

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

Date: 2/11/21

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 2/11/21 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.

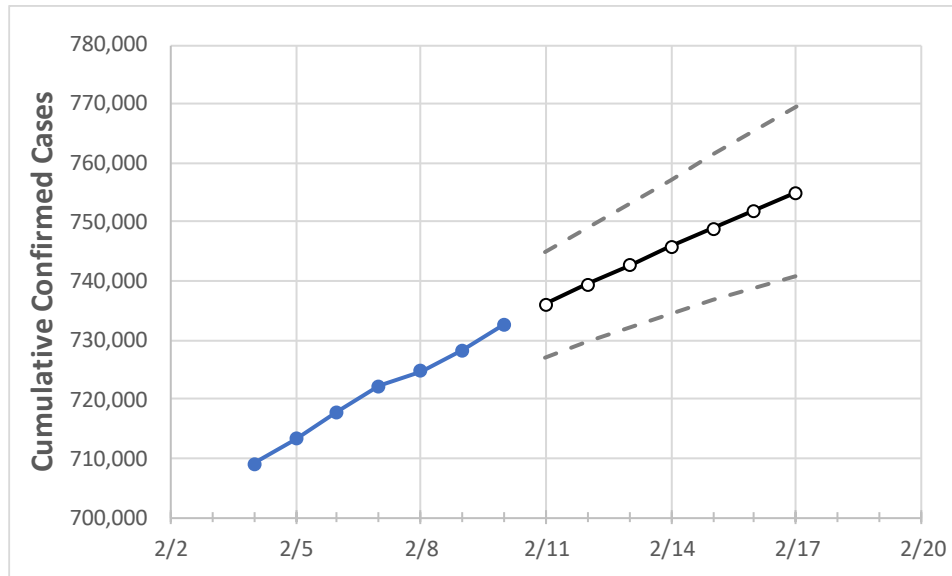
IEM's Modeling Lead

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
New Jersey	722,167	724,728	728,304	732,674	736,099	739,441	742,704	745,773	748,929	751,921	754,930

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Bergen	69,951	70,209	70,526	70,978	71,339	71,690	72,039	72,378	72,717	73,048	73,373
Burlington	32,811	32,919	33,056	33,215	33,364	33,511	33,655	33,794	33,931	34,061	34,190
Camden	41,419	41,517	41,638	41,843	41,969	42,088	42,202	42,311	42,419	42,519	42,616
Essex	67,316	67,620	67,893	68,413	68,747	69,079	69,400	69,717	70,030	70,333	70,637
Gloucester	22,579	22,645	22,720	22,834	22,910	22,984	23,056	23,125	23,190	23,253	23,311
Hudson	63,293	63,457	63,736	64,105	64,355	64,602	64,841	65,067	65,294	65,509	65,724
Hunterdon	6,183	6,200	6,252	6,293	6,329	6,365	6,401	6,436	6,470	6,505	6,540
Mercer	25,812	25,922	26,024	26,154	26,254	26,356	26,451	26,546	26,639	26,729	26,818
Middlesex	66,494	66,773	67,157	67,578	67,926	68,258	68,590	68,910	69,233	69,549	69,851
Monmouth	51,104	51,350	51,693	52,017	52,289	52,546	52,799	53,048	53,291	53,527	53,761
Morris	33,849	34,003	34,209	34,421	34,632	34,844	35,050	35,252	35,453	35,650	35,844
Ocean	52,585	52,781	53,278	53,580	53,897	54,211	54,524	54,836	55,142	55,432	55,730
Passaic	52,866	52,987	53,188	53,576	53,787	53,992	54,205	54,418	54,620	54,825	55,018
Somerset	20,728	20,812	20,917	21,046	21,152	21,255	21,358	21,459	21,559	21,657	21,754
Sussex	8,200	8,242	8,279	8,344	8,385	8,426	8,465	8,503	8,540	8,574	8,609
Union	52,602	52,736	52,919	53,193	53,363	53,533	53,700	53,863	54,023	54,174	54,331
Warren	6,394	6,421	6,456	6,491	6,528	6,565	6,602	6,637	6,672	6,706	6,740

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:											
	2/7	2/8	2/9	2/10	2/12			2/14			2/16					
Bergen	69,951	70,209	70,526	70,978	71,690	(14,338)	[3,441]	{1,721}	72,378	(14,476)	[3,474]	{1,737}	73,048	(14,610)	[3,506]	{1,753}
Burlington	32,811	32,919	33,056	33,215	33,511	(6,702)	[1,609]	{804}	33,794	(6,759)	[1,622]	{811}	34,061	(6,812)	[1,635]	{817}
Camden	41,419	41,517	41,638	41,843	42,088	(8,418)	[2,020]	{1,010}	42,311	(8,462)	[2,031]	{1,015}	42,519	(8,504)	[2,041]	{1,020}
Essex	67,316	67,620	67,893	68,413	69,079	(13,816)	[3,316]	{1,658}	69,717	(13,943)	[3,346]	{1,673}	70,333	(14,067)	[3,376]	{1,688}
Gloucester	22,579	22,645	22,720	22,834	22,984	(4,597)	[1,103]	{552}	23,125	(4,625)	[1,110]	{555}	23,253	(4,651)	[1,116]	{558}
Hudson	63,293	63,457	63,736	64,105	64,602	(12,920)	[3,101]	{1,550}	65,067	(13,013)	[3,123]	{1,562}	65,509	(13,102)	[3,144]	{1,572}
Hunterdon	6,183	6,200	6,252	6,293	6,365	(1,273)	[306]	{153}	6,436	(1,287)	[309]	{154}	6,505	(1,301)	[312]	{156}
Mercer	25,812	25,922	26,024	26,154	26,356	(5,271)	[1,265]	{633}	26,546	(5,309)	[1,274]	{637}	26,729	(5,346)	[1,283]	{641}
Middlesex	66,494	66,773	67,157	67,578	68,258	(13,652)	[3,276]	{1,638}	68,910	(13,782)	[3,308]	{1,654}	69,549	(13,910)	[3,338]	{1,669}
Monmouth	51,104	51,350	51,693	52,017	52,546	(10,509)	[2,522]	{1,261}	53,048	(10,610)	[2,546]	{1,273}	53,527	(10,705)	[2,569]	{1,285}
Morris	33,849	34,003	34,209	34,421	34,844	(6,969)	[1,673]	{836}	35,252	(7,050)	[1,692]	{846}	35,650	(7,130)	[1,711]	{856}
Ocean	52,585	52,781	53,278	53,580	54,211	(10,842)	[2,602]	{1,301}	54,836	(10,967)	[2,632]	{1,316}	55,432	(11,086)	[2,661]	{1,330}
Passaic	52,866	52,987	53,188	53,576	53,992	(10,798)	[2,592]	{1,296}	54,418	(10,884)	[2,612]	{1,306}	54,825	(10,965)	[2,632]	{1,316}
Somerset	20,728	20,812	20,917	21,046	21,255	(4,251)	[1,020]	{510}	21,459	(4,292)	[1,030]	{515}	21,657	(4,331)	[1,040]	{520}
Sussex	8,200	8,242	8,279	8,344	8,426	(1,685)	[404]	{202}	8,503	(1,701)	[408]	{204}	8,574	(1,715)	[412]	{206}
Union	52,602	52,736	52,919	53,193	53,533	(10,707)	[2,570]	{1,285}	53,863	(10,773)	[2,585]	{1,293}	54,174	(10,835)	[2,600]	{1,300}
Warren	6,394	6,421	6,456	6,491	6,565	(1,313)	[315]	{158}	6,637	(1,327)	[319]	{159}	6,706	(1,341)	[322]	{161}

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.