

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

Date: 7/31/20

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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 7/31/20 11 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.

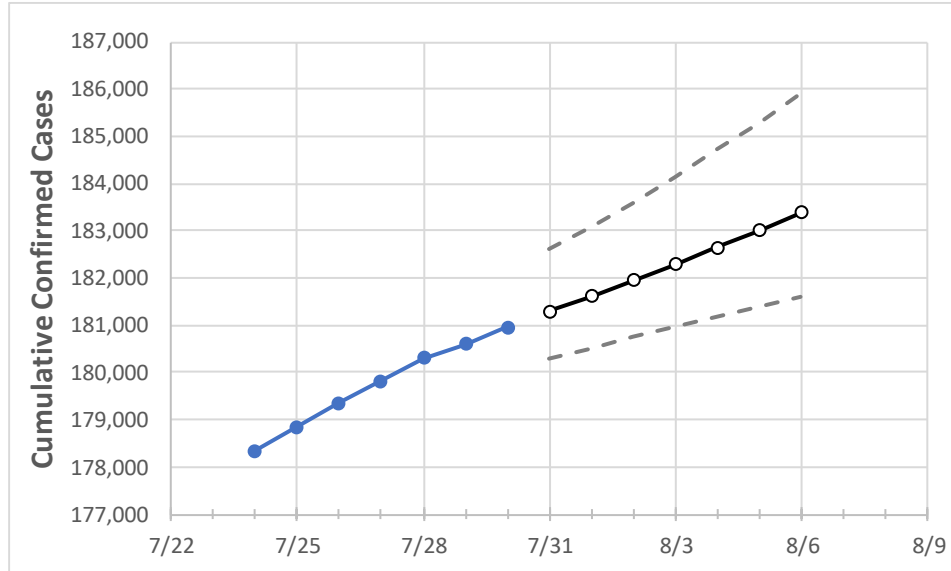
IEM's Modeling Lead

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:							
	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5	8/6	
New Jersey	179,812	180,295	180,599	180,970	181,288	181,615	181,951	182,296	182,650	183,013	183,387	

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 20%, and are often within 10%, of actual confirmed cases.

New Jersey Counties

	Actual Confirmed Cases On:				Projected Cases For:							
	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5	8/6	
Bergen	20,280	20,341	20,391	20,412	20,439	20,466	20,494	20,522	20,551	20,580	20,610	
Burlington	5,642	5,684	5,721	5,732	5,752	5,774	5,796	5,818	5,842	5,866	5,891	
Camden	8,130	8,167	8,225	8,240	8,270	8,301	8,333	8,365	8,398	8,432	8,467	
Essex	19,335	19,376	19,428	19,441	19,464	19,488	19,513	19,538	19,564	19,590	19,618	
Gloucester	2,986	2,999	3,017	3,031	3,046	3,061	3,077	3,092	3,109	3,125	3,142	
Hudson	19,387	19,399	19,430	19,434	19,446	19,459	19,472	19,484	19,497	19,510	19,523	
Hunterdon	1,122	1,123	1,125	1,125	1,127	1,129	1,131	1,133	1,135	1,137	1,140	
Mercer	7,934	7,966	7,984	8,000	8,014	8,028	8,042	8,057	8,073	8,089	8,105	
Middlesex	17,557	17,580	17,615	17,626	17,654	17,682	17,710	17,739	17,768	17,798	17,828	
Monmouth	9,908	9,947	9,985	10,004	10,031	10,058	10,086	10,114	10,143	10,173	10,203	
Morris	7,076	7,091	7,102	7,109	7,120	7,131	7,143	7,154	7,166	7,178	7,190	
Ocean	10,238	10,293	10,330	10,356	10,390	10,425	10,461	10,499	10,539	10,580	10,623	
Passaic	17,327	17,348	17,370	17,384	17,403	17,423	17,443	17,464	17,485	17,507	17,530	
Somerset	5,139	5,155	5,163	5,170	5,178	5,187	5,196	5,205	5,214	5,223	5,232	
Sussex	1,285	1,286	1,290	1,293	1,297	1,301	1,305	1,309	1,314	1,318	1,323	
Union	16,376	16,410	16,439	16,456	16,464	16,472	16,482	16,494	16,507	16,522	16,539	
Warren	1,315	1,321	1,326	1,326	1,331	1,336	1,341	1,346	1,352	1,358	1,364	

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:											
	7/27	7/28	7/29	7/30	8/1				8/3				8/5			
Bergen	20,280	20,341	20,391	20,412	20,466	(4,093)	[982]	{491}	20,522	(4,104)	[985]	{493}	20,580	(4,116)	[988]	{494}
Burlington	5,642	5,684	5,721	5,732	5,774	(1,155)	[277]	{139}	5,818	(1,164)	[279]	{140}	5,866	(1,173)	[282]	{141}
Camden	8,130	8,167	8,225	8,240	8,301	(1,660)	[398]	{199}	8,365	(1,673)	[402]	{201}	8,432	(1,686)	[405]	{202}
Essex	19,335	19,376	19,428	19,441	19,488	(3,898)	[935]	{468}	19,538	(3,908)	[938]	{469}	19,590	(3,918)	[940]	{470}
Gloucester	2,986	2,999	3,017	3,031	3,061	(612)	[147]	{73}	3,092	(618)	[148]	{74}	3,125	(625)	[150]	{75}
Hudson	19,387	19,399	19,430	19,434	19,459	(3,892)	[934]	{467}	19,484	(3,897)	[935]	{468}	19,510	(3,902)	[936]	{468}
Hunterdon	1,122	1,123	1,125	1,125	1,129	(226)	[54]	{27}	1,133	(227)	[54]	{27}	1,137	(227)	[55]	{27}
Mercer	7,934	7,966	7,984	8,000	8,028	(1,606)	[385]	{193}	8,057	(1,611)	[387]	{193}	8,089	(1,618)	[388]	{194}
Middlesex	17,557	17,580	17,615	17,626	17,682	(3,536)	[849]	{424}	17,739	(3,548)	[851]	{426}	17,798	(3,560)	[854]	{427}
Monmouth	9,908	9,947	9,985	10,004	10,058	(2,012)	[483]	{241}	10,114	(2,023)	[485]	{243}	10,173	(2,035)	[488]	{244}
Morris	7,076	7,091	7,102	7,109	7,131	(1,426)	[342]	{171}	7,154	(1,431)	[343]	{172}	7,178	(1,436)	[345]	{172}
Ocean	10,238	10,293	10,330	10,356	10,425	(2,085)	[500]	{250}	10,499	(2,100)	[504]	{252}	10,580	(2,116)	[508]	{254}
Passaic	17,327	17,348	17,370	17,384	17,423	(3,485)	[836]	{418}	17,464	(3,493)	[838]	{419}	17,507	(3,501)	[840]	{420}
Somerset	5,139	5,155	5,163	5,170	5,187	(1,037)	[249]	{124}	5,205	(1,041)	[250]	{125}	5,223	(1,045)	[251]	{125}
Sussex	1,285	1,286	1,290	1,293	1,301	(260)	[62]	{31}	1,309	(262)	[63]	{31}	1,318	(264)	[63]	{32}
Union	16,376	16,410	16,439	16,456	16,472	(3,294)	[791]	{395}	16,494	(3,299)	[792]	{396}	16,522	(3,304)	[793]	{397}
Warren	1,315	1,321	1,326	1,326	1,336	(267)	[64]	{32}	1,346	(269)	[65]	{32}	1,358	(272)	[65]	{33}

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.