

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

Date: 2/2/21

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 2/2/21 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.

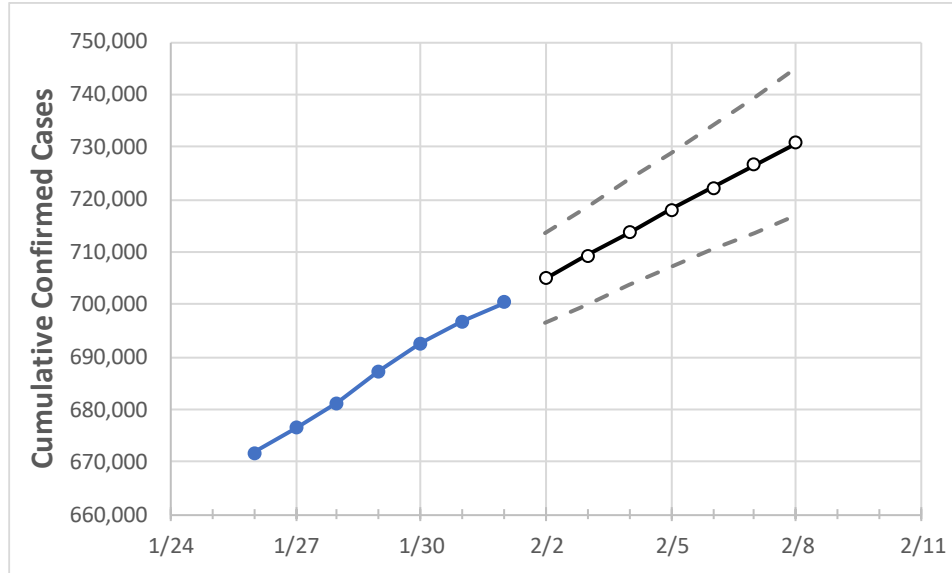
IEM's Modeling Lead

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:							
	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	
New Jersey	687,269	692,543	696,829	700,346	704,867	709,312	713,680	718,042	722,281	726,517	730,697	

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:							
	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	
Bergen	66,318	66,836	67,253	67,609	68,045	68,469	68,904	69,333	69,755	70,172	70,612	
Burlington	31,111	31,359	31,577	31,695	31,889	32,081	32,267	32,453	32,629	32,807	32,978	
Camden	39,956	40,201	40,402	40,534	40,755	40,965	41,173	41,380	41,585	41,783	41,977	
Essex	64,264	64,755	65,161	65,485	65,909	66,337	66,761	67,193	67,614	68,028	68,442	
Gloucester	21,650	21,803	21,907	21,991	22,142	22,290	22,435	22,578	22,718	22,854	22,991	
Hudson	60,568	60,990	61,391	61,614	61,970	62,314	62,665	63,006	63,343	63,666	63,993	
Hunterdon	5,795	5,854	5,897	5,924	5,962	6,000	6,038	6,074	6,109	6,144	6,178	
Mercer	24,726	24,930	25,044	25,166	25,312	25,456	25,600	25,740	25,878	26,017	26,152	
Middlesex	63,029	63,619	63,956	64,349	64,794	65,223	65,657	66,081	66,505	66,929	67,349	
Monmouth	48,350	48,804	49,109	49,378	49,746	50,113	50,476	50,822	51,168	51,506	51,843	
Morris	31,732	32,052	32,317	32,528	32,825	33,124	33,421	33,714	34,012	34,305	34,592	
Ocean	49,418	49,860	50,229	50,501	50,895	51,276	51,663	52,041	52,416	52,795	53,160	
Passaic	50,725	50,976	51,262	51,620	51,889	52,157	52,424	52,696	52,966	53,241	53,509	
Somerset	19,678	19,802	19,946	20,032	20,151	20,270	20,388	20,503	20,618	20,730	20,841	
Sussex	7,724	7,801	7,847	7,900	7,960	8,018	8,075	8,129	8,184	8,237	8,288	
Union	50,685	50,966	51,257	51,441	51,671	51,902	52,126	52,343	52,563	52,773	52,982	
Warren	5,985	6,048	6,078	6,123	6,167	6,212	6,254	6,297	6,338	6,379	6,420	

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:											
	1/29	1/30	1/31	2/1	2/3			2/5			2/7					
Bergen	66,318	66,836	67,253	67,609	68,469	(13,694)	[3,287]	{1,643}	69,333	(13,867)	[3,328]	{1,664}	70,172	(14,034)	[3,368]	{1,684}
Burlington	31,111	31,359	31,577	31,695	32,081	(6,416)	[1,540]	{770}	32,453	(6,491)	[1,558]	{779}	32,807	(6,561)	[1,575]	{787}
Camden	39,956	40,201	40,402	40,534	40,965	(8,193)	[1,966]	{983}	41,380	(8,276)	[1,986]	{993}	41,783	(8,357)	[2,006]	{1,003}
Essex	64,264	64,755	65,161	65,485	66,337	(13,267)	[3,184]	{1,592}	67,193	(13,439)	[3,225]	{1,613}	68,028	(13,606)	[3,265]	{1,633}
Gloucester	21,650	21,803	21,907	21,991	22,290	(4,458)	[1,070]	{535}	22,578	(4,516)	[1,084]	{542}	22,854	(4,571)	[1,097]	{548}
Hudson	60,568	60,990	61,391	61,614	62,314	(12,463)	[2,991]	{1,496}	63,006	(12,601)	[3,024]	{1,512}	63,666	(12,733)	[3,056]	{1,528}
Hunterdon	5,795	5,854	5,897	5,924	6,000	(1,200)	[288]	{144}	6,074	(1,215)	[292]	{146}	6,144	(1,229)	[295]	{147}
Mercer	24,726	24,930	25,044	25,166	25,456	(5,091)	[1,222]	{611}	25,740	(5,148)	[1,236]	{618}	26,017	(5,203)	[1,249]	{624}
Middlesex	63,029	63,619	63,956	64,349	65,223	(13,045)	[3,131]	{1,565}	66,081	(13,216)	[3,172]	{1,586}	66,929	(13,386)	[3,213]	{1,606}
Monmouth	48,350	48,804	49,109	49,378	50,113	(10,023)	[2,405]	{1,203}	50,822	(10,164)	[2,439]	{1,220}	51,506	(10,301)	[2,472]	{1,236}
Morris	31,732	32,052	32,317	32,528	33,124	(6,625)	[1,590]	{795}	33,714	(6,743)	[1,618]	{809}	34,305	(6,861)	[1,647]	{823}
Ocean	49,418	49,860	50,229	50,501	51,276	(10,255)	[2,461]	{1,231}	52,041	(10,408)	[2,498]	{1,249}	52,795	(10,559)	[2,534]	{1,267}
Passaic	50,725	50,976	51,262	51,620	52,157	(10,431)	[2,504]	{1,252}	52,696	(10,539)	[2,529]	{1,265}	53,241	(10,648)	[2,556]	{1,278}
Somerset	19,678	19,802	19,946	20,032	20,270	(4,054)	[973]	{486}	20,503	(4,101)	[984]	{492}	20,730	(4,146)	[995]	{498}
Sussex	7,724	7,801	7,847	7,900	8,018	(1,604)	[385]	{192}	8,129	(1,626)	[390]	{195}	8,237	(1,647)	[395]	{198}
Union	50,685	50,966	51,257	51,441	51,902	(10,380)	[2,491]	{1,246}	52,343	(10,469)	[2,512]	{1,256}	52,773	(10,555)	[2,533]	{1,267}
Warren	5,985	6,048	6,078	6,123	6,212	(1,242)	[298]	{149}	6,297	(1,259)	[302]	{151}	6,379	(1,276)	[306]	{153}

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.