

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

Date: 1/7/21

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 1/7/21 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.

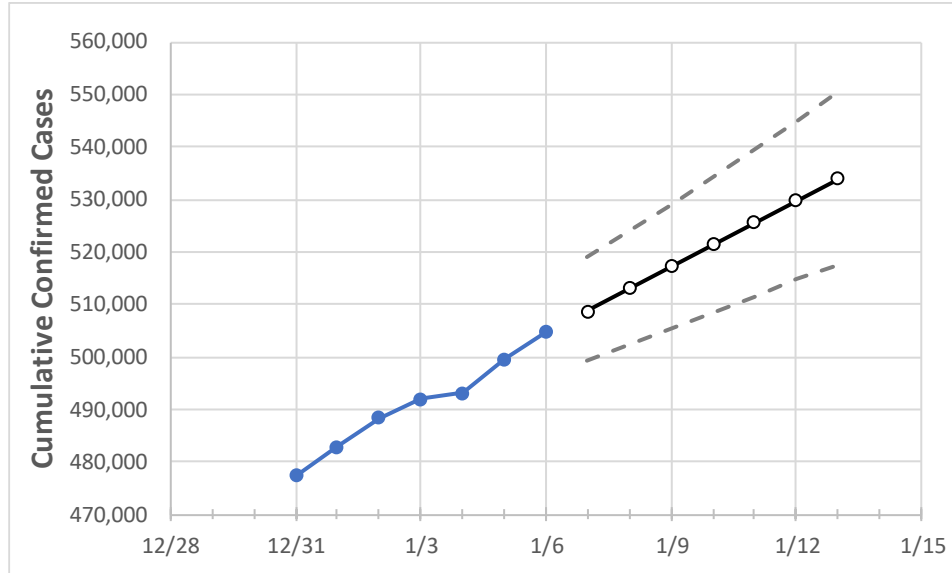
IEM's Modeling Lead

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:						
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13
New Jersey	492,042	493,102	499,636	504,647	508,761	513,010	517,151	521,311	525,539	529,715	533,931

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:							
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	
Bergen	48,302	48,486	48,953	49,480	49,854	50,233	50,610	50,989	51,371	51,747	52,130	
Burlington	21,996	22,099	22,484	22,788	23,044	23,303	23,560	23,822	24,090	24,358	24,622	
Camden	29,475	29,615	29,924	30,242	30,484	30,724	30,965	31,211	31,453	31,690	31,927	
Essex	48,379	48,518	48,879	49,329	49,626	49,910	50,197	50,490	50,780	51,055	51,327	
Gloucester	14,595	14,690	14,918	15,169	15,325	15,484	15,649	15,812	15,972	16,137	16,303	
Hudson	45,226	45,384	45,852	46,291	46,655	47,012	47,384	47,751	48,115	48,473	48,830	
Hunterdon	3,882	3,914	3,981	4,020	4,061	4,101	4,141	4,181	4,222	4,264	4,305	
Mercer	19,204	19,284	19,519	19,707	19,850	19,994	20,139	20,281	20,426	20,569	20,716	
Middlesex	46,256	46,676	47,095	47,560	47,991	48,420	48,850	49,280	49,716	50,140	50,571	
Monmouth	33,165	33,472	33,778	34,193	34,564	34,932	35,298	35,658	36,024	36,395	36,777	
Morris	20,880	21,068	21,255	21,426	21,604	21,780	21,956	22,129	22,306	22,478	22,650	
Ocean	33,718	34,049	34,379	34,741	35,127	35,513	35,903	36,294	36,687	37,090	37,488	
Passaic	40,619	40,821	41,023	41,267	41,441	41,614	41,785	41,955	42,123	42,284	42,440	
Somerset	13,003	13,096	13,189	13,303	13,404	13,506	13,607	13,710	13,813	13,915	14,014	
Sussex	4,715	4,770	4,825	4,883	4,953	5,024	5,095	5,166	5,239	5,310	5,382	
Union	37,298	37,467	37,635	37,849	38,036	38,221	38,400	38,580	38,758	38,939	39,111	
Warren	4,078	4,121	4,163	4,197	4,240	4,284	4,328	4,371	4,413	4,455	4,498	

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:											
	1/3	1/4	1/5	1/6	1/8				1/10				1/12			
Bergen	48,302	48,486	48,953	49,480	50,233	(10,047)	[2,411]	{1,206}	50,989	(10,198)	[2,447]	{1,224}	51,747	(10,349)	[2,484]	{1,242}
Burlington	21,996	22,099	22,484	22,788	23,303	(4,661)	[1,119]	{559}	23,822	(4,764)	[1,143]	{572}	24,358	(4,872)	[1,169]	{585}
Camden	29,475	29,615	29,924	30,242	30,724	(6,145)	[1,475]	{737}	31,211	(6,242)	[1,498]	{749}	31,690	(6,338)	[1,521]	{761}
Essex	48,379	48,518	48,879	49,329	49,910	(9,982)	[2,396]	{1,198}	50,490	(10,098)	[2,424]	{1,212}	51,055	(10,211)	[2,451]	{1,225}
Gloucester	14,595	14,690	14,918	15,169	15,484	(3,097)	[743]	{372}	15,812	(3,162)	[759]	{379}	16,137	(3,227)	[775]	{387}
Hudson	45,226	45,384	45,852	46,291	47,012	(9,402)	[2,257]	{1,128}	47,751	(9,550)	[2,292]	{1,146}	48,473	(9,695)	[2,327]	{1,163}
Hunterdon	3,882	3,914	3,981	4,020	4,101	(820)	[197]	{98}	4,181	(836)	[201]	{100}	4,264	(853)	[205]	{102}
Mercer	19,204	19,284	19,519	19,707	19,994	(3,999)	[960]	{480}	20,281	(4,056)	[973]	{487}	20,569	(4,114)	[987]	{494}
Middlesex	46,256	46,676	47,095	47,560	48,420	(9,684)	[2,324]	{1,162}	49,280	(9,856)	[2,365]	{1,183}	50,140	(10,028)	[2,407]	{1,203}
Monmouth	33,165	33,472	33,778	34,193	34,932	(6,986)	[1,677]	{838}	35,658	(7,132)	[1,712]	{856}	36,395	(7,279)	[1,747]	{873}
Morris	20,880	21,068	21,255	21,426	21,780	(4,356)	[1,045]	{523}	22,129	(4,426)	[1,062]	{531}	22,478	(4,496)	[1,079]	{539}
Ocean	33,718	34,049	34,379	34,741	35,513	(7,103)	[1,705]	{852}	36,294	(7,259)	[1,742]	{871}	37,090	(7,418)	[1,780]	{890}
Passaic	40,619	40,821	41,023	41,267	41,614	(8,323)	[1,997]	{999}	41,955	(8,391)	[2,014]	{1,007}	42,284	(8,457)	[2,030]	{1,015}
Somerset	13,003	13,096	13,189	13,303	13,506	(2,701)	[648]	{324}	13,710	(2,742)	[658]	{329}	13,915	(2,783)	[668]	{334}
Sussex	4,715	4,770	4,825	4,883	5,024	(1,005)	[241]	{121}	5,166	(1,033)	[248]	{124}	5,310	(1,062)	[255]	{127}
Union	37,298	37,467	37,635	37,849	38,221	(7,644)	[1,835]	{917}	38,580	(7,716)	[1,852]	{926}	38,939	(7,788)	[1,869]	{935}
Warren	4,078	4,121	4,163	4,197	4,284	(857)	[206]	{103}	4,371	(874)	[210]	{105}	4,455	(891)	[214]	{107}

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.