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

Date: 2/25/22

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 2/25/22 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.

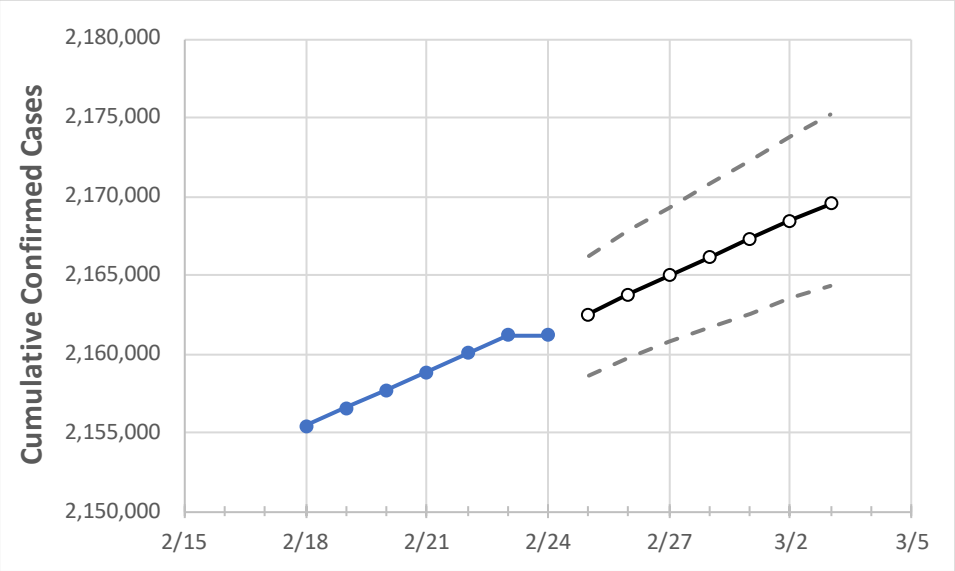
IEM's Modeling Lead

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:						
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3
New Jersey	2,158,820	2,160,023	2,161,190	2,161,190	2,162,504	2,163,785	2,164,974	2,166,121	2,167,308	2,168,449	2,169,541

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:						
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3
Bergen	217,504	217,630	217,704	217,704	217,825	217,947	218,063	218,173	218,279	218,391	218,488
Burlington	100,446	100,497	100,548	100,548	100,612	100,683	100,743	100,804	100,862	100,922	100,975
Camden	123,780	123,837	123,884	123,884	123,945	124,001	124,053	124,104	124,152	124,200	124,243
Essex	208,358	208,455	208,566	208,566	208,667	208,767	208,864	208,956	209,052	209,144	209,232
Gloucester	68,748	68,785	68,816	68,816	68,850	68,881	68,914	68,943	68,971	69,000	69,026
Hudson	167,124	167,233	167,345	167,345	167,454	167,560	167,660	167,758	167,859	167,961	168,059
Hunterdon	23,986	23,996	24,015	24,015	24,029	24,041	24,053	24,065	24,077	24,087	24,098
Mercer	74,309	74,347	74,373	74,373	74,421	74,463	74,507	74,546	74,585	74,626	74,660
Middlesex	187,649	187,775	187,862	187,862	187,984	188,112	188,227	188,343	188,452	188,561	188,675
Monmouth	160,818	160,886	160,952	160,952	161,023	161,088	161,152	161,212	161,273	161,328	161,381
Morris	115,811	115,876	115,937	115,937	116,006	116,074	116,139	116,203	116,266	116,330	116,384
Ocean	159,231	159,304	159,353	159,353	159,421	159,486	159,543	159,601	159,655	159,709	159,759
Passaic	141,908	141,950	142,007	142,007	142,066	142,122	142,175	142,228	142,280	142,331	142,373
Somerset	66,071	66,119	66,167	66,167	66,211	66,250	66,290	66,332	66,366	66,405	66,441
Sussex	33,251	33,269	33,293	33,293	33,312	33,330	33,347	33,362	33,380	33,395	33,410
Union	141,636	141,719	141,830	141,830	142,062	142,245	142,439	142,664	142,877	143,072	143,298
Warren	23,438	23,450	23,473	23,473	23,487	23,501	23,514	23,526	23,539	23,551	23,562

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:		
	2/21	2/22	2/23	2/24	2/26	2/28	3/2
Bergen	217,504	217,630	217,704	217,704	217,947 (43,589) [10,461] {5,231}	218,173 (43,635) [10,472] {5,236}	218,391 (43,678) [10,483] {5,241}
Burlington	100,446	100,497	100,548	100,548	100,683 (20,137) [4,833] {2,416}	100,804 (20,161) [4,839] {2,419}	100,922 (20,184) [4,844] {2,422}
Camden	123,780	123,837	123,884	123,884	124,001 (24,800) [5,952] {2,976}	124,104 (24,821) [5,957] {2,978}	124,200 (24,840) [5,962] {2,981}
Essex	208,358	208,455	208,566	208,566	208,767 (41,753) [10,021] {5,010}	208,956 (41,791) [10,030] {5,015}	209,144 (41,829) [10,039] {5,019}
Gloucester	68,748	68,785	68,816	68,816	68,881 (13,776) [3,306] {1,653}	68,943 (13,789) [3,309] {1,655}	69,000 (13,800) [3,312] {1,656}
Hudson	167,124	167,233	167,345	167,345	167,560 (33,512) [8,043] {4,021}	167,758 (33,552) [8,052] {4,026}	167,961 (33,592) [8,062] {4,031}
Hunterdon	23,986	23,996	24,015	24,015	24,041 (4,808) [1,154] {577}	24,065 (4,813) [1,155] {578}	24,087 (4,817) [1,156] {578}
Mercer	74,309	74,347	74,373	74,373	74,463 (14,893) [3,574] {1,787}	74,546 (14,909) [3,578] {1,789}	74,626 (14,925) [3,582] {1,791}
Middlesex	187,649	187,775	187,862	187,862	188,112 (37,622) [9,029] {4,515}	188,343 (37,669) [9,040] {4,520}	188,561 (37,712) [9,051] {4,525}
Monmouth	160,818	160,886	160,952	160,952	161,088 (32,218) [7,732] {3,866}	161,212 (32,242) [7,738] {3,869}	161,328 (32,266) [7,744] {3,872}
Morris	115,811	115,876	115,937	115,937	116,074 (23,215) [5,572] {2,786}	116,203 (23,241) [5,578] {2,789}	116,330 (23,266) [5,584] {2,792}
Ocean	159,231	159,304	159,353	159,353	159,486 (31,897) [7,655] {3,828}	159,601 (31,920) [7,661] {3,830}	159,709 (31,942) [7,666] {3,833}
Passaic	141,908	141,950	142,007	142,007	142,122 (28,424) [6,822] {3,411}	142,228 (28,446) [6,827] {3,413}	142,331 (28,466) [6,832] {3,416}
Somerset	66,071	66,119	66,167	66,167	66,250 (13,250) [3,180] {1,590}	66,332 (13,266) [3,184] {1,592}	66,405 (13,281) [3,187] {1,594}
Sussex	33,251	33,269	33,293	33,293	33,330 (6,666) [1,600] {800}	33,362 (6,672) [1,601] {801}	33,395 (6,679) [1,603] {801}
Union	141,636	141,719	141,830	141,830	142,245 (28,449) [6,828] {3,414}	142,664 (28,533) [6,848] {3,424}	143,072 (28,614) [6,867] {3,434}
Warren	23,438	23,450	23,473	23,473	23,501 (4,700) [1,128] {564}	23,526 (4,705) [1,129] {565}	23,551 (4,710) [1,130] {565}

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.