SEIR Method:

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Introduction

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The SEIR Method is a crucial framework in epidemiological modeling. It helps in understanding the dynamics of infectious diseases by categorizing the population into Susceptible, Exposed, Infectious, and Recovered groups. This presentation will provide a comprehensive overview of its principles and applications.

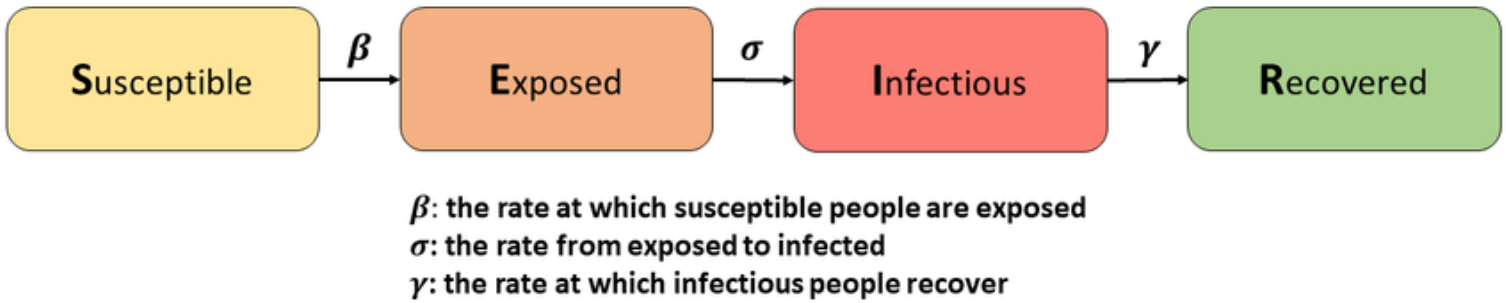


Figure: SEIR

Mathematical Formulation

Mathematical Formulation

The SEIR model is represented by the variables S, E, I, R, where:

- $S(t)$: Susceptible individuals.
- $E(t)$: Exposed individuals (infected but not yet infectious).
- $I(t)$: Infectious individuals.
- $R(t)$: Recovered individuals.

The differential equations are given by:

$$\begin{aligned}
\frac{dS}{dt} &= -\beta \frac{SI}{N}, \\
\frac{dE}{dt} &= \beta \frac{SI}{N} - \alpha E, \\
\frac{dI}{dt} &= \alpha E - \gamma I, \\
\frac{dR}{dt} &= \gamma I.
\end{aligned}$$

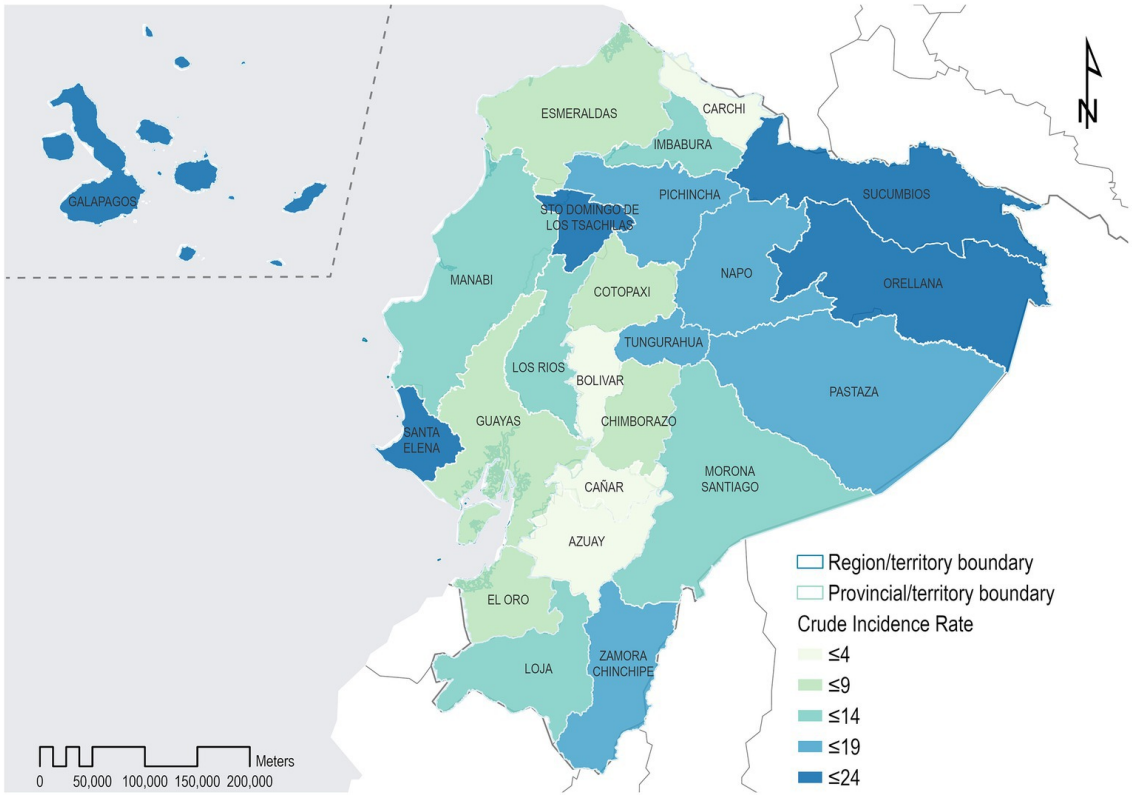
Mathematical Formulation

Where:

- β: Transmission rate.
- α: Incubation rate.
- γ: Recovery rate.
- N: Total population size ($N = S + E + I + R$).

Applications in Public Health

The SEIR model is extensively used in public health to forecast disease spread, evaluate intervention strategies, and inform policy decisions. By simulating different scenarios, health officials can assess the impact of measures such as vaccination, quarantine, and social distancing.



Why Use a Database?

Why Use a Database?

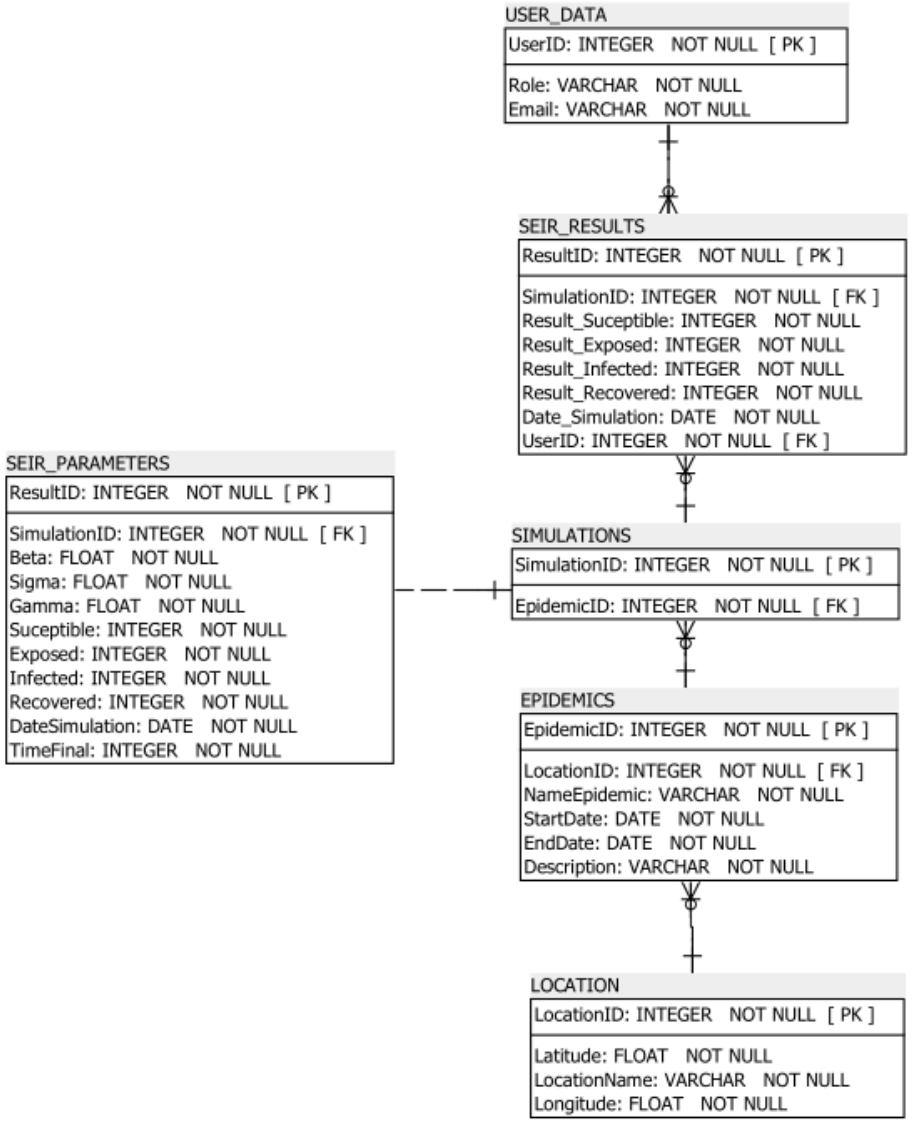
Using a database for managing data in the SEIR model offers several key advantages:

- **Efficiency:** A database allows for the structured storage of large datasets, enabling quick retrieval and processing of information.
- **Scalability:** Handles increasing data volumes as simulations grow in complexity or include more variables.
- **Organization:** Ensures data integrity and consistency through well-defined schema structures.

Benefits of a Database

- **Data Simulation:** Databases facilitate real-time data simulations, crucial for observing SEIR dynamics under different scenarios.
- **Collaboration:** Centralized data storage promotes team collaboration, allowing multiple users to access, modify, and analyze data simultaneously.
- **Backup and Security:** Ensures data safety through backup mechanisms and access control protocols.

Design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UserID: INTEGER NOT NULL [PK]
Role: VARCHAR NOT NULL
Email: VARCHAR NOT NULL
SEIR_RESULTS
ResultID: INTEGER NOT NULL [PK]
SimulationID: INTEGER NOT NULL [FK]
Result_Suceptible: INTEGER NOT NULL
Result_Exposed: INTEGER NOT NULL
Result_Infected: INTEGER NOT NULL
Result_Recovered: INTEGER NOT NULL
Date_Simulation: DATE NOT NULL
UserID: INTEGER NOT NULL [FK]
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SimulationID: INTEGER NOT NULL [FK]
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Gamma: FLOAT NOT NULL
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Exposed: INTEGER NOT NULL
Infected: INTEGER NOT NULL
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TimeFinal: INTEGER NOT NULL
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EpidemicID: INTEGER NOT NULL [FK]
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EndDate: DATE NOT NULL
Description: VARCHAR NOT NULL
LOCATION
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Latitude: FLOAT NOT NULL
LocationName: VARCHAR NOT NULL
Longitude: FLOAT NOT NULL

Conclusions

- Implementing a database enhances the SEIR model is capability to manage, simulate, and analyze data efficiently.
- It enables public health officials and researchers to make data-driven decisions by providing structured and reliable data storage.
- The use of a database is a crucial step toward improving the accuracy and scalability of epidemiological studies.