<u>**Mathematical Equations With Key Variables and Error Terms**</u>

1A. Overall Integrated Model Equation

We want an overarching way to evaluate how **Time (T)**, **Distance (D)**, **Money (M)**, and **Climate (C)** jointly affect a measure of net benefit (or cost-effectiveness) comparing Telemedicine (eSanjeevani) to In‑Person consultations. One way to represent that overall relationship is to model a latent “net benefit” for each patient is as follows:

$$\alpha_0 = \alpha_1 \mathbf{T}_1 + \alpha_2 \mathbf{D}_1 + \alpha_3 \mathbf{M}_1 + \alpha_4 \mathbf{C}_1 + \epsilon$$

Where:

- α_0 = net benefit for patient/consultation i
- T_1 = time variable(s) (e.g., total travel + consultation time)
- D_1 = distance traveled
- M_1 = monetary costs or savings
- C_1= climate/emissions variable
- ϵ= error term

1B. Sub‑Model Equations

(i) Time Model

$$T_1 = \beta_0 + \beta_1 A\textbf{(Consultation type)} + \beta_2 B\ \textbf{(Travel Time)} + \beta_3 C\ \textbf{(Wait Time)} + \beta_4 D\ \textbf{(Facility Type)} + \epsilon_1$$

Where:

- T_1= Total time taken by the patient
- β_0 ..β_4 = Coefficients to be estimated
- ϵ_1= Error Term
- A(Consultation Type= Coded 0 or 1 (for teleconsultation or in-person consultation)
- D (Facility Type)= Coded for different facility types (AAMs, PHC, CHC, DH)

(ii) Distance Model

$$\mathbf{D}_1 = \delta_0 + \delta_1 E\ \textbf{(Distance Travelled)} + \delta_3 F\ \textbf{(Mode of Transport)} + \beta_1 A\textbf{(Consultation type)} + \epsilon_2$$

Where:

- D_1= Total Distance Travelled by the patient
- F(Mode of Transport)= Coded for different type of transport taken by patient (Public transport- bus, auto, two-wheeler, cycle, car)
- $\delta_0...\delta_3$= Coefficients to be Calculated
- ϵ_2= Error Term

(iii) Money (Cost) Model

$$\mathbf{M_1 = \gamma_0 + \gamma_1 G \text{ (Wage Rate/Loss)} + \gamma_2 H \text{ (Medication Cost)} + \gamma_3 I \text{ (Accomodation Cost)} + \gamma_4 J \text{ (Internet Cost)} + \gamma_5 K \text{ (Travel Cost)} + \delta_3 F \text{ (Mode of Transport)} + \beta_1 A \text{ (Consultation type)} + \epsilon_3}$$

Where:

- M_1= Total Cost borne by the patient
- K (Travel Cost) = Per km cost according to mode of transport
- G (Wage Rate/Loss)= wage loss per day
- $\gamma_0 \ldots \gamma_5$= Coefficients that need to be calculated
- ϵ_3= Error Term

(iv) Climate (Emissions) Model

$$\mathbf{C_1 = \theta_0 + \delta_1 E \text{ (Distance Travelled)} + \delta_3 F \text{ (Mode of Transport)} + \theta_1 L \text{ (Facility Type Energy)} + \beta_4 D \text{ (Facility Type)} + \epsilon_4}$$

Where:

- C_1 = Total Carbon Emissions
- $\theta_0 \ldots \theta_1$= Coefficients that need to be calculated
- ϵ_4= Error Term

Carbon Emission Calculation,

$$\mathbf{Emissions_{Total} = Emissions_{transport} + Emissions_{facility}}$$

Carbon emissions = Activity (distance traveled, energy consumed) × ***Emission Factor*** **(CO_2 per km or CO_2 per kWh).**

1C. Cost‑Benefit Analysis (CBA) Formulation

A simplified economic equation for *net present value (NPV)* might be:

NPV = Sum over t=1 to T of [(MonetizedBenefits_t - MonetizedCosts_t) / (1 + r)^t]

Where:

- t = time period (month, year, etc.)
- MonetizedBenefits_t = financial value of time/distance/emissions savings
- MonetizedCosts_t = cost of telemedicine setup, training, etc.
- r = chosen discount rate (e.g., 5%)

Key Assumptions

Linearity: The relationship between net benefit and each predictor is approximately linear in this simple specification.

Exogeneity: We assume (T,D,M,C)(T, D, M, C)(T,D,M,C) are not systematically influenced by omitted confounders.

Measurement Validity: Time, distance, cost, and climate data are properly measured and accurate.

Key Assumptions for Sub‑Models

Linear or log‑linear specifications may be used.

Errors ϵ_1, ϵ_2, ϵ_3, ϵ_4, ϵ ideally have constant variance and no serial correlation.

Emission factors for transport modes and facility electricity usage are assumed stable and taken from IPCC (2006) [EFDB - Basic Search]