

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

Date: 1/25/21

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 1/25/21 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.

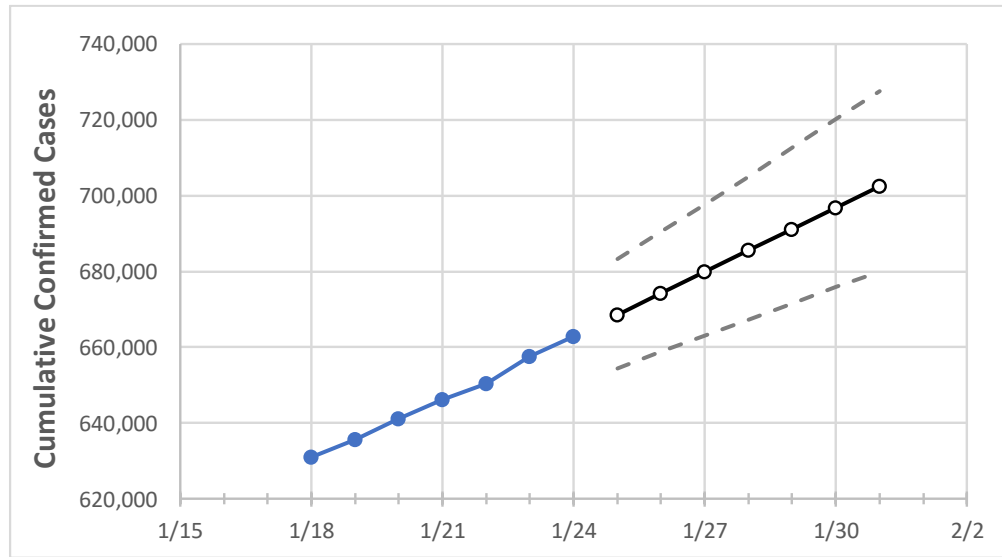
IEM's Modeling Lead

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:							
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	
New Jersey	646,189	650,389	657,536	662,808	668,427	674,153	679,828	685,531	691,168	696,835	702,441	

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:							
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	
Bergen	62,551	62,908	63,563	64,044	64,572	65,094	65,628	66,169	66,686	67,226	67,758	
Burlington	29,277	29,458	29,765	30,050	30,323	30,590	30,863	31,130	31,398	31,667	31,934	
Camden	37,755	38,036	38,416	38,713	39,004	39,298	39,588	39,883	40,167	40,454	40,735	
Essex	60,526	60,812	61,381	61,919	62,389	62,868	63,343	63,822	64,301	64,797	65,272	
Gloucester	20,206	20,357	20,585	20,749	20,939	21,131	21,324	21,518	21,715	21,906	22,098	
Hudson	57,220	57,553	58,143	58,640	59,111	59,584	60,054	60,528	61,000	61,479	61,961	
Hunterdon	5,421	5,468	5,551	5,593	5,656	5,724	5,791	5,858	5,925	5,990	6,059	
Mercer	23,409	23,532	23,774	23,972	24,150	24,330	24,514	24,701	24,888	25,073	25,263	
Middlesex	59,094	59,468	60,084	60,635	61,161	61,687	62,204	62,734	63,246	63,762	64,289	
Monmouth	44,877	45,267	45,865	46,254	46,725	47,198	47,670	48,141	48,613	49,091	49,556	
Morris	29,185	29,478	29,881	30,102	30,391	30,683	30,979	31,280	31,577	31,878	32,182	
Ocean	45,813	46,186	46,813	47,232	47,715	48,195	48,672	49,162	49,668	50,154	50,654	
Passaic	48,691	48,879	49,260	49,500	49,779	50,056	50,346	50,639	50,924	51,218	51,511	
Somerset	18,565	18,695	18,858	19,025	19,187	19,351	19,518	19,684	19,850	20,016	20,183	
Sussex	7,099	7,185	7,287	7,374	7,476	7,578	7,677	7,780	7,883	7,987	8,088	
Union	48,515	48,741	49,139	49,404	49,753	50,090	50,433	50,777	51,127	51,471	51,810	
Warren	5,568	5,626	5,694	5,741	5,795	5,849	5,903	5,956	6,010	6,062	6,113	

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:											
	1/21	1/22	1/23	1/24	1/26			1/28			1/30					
Bergen	62,551	62,908	63,563	64,044	65,094	(13,019)	[3,125]	{1,562}	66,169	(13,234)	[3,176]	{1,588}	67,226	(13,445)	[3,227]	{1,613}
Burlington	29,277	29,458	29,765	30,050	30,590	(6,118)	[1,468]	{734}	31,130	(6,226)	[1,494]	{747}	31,667	(6,333)	[1,520]	{760}
Camden	37,755	38,036	38,416	38,713	39,298	(7,860)	[1,886]	{943}	39,883	(7,977)	[1,914]	{957}	40,454	(8,091)	[1,942]	{971}
Essex	60,526	60,812	61,381	61,919	62,868	(12,574)	[3,018]	{1,509}	63,822	(12,764)	[3,063]	{1,532}	64,797	(12,959)	[3,110]	{1,555}
Gloucester	20,206	20,357	20,585	20,749	21,131	(4,226)	[1,014]	{507}	21,518	(4,304)	[1,033]	{516}	21,906	(4,381)	[1,051]	{526}
Hudson	57,220	57,553	58,143	58,640	59,584	(11,917)	[2,860]	{1,430}	60,528	(12,106)	[2,905]	{1,453}	61,479	(12,296)	[2,951]	{1,475}
Hunterdon	5,421	5,468	5,551	5,593	5,724	(1,145)	[275]	{137}	5,858	(1,172)	[281]	{141}	5,990	(1,198)	[288]	{144}
Mercer	23,409	23,532	23,774	23,972	24,330	(4,866)	[1,168]	{584}	24,701	(4,940)	[1,186]	{593}	25,073	(5,015)	[1,204]	{602}
Middlesex	59,094	59,468	60,084	60,635	61,687	(12,337)	[2,961]	{1,480}	62,734	(12,547)	[3,011]	{1,506}	63,762	(12,752)	[3,061]	{1,530}
Monmouth	44,877	45,267	45,865	46,254	47,198	(9,440)	[2,265]	{1,133}	48,141	(9,628)	[2,311]	{1,155}	49,091	(9,818)	[2,356]	{1,178}
Morris	29,185	29,478	29,881	30,102	30,683	(6,137)	[1,473]	{736}	31,280	(6,256)	[1,501]	{751}	31,878	(6,376)	[1,530]	{765}
Ocean	45,813	46,186	46,813	47,232	48,195	(9,639)	[2,313]	{1,157}	49,162	(9,832)	[2,360]	{1,180}	50,154	(10,031)	[2,407]	{1,204}
Passaic	48,691	48,879	49,260	49,500	50,056	(10,011)	[2,403]	{1,201}	50,639	(10,128)	[2,431]	{1,215}	51,218	(10,244)	[2,458]	{1,229}
Somerset	18,565	18,695	18,858	19,025	19,351	(3,870)	[929]	{464}	19,684	(3,937)	[945]	{472}	20,016	(4,003)	[961]	{480}
Sussex	7,099	7,185	7,287	7,374	7,578	(1,516)	[364]	{182}	7,780	(1,556)	[373]	{187}	7,987	(1,597)	[383]	{192}
Union	48,515	48,741	49,139	49,404	50,090	(10,018)	[2,404]	{1,202}	50,777	(10,155)	[2,437]	{1,219}	51,471	(10,294)	[2,471]	{1,235}
Warren	5,568	5,626	5,694	5,741	5,849	(1,170)	[281]	{140}	5,956	(1,191)	[286]	{143}	6,062	(1,212)	[291]	{145}

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.