

COVID-19 in West Africa: National Projections of Total and Severe Infections Under Different Lockdown Scenarios

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06 July 2020

Overview: COVID-19 in Africa

- The first confirmed COVID-19 case in Africa occurred in Egypt on February 14, 2020
- Thus far, African countries have reported lower disease incidence than most other countries; however, the spread of the COVID-19 pandemic is gathering pace
- Infectious disease surveillance and reporting infrastructure remains highly underdeveloped in many African countries, and COVID-19 testing is limited given the shortage of human resources and appropriate laboratory and surveillance facilities across the continent
- African populations may be at particular risk for high morbidity and mortality from COVID-19 given the high prevalence of immunocompromised individuals including those with HIV, malnutrition, and other communicable and non-communicable comorbidities
- To contain the spread of COVID-19 and keep infections at a manageable level, many countries instituted curfews, lockdowns, and other social distancing interventions. The impact of such measures is unknown, and many countries are now looking to ease lockdown restrictions nationwide and resume cross-border travel.

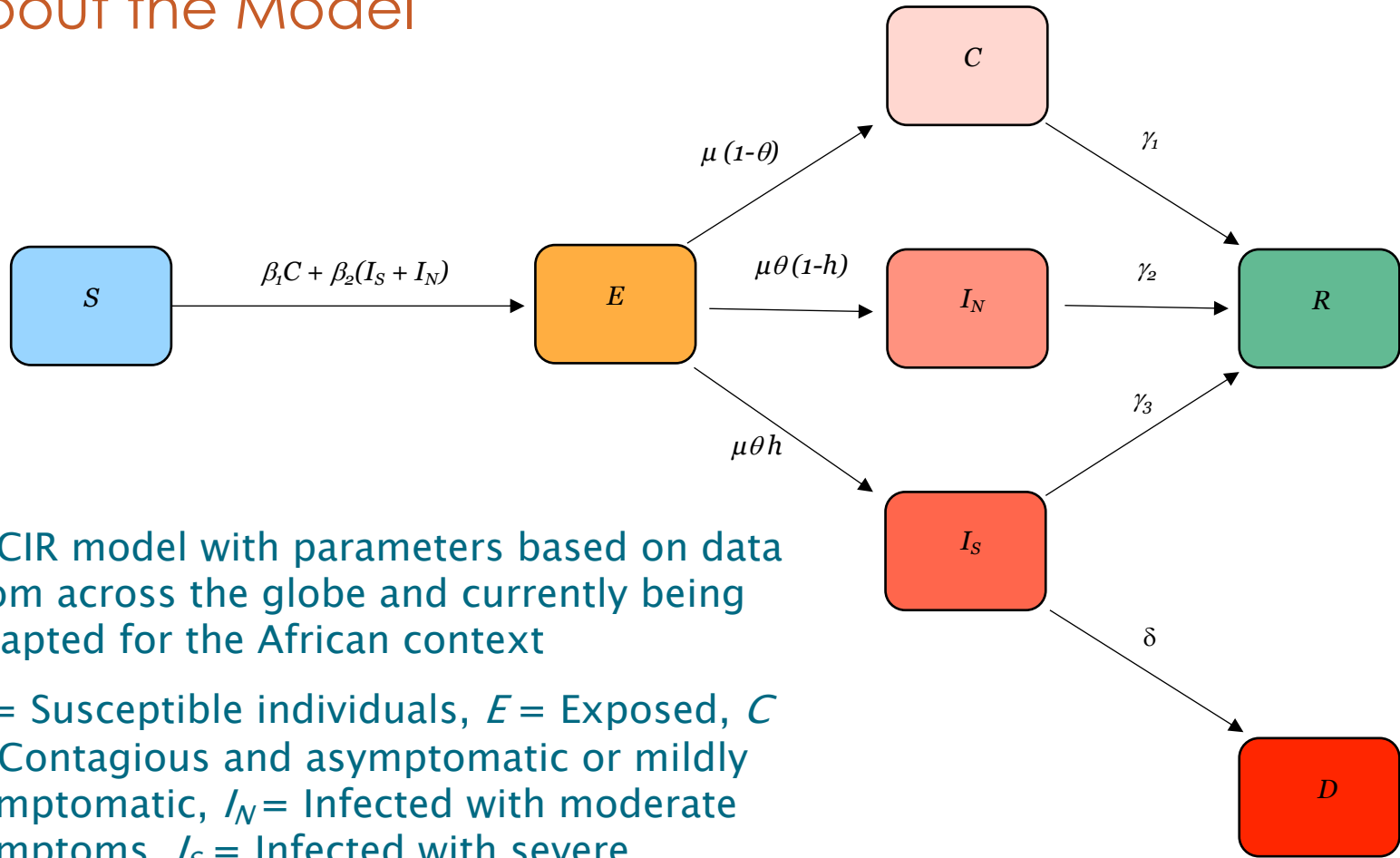
Modeling Objectives

- The purpose of this model analysis is to estimate potential COVID-19 case burdens in each country and region of Africa considering various social distancing scenarios.
- The model is for planning purposes and is based on the current understanding of COVID-19 transmission and disease progression and the most up-to-date assumptions.
- The results here are not forecasts but scenarios that may unfold given the assumptions about social-distancing and population health.

Disclaimers

- As with all responsive research, this work has not been peer-reviewed.
- This research was funded by the Centers for Disease Control and Prevention's Modeling in Infectious Disease (MInD) Network and was produced by a team of researchers at CDDEP and John Hopkins University; this work does not represent the views of these institutions.
- For comments or clarifications, please email communications@cddep.org

About the Model



- SECIR model with parameters based on data from across the globe and currently being adapted for the African context
- S = Susceptible individuals, E = Exposed, C = Contagious and asymptomatic or mildly symptomatic, I_N = Infected with moderate symptoms, I_S = Infected with severe symptoms, R = Recovered, D = Dead

About the Model: Assumptions & Limitations

- We used case data (current as of 03 July 2020) for African nations and territories for 200 days after the first 20 or more confirmed cases were recorded.
 - The Seychelles have not yet reached this 20-case threshold, remaining at 11 confirmed cases respectively since April 6, 2020. The highest number and the date this figure was first recorded were used to initiate the model.
 - Comoros, Mayote, Reunion Island, Lesotho, and St. Helena were excluded in the analysis due to lack of sufficient case data

About the Model: Scenarios

We provide case projections for the following four scenarios:

1. **Baseline:** Disease continues to spread with no curfew, lockdown, social distancing, or other intervention(s) and with no change in transmission rate ($R_0 = 2.74$)
 2. **Moderate Lockdown:** Disease transmission is reduced by 25% during the lockdown period, then transmission resumes at 90% of the pre-lockdown value due to sustained changes in behavior
 3. **Hard Lockdown:** Disease transmission falls 44% during the lockdown period, then transmission resumes at 90% of pre-lockdown levels.
 4. **Hard Lockdown and Continued Social Distancing/Isolating Cases:** Disease transmission is reduced by 44% during the lockdown period then, through social distancing regulations and isolation of symptomatic individuals, resumes at 75% of pre-lockdown levels
- For each scenario, we estimate the total number of asymptomatic or mildly symptomatic, moderately symptomatic, and severely symptomatic cases. The rate of severely symptomatic cases is based on the rate of hospitalization in other parts of the world, although access to hospital care is likely to differ greatly between different parts of Africa

About the Model: Parameters

- To incorporate the varying age structures of different countries into the model, parameters were weighted by the proportion of the population in the 0–64, 65–79, and 80 and above age brackets in each country to form a unique set of parameters for each country
 - Population data were obtained from the World Bank for 2018 or from IndexMundi for Eritrea

About the Model: Parameters

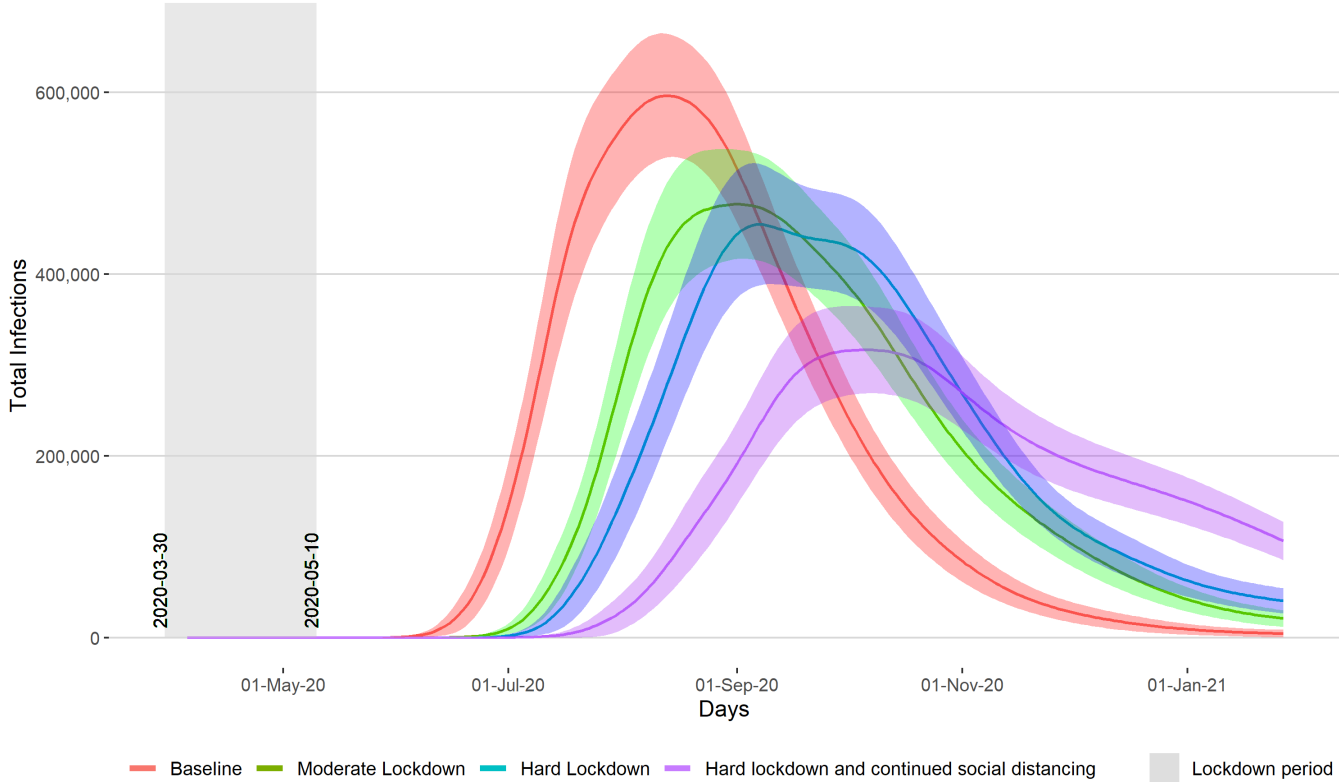
- Incubation period: 3 days
- 85 percent of infected population have no/mild symptoms
- Rate of progression to severe disease is 6 percent
- Asymptomatic clearance period: 3 days
- Symptomatic clearance period of 5 days
- Infection rate for symptomatic transmissions:
 - 0.579 (confidence intervals of 0.443–0.917) for ages 0–64
 - 0.672 (0.514–1.065) for ages 65–79
 - 0.660 (0.506–1.046) for ages 80 years or older
- Infection rate for symptomatic cases:
 - 0.0307 (0.0245– 0.0368) for ages 0–64
 - 0.0356 (0.0285–0.0427) for ages 65–70
 - 0.0350 (0.0280–0.0420) for those 80 years and older

Regional Definitions

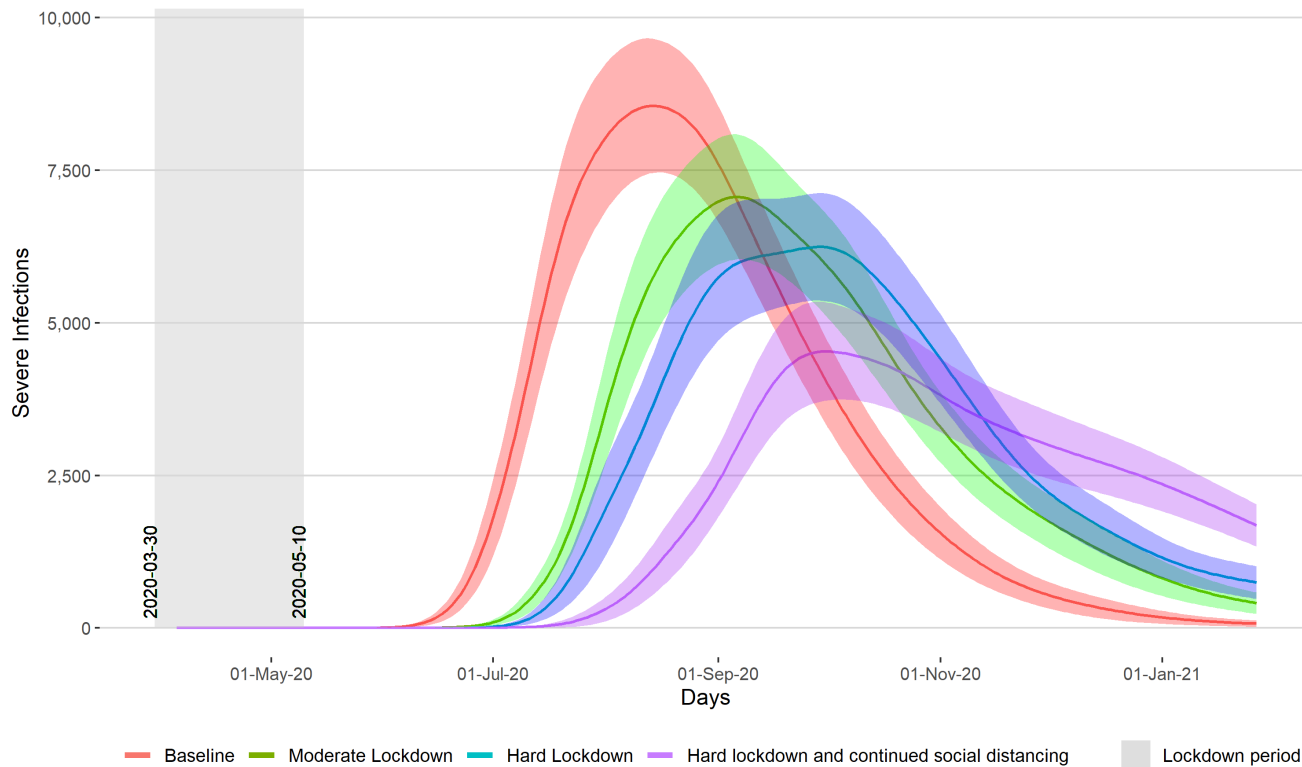
- We present national case projections by region. Intermediate regional classification of nations, outlined below, followed those set forth by the [United Nations Statistics Division](#).
- **North Africa:** Algeria, Egypt, Libya, Morocco, Sudan, Tunisia
- **Middle Africa:** Angola, Cameroon, Central African Republic, Chad, Congo–Kinshasa (Democratic Republic of the Congo), Congo–Brazzaville (Republic of the Congo), Equatorial Guinea, Gabon, Sao Tome and Principe
- **West Africa:** Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea–Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo
- **East Africa:** Burundi, Djibouti, Ethiopia, Eritrea, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Seychelles, Somalia, South Sudan, Tanzania, Uganda, Zambia, Zimbabwe
- **Southern Africa:** Botswana, Eswatini, Namibia, South Africa

Projections: West Africa

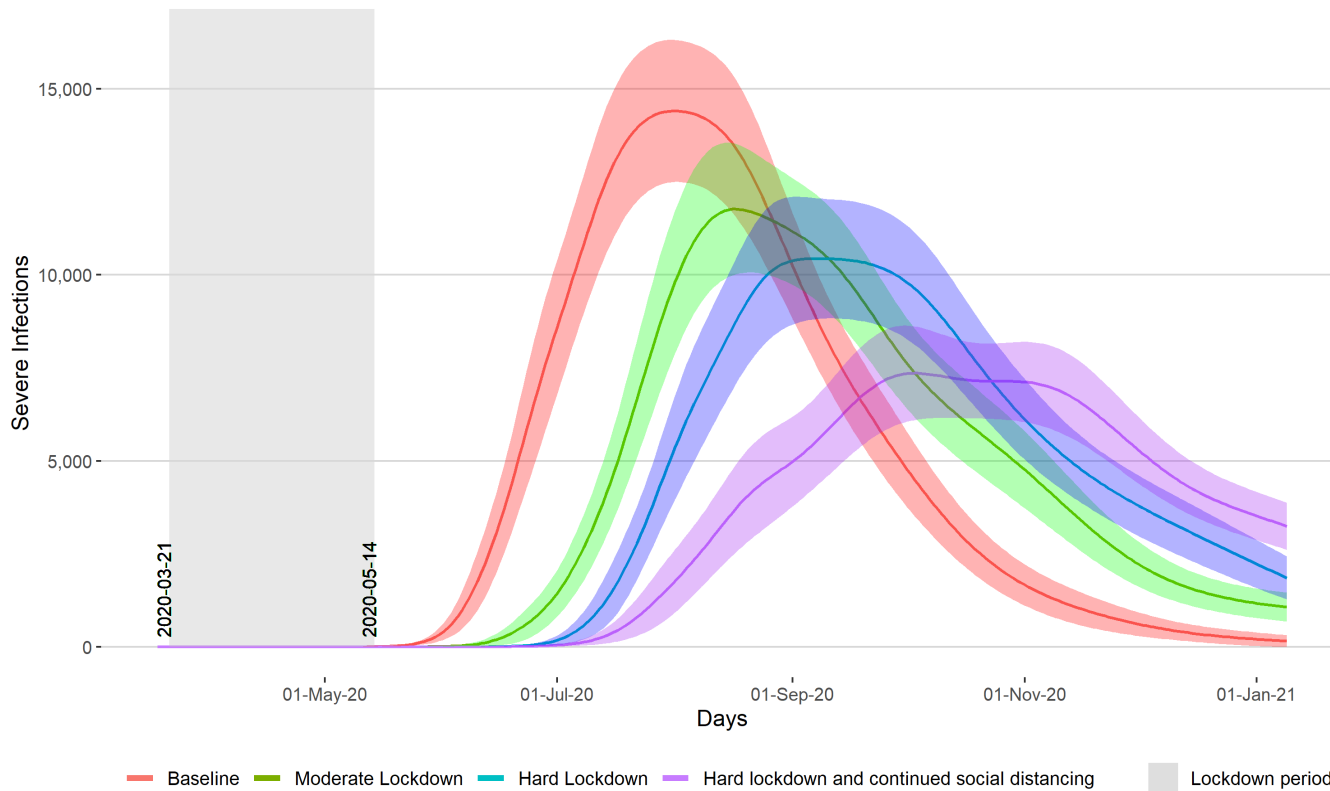
Benin: Projected Total Infections (Asymptomatic, Symptomatic, and Severe) With and Without Lockdown



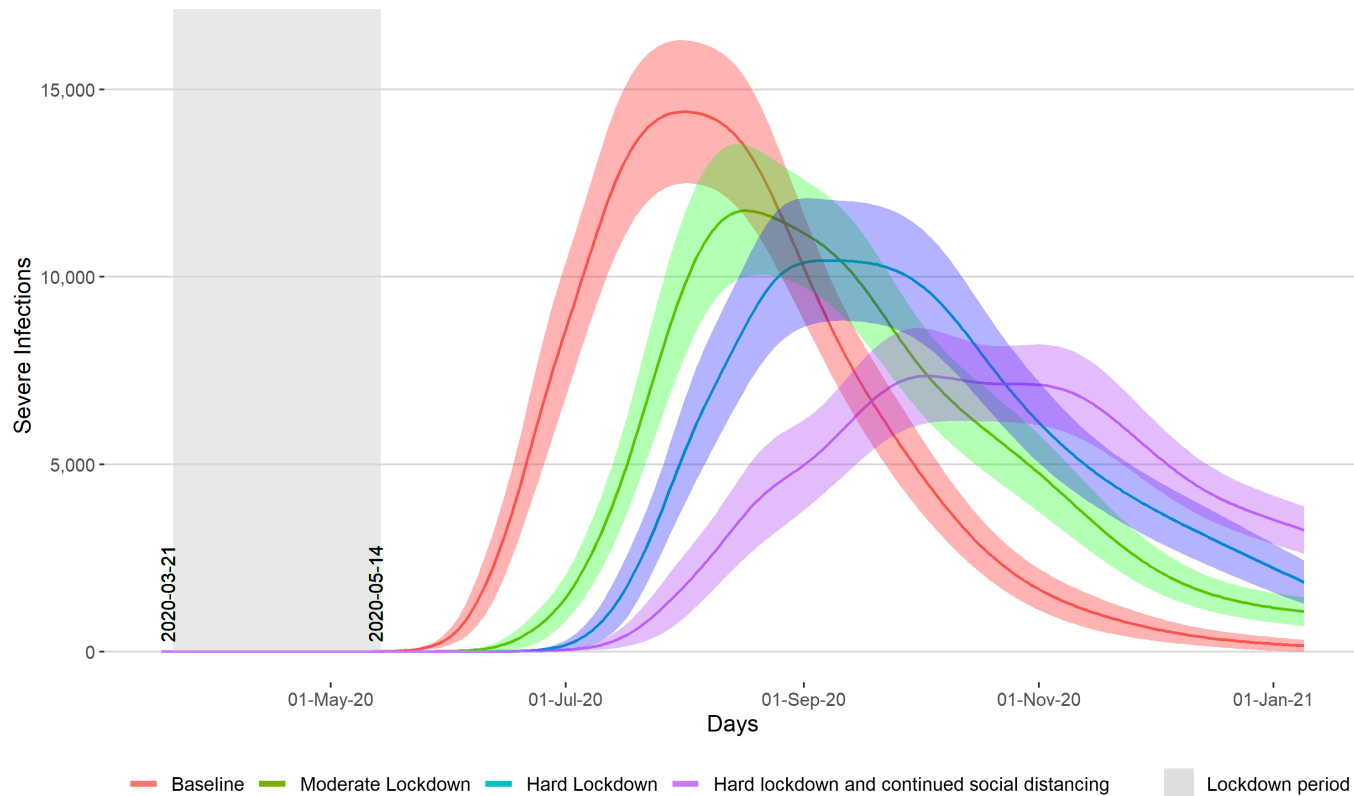
Benin: Projected Severe Infections With and Without Lockdown



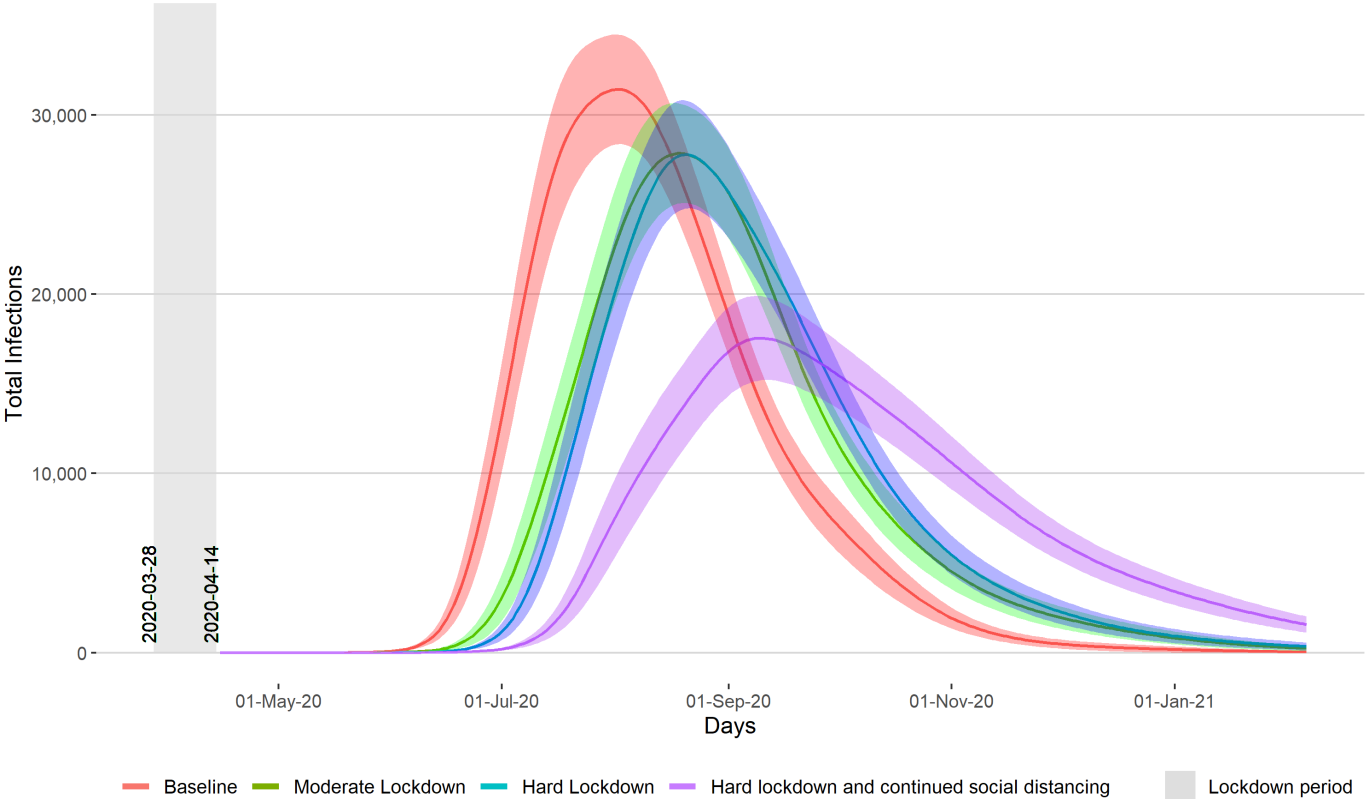
Burkina Faso: Projected Total Infections (Asymptomatic, Symptomatic, and Severe) With and Without Lockdown



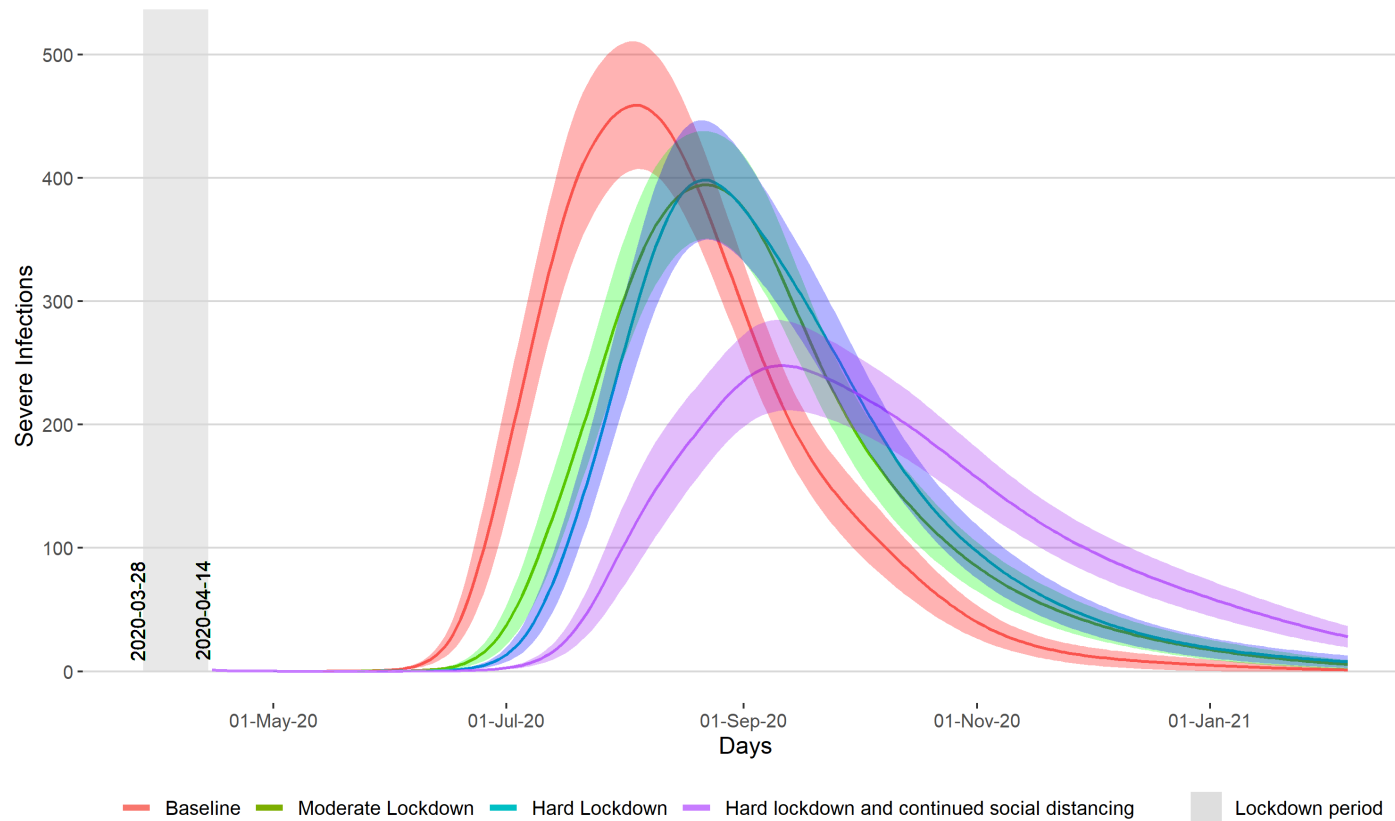
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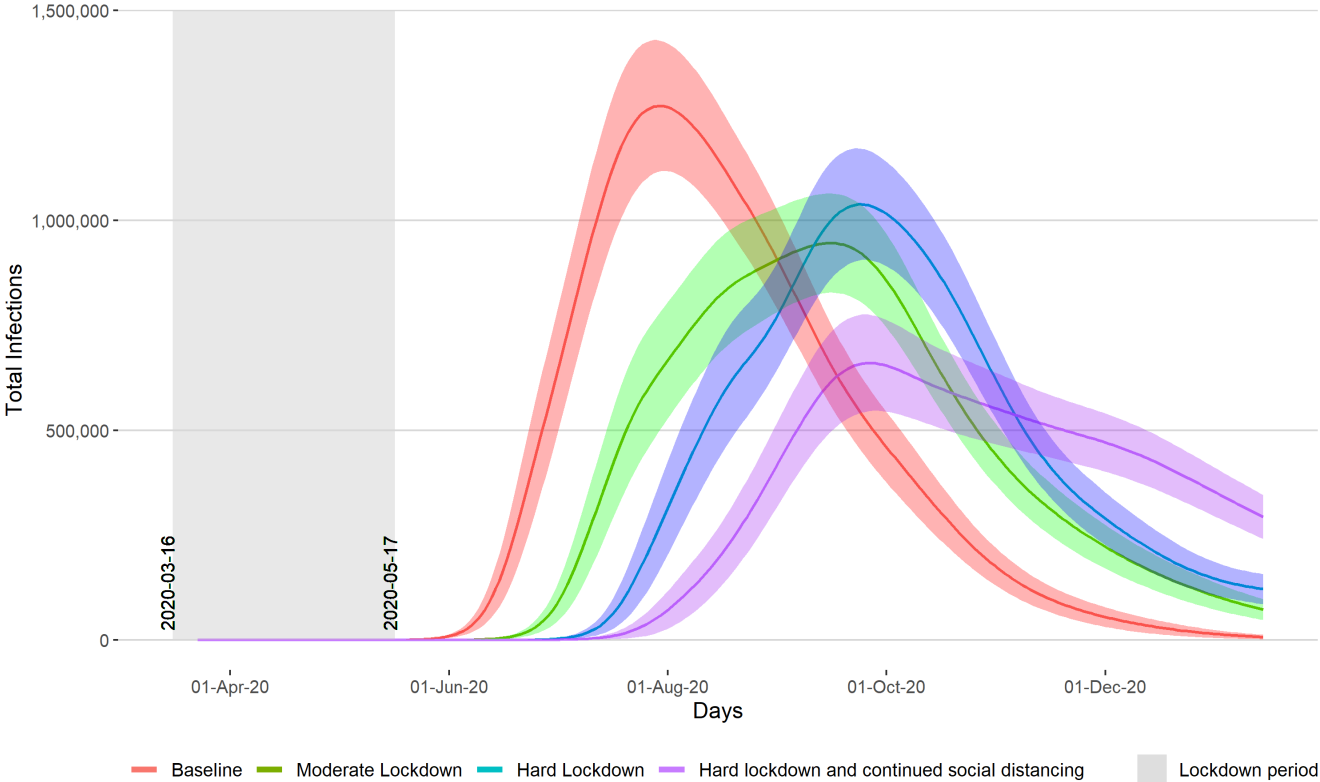
Cabo Verde: Projected Total Infections (Asymptomatic, Symptomatic, and Severe) With and Without Lockdown



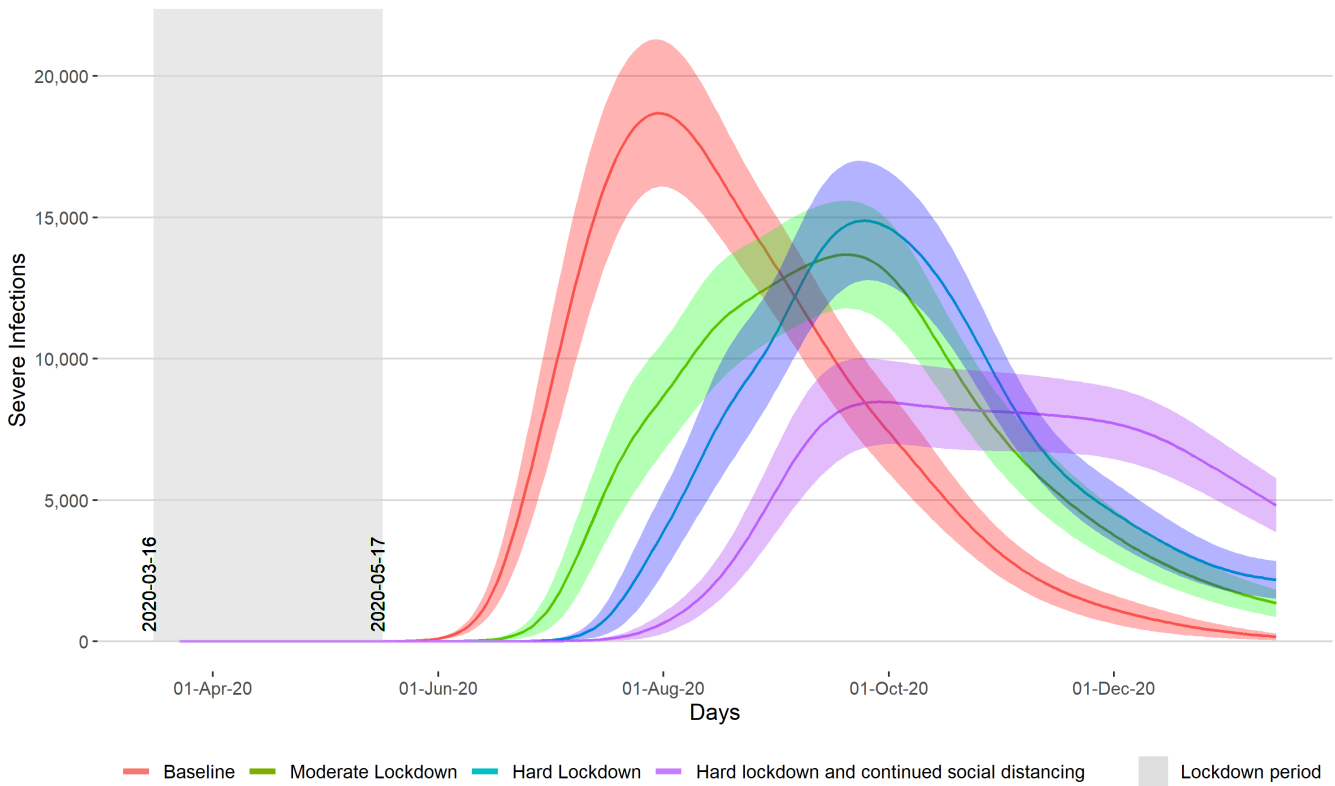
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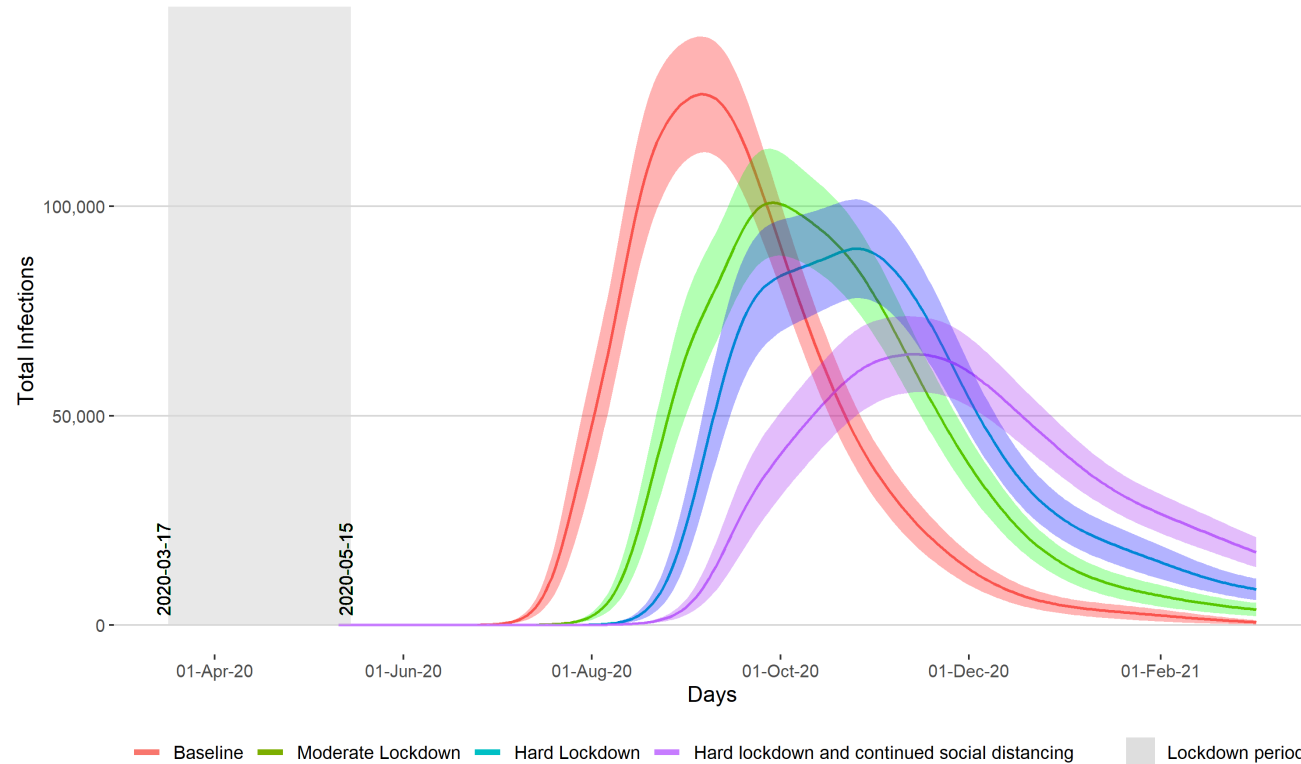
Cote D'Ivoire: Projected Total Infections (Asymptomatic, Symptomatic, and Severe) With and Without Lockdown



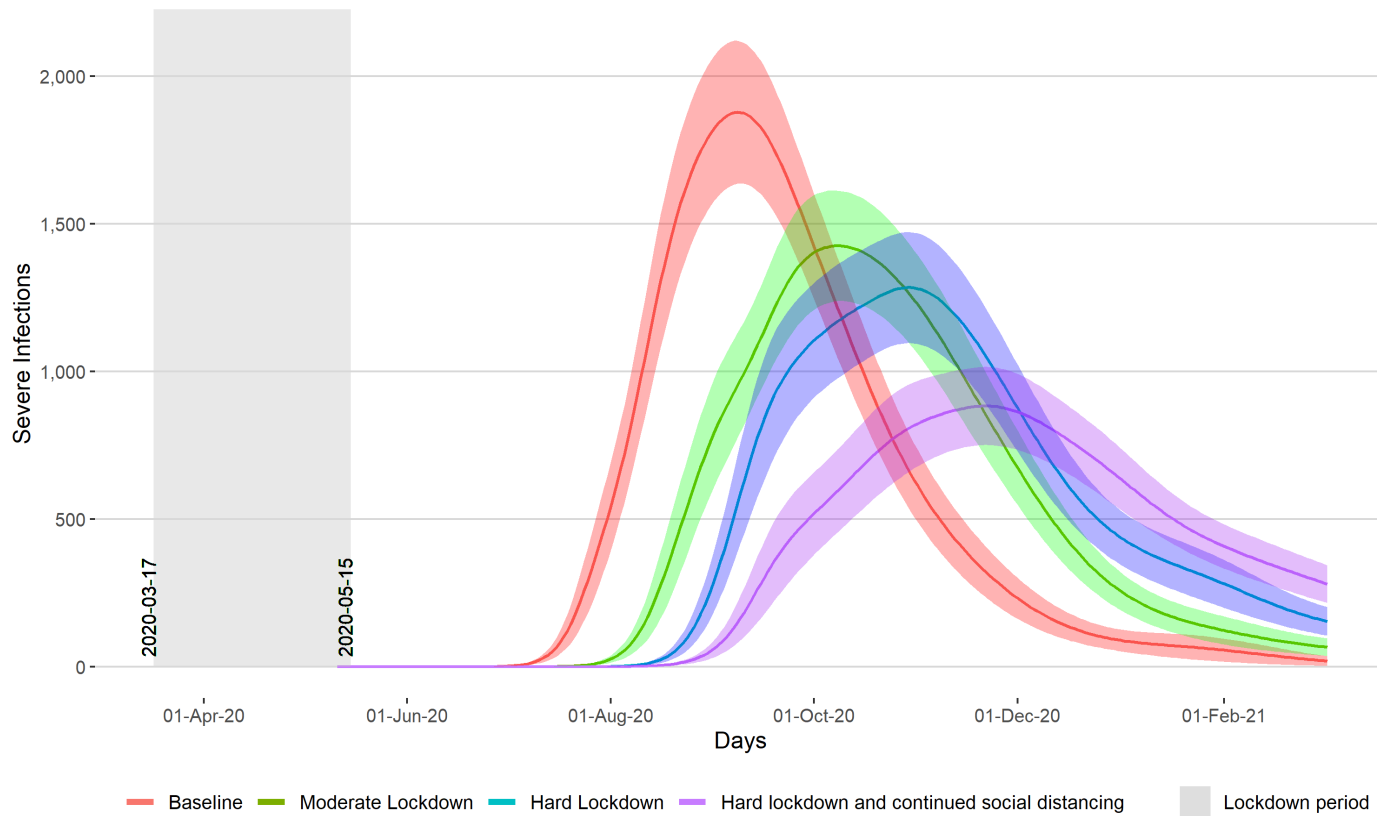
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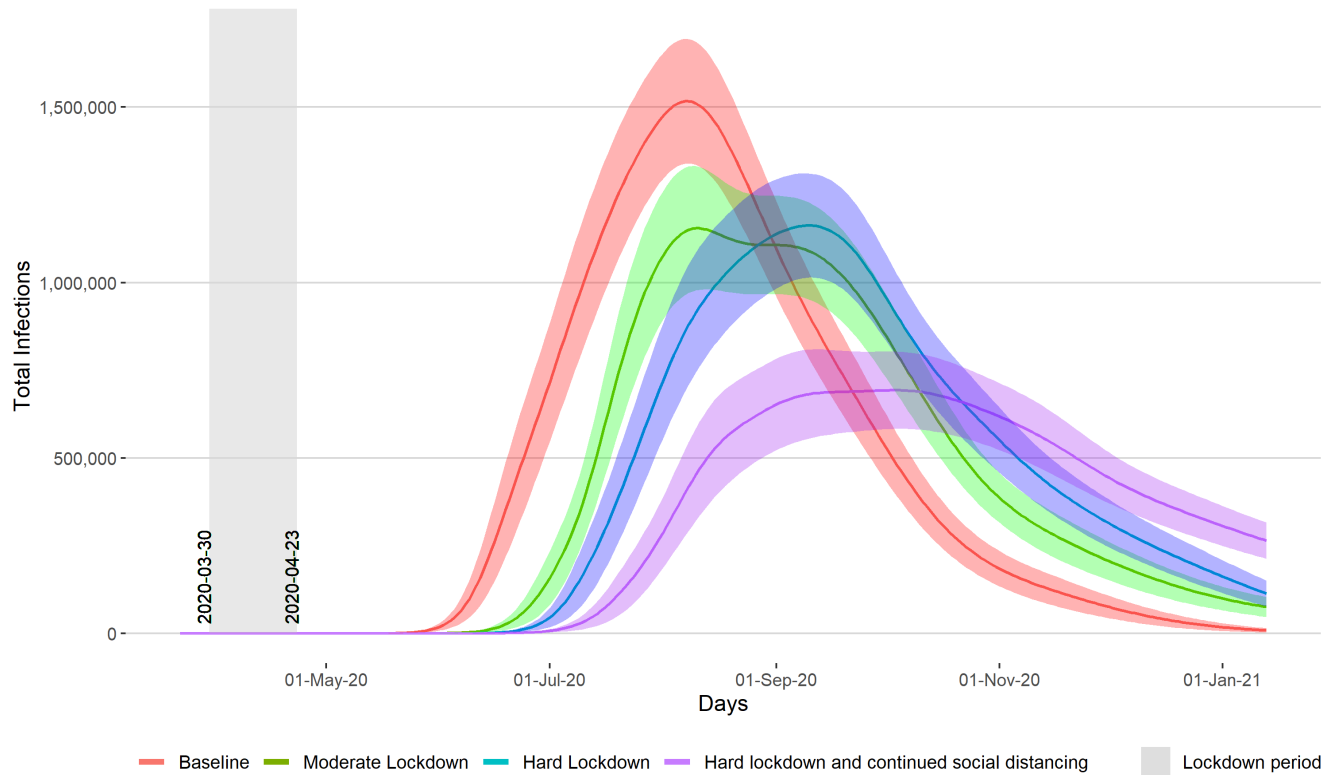
Gambia: Projected Total Infections (Asymptomatic, Symptomatic, and Severe) With and Without Lockdown



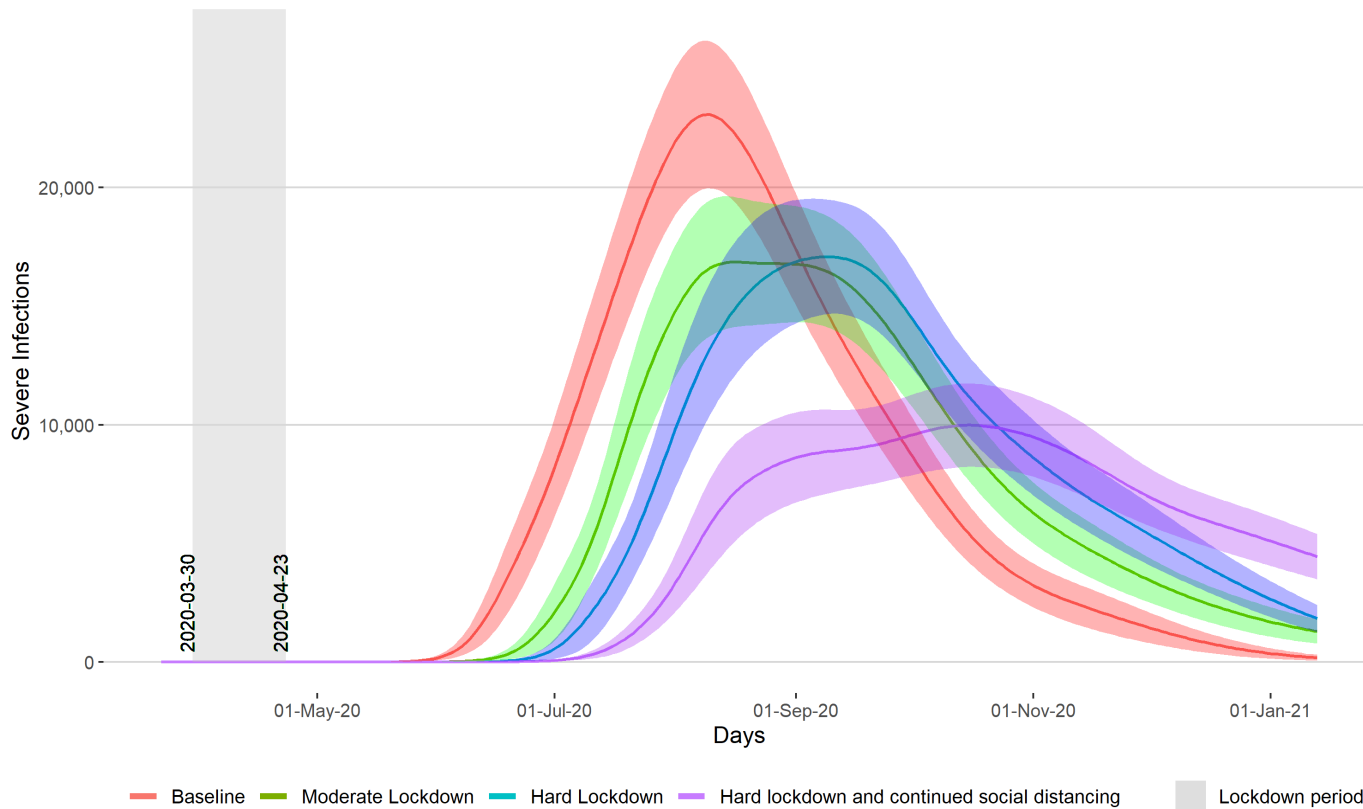
Gambia: Projected Severe Infections With and Without Lockdown



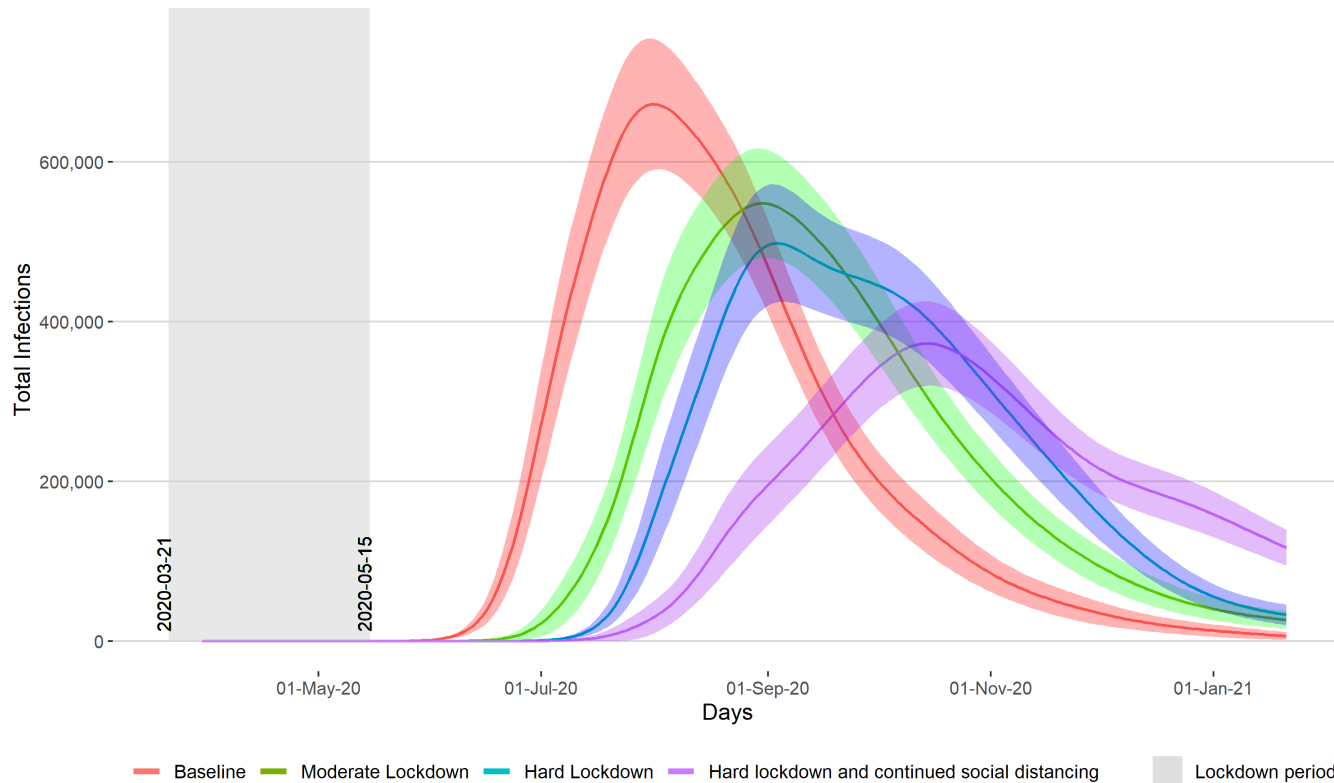
Ghana: Projected Total Infections (Asymptomatic, Symptomatic, and Severe) With and Without Lockdown



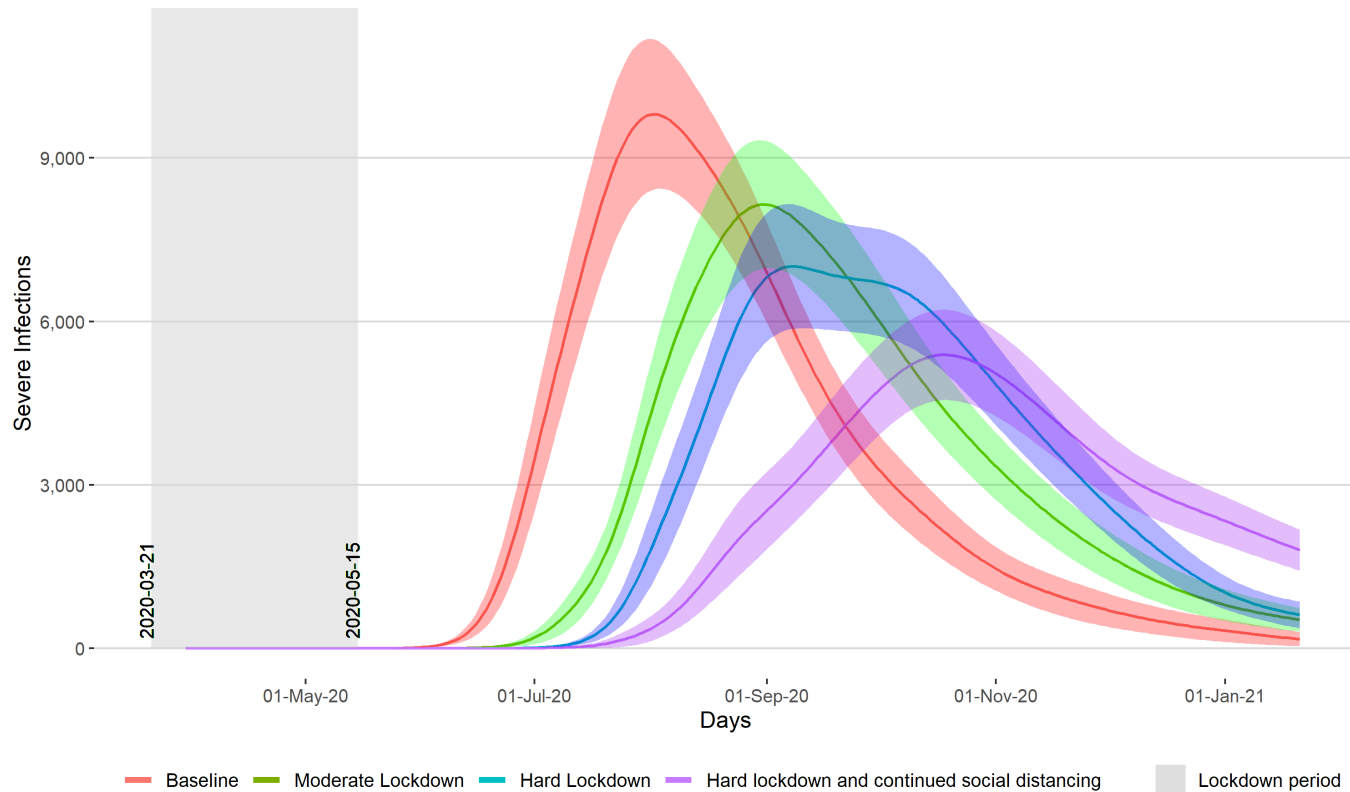
Ghana: Projected Severe Infections With and Without Lockdown



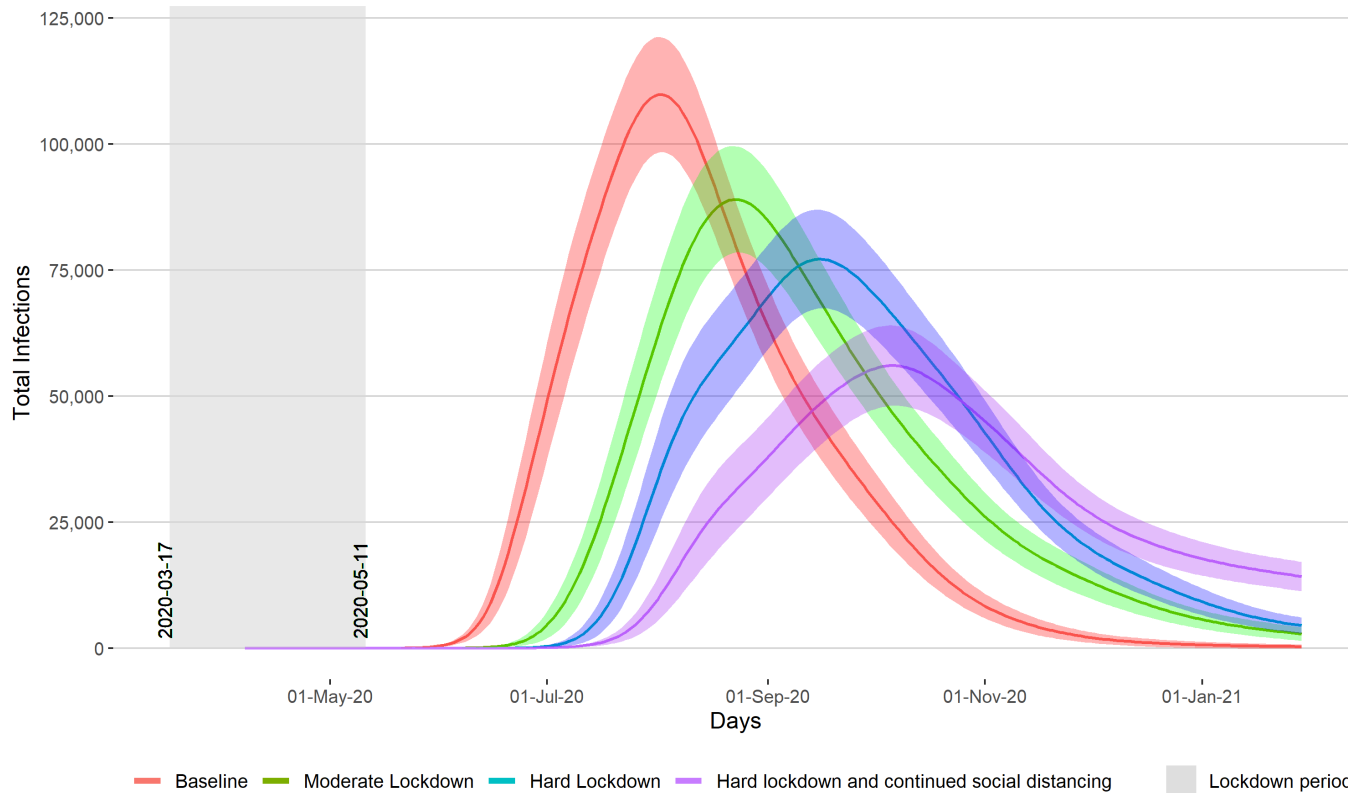
Guinea: Projected Total Infections (Asymptomatic, Symptomatic, and Severe) With and Without Lockdown



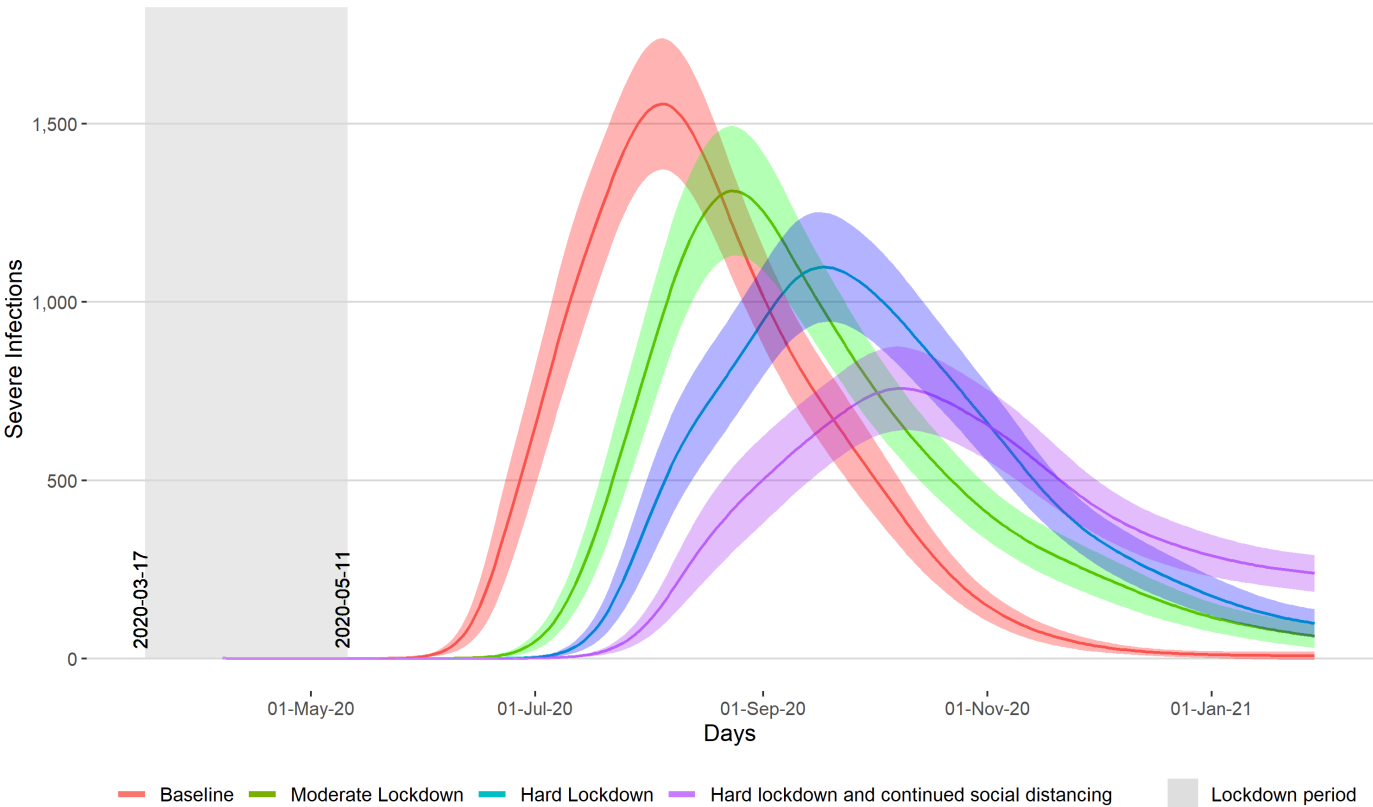
Guinea: Projected Severe Infections With and Without Lockdown



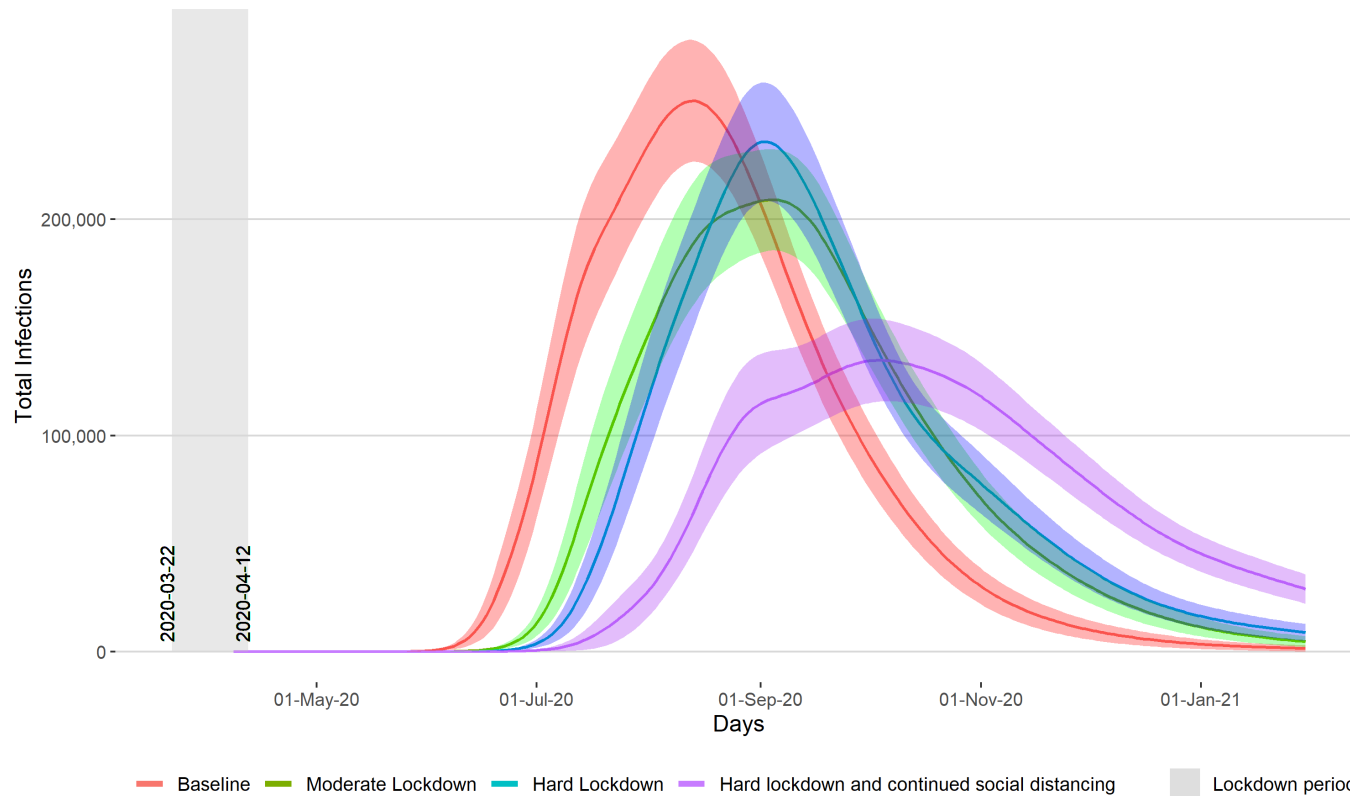
Guinea Bissau: Projected Total Infections (Asymptomatic, Symptomatic, and Severe) With and Without Lockdown



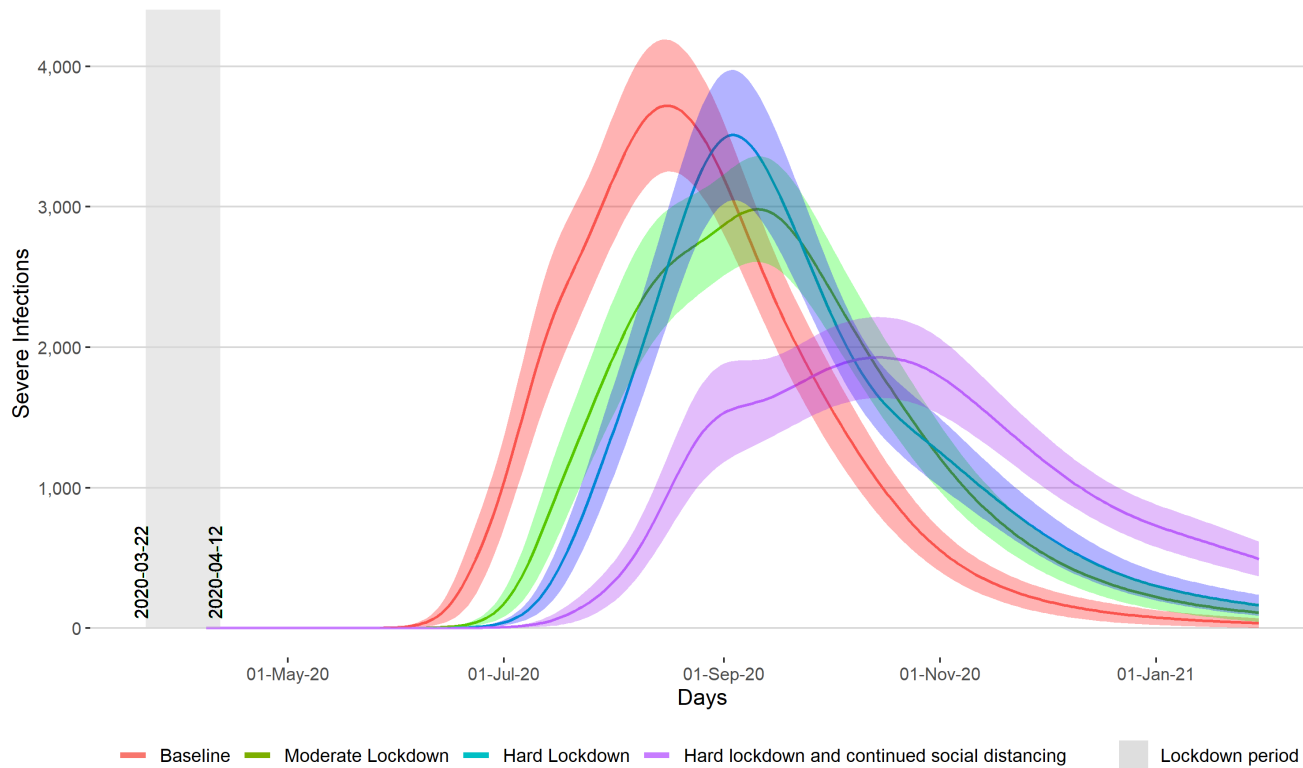
Guinea Bissau: Projected Severe Infections With and Without Lockdown



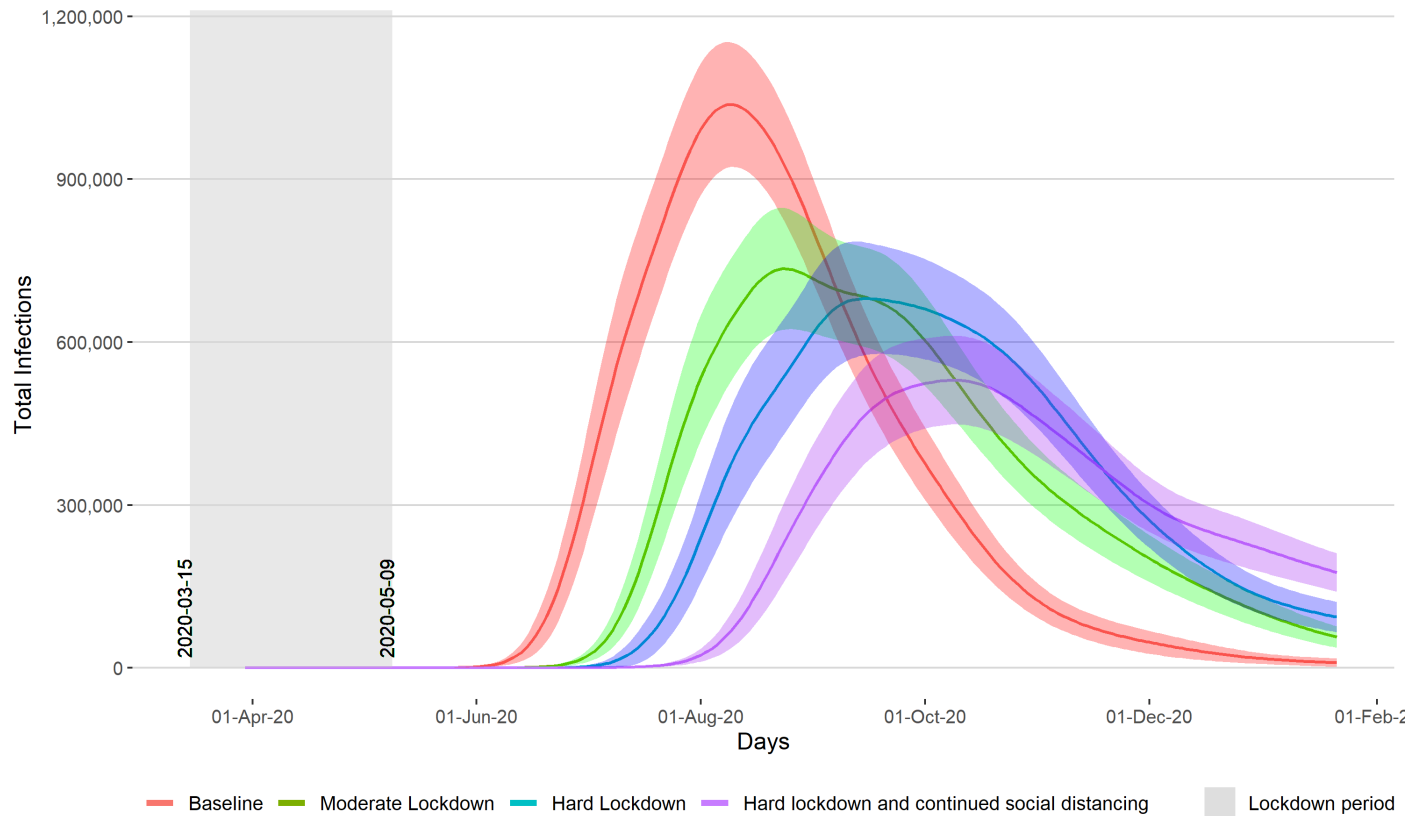
Liberia: Projected Total Infections (Asymptomatic, Symptomatic, and Severe) With and Without Lockdown



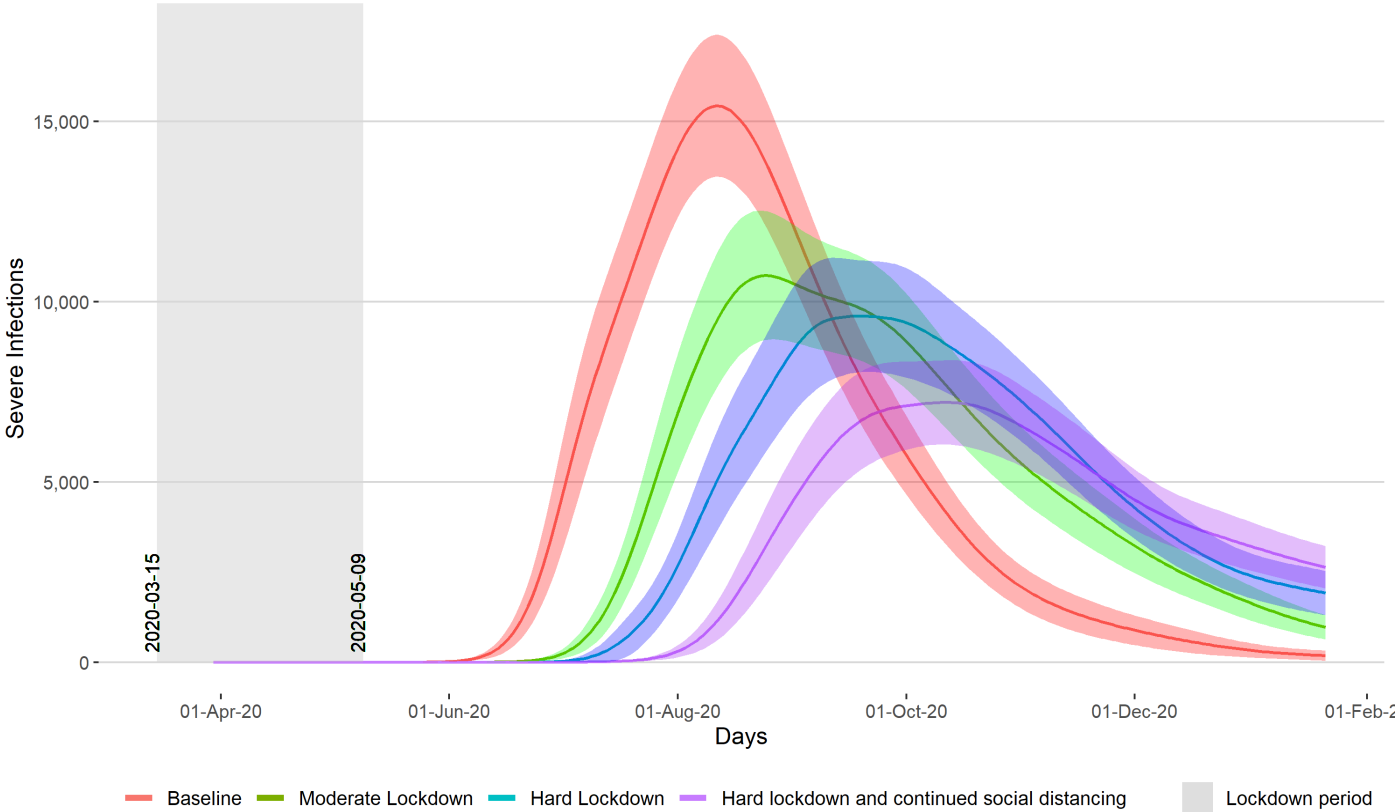
Liberia: Projected Severe Infections With and Without Lockdown



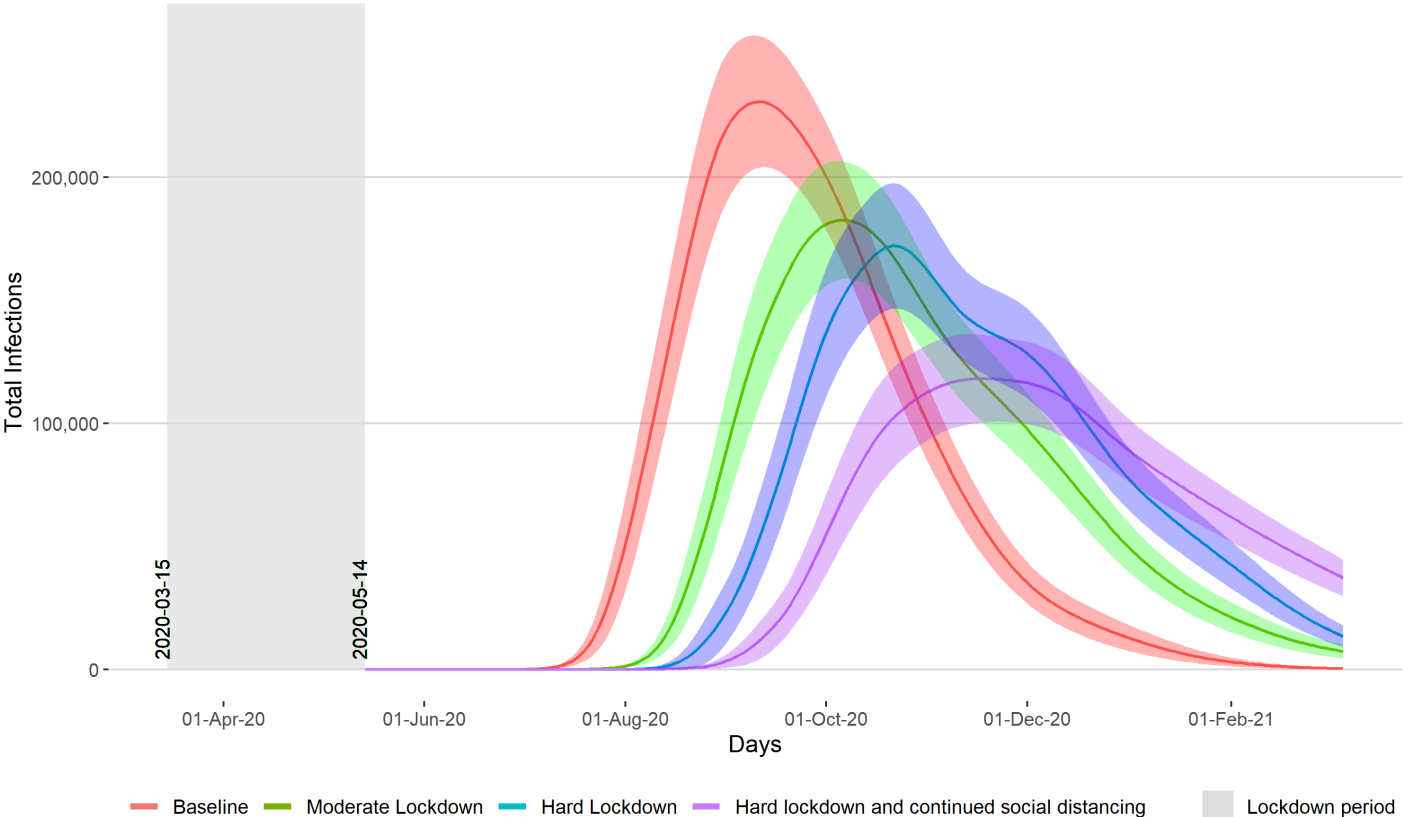
Mali: Projected Total Infections (Asymptomatic, Symptomatic, and Severe) With and Without Lockdown



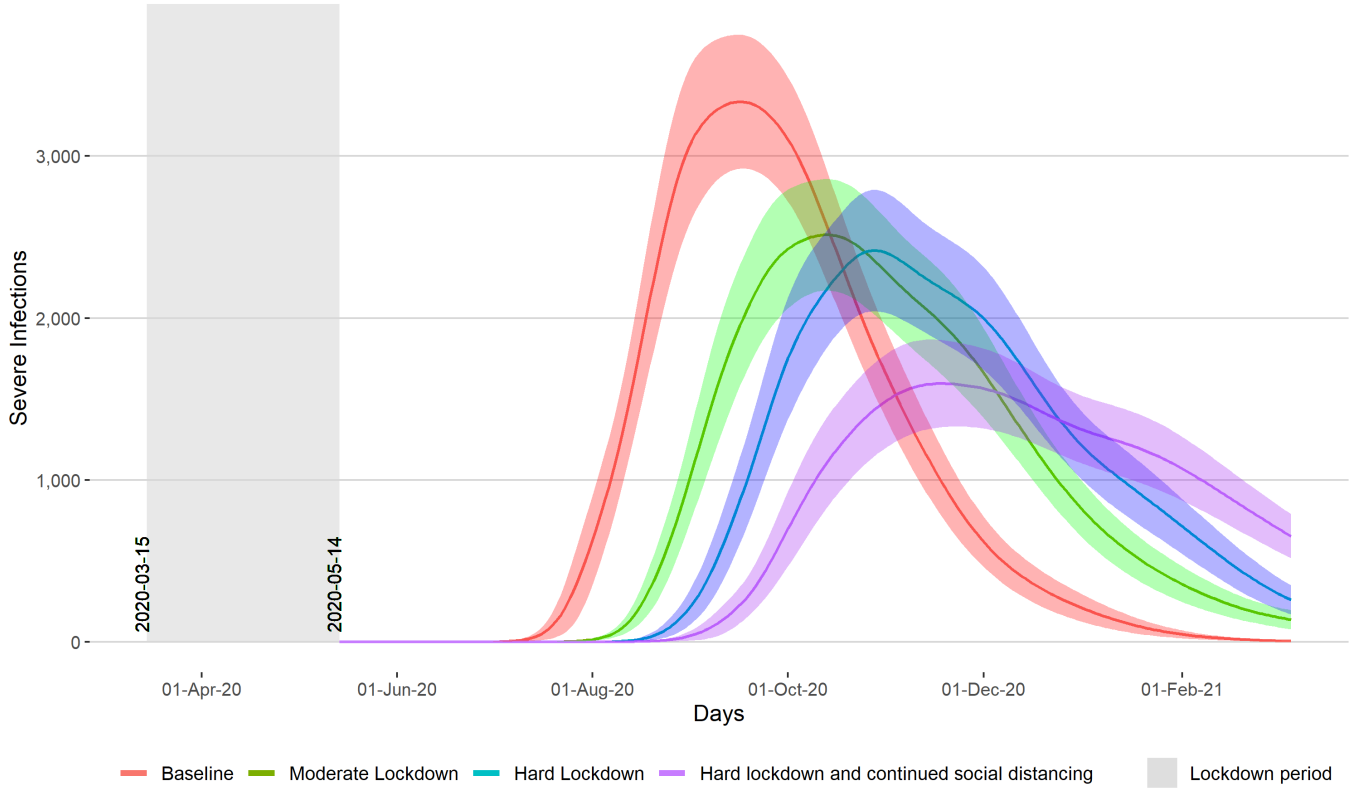
Mali: Projected Severe Infections With and Without Lockdown



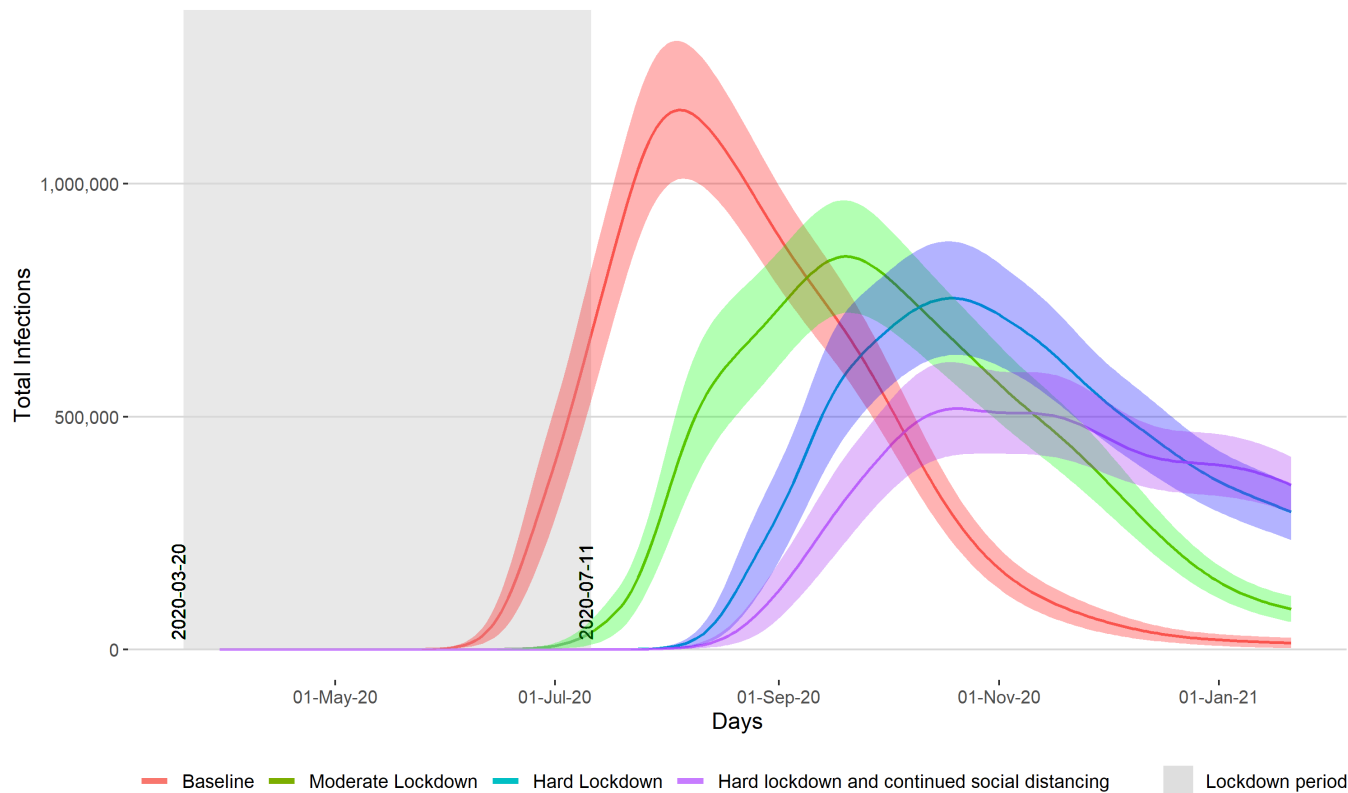
Mauritania: Projected Total Infections (Asymptomatic, Symptomatic, and Severe) With and Without Lockdown



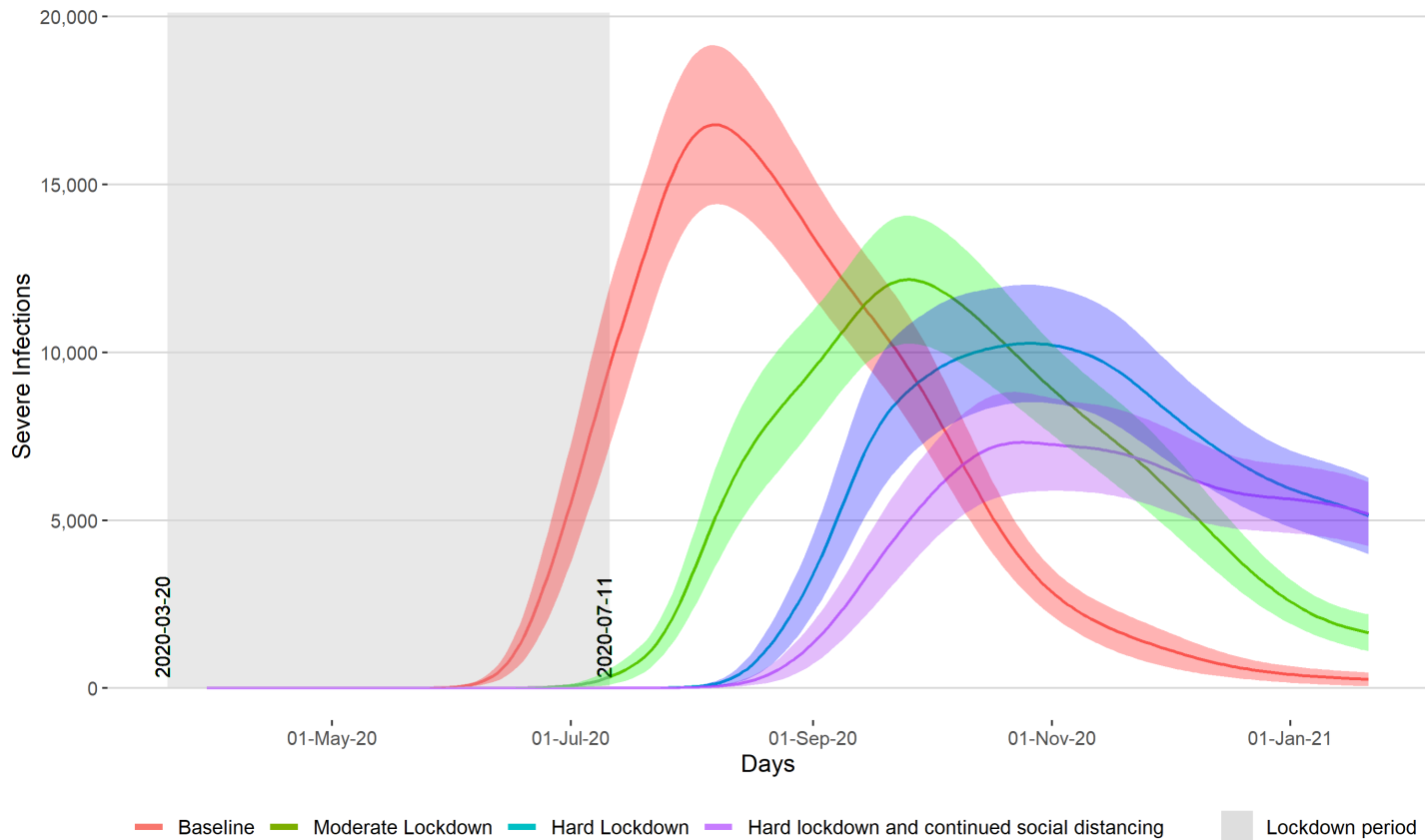
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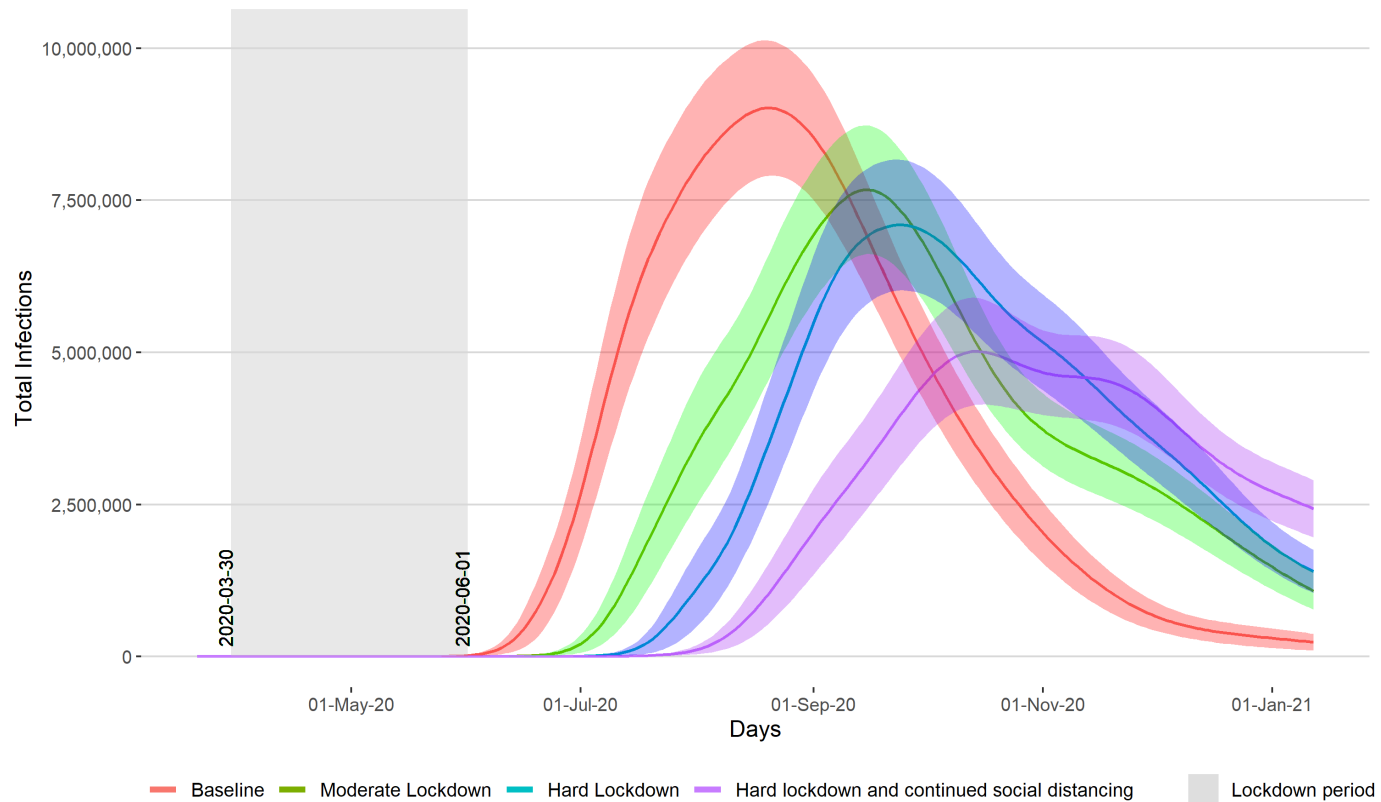
Niger: Projected Total Infections (Asymptomatic, Symptomatic, and Severe) With and Without Lockdown



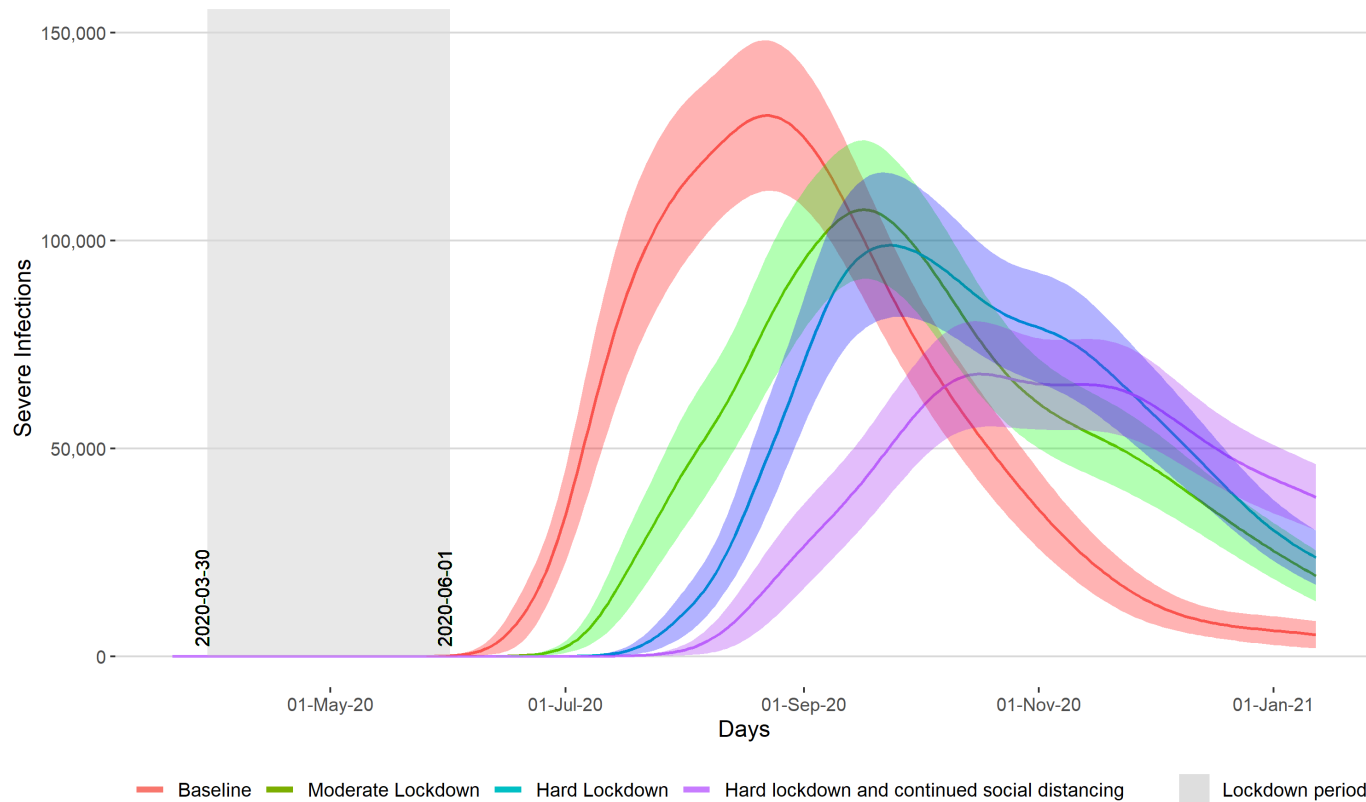
Niger: Projected Severe Infections With and Without Lockdown



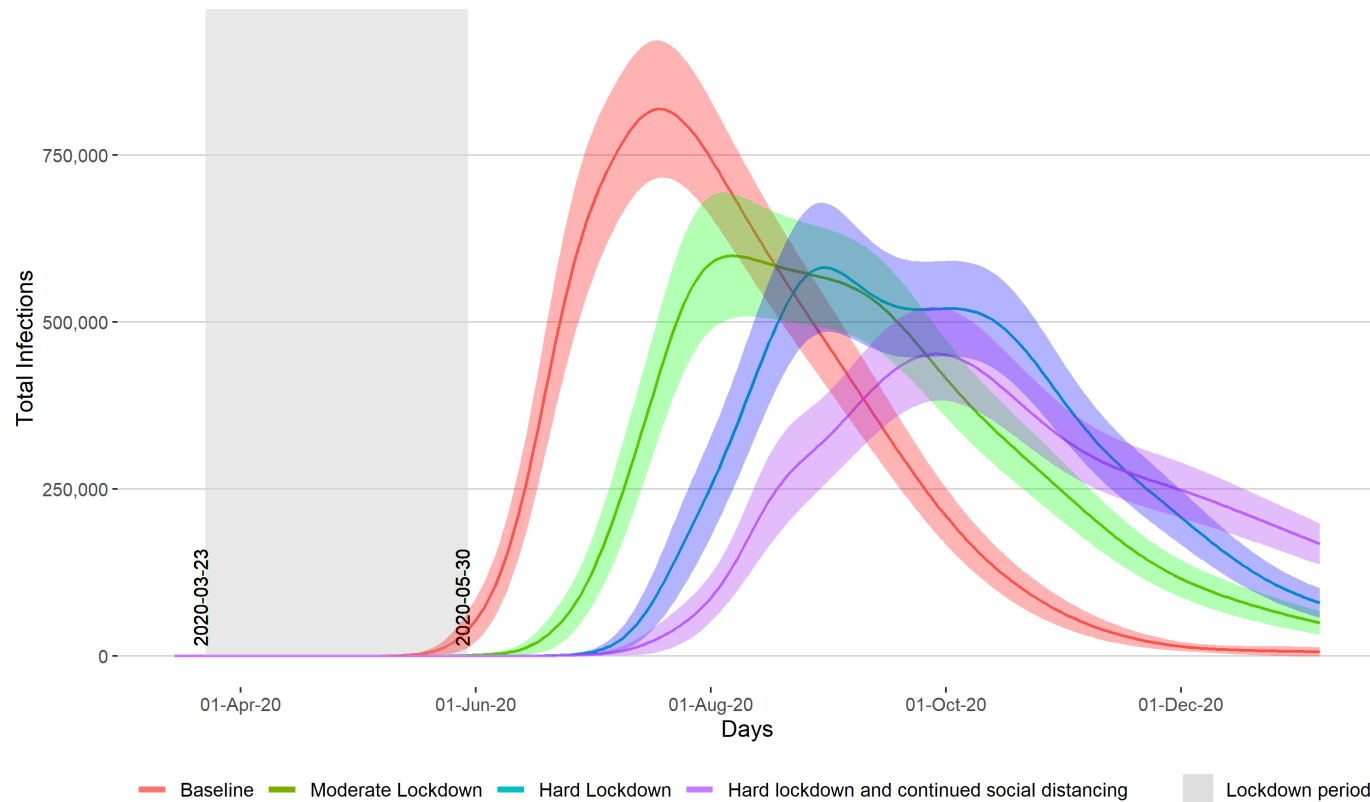
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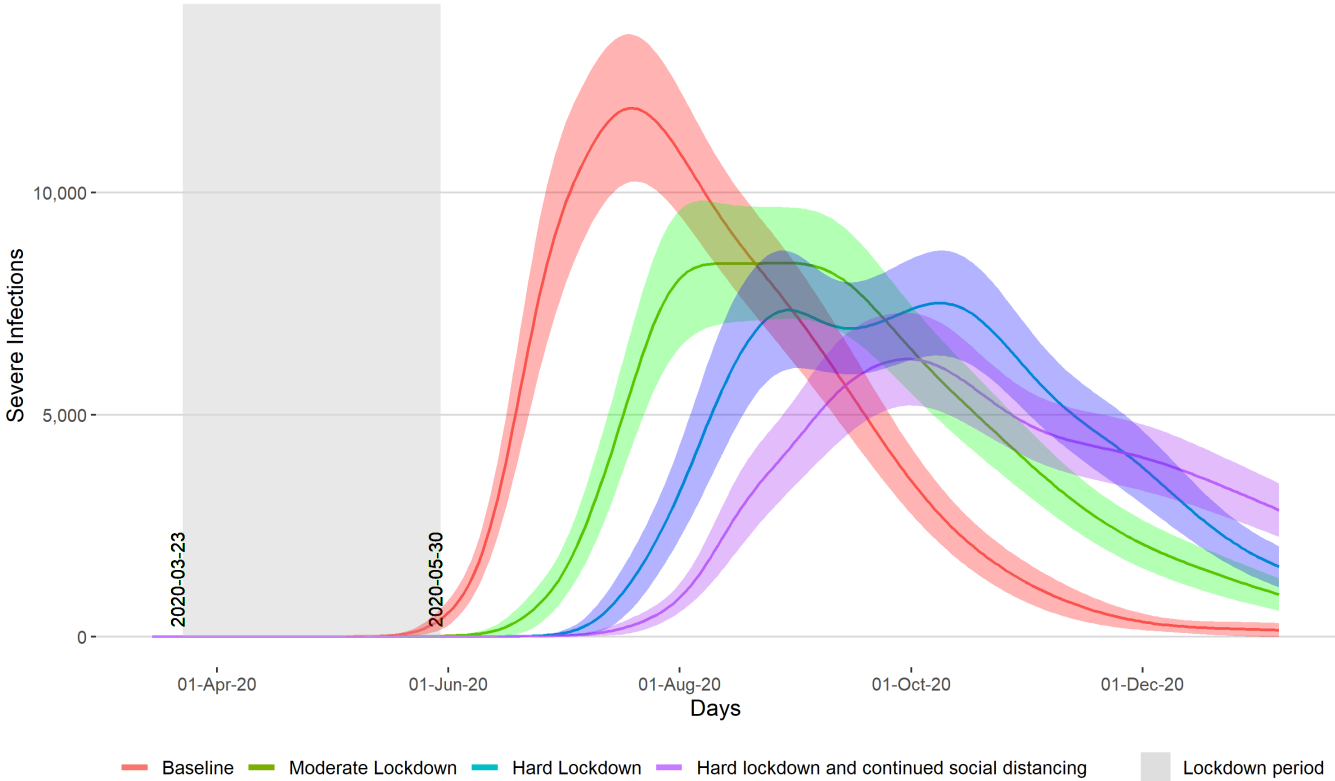
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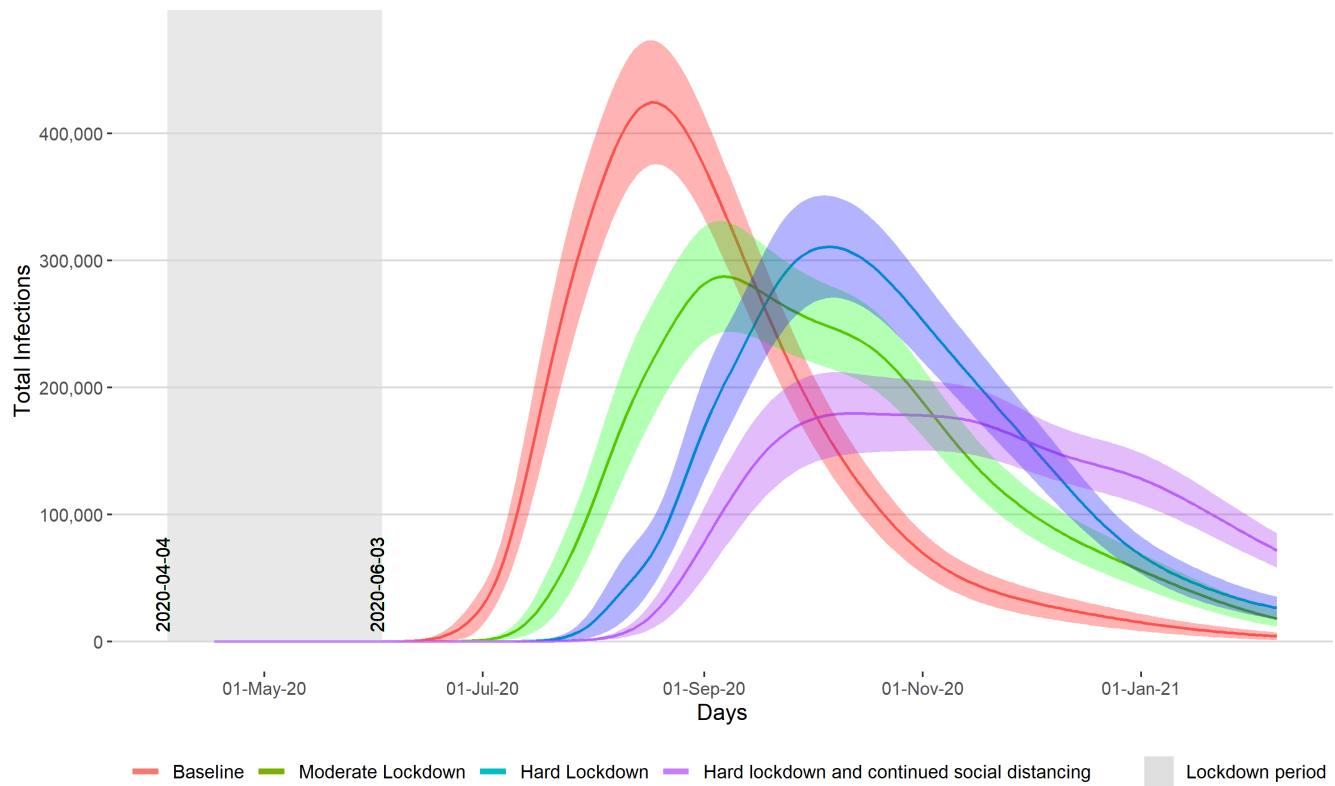
Senegal: Projected Total Infections (Asymptomatic, Symptomatic, and Severe) With and Without Lockdown



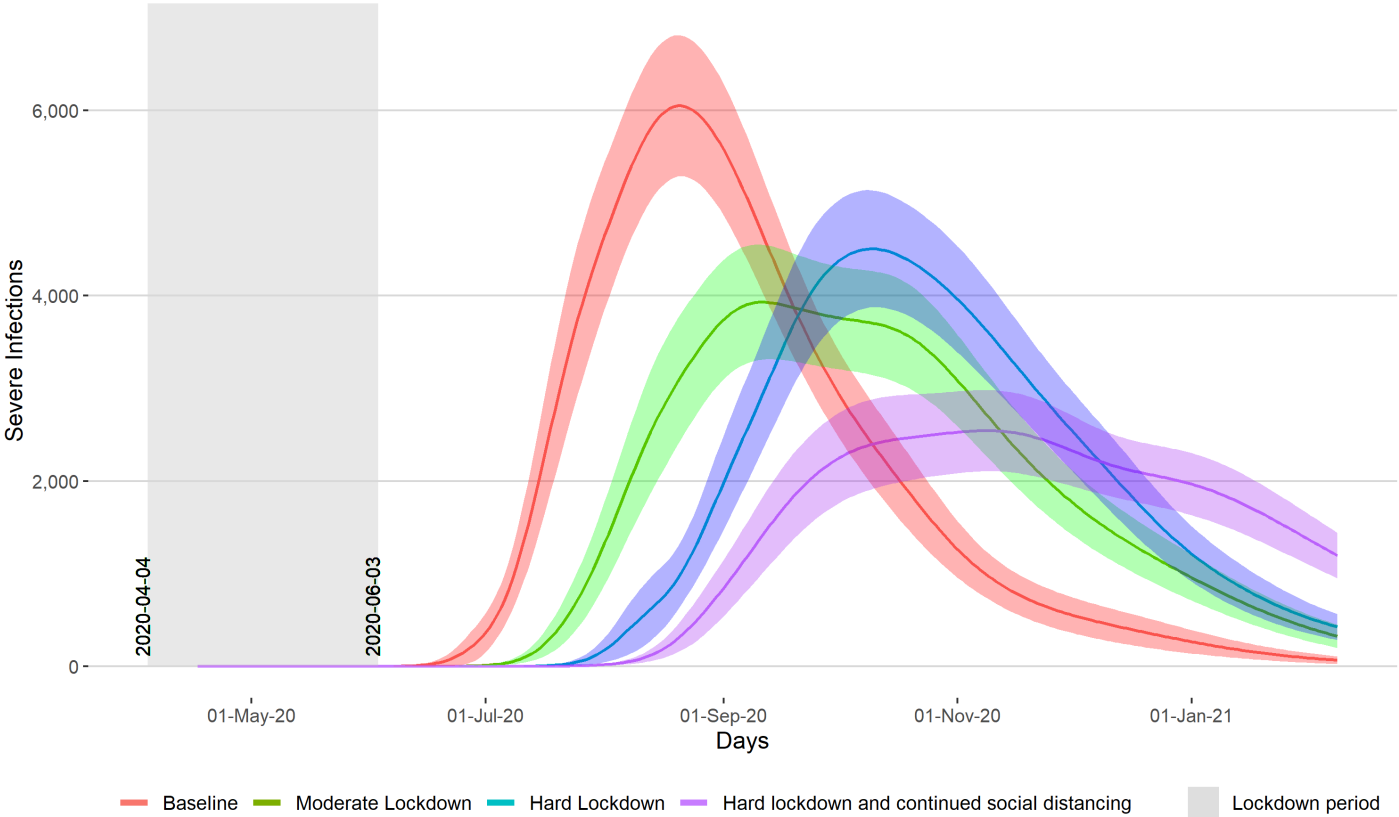
Senegal: Projected Severe Infections With and Without Lockdown



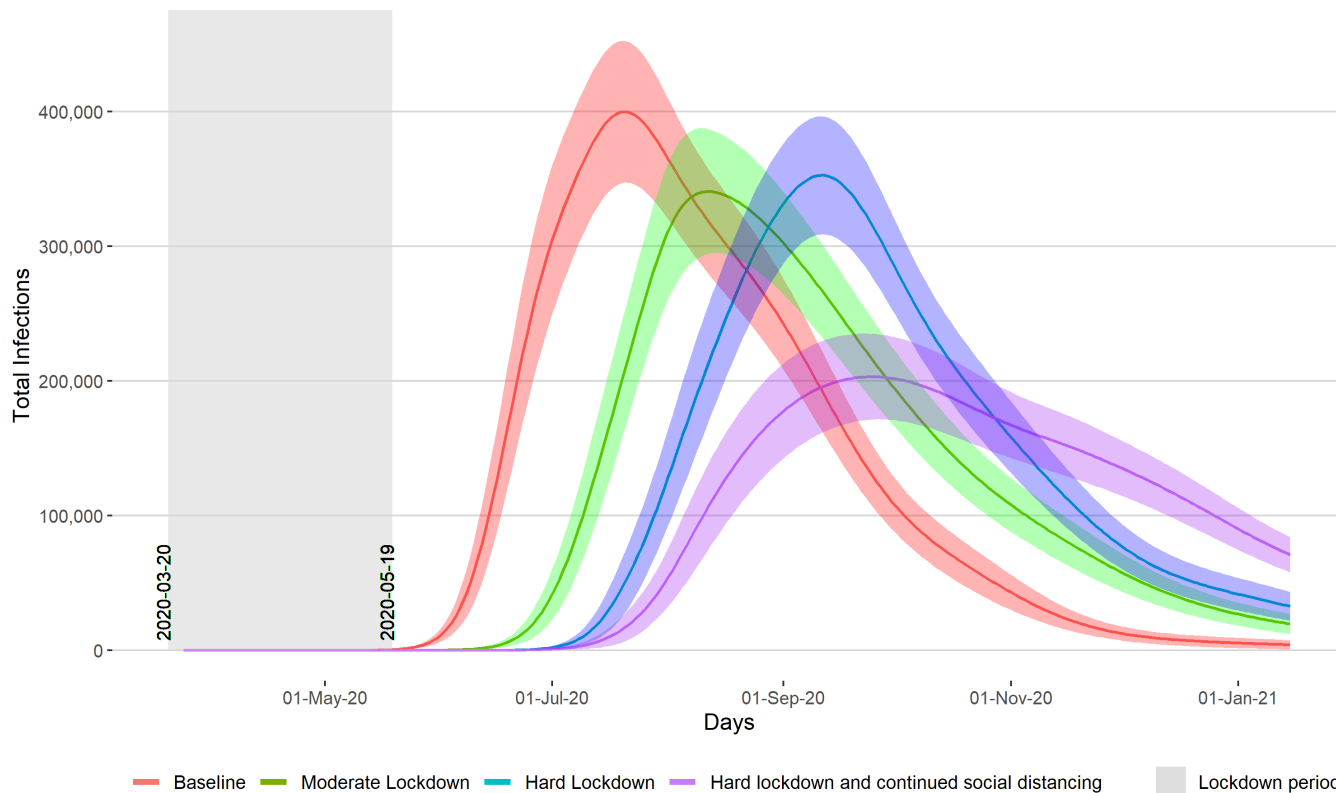
Sierra Leone: Projected Total Infections (Asymptomatic, Symptomatic, and Severe) With and Without Lockdown



Sierra Leone: Projected Severe Infections With and Without Lockdown



Togo: Projected Total Infections (Asymptomatic, Symptomatic, and Severe) With and Without Lockdown



Togo: Projected Severe Infections With and Without Lockdown

