Formulae Sheet

This sheet contains the full list of all health indicators required at MBBS level, for PG Entrance and USMLE.

In the rates and ratios the multiplier can be changed as needed.

I. Morbidity Indicators

$$\text{Incidence rate} = \frac{\text{New cases arising in a defined period}}{\text{Persons at risk}} \times 1000 \text{ (per unit of time)}$$

$$\text{Incidence rate (per 1000 person-years)} = \frac{\text{New cases}}{\text{Person-years of observation}} \times 1000$$

$$\text{Prevalence rate} = \frac{\text{Existing cases at a point (or period) of time}}{\text{Persons at risk}} \times 1000$$

Prevalence rate = Incidence rate × Average duration of disease (under stable conditions)

$$\text{Infectivity} = \frac{\text{Infected}}{\text{Susceptibles exposed}}$$

$$\text{Pathogenecity} = \frac{\text{Cases who develop disease}}{\text{Infected}}$$

$$\text{Virulence} = \frac{\text{Cases developing serious condition (including mortality)}}{\text{Cases with disease}}$$

$$\text{Case-fatality rate} = \frac{\text{Deaths}}{\text{Cases with disease}}$$

$$\text{Attack rate} = \frac{\text{Spells (or episodes)}}{\text{Persons at risk}} \times 100 \text{ (per unit of time)}$$

$$\text{Secondary attack rate (SAR)} = \frac{\text{New spells out of the denominator}}{\text{Susceptibles exposed to the primary case during infectious period}} \times 100$$

II. Mortality Indicators

(Numerator and denominator measured for the same period – generally one year)

$$\text{Still birth ratio} = \frac{\text{Still births}}{\text{Live births}} \times 1000$$

$$\text{Still birth rate} = \frac{\text{Still births}}{\text{Still births+Live births}} \times 1000$$

$$\text{Early neonatal mortality rate} = \frac{\text{Deaths within 7 days of life}}{\text{Live births}} \times 1000$$

$$\text{Perinatal mortality ratio (PMR)} = \frac{\text{Still births + Deaths within 7 days of life}}{\text{Live births}} \times 1000$$

$$\text{Perinatal mortality rate} = \frac{\text{Still births + Deaths within 7 days of life}}{\text{Still births + Live births}} \times 1000$$

$$\text{Late neonatal mortality rate} = \frac{\text{Deaths during 7 to <28 days of life}}{\text{Live births}} \times 1000$$

$$\text{Neonatal mortality rate (NMR)} = \frac{\text{Neonatal (<28 days) deaths}}{\text{Live births}} \times 1000$$

$$\text{Postneonatal mortality rate} = \frac{\text{Postneonatal (28 to <365 days) deaths}}{\text{Live births}} \times 1000$$

$$\text{Infant mortality rate (IMR)} = \frac{\text{Infant (<365 days) deaths}}{\text{Live births}} \times 1000$$

$$\text{Child mortality rate} = \frac{\text{Deaths of children of age <5 years}}{\text{Live births}} \times 1000$$

(Also called under-five mortality rate – U5MR)

$$\text{Maternal mortality ratio (MMR)} = \frac{\text{Deaths of women due to pregnancy and childbirth}}{\text{Live births}} \times 1000$$

$$\text{Proportional death rate (<5 years)} = \frac{\text{Deaths of children of age <5 years}}{\text{All deaths}}$$

$$\text{Proportional death rate } (\geq 60 \text{ years}) = \frac{\text{Deaths of persons of age } \geq 60 \text{ years}}{\text{All deaths}}$$

$$\text{Crude death rate (CDR)} = \frac{\text{Deaths}}{\text{Mid-year population}} \times 1000$$

$$\text{Age-specific deaths rate} = \frac{\text{Deaths in specific age-group}}{\text{Mid-year population in that age-group}} \times 1000$$

$$\text{Cause-specific death rate} = \frac{\text{Deaths due to the specific cause}}{\text{Mid-year population}} \times 1000$$

Standardized death rate (direct and indirect): See glossary (no formula)

Standardized mortality ratio: See glossary (no formula)

Expectation of life at birth (ELB): See glossary (no formula)

Expectation of life at any other age: See glossary (no formula)

Healthy expectation of life: See glossary (no formula)

Disability-free life expectancy (DFLE): See glossary (no formula)

Health-adjusted life expectancy (HALE): See glossary (no formula)

Disability-adjusted life expectancy (DALE): Same as HALE

Disability-adjusted life years (DALY): See glossary (no formula)

III. Fertility Indicators

(*Numerator and denominator measured for the same period – generally one year*)

$$\text{Birth rate} = \frac{\text{Live births}}{\text{Mid-year population}} \times 1000$$

$$\text{General fertility rate (GFR)} = \frac{\text{Live births}}{\text{Females of reproductive age-group (15-49 years)}} \times 1000$$

$$\text{Age-specific fertility rate} = \frac{\text{Live births to women of particular age-group}}{\text{Women of that age-group}} \times 1000$$

Total fertility rate (TFR): See glossary (no formula)

Gross reproduction rate (GRR): See glossary (no formula)

Net reproduction rate (NRR): See glossary (no formula)

$$\text{Couple protection rate} = \frac{\text{Eligible couples using contraceptives}}{\text{Eligible couples}} \times 100$$

Births averted: See text (no formula)

IV. Demographic and Social Indicators

$$\text{Dependency ratio} = \frac{\text{Persons of age} <15 \text{ and } \geq 60 \text{ years}}{\text{Persons of age 15-59 years}} \times 100$$

$$\text{Sex ratio} = \frac{\text{Females}}{\text{Males}} \times 1000$$

$$\text{Literacy rate} = \frac{\text{Literates of age} \geq 7 \text{ years}}{\text{Population of age} \geq 7 \text{ years}} \times 100$$

Natural growth rate of population = Birth rate – Death rate

Doctor-population ratio = $\frac{\text{Doctors}}{\text{Population}} \times 1000$, or $\frac{\text{Population}}{\text{Doctors}}$ (both are used)

Bed-population ratio = $\frac{\text{Beds}}{\text{Population}} \times 1000$, or $\frac{\text{Population}}{\text{Beds}}$ (both are used)

Bed-occupancy rate = $\frac{\text{Patient-days that beds are occupied}}{\text{Patient-days of all beds}} \times 100$

Average duration of stay = $\frac{\text{Total patient-days of stay}}{\text{Number of patients admitted}}$

Water coverage = $\frac{\text{Population with access to safe water}}{\text{Total population}} \times 100$

Sanitation coverage = $\frac{\text{Population with access to sanitation facilities}}{\text{Total population}} \times 1000$

Immunization coverage = $\frac{\text{Children fully immunized}}{\text{Total children}}$ (generally for children of age <2 year

Can be calculated separately for each immunization also.

Average age at effective marriage: See text (no formula)

Divorce rate = $\frac{\text{Divorces}}{\text{Marriages}} \times 100$

Sex outside marriage: See text (no formula)

Smoking index: See glossary (no formula)

Accident death rate = $\frac{\text{Deaths due to accidents}}{\text{Total deaths}} \times 1000$

V. Statistical Summaries

Mean (ungrouped data) = $\frac{\Sigma x}{n}$

Mean (grouped data) = $\frac{\Sigma fx}{\Sigma f}$ (also called 'Weighted mean')

Median: Arrange in ascending order

$\left(\frac{n+1}{2}\right)$th value if n is odd, and average of $\left(\frac{n}{2}\right)$th and $\left(\frac{n}{2}+1\right)$th value if n is even

Mode: See glossary (no formula)

kth percentile = $\left(\frac{k \times n}{100}\right)$th value after arranging in ascending order

kth quartile = $\left(\frac{k \times n}{4}\right)$th value after arranging in ascending order

kth tertile $= \left(\frac{k \times n}{3}\right)$th value after arranging in ascending order

Range = Maximum value – Minimum value

Standard deviation (SD): Population, $\sigma = \sqrt{\frac{\Sigma(x-\mu)^2}{n}}$, Sample, $s = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$

Variance: Remove square root sign from the formula of SD, or square of SD

VI. Strength of Association/Correlation

$$\text{Relative risk} = \frac{\text{Incidence rate among exposed}}{\text{Incidence rate among nonexposed}}$$

Attributable risk = Incidence rate among exposed – Incidence rate among nonexposed

$$\text{Odds ratio} = \frac{\text{Cases with exposure/Cases without exposure}}{\text{Controls with exposure/Controls without exposure}}$$

$$\text{Correlation coefficient} = \frac{\Sigma(x-\bar{x})(y-\bar{y})/(n-1)}{s_x \times s_y}$$

VII. Confidence Intervals

Confidence interval for population mean μ (σ known)

$$\left(\bar{x} - z_{\alpha/2}\sigma/\sqrt{n}, \bar{x} + z_{\alpha/2}\sigma/\sqrt{n}\right)$$

For 95% confidence, $z_{\alpha/2} = 1.96 = 2$ approximately

Confidence interval for population mean μ (σ not known)

$$\left(\bar{x} - t_{\nu,\alpha/2}s/\sqrt{n}, \bar{x} + t_{\nu,\alpha/2}s/\sqrt{n}\right), \quad \text{where } \nu = n - 1$$

Confidence interval for population proportion π (large n)

$$\left(p - z_{\alpha/2}\sqrt{\frac{pq}{n}}, p + z_{\alpha/2}\sqrt{\frac{pq}{n}}\right),$$

where $q = 1-p$. For 95% confidence, $z_{\alpha/2} = 1.96 = 2$ approximately

Confidence interval for difference in population mean $\mu_1 - \mu_2$ (σ not known)

$$\left\{(\bar{x}_1 - \bar{x}_2) - t_{\nu,\alpha/2}s_p\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}, (\bar{x}_1 - \bar{x}_2) + t_{\nu,\alpha/2}s_p\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}\right\},$$

where $s_p = \sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}}$, and $\nu = n_1 + n_2 - 2$

Confidence interval for difference in population proportion $\pi_1 - \pi_2$ (large n_1 and n_2)

$$\left\{(p_1-p_2)-z_{\alpha/2}\sqrt{\frac{p_1q_1}{n_1}+\frac{p_2q_2}{n_2}},\ (p_1-p_2)+z_{\alpha/2}\sqrt{\frac{p_1q_1}{n_1}+\frac{p_2q_2}{n_2}}\right\},$$

where $q_1 = 1-p_1$, $q_2 = 1-p_2$. For 95% confidence $z_{\alpha/2} = 1.96 = 2$ approximately

VIII. Criteria for Test of Hypothesis

One-sample t-test: $t = \dfrac{\bar{x}-\mu_0}{s/\sqrt{n}}$ with $\nu = (n-1)$ df

Two-sample t-test (unpaired): $t = \dfrac{\bar{x}_1-\bar{x}_2}{s_p\sqrt{\dfrac{1}{n_1}+\dfrac{1}{n_2}}}$, with $\nu = (n_1+n_2-2)\,df$

where $s_p = \sqrt{\dfrac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}}$

Paired t-test: $t = \dfrac{\bar{d}}{s_d/\sqrt{n}}$ with $\nu = (n-1)$ df

Proportion test: $z = \dfrac{p_1-p_2}{\sqrt{\dfrac{p_1q_1}{n_1}+\dfrac{p_2q_2}{n_2}}}$, where $q_1 = 1-p_1$ and $q_2 = 1-p_2$

Chi-square test: $\chi^2 = \Sigma\dfrac{(O-E)^2}{E}$ with $(r-1)\times(c-1)$ df

Sign test: See text (no formula)

Wilcoxon signed rank test: See text (no formula)

Wilcoxon rank sum test: See text (no formula)

Mann-Whitney test: See text (no formula)