

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

Date: 9/21/20

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 9/21/20 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.

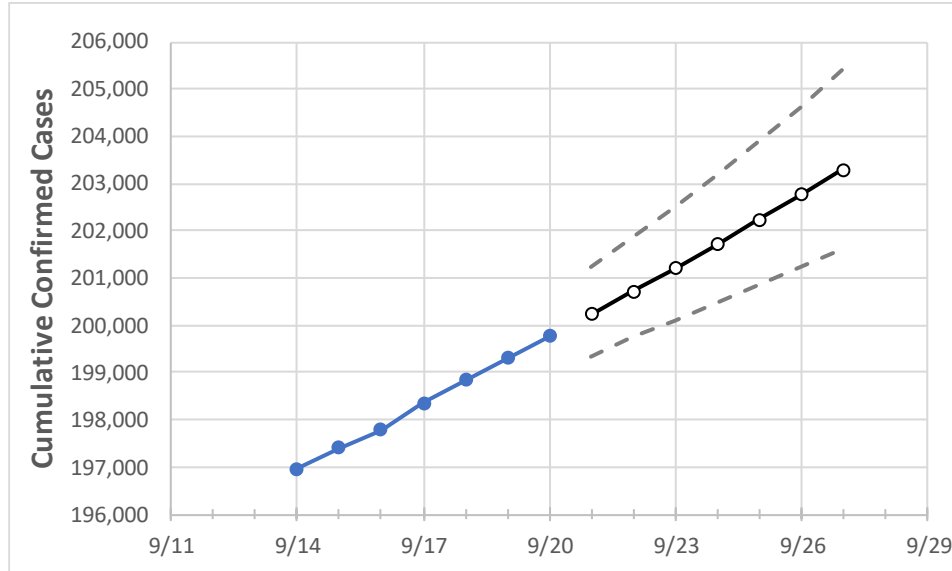
IEM's Modeling Lead

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:							
	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	
New Jersey	198,361	198,848	199,309	199,762	200,234	200,717	201,211	201,716	202,233	202,761	203,301	

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:							
	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	
Bergen	22,087	22,119	22,145	22,168	22,189	22,210	22,231	22,252	22,273	22,294	22,314	
Burlington	6,830	6,862	6,901	6,930	6,963	6,998	7,034	7,071	7,109	7,149	7,190	
Camden	9,607	9,633	9,667	9,707	9,738	9,769	9,801	9,834	9,867	9,901	9,936	
Essex	20,749	20,773	20,803	20,833	20,858	20,883	20,908	20,934	20,960	20,986	21,013	
Gloucester	4,222	4,258	4,281	4,313	4,354	4,397	4,440	4,485	4,531	4,578	4,627	
Hudson	20,437	20,454	20,468	20,482	20,497	20,512	20,526	20,541	20,556	20,571	20,586	
Hunterdon	1,275	1,277	1,282	1,286	1,290	1,293	1,297	1,301	1,305	1,309	1,313	
Mercer	8,534	8,544	8,563	8,567	8,577	8,586	8,596	8,606	8,615	8,625	8,635	
Middlesex	18,971	19,016	19,050	19,089	19,132	19,177	19,223	19,271	19,320	19,371	19,425	
Monmouth	11,358	11,403	11,438	11,500	11,549	11,601	11,654	11,710	11,768	11,828	11,891	
Morris	7,697	7,706	7,718	7,742	7,754	7,767	7,779	7,792	7,805	7,819	7,832	
Ocean	12,005	12,095	12,182	12,241	12,311	12,384	12,461	12,541	12,625	12,713	12,806	
Passaic	18,749	18,774	18,799	18,822	18,845	18,869	18,893	18,917	18,942	18,966	18,991	
Somerset	5,629	5,671	5,685	5,691	5,709	5,728	5,748	5,769	5,791	5,815	5,839	
Sussex	1,430	1,431	1,450	1,452	1,454	1,457	1,459	1,462	1,464	1,467	1,469	
Union	17,367	17,390	17,415	17,440	17,458	17,477	17,496	17,515	17,535	17,555	17,576	
Warren	1,424	1,428	1,428	1,428	1,431	1,433	1,436	1,439	1,442	1,445	1,448	

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:											
	9/17	9/18	9/19	9/20	9/22				9/24				9/26			
Bergen	22,087	22,119	22,145	22,168	22,210	(4,442)	[1,066]	{533}	22,252	(4,450)	[1,068]	{534}	22,294	(4,459)	[1,070]	{535}
Burlington	6,830	6,862	6,901	6,930	6,998	(1,400)	[336]	{168}	7,071	(1,414)	[339]	{170}	7,149	(1,430)	[343]	{172}
Camden	9,607	9,633	9,667	9,707	9,769	(1,954)	[469]	{234}	9,834	(1,967)	[472]	{236}	9,901	(1,980)	[475]	{238}
Essex	20,749	20,773	20,803	20,833	20,883	(4,177)	[1,002]	{501}	20,934	(4,187)	[1,005]	{502}	20,986	(4,197)	[1,007]	{504}
Gloucester	4,222	4,258	4,281	4,313	4,397	(879)	[211]	{106}	4,485	(897)	[215]	{108}	4,578	(916)	[220]	{110}
Hudson	20,437	20,454	20,468	20,482	20,512	(4,102)	[985]	{492}	20,541	(4,108)	[986]	{493}	20,571	(4,114)	[987]	{494}
Hunterdon	1,275	1,277	1,282	1,286	1,293	(259)	[62]	{31}	1,301	(260)	[62]	{31}	1,309	(262)	[63]	{31}
Mercer	8,534	8,544	8,563	8,567	8,586	(1,717)	[412]	{206}	8,606	(1,721)	[413]	{207}	8,625	(1,725)	[414]	{207}
Middlesex	18,971	19,016	19,050	19,089	19,177	(3,835)	[920]	{460}	19,271	(3,854)	[925]	{462}	19,371	(3,874)	[930]	{465}
Monmouth	11,358	11,403	11,438	11,500	11,601	(2,320)	[557]	{278}	11,710	(2,342)	[562]	{281}	11,828	(2,366)	[568]	{284}
Morris	7,697	7,706	7,718	7,742	7,767	(1,553)	[373]	{186}	7,792	(1,558)	[374]	{187}	7,819	(1,564)	[375]	{188}
Ocean	12,005	12,095	12,182	12,241	12,384	(2,477)	[594]	{297}	12,541	(2,508)	[602]	{301}	12,713	(2,543)	[610]	{305}
Passaic	18,749	18,774	18,799	18,822	18,869	(3,774)	[906]	{453}	18,917	(3,783)	[908]	{454}	18,966	(3,793)	[910]	{455}
Somerset	5,629	5,671	5,685	5,691	5,728	(1,146)	[275]	{137}	5,769	(1,154)	[277]	{138}	5,815	(1,163)	[279]	{140}
Sussex	1,430	1,431	1,450	1,452	1,457	(291)	[70]	{35}	1,462	(292)	[70]	{35}	1,467	(293)	[70]	{35}
Union	17,367	17,390	17,415	17,440	17,477	(3,495)	[839]	{419}	17,515	(3,503)	[841]	{420}	17,555	(3,511)	[843]	{421}
Warren	1,424	1,428	1,428	1,428	1,433	(287)	[69]	{34}	1,439	(288)	[69]	{35}	1,445	(289)	[69]	{35}

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.