

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/21/20**

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 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 12/21/20 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.

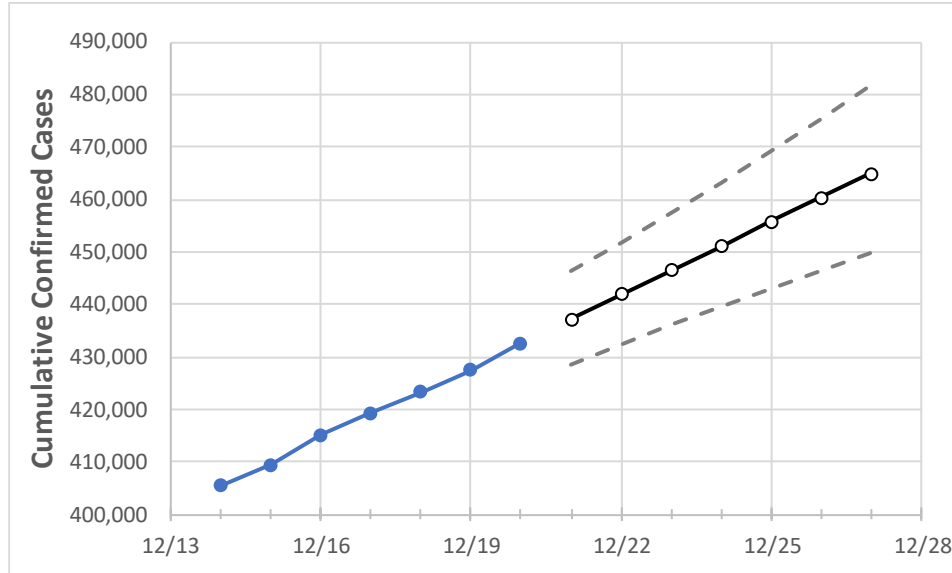
IEM's Modeling Lead

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:						
	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27
New Jersey	419,330	423,226	427,417	432,592	437,221	441,851	446,479	451,106	455,731	460,354	464,974

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:						
	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27
Bergen	42,008	42,401	42,751	43,119	43,463	43,804	44,140	44,473	44,802	45,128	45,450
Burlington	17,812	17,941	18,184	18,466	18,684	18,901	19,118	19,334	19,549	19,764	19,978
Camden	24,872	25,116	25,404	25,781	26,060	26,336	26,610	26,881	27,150	27,417	27,681
Essex	42,666	43,038	43,375	43,793	44,184	44,574	44,962	45,350	45,737	46,123	46,508
Gloucester	12,052	12,164	12,327	12,516	12,666	12,815	12,963	13,110	13,255	13,400	13,543
Hudson	38,675	39,076	39,390	39,769	40,135	40,500	40,862	41,221	41,579	41,934	42,287
Hunterdon	3,185	3,227	3,269	3,338	3,386	3,435	3,485	3,535	3,587	3,639	3,692
Mercer	16,897	16,998	17,138	17,349	17,523	17,696	17,870	18,045	18,219	18,394	18,568
Middlesex	38,857	39,220	39,647	40,232	40,758	41,291	41,830	42,375	42,927	43,485	44,049
Monmouth	26,824	27,157	27,563	27,954	28,350	28,749	29,153	29,560	29,971	30,386	30,806
Morris	17,547	17,721	17,882	18,119	18,337	18,554	18,772	18,989	19,206	19,423	19,639
Ocean	27,522	27,864	28,168	28,637	29,010	29,388	29,771	30,160	30,555	30,956	31,362
Passaic	36,690	36,988	37,236	37,488	37,782	38,071	38,355	38,634	38,908	39,177	39,441
Somerset	11,222	11,292	11,379	11,494	11,614	11,735	11,856	11,978	12,100	12,222	12,345
Sussex	3,555	3,616	3,669	3,747	3,808	3,869	3,931	3,994	4,057	4,121	4,186
Union	33,588	33,750	33,978	34,251	34,518	34,784	35,049	35,312	35,574	35,834	36,093
Warren	3,289	3,323	3,361	3,413	3,461	3,509	3,557	3,606	3,654	3,703	3,753

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:											
	12/17	12/18	12/19	12/20	12/22				12/24				12/26			
Bergen	42,008	42,401	42,751	43,119	43,804	(8,761)	[2,103]	{1,051}	44,473	(8,895)	[2,135]	{1,067}	45,128	(9,026)	[2,166]	{1,083}
Burlington	17,812	17,941	18,184	18,466	18,901	(3,780)	[907]	{454}	19,334	(3,867)	[928]	{464}	19,764	(3,953)	[949]	{474}
Camden	24,872	25,116	25,404	25,781	26,336	(5,267)	[1,264]	{632}	26,881	(5,376)	[1,290]	{645}	27,417	(5,483)	[1,316]	{658}
Essex	42,666	43,038	43,375	43,793	44,574	(8,915)	[2,140]	{1,070}	45,350	(9,070)	[2,177]	{1,088}	46,123	(9,225)	[2,214]	{1,107}
Gloucester	12,052	12,164	12,327	12,516	12,815	(2,563)	[615]	{308}	13,110	(2,622)	[629]	{315}	13,400	(2,680)	[643]	{322}
Hudson	38,675	39,076	39,390	39,769	40,500	(8,100)	[1,944]	{972}	41,221	(8,244)	[1,979]	{989}	41,934	(8,387)	[2,013]	{1,006}
Hunterdon	3,185	3,227	3,269	3,338	3,435	(687)	[165]	{82}	3,535	(707)	[170]	{85}	3,639	(728)	[175]	{87}
Mercer	16,897	16,998	17,138	17,349	17,696	(3,539)	[849]	{425}	18,045	(3,609)	[866]	{433}	18,394	(3,679)	[883]	{441}
Middlesex	38,857	39,220	39,647	40,232	41,291	(8,258)	[1,982]	{991}	42,375	(8,475)	[2,034]	{1,017}	43,485	(8,697)	[2,087]	{1,044}
Monmouth	26,824	27,157	27,563	27,954	28,749	(5,750)	[1,380]	{690}	29,560	(5,912)	[1,419]	{709}	30,386	(6,077)	[1,459]	{729}
Morris	17,547	17,721	17,882	18,119	18,554	(3,711)	[891]	{445}	18,989	(3,798)	[911]	{456}	19,423	(3,885)	[932]	{466}
Ocean	27,522	27,864	28,168	28,637	29,388	(5,878)	[1,411]	{705}	30,160	(6,032)	[1,448]	{724}	30,956	(6,191)	[1,486]	{743}
Passaic	36,690	36,988	37,236	37,488	38,071	(7,614)	[1,827]	{914}	38,634	(7,727)	[1,854]	{927}	39,177	(7,835)	[1,880]	{940}
Somerset	11,222	11,292	11,379	11,494	11,735	(2,347)	[563]	{282}	11,978	(2,396)	[575]	{287}	12,222	(2,444)	[587]	{293}
Sussex	3,555	3,616	3,669	3,747	3,869	(774)	[186]	{93}	3,994	(799)	[192]	{96}	4,121	(824)	[198]	{99}
Union	33,588	33,750	33,978	34,251	34,784	(6,957)	[1,670]	{835}	35,312	(7,062)	[1,695]	{847}	35,834	(7,167)	[1,720]	{860}
Warren	3,289	3,323	3,361	3,413	3,509	(702)	[168]	{84}	3,606	(721)	[173]	{87}	3,703	(741)	[178]	{89}

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.