

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

Date: 9/9/20

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 9/9/20 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.

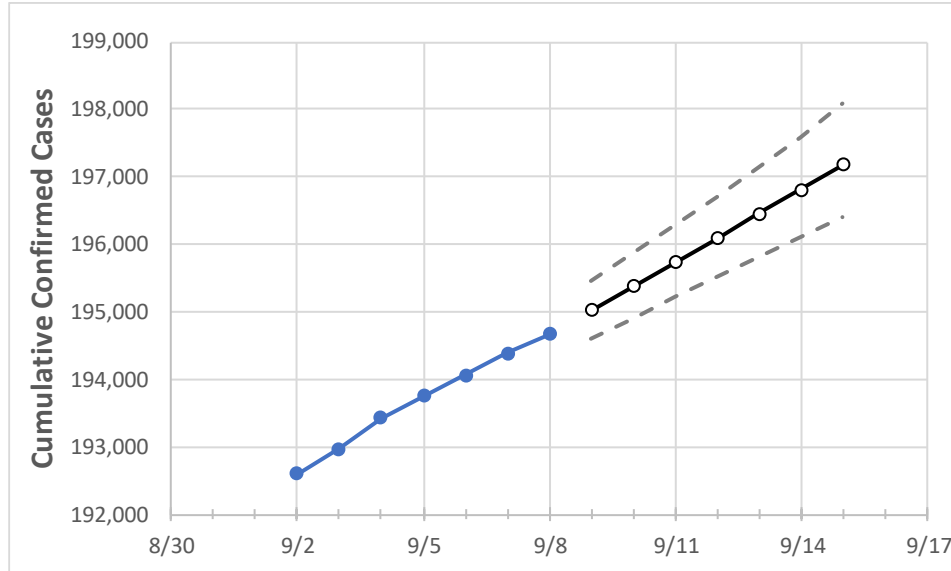
IEM's Modeling Lead

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:						
	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15
New Jersey	193,747	194,058	194,390	194,667	195,018	195,371	195,728	196,088	196,451	196,817	197,187

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:						
	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15
Bergen	21,755	21,788	21,816	21,844	21,868	21,892	21,916	21,940	21,964	21,987	22,011
Burlington	6,541	6,559	6,581	6,606	6,627	6,648	6,669	6,691	6,713	6,735	6,758
Camden	9,292	9,311	9,336	9,355	9,377	9,399	9,421	9,443	9,464	9,486	9,507
Essex	20,488	20,505	20,528	20,545	20,569	20,594	20,618	20,642	20,666	20,690	20,715
Gloucester	3,783	3,809	3,830	3,853	3,872	3,890	3,909	3,928	3,947	3,967	3,986
Hudson	20,243	20,261	20,286	20,293	20,306	20,319	20,331	20,344	20,356	20,368	20,380
Hunterdon	1,228	1,229	1,234	1,235	1,238	1,241	1,244	1,247	1,250	1,253	1,257
Mercer	8,401	8,406	8,422	8,432	8,442	8,452	8,463	8,473	8,484	8,494	8,505
Middlesex	18,553	18,586	18,603	18,625	18,645	18,665	18,685	18,705	18,725	18,745	18,764
Monmouth	10,890	10,926	10,951	10,966	10,992	11,018	11,045	11,072	11,100	11,128	11,157
Morris	7,562	7,569	7,581	7,592	7,601	7,611	7,621	7,630	7,640	7,649	7,659
Ocean	11,427	11,462	11,495	11,522	11,566	11,612	11,659	11,708	11,758	11,810	11,864
Passaic	18,484	18,499	18,520	18,533	18,552	18,571	18,589	18,607	18,625	18,643	18,660
Somerset	5,451	5,462	5,478	5,481	5,488	5,494	5,501	5,508	5,515	5,522	5,529
Sussex	1,413	1,412	1,416	1,421	1,425	1,429	1,433	1,438	1,443	1,447	1,452
Union	17,196	17,212	17,218	17,238	17,252	17,266	17,280	17,293	17,307	17,321	17,334
Warren	1,404	1,409	1,408	1,411	1,413	1,415	1,417	1,419	1,421	1,423	1,425

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:											
	9/5	9/6	9/7	9/8	9/10				9/12				9/14			
Bergen	21,755	21,788	21,816	21,844	21,892	(4,378)	[1,051]	{525}	21,940	(4,388)	[1,053]	{527}	21,987	(4,397)	[1,055]	{528}
Burlington	6,541	6,559	6,581	6,606	6,648	(1,330)	[319]	{160}	6,691	(1,338)	[321]	{161}	6,735	(1,347)	[323]	{162}
Camden	9,292	9,311	9,336	9,355	9,399	(1,880)	[451]	{226}	9,443	(1,889)	[453]	{227}	9,486	(1,897)	[455]	{228}
Essex	20,488	20,505	20,528	20,545	20,594	(4,119)	[988]	{494}	20,642	(4,128)	[991]	{495}	20,690	(4,138)	[993]	{497}
Gloucester	3,783	3,809	3,830	3,853	3,890	(778)	[187]	{93}	3,928	(786)	[189]	{94}	3,967	(793)	[190]	{95}
Hudson	20,243	20,261	20,286	20,293	20,319	(4,064)	[975]	{488}	20,344	(4,069)	[976]	{488}	20,368	(4,074)	[978]	{489}
Hunterdon	1,228	1,229	1,234	1,235	1,241	(248)	[60]	{30}	1,247	(249)	[60]	{30}	1,253	(251)	[60]	{30}
Mercer	8,401	8,406	8,422	8,432	8,452	(1,690)	[406]	{203}	8,473	(1,695)	[407]	{203}	8,494	(1,699)	[408]	{204}
Middlesex	18,553	18,586	18,603	18,625	18,665	(3,733)	[896]	{448}	18,705	(3,741)	[898]	{449}	18,745	(3,749)	[900]	{450}
Monmouth	10,890	10,926	10,951	10,966	11,018	(2,204)	[529]	{264}	11,072	(2,214)	[531]	{266}	11,128	(2,226)	[534]	{267}
Morris	7,562	7,569	7,581	7,592	7,611	(1,522)	[365]	{183}	7,630	(1,526)	[366]	{183}	7,649	(1,530)	[367]	{184}
Ocean	11,427	11,462	11,495	11,522	11,612	(2,322)	[557]	{279}	11,708	(2,342)	[562]	{281}	11,810	(2,362)	[567]	{283}
Passaic	18,484	18,499	18,520	18,533	18,571	(3,714)	[891]	{446}	18,607	(3,721)	[893]	{447}	18,643	(3,729)	[895]	{447}
Somerset	5,451	5,462	5,478	5,481	5,494	(1,099)	[264]	{132}	5,508	(1,102)	[264]	{132}	5,522	(1,104)	[265]	{133}
Sussex	1,413	1,412	1,416	1,421	1,429	(286)	[69]	{34}	1,438	(288)	[69]	{35}	1,447	(289)	[69]	{35}
Union	17,196	17,212	17,218	17,238	17,266	(3,453)	[829]	{414}	17,293	(3,459)	[830]	{415}	17,321	(3,464)	[831]	{416}
Warren	1,404	1,409	1,408	1,411	1,415	(283)	[68]	{34}	1,419	(284)	[68]	{34}	1,423	(285)	[68]	{34}

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.