dial thermometer of an ice-lined refrigerator (ILR) in a primary health center reads  $-4^{\circ}\text{C}$ . Which of the following vaccines stored in the ILR is at the highest risk of losing its potency due to this temperature sub-zero exposure?



- (A) Oral Polio Vaccine (OPV)
- (B) Measles-Rubella (MR) Vaccine
- (C) Hepatitis B Vaccine
- (D) BCG Vaccine

**Q16.** The crude birth rate of a state is 20 per 1,000 population, and the crude death rate is 6 per 1,000 population. Ignoring the effects of migration, what is the annual growth rate of this state's population?

- (A) 14%
- (B) 1.4%
- (C) 2.6%
- (D) 0.14%

**Q17.** Under the National Leprosy Eradication Programme (NLEP), a patient presenting with 6 skin lesions, no asymmetric nerve involvement, and a positive skin smear for acid-fast bacilli is classified and treated as:

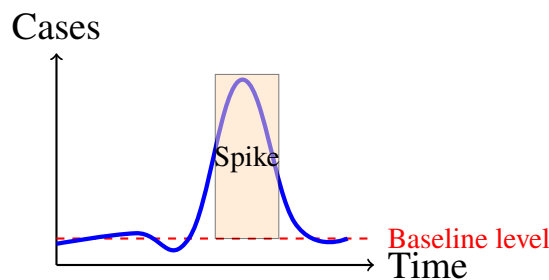


- (A) Paucibacillary (PB) Leprosy with 6 months of MDT
- (B) Multibacillary (MB) Leprosy with 6 months of MDT
- (C) Multibacillary (MB) Leprosy with 12 months of MDT
- (D) Paucibacillary (PB) Leprosy with 12 months of MDT

**Q18.** An epidemiological investigator is analyzing data where the independent variable is “Smoking Status” (Smoker vs. Non-smoker) and the dependent variable is “Hypertension Status” (Hypertensive vs. Non-hypertensive). Which statistical test is most appropriate to determine if there is a significant association between these two variables?

- (A) Student’s t-test
- (B) Chi-square test
- (C) Pearson’s correlation coefficient
- (D) Analysis of Variance (ANOVA)

**Q19.** A primary health center reports 12 cases of a rare neurological condition over a span of two weeks in a single village where normally no such cases are seen. This sudden, clear excess over expected normalcy is best defined as a/an:



- (A) Endemic
- (B) Pandemic
- (C) Epidemic
- (D) Sporadic occurrence

**Q20.** According to the Bio-Medical Waste Management Rules in India, anatomical waste, placenta, and discarded human tissues must be segregated into which colored non-chlorinated plastic bags for disposal?



- (A) Red
- (B) Yellow
- (C) Blue
- (D) Black

**Q21.** The Sustainable Development Goal (SDG) 3 targets a global reduction in the Maternal Mortality Ratio (MMR). What is the specific target value set for the global MMR to be achieved by the year 2030?

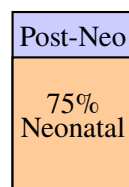
- (A) Less than 100 per 100,000 live births
- (B) Less than 70 per 100,000 live births
- (C) Less than 50 per 100,000 live births
- (D) Less than 30 per 100,000 live births

**Q22.** A diagnostic test for a specific viral infection has a sensitivity of 95% and a specificity of 90%. If this test is applied in a community where the actual prevalence of the infection is zero, what percentage of the population will return a positive test result?

- (A) 0%
- (B) 5%
- (C) 10%
- (D) 95%

**Q23.** In a progressive country, the absolute number of infant deaths has declined significantly, but the proportion of neonatal deaths out of total infant deaths has risen to nearly 75%. Which of the following programmatic interventions will be most effective in further reducing the Infant Mortality Rate (IMR) in this scenario?

Total Infant Deaths



- (A) Universal Vitamin A supplementation campaigns
- (B) Early initiation of breastfeeding and essential newborn care
- (C) Mass distribution of ORS packets for childhood diarrhea
- (D) Intensive school health screening programs

**Q24.** A prospective cohort study is conducted to evaluate the relationship between physical inactivity and coronary heart disease (CHD). During the analysis, the investigator finds that age is associated with both physical inactivity and CHD risk. To eliminate the effect of age as a confounding variable during the analysis phase, which method should be used?

- (A) Matching
- (B) Stratification
- (C) Randomization
- (D) Blinding

**Q25.** Under the National AIDS Control Programme (NACP), which of the following mechanisms represents the primary operational unit at the grassroots level for the delivery of targeted interventions among high-risk groups (HRGs)?

- (A) Anti-Retroviral Therapy (ART) Centers
- (B) Integrated Counseling and Testing Centers (ICTC)
- (C) Non-Governmental Organizations (NGOs) via Targeted Intervention (TI) projects
- (D) State AIDS Control Societies (SACS)



## Detailed Solutions

Q1.

## Solution

**Concept:** The Positive Predictive Value (PPV) is an essential metric in epidemiology that indicates the probability that a subject has the disease given that the screening test result is positive. It is calculated by dividing the number of true positives ( $TP$ ) by the total number of individuals who test positive, which includes both true positives ( $TP$ ) and false positives ( $FP$ ).

**Solution:** Step 1: Identify the given data parameters from the problem statement:

Total true diseased individuals ( $TP + FN$ ) = 1,000

True positives ( $TP$ ) = 900

Total non-diseased individuals ( $TN + FP$ ) = 99,000

False positives ( $FP$ ) = 9,900

Step 2: Calculate the total number of individuals who tested positive:

$$\text{Total Positives} = TP + FP$$

$$\text{Total Positives} = 900 + 9,900 = 10,800$$

Step 3: Apply the Positive Predictive Value formula:

$$PPV = \frac{TP}{TP + FP} \times 100$$

Step 4: Substitute the calculated numbers into the formula to find the value:

$$PPV = \frac{900}{10,800} \times 100$$

$$PPV = \frac{1}{12} \times 100 = 8.33\%$$

Step 5: Conclude that the probability of a person actually having the disease after testing positive is 8.33%.

**Final Answer:**

**Answer: (C)**

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Q2.

**Solution**

**Concept:** In biostatistics, the distribution of biological variables is analyzed using symmetry indicators. A perfectly symmetrical, bell-shaped distribution is known as a normal distribution. In a normal distribution, measures of central tendency coincide perfectly. Deviations from this symmetry are quantified using the measure of skewness.

**Solution:** Step 1: Understand the mathematical characteristics of a normal distribution curve. In a standard Gaussian distribution, the frequency curve is fully symmetric around its central peak.

Step 2: Relate the central values to symmetry. For a distribution that is completely balanced and unskewed, the arithmetic mean, the geometric median, and the most frequent value (mode) must lie at the exact same coordinate.

Step 3: Define skewness as the measure of the asymmetry of a real-valued probability distribution. If skewness is equal to 0, the distribution is perfectly symmetrical, which means mean = median = mode.

Step 4: Evaluate the alternate parameters. Standard deviation and variance only measure the spread or dispersion of the dataset, not its symmetry. The interquartile range establishes the boundaries of the middle 50% of data points but does not evaluate absolute modal alignment.

Step 5: Conclude that calculating skewness is the most definitive mechanism to check the structural identity of the three central parameters.

**Final Answer:**

**Answer: (B)**

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Q3.

**Solution**

**Concept:** The National Tuberculosis Elimination Program (NTEP) follows structured public health drug management guidelines matching the World Health Organization recommendations. For newly diagnosed pulmonary tuberculosis patients, the drug schedule is strictly daily rather than intermittent to prevent treatment failure and emergence of resistance.

**Solution:** Step 1: Breakdown the standard regimen structure for a new case of drug-susceptible pulmonary tuberculosis under current national guidelines. The overall treatment is split into an Intensive Phase and a Continuation Phase.

Step 2: Analyze the Intensive Phase duration. The Intensive Phase lasts for 2 months and consists of four primary antitubercular medications administered daily.

Step 3: Analyze the Continuation Phase configuration. The Continuation Phase immediately follows the intensive phase and lasts for a duration of exactly 4 months (16 weeks).

Step 4: Determine the frequency of dosing based on updated protocols. To maintain steady-state serum drug levels and eliminate latent bacilli, current public health protocols mandate that drugs in both phases must be taken on a daily basis, departing entirely from older intermittent (thrice weekly) regimens.

Step 5: Combine the phase duration and the frequency criteria to arrive at the full answer.

**Final Answer:**

**Answer: (B)**

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Q4.

**Solution**

**Concept:** Relative Risk (RR) is used in epidemiological studies to determine the strength of an association between an exposure and an outcome. It compares the incidence of disease among an exposed group to the incidence of disease among an unexposed group.

**Solution:** Step 1: Extract the operational frequencies from the investigation details:

Exposed group (ate chicken salad) = 90 (45 ill, 45 not ill)

Unexposed group (did not eat salad) = 60 (10 ill, 50 not ill)

Step 2: Calculate the incidence of illness in the exposed cohort ( $I_e$ ):

$$I_e = \frac{\text{Ill in exposed}}{\text{Total exposed}} = \frac{45}{90} = 0.5$$

Step 3: Calculate the incidence of illness in the unexposed cohort ( $I_u$ ):

$$I_u = \frac{\text{Ill in unexposed}}{\text{Total unexposed}} = \frac{10}{60} = 0.1667$$

Step 4: Compute the Relative Risk (RR) by dividing  $I_e$  by  $I_u$ :

$$\text{RR} = \frac{I_e}{I_u} = \frac{0.5}{0.1667} = 3.0$$

Step 5: Interpret the final metric value. An RR of 3.0 implies that students who consumed the chicken salad had 3 times higher risk of getting sick compared to those who did not.

**Final Answer:**

**Answer: (A)**

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Q5.

**Solution**

**Concept:** The National Immunization Schedule (NIS) provides guidelines for catching up on missed immunizations. At 9 to 12 months of age, children become eligible for specific live and sub-unit vaccines, including the first dose of Measles-Rubella (MR), Japanese Encephalitis (JE) in endemic areas, and Vitamin A prophylaxis.

**Solution:** Step 1: Evaluate the vaccine eligibility of a 12-month-old child presenting with delayed immunization history. The child falls into the operational window for the primary doses normally scheduled at 9 completed months.

Step 2: Assess option requirements for the first dose of Measles-Rubella and Japanese Encephalitis. Both MR 1st dose and JE 1st dose are scheduled from 9 to 12 months.

Step 3: Assess the Vitamin A supplementation guidelines. The first dose of Vitamin A (1 lakh IU) must be administered along with the MR 1st dose at 9–12 months of age. Sub-sequent doses are 2 lakh IU given at 6-month intervals.

Step 4: Examine why other combinations are incorrect. Option B lists the second dose of Vitamin A, which cannot be given before the first dose is completed. Option C contains booster doses which are scheduled at 16–24 months. Option D is incorrect because Rotavirus vaccine cannot be initiated or completed at this advanced age.

Step 5: Verify that MR 1st dose, JE 1st dose, and Vitamin A 1st dose form the correct catch-up combination.

**Final Answer:** MR 1st dose, JE 1st dose, Vitamin A 1st dose

**Answer: (A)**

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Q6.

**Solution**

**Concept:** Epidemiological study designs are classified based on how subjects are selected and whether the tracking direction moves forward or backward relative to exposure and outcome. A study that starts with an identified disease status and probes backward to historical exposures is classified as a case-control study.

**Solution:** Step 1: Analyze the selection process of the study subjects. The investigators selected two distinct populations based explicitly on their current health outcomes: 200 women with thromboembolism and 400 women without the disease.

Step 2: Define the terminology for these groups. The diseased group represents the “cases” and the healthy comparison group represents the “controls.”

Step 3: Analyze the direction of data collection. The investigators looked backward in time to determine past usage of oral contraceptives (exposure status) in both groups.

Step 4: Match these design parameters with classic epidemiological frameworks. Because the selection is based on the disease status and exposure is measured retrospectively, it fits the description of a Case-Control Study.

Step 5: Contrast with alternative designs. A cohort study selects based on exposure and tracks outcomes prospectively. A cross-sectional study assesses exposure and outcome simultaneously. An RCT involves active intervention by researchers.

**Final Answer:**

**Answer: (B)**

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Q7.

**Solution**

**Concept:** Environmental sanitation and water safety involve monitoring dissolved minerals. Fluoride is a double-edged sword in public health; optimal concentrations prevent dental caries, while excessive levels lead to dental and skeletal fluorosis. The World Health Organization establishes acceptable thresholds to guide safe municipal distribution.

**Solution:** Step 1: Understand the biological role of fluoride in drinking water. Low amounts help strengthen tooth enamel, but levels above safe thresholds cause mottling of teeth, known as dental fluorosis.

Step 2: Review the specific criteria given by public health bodies. The World Health Organization (WHO) and Indian standards define the ideal range of fluoride concentration for drinking purposes.

Step 3: Identify the optimum level. The recommended range is 0.5 to 0.8 mg/L. Within this range, maximum dental protection is achieved without structural toxicity.

Step 4: Identify the absolute upper permissible limit. The absolute safe limit is 1.5 mg/L, beyond which water requires artificial defluoridation using techniques like the Nalgonda technique.

Step 5: Select the target range from the choices provided, which matches the optimum range of 0.5 to 0.8 mg/L.

**Final Answer:** 0.5 to 0.8 mg/L

**Answer: (B)**

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Q8.

**Solution**

**Concept:** Hypothesis testing in biostatistics requires matching data types and group counts to specific tests. When evaluating a continuous variable across two separate, unrelated groups that exhibit normal distributions, parametric tests comparing sample means are utilized.

**Solution:** Step 1: Define the nature of the data collected in the trial. The reduction in systolic blood pressure is a continuous numerical variable measured in mmHg.

Step 2: Identify the number and relationship of the study groups. There are two independent groups: patients receiving the new drug and patients receiving the standard drug.

Step 3: Evaluate underlying data assumptions. The problem explicitly states that the data are independent and normally distributed, satisfying the prerequisites for a parametric test.

Step 4: Choose the appropriate test based on these characteristics. To compare the means of two independent, normally distributed groups, the Unpaired (Independent) t-test must be used.

Step 5: Rule out other tests. A paired t-test is used for pre- and post-treatment measurements on the same individuals. A Chi-square test evaluates categorical data. One-way ANOVA compares three or more continuous groups.

**Final Answer:**

**Answer:** (C)

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Q9.

**Solution**

**Concept:** The RMNCH+A strategy integrates lifecycle health interventions. The adolescent component includes specific public health approaches to combat iron-deficiency anemia among school-going and non-school-going adolescents to break the intergenerational cycle of malnutrition.

**Solution:** Step 1: Identify the operational objectives of the RMNCH+A framework targeting the “A” (Adolescent) pillar. Anemia control is a major focus area for this subgroup.

Step 2: Examine the design of the main anti-anemia intervention for adolescents. The programmatic response is the Weekly Iron and Folic Acid Supplementation (WIFS) program.

Step 3: Review the medication dosage and composition used in this program. It provides a fixed-dose tablet containing 100 mg elemental iron and 500  $\mu\text{g}$  folic acid, distributed weekly.

Step 4: Identify the target audience for this specific distribution scheme. It is given to adolescent boys and girls in government/municipal schools and out-of-school adolescent girls via community Anganwadi centers.

Step 5: Differentiate this from child programs. Daily iron and bi-weekly syrup formulations are meant for infants and younger pediatric cohorts, not the adolescent demographic.

**Final Answer:**

**Answer:** (A)

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Q10.

**Solution**

**Concept:** Vaccine Efficacy (VE) measures the proportionate reduction in disease incidence among vaccinated individuals compared to an unvaccinated or placebo cohort under ideal clinical trial conditions. It is calculated using relative risk parameters.

**Solution:** Step 1: Identify the incidence values given in the clinical trial results:

Incidence in the vaccinated group ( $I_v$ ) = 2% = 0.02

Incidence in the placebo group ( $I_p$ ) = 10% = 0.10

Step 2: State the standard formula used to compute Vaccine Efficacy:

$$VE = \frac{I_p - I_v}{I_p} \times 100$$

Alternatively, it can be expressed as:  $VE = (1 - \text{Relative Risk}) \times 100$ .

Step 3: Substitute the incidence values into the main equation:

$$VE = \frac{10 - 2}{10} \times 100$$

Step 4: Perform the final simplification steps:

$$VE = \frac{8}{10} \times 100 = 80\%$$

Step 5: Conclude that the vaccine successfully reduced the risk of infection by 80% in the treated population.

**Final Answer:**

**Answer: (B)**

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Q11.

**Solution**

**Concept:** Socio-economic classification systems are essential tools used in community medicine to categorize populations. The Modified Kuppuswamy Scale is specifically designed for urban settings and relies on three distinct pillars to calculate a composite score indicating a family's status.

**Solution:** Step 1: Review the history and purpose of the Modified Kuppuswamy Scale. It is updated regularly to account for inflation and economic shifts in urban communities.

Step 2: Analyze the structural parameters of the index. The scale assesses three distinct socio-economic variables regarding the head of the family.

Step 3: Specify the parameters:

1. Education of the head of the family.
2. Occupation of the head of the family.
3. Per capita monthly income of the family (total income divided by total members).

Step 4: Compare this scale with other classification systems. The BG Prasad Scale relies entirely on per capita income. The Udai Pareek Scale is used primarily for rural populations and considers assets and housing styles.

Step 5: Select Option D, which correctly identifies occupation of head, education of head, and per capita income as the three components.

**Final Answer:** Occupation of head, Education of head, Per capita income

**Answer: (D)**

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Q12.

**Solution**

**Concept:** Vector-borne disease control programs target public health elimination goals through coordinated community drug deployment. For Lymphatic Filariasis, elimination strategies aim to disrupt transmission by lowering microfilaria levels in the human reservoir population.

**Solution:** Step 1: Identify the main mechanism used to eliminate Lymphatic Filariasis in endemic areas. Vector suppression alone is insufficient, so public health strategies focus on clearing circulating microfilariae from human blood.

Step 2: Define the primary operational intervention. This strategy is known as Mass Drug Administration (MDA), where entire eligible populations in endemic areas are given single therapeutic doses of anti-filarial drugs annually.

Step 3: Identify the combination of drugs used in India's national program. The standard regimen includes Diethylcarbamazine (DEC) administered alongside Albendazole.

Step 4: Understand the rationale for this approach. Giving these medications annually to communities for consecutive years lowers microfilarial loads below transmission thresholds.

**Final Answer:** Mass Drug Administration (MDA) of Diethylcarbamazine (DEC) and Albendazole

**Answer:** (A)

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Q13.

**Solution**

**Concept:** Attributable Risk (AR) or Risk Difference quantifies the absolute excess risk of disease that can be directly blamed on a specific exposure. It measures the excess disease incidence that could be avoided if the exposure were completely eliminated.

**Solution:** Step 1: Identify the raw numbers provided in the cohort study:

Exposed cohort (5,000 smokers) developed 150 cases.

Unexposed cohort (5,000 non-smokers) developed 30 cases.

Step 2: Calculate the incidence of lung cancer in the exposed group ( $I_e$ ):

$$I_e = \frac{150}{5,000} = 0.03 = 3\%$$

Step 3: Calculate the incidence of lung cancer in the unexposed group ( $I_u$ ):

$$I_u = \frac{30}{5,000} = 0.006 = 0.6\%$$

Step 4: Use the Attributable Risk formula to find the absolute difference:

$$AR = I_e - I_u$$

$$AR = 3\% - 0.6\% = 2.4\%$$

Step 5: Conclude that 2.4% of the total risk of developing lung cancer in smokers is directly attributable to their smoking habit.

**Final Answer:**

**Answer: (B)**

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Q14.

**Solution**

**Concept:** A Confidence Interval (CI) establishes an estimated range of values that is likely to include an unknown population parameter. For a 95% confidence level, the boundary limits are calculated by taking the sample mean and adding or subtracting 1.96 times the standard error of the mean (SE).

**Solution:** Step 1: List the statistical values given in the problem:

Sample mean ( $\bar{X}$ ) = 110 mg/dL

Standard error (SE) = 2 mg/dL

Confidence level required = 95%

Step 2: Determine the Z-score multiplier corresponding to a 95% confidence level. The standard critical value is  $Z = 1.96$ , which can be rounded to 2 for quick calculations.

Step 3: Write out the mathematical equation for confidence interval boundaries:

$$95\% \text{ CI} = \bar{X} \pm (Z \times \text{SE})$$

Step 4: Substitute the given values into the equation:

$$\text{Lower Limit} = 110 - (1.96 \times 2) \approx 110 - 4 = 106 \text{ mg/dL}$$

$$\text{Upper Limit} = 110 + (1.96 \times 2) \approx 110 + 4 = 114 \text{ mg/dL}$$

Step 5: The resulting interval spans from 106 to 114 mg/dL.

**Final Answer:** 106 to 114 mg/dL

**Answer: (B)**

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Q15.

**Solution**

**Concept:** Cold chain logistics require strict management of vaccine-specific storage environments. Vaccines are broadly grouped into freeze-sensitive and freeze-resistant categories. Exposing a freeze-sensitive vaccine to temperatures below freezing causes irreversible denaturing of its adjuvant components, leading to a permanent loss of potency.

**Solution:** Step 1: Analyze the current storage temperature reported inside the Ice-Lined Refrigerator (ILR). A reading of  $-4^{\circ}\text{C}$  means the vaccines are being kept in sub-zero conditions, which is outside the safe  $+2^{\circ}\text{C}$  to  $+8^{\circ}\text{C}$  storage window.

Step 2: Evaluate how different classes of vaccines react to freezing conditions.

Step 3: Identify freeze-resistant options. Live viral vaccines like Oral Polio Vaccine (OPV) and Measles-Rubella (MR) can tolerate freezing temperatures without losing structural potency. BCG can also tolerate freezing after reconstitution rules are managed.

Step 4: Identify freeze-sensitive options. Hepatitis B is highly sensitive to freezing. It contains an aluminum adjuvant that aggregates into crystal patterns when frozen, completely destroying its immunogenicity.

Step 5: Conclude that Hepatitis B is at the highest risk of damage in this scenario.

**Final Answer:**

**Answer:** (C)

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Q16.

**Solution**

**Concept:** Demographic growth dynamics are calculated by comparing vital indicators like birth rates and death rates. The natural growth rate of a population represents the difference between the Crude Birth Rate (CBR) and the Crude Death Rate (CDR), scaled to a percentage format.

**Solution:** Step 1: Note the given demographic parameters:

Crude Birth Rate (CBR) = 20 per 1,000 individuals

Crude Death Rate (CDR) = 6 per 1,000 individuals

Step 2: Calculate the net rate of natural increase per 1,000 people in the population:

$$\text{Natural Increase} = \text{CBR} - \text{CDR}$$

$$\text{Natural Increase} = 20 - 6 = 14 \text{ per } 1,000 \text{ population}$$

Step 3: Convert this rate from a per-1,000 baseline to a standard percentage (per-100) baseline to determine the annual growth rate:

$$\text{Annual Growth Rate} = \frac{14}{1,000} \times 100$$

$$\text{Annual Growth Rate} = 1.4\%$$

Step 4: Verify the calculations to avoid decimal point errors. A rate of 14 per 1,000 is equivalent to 1.4 per 100, or 1.4%.

**Final Answer:**

**Answer: (B)**

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Q17.

**Solution**

**Concept:** The National Leprosy Eradication Programme (NLEP) classifies leprosy cases into Paucibacillary (PB) and Multibacillary (MB) categories to determine the appropriate multi-drug therapy (MDT) regimen. This classification is based on the number of skin lesions, nerve involvement, and slit-skin smear results.

**Solution:** Step 1: Analyze the clinical criteria for the patient:

Number of skin lesions = 6

Slit-skin smear status = Positive for acid-fast bacilli

Step 2: Apply the classification rules used by the NLEP. A patient is classified as having Multibacillary (MB) leprosy if they have more than 5 skin lesions, more than 1 enlarged nerve trunk, or any positive slit-skin smear result.

Step 3: Determine the patient's classification based on these rules. The presence of 6 lesions and a positive skin smear confirms a classification of Multibacillary (MB) leprosy.

Step 4: Determine the appropriate treatment duration for MB leprosy under standard guidelines. The standard multi-drug therapy (MDT) regimen for MB leprosy consists of Rifampicin, Clofazimine, and Dapsone administered over a duration of 12 months.

Step 5: Select Option C as the choice that matches both classification and treatment duration.

**Final Answer:**

**Answer:** (C)

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Q18.

**Solution**

**Concept:** Selecting the right test of significance depends on the scale of measurement of the variables being analyzed. When evaluating the relationship between two independent variables that are both categorical, non-parametric tests like the Chi-square test are used.

**Solution:** Step 1: Identify the measurement scale for the independent variable, "Smoking Status." The data are divided into two distinct categories: Smoker and Non-smoker. This is a qualitative, categorical variable.

Step 2: Identify the measurement scale for the dependent variable, "Hypertension Status." This variable is also categorical, divided into Hypertensive and Non-hypertensive.

Step 3: Determine the structural format of the data. Cross-tabulating two categorical variables creates a  $2 \times 2$  contingency table of observed frequencies.

Step 4: Select the appropriate test of significance. The Chi-square ( $\chi^2$ ) test is designed to evaluate categorical data and determine if there is a significant association between observed and expected frequencies across categories.

Step 5: Eliminate alternative options. Student's t-test and ANOVA require continuous dependent variables, while Pearson's correlation coefficient requires both variables to be continuous.

**Final Answer:**

**Answer: (B)**

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Q19.

**Solution**

**Concept:** Epidemiology classifies disease occurrence patterns based on time, location, and the number of cases relative to historical expectations. An epidemic is defined as the occurrence of cases of an illness in a community or region that is clearly in excess of normal expectancy.

**Solution:** Step 1: Analyze the clinical scenario details. A total of 12 cases of a rare neurological disease were identified over a brief two-week period within a single village.

Step 2: Evaluate the baseline historical background of this disease. The problem states that normally zero cases are seen in this area, meaning the baseline expectation is zero.

Step 3: Define the terminology for this pattern. When a disease occurs at a level that is clearly in excess of normal baseline expectations, it is classified as an epidemic. For a rare disease with a baseline expectation of zero, even a single case can indicate an outbreak or epidemic.

Step 4: Differentiate this from other distribution terms. An endemic status means a disease is constantly present at a stable level in a population. A pandemic is an epidemic that spreads across countries or continents. A sporadic occurrence describes isolated, scattered cases with no links in time or space.

**Final Answer:**

**Answer:** (C)

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Q20.

**Solution**

**Concept:** Bio-Medical Waste Management Rules outline a color-coded segregation system to ensure safe handling, treatment, and disposal of clinical waste. Human anatomical waste must be separated at the point of generation into specific colored containers for final incineration.

**Solution:** Step 1: Review the color-coding rules for biomedical waste management. Different types of waste require different disposal pathways based on their composition and biohazard risk.

Step 2: Identify the disposal pathway for human anatomical waste, including organs, tissues, and placentas. These materials must undergo deep burial or incineration.

Step 3: Identify the bag color designated for waste intended for incineration. Human anatomical waste must be collected in non-chlorinated Yellow plastic bags.

Step 4: Review the contents assigned to other colors for comparison. Red bags are used for recyclable contaminated plastic waste. Blue boxes are used for glass vials and metallic implants. Black containers or cards are used for hazardous chemical or general municipal waste.

Step 5: Confirm that human anatomical waste belongs exclusively in the yellow bag category.

**Final Answer:**

**Answer: (B)**

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Q21.

**Solution**

**Concept:** Sustainable Development Goals (SDGs) include specific health targets under Goal 3, which focuses on ensuring healthy lives and promoting well-being for all ages. Target 3.1 aims to reduce maternal mortality worldwide using a measurable ratio standard.

**Solution:** Step 1: Define the target indicator used to measure maternal mortality. The Maternal Mortality Ratio (MMR) is calculated as the number of maternal deaths per 100,000 live births.

Step 2: Review the global targets established under United Nations Sustainable Development Goal 3.1.

Step 3: Identify the target value. The goal mandates reducing the global maternal mortality ratio to less than 70 per 100,000 live births by the year 2030.

Step 4: Note additional context for country-level implementation. While the global target is less than 70, individual countries set localized targets based on their baselines, but the official global SDG target value is fixed at 70.

**Final Answer:**

**Answer: (B)**

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Q22.

**Solution**

**Concept:** The performance of a screening test depends on its sensitivity, its specificity, and the prevalence of the disease in the population being tested. Specificity is defined as the ability of a test to correctly identify individuals who do not have the disease (true negatives).

**Solution:** Step 1: Analyze the properties of the population given in the problem. The true prevalence of the viral infection in this community is zero, meaning that 100% of the population is healthy and free of the disease ( $TN + FP = 100\%$ ).

Step 2: Apply the definition of specificity. The test has a specificity of 90%, which means it will correctly return a negative result for 90% of the healthy individuals.

Step 3: Determine the proportion of false positive results. The remaining healthy individuals will receive an incorrect positive result due to the limitations of the test. This proportion is calculated as:

$$\text{False Positive Rate} = 100\% - \text{Specificity}$$

$$\text{False Positive Rate} = 100\% - 90\% = 10\%$$

Step 4: Calculate the total percentage of positive results. Since there are no true positive cases in the community, the only positive results will be these false positives, which account for 10% of the total population tested.

**Final Answer:**

**Answer:** (C)

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Q23.

**Solution**

**Concept:** The Infant Mortality Rate (IMR) is a key indicator of child survival and is divided into neonatal mortality (deaths within the first 28 days of life) and post-neonatal mortality. When neonatal deaths make up the vast majority of infant deaths, interventions must focus on specialized perinatal and newborn care.

**Solution:** Step 1: Analyze the demographic shift described in the scenario. While overall infant deaths are declining, neonatal deaths now account for 75% of the remaining infant mortality burden.

Step 2: Understand the primary causes of neonatal mortality. Deaths in the first month of life are largely driven by birth asphyxia, prematurity, low birth weight, and neonatal sepsis.

Step 3: Evaluate which public health interventions address these specific causes. General measures like distributing ORS packets or providing Vitamin A supplements target post-neonatal issues like diarrhea and childhood infections, but have little impact on early neonatal survival.

Step 4: Identify effective neonatal interventions. Providing essential newborn care—including maintaining warmth, ensuring clean cord care, and supporting the early initiation of exclusive breastfeeding—directly addresses the main causes of early neonatal mortality.

Step 5: Conclude that strengthening newborn care practices is the most effective strategy to further reduce the Infant Mortality Rate in this community.

**Final Answer:**

**Answer: (B)**

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Q24.

**Solution**

**Concept:** Confounding variables can distort the observed association between an exposure and an outcome. Control methods can be applied either during the design phase of a study (such as randomization, restriction, or matching) or during the data analysis phase (such as stratification or statistical modeling).

**Solution:** Step 1: Identify the confounding variable in this cohort study. Age is acting as a confounder because it is associated with both the exposure (physical inactivity) and the outcome (coronary heart disease).

Step 2: Note the specific timing constraint specified in the question. The investigator wants to address the confounding variable during the data analysis phase, not during the study design phase.

Step 3: Evaluate the options based on this timing constraint. Randomization and matching are effective techniques for controlling confounders, but they must be implemented during the design phase of a study. Blinding is used to prevent bias, not to control confounding variables.

Step 4: Evaluate analysis-phase techniques. Stratification involves dividing the study data into sub-groups based on the confounding variable (such as age groups) and analyzing each sub-group separately to isolate the effect of the primary exposure.

Step 5: Conclude that stratification is the correct technique to use during the analysis phase.

**Final Answer:**

**Answer: (B)**

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Q25.

**Solution**

**Concept:** The National AIDS Control Programme (NACP) uses a decentralized operational framework to manage HIV prevention and control. To reach high-risk groups (HRGs), the program relies on targeted interventions managed by community-level units to deliver prevention services directly to vulnerable populations.

**Solution:** Step 1: Review the organizational structure of the NACP. Prevention strategies are designed to focus resources on specific high-risk groups (HRGs), such as commercial sex workers, men who have sex with men, and people who inject drugs.

Step 2: Identify the operational units responsible for executing these focused prevention strategies. These programs are implemented through Targeted Intervention (TI) projects.

Step 3: Analyze how these projects are managed at the grassroots level. Targeted Intervention projects are typically implemented by non-governmental organizations (NGOs) or community-based organizations that have established access to vulnerable populations.

Step 4: Distribute services through these units. These projects provide peer counseling, condom distribution, treatment for sexually transmitted infections, and clean needle exchanges directly within the community.

Step 5: Compare with other program components. Integrated Counseling and Testing Centers (ICTCs) and Anti-Retroviral Therapy (ART) centers are facility-based clinical units focused on diagnosis and treatment, while State AIDS Control Societies (SACS) handle administration at the state level.

**Final Answer:** Non-Governmental Organizations (NGOs) via Targeted Intervention (TI) projects

**Answer: (C)**

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**Answer Key**

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	C	2	B	3	B	4	A	5	A
6	B	7	B	8	C	9	A	10	B
11	D	12	A	13	B	14	B	15	C
16	B	17	C	18	B	19	C	20	B
21	B	22	C	23	B	24	B	25	C

