

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

Date: 9/8/20

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 9/8/20 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.

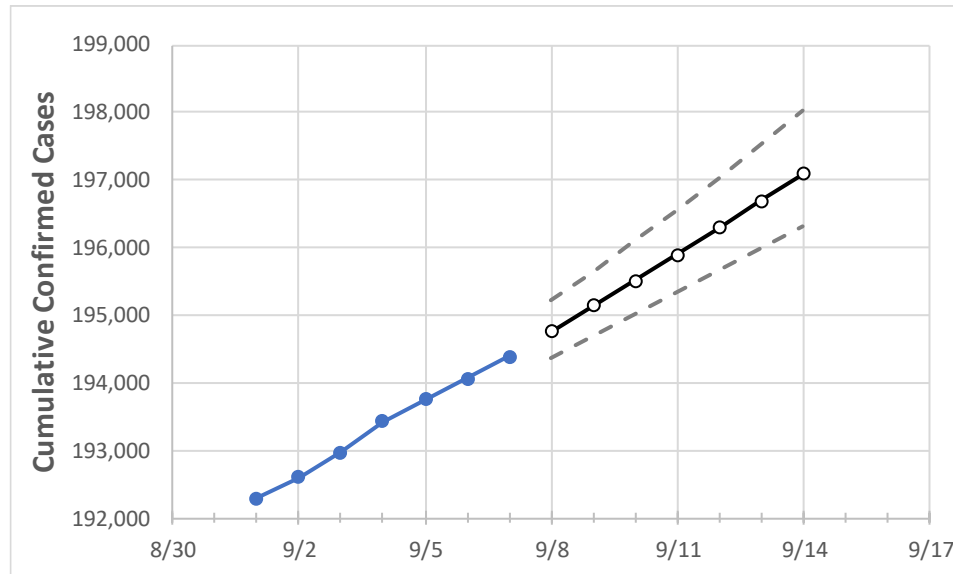
IEM's Modeling Lead

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:							
	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	
New Jersey	193,422	193,747	194,058	194,390	194,759	195,134	195,514	195,901	196,293	196,690	197,094	

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:							
	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	
Bergen	21,752	21,755	21,788	21,816	21,840	21,864	21,887	21,911	21,933	21,956	21,979	
Burlington	6,521	6,541	6,559	6,581	6,600	6,620	6,640	6,660	6,680	6,700	6,720	
Camden	9,270	9,292	9,311	9,336	9,359	9,381	9,404	9,426	9,448	9,470	9,493	
Essex	20,463	20,488	20,505	20,528	20,554	20,580	20,606	20,632	20,659	20,685	20,712	
Gloucester	3,762	3,783	3,809	3,830	3,848	3,865	3,883	3,901	3,919	3,938	3,956	
Hudson	20,227	20,243	20,261	20,286	20,300	20,314	20,327	20,341	20,354	20,368	20,381	
Hunterdon	1,223	1,228	1,229	1,234	1,237	1,240	1,243	1,247	1,250	1,254	1,257	
Mercer	8,390	8,401	8,406	8,422	8,432	8,442	8,452	8,463	8,473	8,484	8,495	
Middlesex	18,531	18,553	18,586	18,603	18,623	18,642	18,662	18,682	18,701	18,720	18,740	
Monmouth	10,862	10,890	10,926	10,951	10,977	11,003	11,030	11,058	11,086	11,115	11,145	
Morris	7,548	7,562	7,569	7,581	7,591	7,600	7,610	7,619	7,629	7,639	7,648	
Ocean	11,358	11,427	11,462	11,495	11,542	11,590	11,641	11,693	11,747	11,804	11,862	
Passaic	18,469	18,484	18,499	18,520	18,541	18,563	18,584	18,604	18,625	18,645	18,665	
Somerset	5,446	5,451	5,462	5,478	5,486	5,493	5,501	5,509	5,517	5,526	5,534	
Sussex	1,408	1,413	1,412	1,416	1,419	1,423	1,427	1,431	1,434	1,438	1,442	
Union	17,187	17,196	17,212	17,218	17,231	17,244	17,257	17,270	17,283	17,295	17,308	
Warren	1,402	1,404	1,409	1,408	1,410	1,412	1,413	1,415	1,417	1,419	1,421	

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:											
	9/4	9/5	9/6	9/7	9/9				9/11				9/13			
Bergen	21,752	21,755	21,788	21,816	21,864	(4,373)	[1,049]	{525}	21,911	(4,382)	[1,052]	{526}	21,956	(4,391)	[1,054]	{527}
Burlington	6,521	6,541	6,559	6,581	6,620	(1,324)	[318]	{159}	6,660	(1,332)	[320]	{160}	6,700	(1,340)	[322]	{161}
Camden	9,270	9,292	9,311	9,336	9,381	(1,876)	[450]	{225}	9,426	(1,885)	[452]	{226}	9,470	(1,894)	[455]	{227}
Essex	20,463	20,488	20,505	20,528	20,580	(4,116)	[988]	{494}	20,632	(4,126)	[990]	{495}	20,685	(4,137)	[993]	{496}
Gloucester	3,762	3,783	3,809	3,830	3,865	(773)	[186]	{93}	3,901	(780)	[187]	{94}	3,938	(788)	[189]	{95}
Hudson	20,227	20,243	20,261	20,286	20,314	(4,063)	[975]	{488}	20,341	(4,068)	[976]	{488}	20,368	(4,074)	[978]	{489}
Hunterdon	1,223	1,228	1,229	1,234	1,240	(248)	[60]	{30}	1,247	(249)	[60]	{30}	1,254	(251)	[60]	{30}
Mercer	8,390	8,401	8,406	8,422	8,442	(1,688)	[405]	{203}	8,463	(1,693)	[406]	{203}	8,484	(1,697)	[407]	{204}
Middlesex	18,531	18,553	18,586	18,603	18,642	(3,728)	[895]	{447}	18,682	(3,736)	[897]	{448}	18,720	(3,744)	[899]	{449}
Monmouth	10,862	10,890	10,926	10,951	11,003	(2,201)	[528]	{264}	11,058	(2,212)	[531]	{265}	11,115	(2,223)	[534]	{267}
Morris	7,548	7,562	7,569	7,581	7,600	(1,520)	[365]	{182}	7,619	(1,524)	[366]	{183}	7,639	(1,528)	[367]	{183}
Ocean	11,358	11,427	11,462	11,495	11,590	(2,318)	[556]	{278}	11,693	(2,339)	[561]	{281}	11,804	(2,361)	[567]	{283}
Passaic	18,469	18,484	18,499	18,520	18,563	(3,713)	[891]	{446}	18,604	(3,721)	[893]	{447}	18,645	(3,729)	[895]	{447}
Somerset	5,446	5,451	5,462	5,478	5,493	(1,099)	[264]	{132}	5,509	(1,102)	[264]	{132}	5,526	(1,105)	[265]	{133}
Sussex	1,408	1,413	1,412	1,416	1,423	(285)	[68]	{34}	1,431	(286)	[69]	{34}	1,438	(288)	[69]	{35}
Union	17,187	17,196	17,212	17,218	17,244	(3,449)	[828]	{414}	17,270	(3,454)	[829]	{414}	17,295	(3,459)	[830]	{415}
Warren	1,402	1,404	1,409	1,408	1,412	(282)	[68]	{34}	1,415	(283)	[68]	{34}	1,419	(284)	[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.