IEM's AI Modeling: Short-term COVID-19 Projections

Date: 3/25/22

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 3/25/22 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

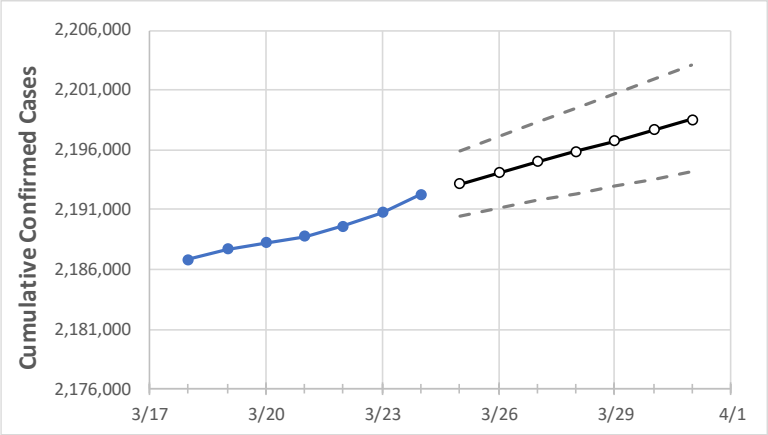
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

New Jersey State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31
New Jersey	2,188,780	2,189,639	2,190,743	2,192,294	2,193,174	2,194,088	2,194,977	2,195,852	2,196,749	2,197,645	2,198,563

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

New Jersey Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31
Bergen	221,339	221,493	221,655	221,825	221,976	222,132	222,289	222,444	222,604	222,767	222,931
Burlington	101,489	101,520	101,563	101,621	101,649	101,678	101,706	101,734	101,761	101,787	101,815
Camden	124,845	124,873	124,927	125,032	125,060	125,090	125,118	125,146	125,176	125,205	125,231
Essex	210,971	210,981	211,125	211,272	211,354	211,436	211,522	211,605	211,685	211,773	211,849
Gloucester	69,432	69,447	69,460	69,485	69,502	69,517	69,533	69,549	69,563	69,579	69,594
Hudson	170,077	170,210	170,278	170,400	170,481	170,568	170,649	170,731	170,810	170,894	170,980
Hunterdon	24,369	24,384	24,401	24,421	24,437	24,452	24,467	24,483	24,499	24,515	24,532
Mercer	75,374	75,401	75,443	75,498	75,530	75,562	75,592	75,624	75,654	75,685	75,713
Middlesex	191,149	191,243	191,423	191,605	191,689	191,771	191,853	191,937	192,015	192,097	192,173
Monmouth	162,601	162,652	162,728	162,804	162,867	162,929	162,991	163,053	163,116	163,180	163,243
Morris	117,569	117,627	117,713	117,792	117,859	117,927	118,001	118,070	118,138	118,210	118,278
Ocean	160,835	160,898	160,974	161,076	161,118	161,164	161,206	161,248	161,293	161,334	161,376
Passaic	143,750	143,807	143,875	143,946	144,003	144,066	144,125	144,190	144,251	144,311	144,374
Somerset	67,074	67,116	67,163	67,204	67,240	67,277	67,315	67,349	67,386	67,428	67,462
Sussex	33,642	33,653	33,667	33,682	33,690	33,698	33,705	33,712	33,719	33,726	33,733
Union	143,776	143,802	143,873	143,986	144,039	144,093	144,147	144,199	144,253	144,302	144,355
Warren	23,722	23,736	23,644	23,763	23,797	23,833	23,868	23,909	23,951	23,993	24,041

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- *Beds: For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report (MMWR, March 18, 2020) and state reports of COVID-19 cases.*
- *ICU: The CDC report found that 24% of hospitalized cases require ICU care.*
- *Ventilators: Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.*

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

*The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.*

New Jersey Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	3/21	3/22	3/23	3/24	3/26	3/28	3/30
Bergen	221,339	221,493	221,655	221,825	222,132 (44,426) [10,662] {5,331}	222,444 (44,489) [10,677] {5,339}	222,767 (44,553) [10,693] {5,346}
Burlington	101,489	101,520	101,563	101,621	101,678 (20,336) [4,881] {2,440}	101,734 (20,347) [4,883] {2,442}	101,787 (20,357) [4,886] {2,443}
Camden	124,845	124,873	124,927	125,032	125,090 (25,018) [6,004] {3,002}	125,146 (25,029) [6,007] {3,004}	125,205 (25,041) [6,010] {3,005}
Essex	210,971	210,981	211,125	211,272	211,436 (42,287) [10,149] {5,074}	211,605 (42,321) [10,157] {5,079}	211,773 (42,355) [10,165] {5,083}
Gloucester	69,432	69,447	69,460	69,485	69,517 (13,903) [3,337] {1,668}	69,549 (13,910) [3,338] {1,669}	69,579 (13,916) [3,340] {1,670}
Hudson	170,077	170,210	170,278	170,400	170,568 (34,114) [8,187] {4,094}	170,731 (34,146) [8,195] {4,098}	170,894 (34,179) [8,203] {4,101}
Hunterdon	24,369	24,384	24,401	24,421	24,452 (4,890) [1,174] {587}	24,483 (4,897) [1,175] {588}	24,515 (4,903) [1,177] {588}
Mercer	75,374	75,401	75,443	75,498	75,562 (15,112) [3,627] {1,813}	75,624 (15,125) [3,630] {1,815}	75,685 (15,137) [3,633] {1,816}
Middlesex	191,149	191,243	191,423	191,605	191,771 (38,354) [9,205] {4,603}	191,937 (38,387) [9,213] {4,606}	192,097 (38,419) [9,221] {4,610}
Monmouth	162,601	162,652	162,728	162,804	162,929 (32,586) [7,821] {3,910}	163,053 (32,611) [7,827] {3,913}	163,180 (32,636) [7,833] {3,916}
Morris	117,569	117,627	117,713	117,792	117,927 (23,585) [5,661] {2,830}	118,070 (23,614) [5,667] {2,834}	118,210 (23,642) [5,674] {2,837}
Ocean	160,835	160,898	160,974	161,076	161,164 (32,233) [7,736] {3,868}	161,248 (32,250) [7,740] {3,870}	161,334 (32,267) [7,744] {3,872}
Passaic	143,750	143,807	143,875	143,946	144,066 (28,813) [6,915] {3,458}	144,190 (28,838) [6,921] {3,461}	144,311 (28,862) [6,927] {3,463}
Somerset	67,074	67,116	67,163	67,204	67,277 (13,455) [3,229] {1,615}	67,349 (13,470) [3,233] {1,616}	67,428 (13,486) [3,237] {1,618}
Sussex	33,642	33,653	33,667	33,682	33,698 (6,740) [1,617] {809}	33,712 (6,742) [1,618] {809}	33,726 (6,745) [1,619] {809}
Union	143,776	143,802	143,873	143,986	144,093 (28,819) [6,916] {3,458}	144,199 (28,840) [6,922] {3,461}	144,302 (28,860) [6,927] {3,463}
Warren	23,722	23,736	23,644	23,763	23,833 (4,767) [1,144] {572}	23,909 (4,782) [1,148] {574}	23,993 (4,799) [1,152] {576}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.