

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

Date: 4/21/21

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 4/21/21 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.

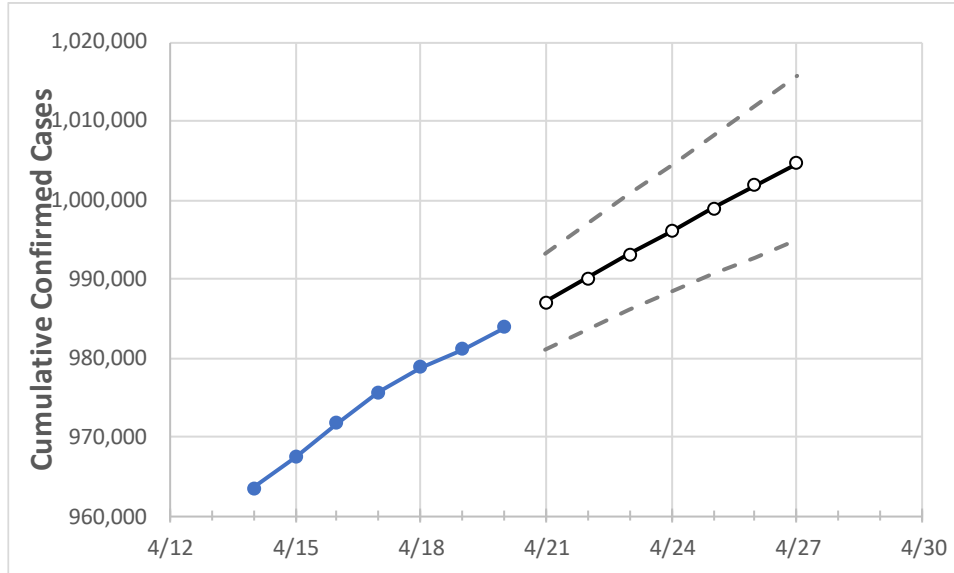
IEM's Modeling Lead

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:						
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27

New Jersey 975,704 978,853 981,036 983,875 986,993 990,070 993,148 996,096 998,998 1,001,905 1,004,699

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:						
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27
Bergen	98,258	98,483	98,660	98,913	99,177	99,428	99,677	99,920	100,155	100,381	100,604
Burlington	42,701	42,825	42,935	43,041	43,170	43,296	43,420	43,541	43,661	43,778	43,894
Camden	52,121	52,289	52,431	52,591	52,771	52,949	53,130	53,310	53,483	53,658	53,837
Essex	92,333	92,705	92,965	93,295	93,656	94,021	94,382	94,739	95,089	95,442	95,778
Gloucester	28,837	28,909	28,973	29,057	29,161	29,266	29,369	29,471	29,573	29,677	29,781
Hudson	85,384	85,684	85,856	86,072	86,337	86,600	86,857	87,111	87,363	87,611	87,852
Hunterdon	9,205	9,243	9,268	9,304	9,340	9,375	9,410	9,443	9,475	9,508	9,538
Mercer	32,664	32,737	32,806	32,885	32,974	33,063	33,149	33,234	33,319	33,402	33,484
Middlesex	89,737	90,031	90,241	90,508	90,821	91,124	91,428	91,730	92,027	92,321	92,612
Monmouth	72,910	73,105	73,288	73,468	73,691	73,908	74,119	74,328	74,538	74,740	74,930
Morris	48,371	48,521	48,603	48,746	48,895	49,040	49,184	49,324	49,460	49,594	49,725
Ocean	73,030	73,180	73,305	73,493	73,671	73,840	74,000	74,160	74,314	74,465	74,612
Passaic	69,152	69,502	69,658	69,858	70,116	70,378	70,628	70,887	71,147	71,409	71,661
Somerset	28,703	28,803	28,864	28,958	29,047	29,133	29,218	29,301	29,382	29,461	29,538
Sussex	13,085	13,133	13,179	13,229	13,290	13,352	13,411	13,467	13,521	13,575	13,628
Union	68,498	68,754	68,915	69,121	69,343	69,564	69,780	69,997	70,211	70,426	70,642
Warren	9,272	9,308	9,327	9,364	9,410	9,455	9,499	9,544	9,589	9,633	9,677

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:											
	4/17	4/18	4/19	4/20	4/22			4/24			4/26					
Bergen	98,258	98,483	98,660	98,913	99,428	(19,886)	[4,773]	{2,386}	99,920	(19,984)	[4,796]	{2,398}	100,381	(20,076)	[4,818]	{2,409}
Burlington	42,701	42,825	42,935	43,041	43,296	(8,659)	[2,078]	{1,039}	43,541	(8,708)	[2,090]	{1,045}	43,778	(8,756)	[2,101]	{1,051}
Camden	52,121	52,289	52,431	52,591	52,949	(10,590)	[2,542]	{1,271}	53,310	(10,662)	[2,559]	{1,279}	53,658	(10,732)	[2,576]	{1,288}
Essex	92,333	92,705	92,965	93,295	94,021	(18,804)	[4,513]	{2,257}	94,739	(18,948)	[4,547]	{2,274}	95,442	(19,088)	[4,581]	{2,291}
Gloucester	28,837	28,909	28,973	29,057	29,266	(5,853)	[1,405]	{702}	29,471	(5,894)	[1,415]	{707}	29,677	(5,935)	[1,424]	{712}
Hudson	85,384	85,684	85,856	86,072	86,600	(17,320)	[4,157]	{2,078}	87,111	(17,422)	[4,181]	{2,091}	87,611	(17,522)	[4,205]	{2,103}
Hunterdon	9,205	9,243	9,268	9,304	9,375	(1,875)	[450]	{225}	9,443	(1,889)	[453]	{227}	9,508	(1,902)	[456]	{228}
Mercer	32,664	32,737	32,806	32,885	33,063	(6,613)	[1,587]	{794}	33,234	(6,647)	[1,595]	{798}	33,402	(6,680)	[1,603]	{802}
Middlesex	89,737	90,031	90,241	90,508	91,124	(18,225)	[4,374]	{2,187}	91,730	(18,346)	[4,403]	{2,202}	92,321	(18,464)	[4,431]	{2,216}
Monmouth	72,910	73,105	73,288	73,468	73,908	(14,782)	[3,548]	{1,774}	74,328	(14,866)	[3,568]	{1,784}	74,740	(14,948)	[3,587]	{1,794}
Morris	48,371	48,521	48,603	48,746	49,040	(9,808)	[2,354]	{1,177}	49,324	(9,865)	[2,368]	{1,184}	49,594	(9,919)	[2,381]	{1,190}
Ocean	73,030	73,180	73,305	73,493	73,840	(14,768)	[3,544]	{1,772}	74,160	(14,832)	[3,560]	{1,780}	74,465	(14,893)	[3,574]	{1,787}
Passaic	69,152	69,502	69,658	69,858	70,378	(14,076)	[3,378]	{1,689}	70,887	(14,177)	[3,403]	{1,701}	71,409	(14,282)	[3,428]	{1,714}
Somerset	28,703	28,803	28,864	28,958	29,133	(5,827)	[1,398]	{699}	29,301	(5,860)	[1,406]	{703}	29,461	(5,892)	[1,414]	{707}
Sussex	13,085	13,133	13,179	13,229	13,352	(2,670)	[641]	{320}	13,467	(2,693)	[646]	{323}	13,575	(2,715)	[652]	{326}
Union	68,498	68,754	68,915	69,121	69,564	(13,913)	[3,339]	{1,670}	69,997	(13,999)	[3,360]	{1,680}	70,426	(14,085)	[3,380]	{1,690}
Warren	9,272	9,308	9,327	9,364	9,455	(1,891)	[454]	{227}	9,544	(1,909)	[458]	{229}	9,633	(1,927)	[462]	{231}

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.