

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

Date: 1/6/21

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 1/6/21 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.

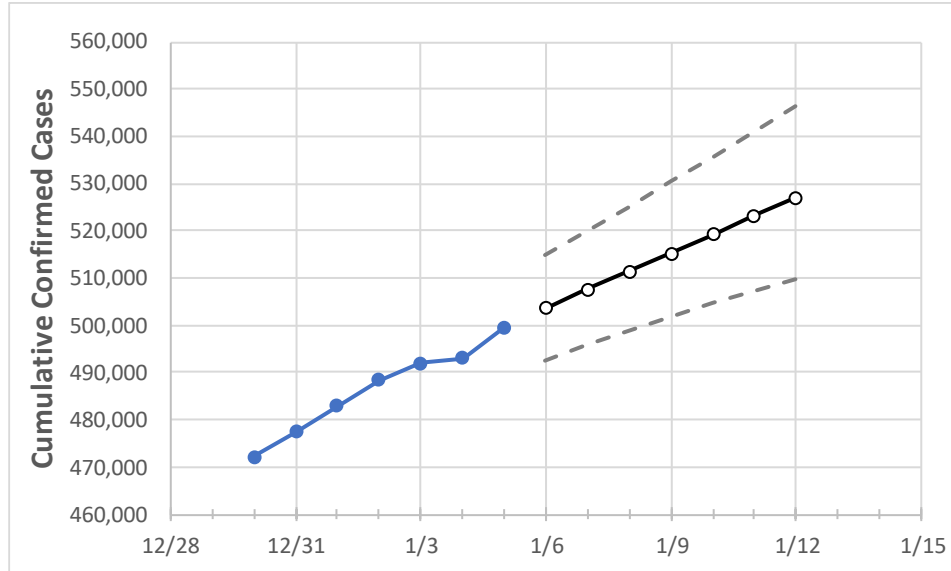
IEM's Modeling Lead

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:						
	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12
New Jersey	488,372	492,042	493,102	499,636	503,595	507,575	511,505	515,288	519,154	523,128	527,050

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:						
	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12
Bergen	48,002	48,302	48,486	48,953	49,311	49,677	50,046	50,408	50,766	51,126	51,486
Burlington	21,777	21,996	22,099	22,484	22,733	22,979	23,230	23,484	23,738	23,997	24,243
Camden	29,278	29,475	29,615	29,924	30,160	30,397	30,627	30,855	31,083	31,303	31,530
Essex	48,070	48,379	48,518	48,879	49,162	49,440	49,719	50,004	50,272	50,548	50,823
Gloucester	14,491	14,595	14,690	14,918	15,067	15,212	15,360	15,508	15,656	15,796	15,940
Hudson	44,886	45,226	45,384	45,852	46,209	46,558	46,909	47,272	47,622	47,977	48,317
Hunterdon	3,868	3,882	3,914	3,981	4,023	4,066	4,109	4,151	4,195	4,239	4,282
Mercer	19,092	19,204	19,284	19,519	19,647	19,771	19,893	20,016	20,139	20,261	20,383
Middlesex	45,805	46,256	46,676	47,095	47,515	47,934	48,349	48,765	49,184	49,607	50,021
Monmouth	32,812	33,165	33,472	33,778	34,139	34,503	34,857	35,224	35,581	35,947	36,310
Morris	20,659	20,880	21,068	21,255	21,439	21,626	21,805	21,990	22,172	22,359	22,538
Ocean	33,423	33,718	34,049	34,379	34,761	35,143	35,530	35,914	36,310	36,698	37,095
Passaic	40,406	40,619	40,821	41,023	41,197	41,370	41,540	41,700	41,864	42,024	42,184
Somerset	12,908	13,003	13,096	13,189	13,292	13,395	13,498	13,598	13,695	13,795	13,896
Sussex	4,639	4,715	4,770	4,825	4,896	4,969	5,043	5,118	5,195	5,270	5,345
Union	37,158	37,298	37,467	37,635	37,821	38,006	38,191	38,368	38,543	38,717	38,891
Warren	4,047	4,078	4,121	4,163	4,207	4,252	4,297	4,341	4,387	4,430	4,472

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:											
	1/2	1/3	1/4	1/5	1/7				1/9				1/11			
Bergen	48,002	48,302	48,486	48,953	49,677	(9,935)	[2,384]	{1,192}	50,408	(10,082)	[2,420]	{1,210}	51,126	(10,225)	[2,454]	{1,227}
Burlington	21,777	21,996	22,099	22,484	22,979	(4,596)	[1,103]	{552}	23,484	(4,697)	[1,127]	{564}	23,997	(4,799)	[1,152]	{576}
Camden	29,278	29,475	29,615	29,924	30,397	(6,079)	[1,459]	{730}	30,855	(6,171)	[1,481]	{741}	31,303	(6,261)	[1,503]	{751}
Essex	48,070	48,379	48,518	48,879	49,440	(9,888)	[2,373]	{1,187}	50,004	(10,001)	[2,400]	{1,200}	50,548	(10,110)	[2,426]	{1,213}
Gloucester	14,491	14,595	14,690	14,918	15,212	(3,042)	[730]	{365}	15,508	(3,102)	[744]	{372}	15,796	(3,159)	[758]	{379}
Hudson	44,886	45,226	45,384	45,852	46,558	(9,312)	[2,235]	{1,117}	47,272	(9,454)	[2,269]	{1,135}	47,977	(9,595)	[2,303]	{1,151}
Hunterdon	3,868	3,882	3,914	3,981	4,066	(813)	[195]	{98}	4,151	(830)	[199]	{100}	4,239	(848)	[203]	{102}
Mercer	19,092	19,204	19,284	19,519	19,771	(3,954)	[949]	{475}	20,016	(4,003)	[961]	{480}	20,261	(4,052)	[973]	{486}
Middlesex	45,805	46,256	46,676	47,095	47,934	(9,587)	[2,301]	{1,150}	48,765	(9,753)	[2,341]	{1,170}	49,607	(9,921)	[2,381]	{1,191}
Monmouth	32,812	33,165	33,472	33,778	34,503	(6,901)	[1,656]	{828}	35,224	(7,045)	[1,691]	{845}	35,947	(7,189)	[1,725]	{863}
Morris	20,659	20,880	21,068	21,255	21,626	(4,325)	[1,038]	{519}	21,990	(4,398)	[1,055]	{528}	22,359	(4,472)	[1,073]	{537}
Ocean	33,423	33,718	34,049	34,379	35,143	(7,029)	[1,687]	{843}	35,914	(7,183)	[1,724]	{862}	36,698	(7,340)	[1,762]	{881}
Passaic	40,406	40,619	40,821	41,023	41,370	(8,274)	[1,986]	{993}	41,700	(8,340)	[2,002]	{1,001}	42,024	(8,405)	[2,017]	{1,009}
Somerset	12,908	13,003	13,096	13,189	13,395	(2,679)	[643]	{321}	13,598	(2,720)	[653]	{326}	13,795	(2,759)	[662]	{331}
Sussex	4,639	4,715	4,770	4,825	4,969	(994)	[238]	{119}	5,118	(1,024)	[246]	{123}	5,270	(1,054)	[253]	{126}
Union	37,158	37,298	37,467	37,635	38,006	(7,601)	[1,824]	{912}	38,368	(7,674)	[1,842]	{921}	38,717	(7,743)	[1,858]	{929}
Warren	4,047	4,078	4,121	4,163	4,252	(850)	[204]	{102}	4,341	(868)	[208]	{104}	4,430	(886)	[213]	{106}

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.