2023 Harvard/University of Global Health Equity
Mathematical Modeling for Infectious Disease Planning
Project worksheet

Part One – Define the research question

In the past week, you have had the opportunity to brainstorm your model structure, interventions, and health outcomes for your project. In this activity, you would finalize your research question using the PICO framework as detailed in the table below.

- Use the framework below to finalize the research question for your project

Item	**Details**
Population/problem: *The population in this context may include the country of interest and the disease.*	
Intervention**:** W*hat type(s) of interventions will be considered in the model?*	
Comparison: *Is there a comparison intervention to be considered in the model? E.g., low vs. high vaccination coverage, no vs some intervention, etc.*	
Outcomes: *what is the desired effect of interest? What is (are) the output(s) of your model?*	

- Write your research question(s) from the above table. What question(s) are you seeking to answer using your model?
- What is the title of your study?
- What is the rationale of your study?
- What are the objectives of your project?
- List and describe your choice of health outcomes for your model.
- List and explain your choice of interventions for your model.
- What types of data are needed to answer your research question using a mathematical model?
- Briefly explain your access to data that can be used to estimate parameters for your model.
- How would you identify additional sources of data for your model?
- Are there uncertainties you need to accommodate for your model?
- Aside your team partner, who will you be working with on this project? (Identify whether there is a need for collaboration with institutions other than yours).

2022-2023 Harvard/University of Global Health Equity
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Part two- Model description

1. Provide a brief description of your model. Briefly describe the compartments, movements between compartments, and the rates governing those movements. [*You will provide a table of parameter descriptions in the last section*.]
2. Does your model consider a frequency or density-dependent transmission? Explain your choice.
3. What are the assumptions of your model?
4. How would the model output impact public health decisions?

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Part Three- Model flow diagram and equations

In the previous activity, you had the opportunity to think through your research question and describe the structure of your model. In this exercise, you will develop your model further using the following questions as a guide:

1. How many state variables are you in your model?
2. What are the state variables, and how would you define them?
3. What is the time frame of your model?
4. What are the limitations of your selected model structure?
5. Draw your compartment model with arrows showing all the transitions between states.
6. Write down the differential equations for your model.

2022-2023 Harvard/University of Global Health Equity
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Part four: Parameters for your model

1. Make a list of all the parameters needed for your model.
2. What symbols represent the parameters in your model?
3. Describe the biological meaning of all the parameters in your model.
4. What data sources might you use to acquire these parameters?
5. Using the articles you identified in your literature review, provide some initial values for your parameters. *We will work on finalizing your parameter values during the practicum session.*
6.
7. Complete the table below with your answers from 1-5, and provide the references at the end of the document

Parameter	**Interpretation/definition**	**Unit**	**Symbol**	**Potential data source**	**Value**	**Reference(s) if any**

8. BONUS: Are there any parameters the authors in the studies you looked at used, which are not included in your model? Please explain.

Resources:

1. https://guides.library.harvard.edu/c.php?g=309833&p=2069900
2. https://libguides.mssm.edu/ebm/ebp_pico#:~:text=The%20PICO%20framework%20is%20the,Comparison%20or%20control
3. https://canberra.libguides.com/c.php?g=599346&p=4149722

NB: Please note that we will be focusing on the structure of your basic transmission model. We will address heterogeneity in your model later in the course.