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

Date: 4/29/21

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 4/29/21 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.

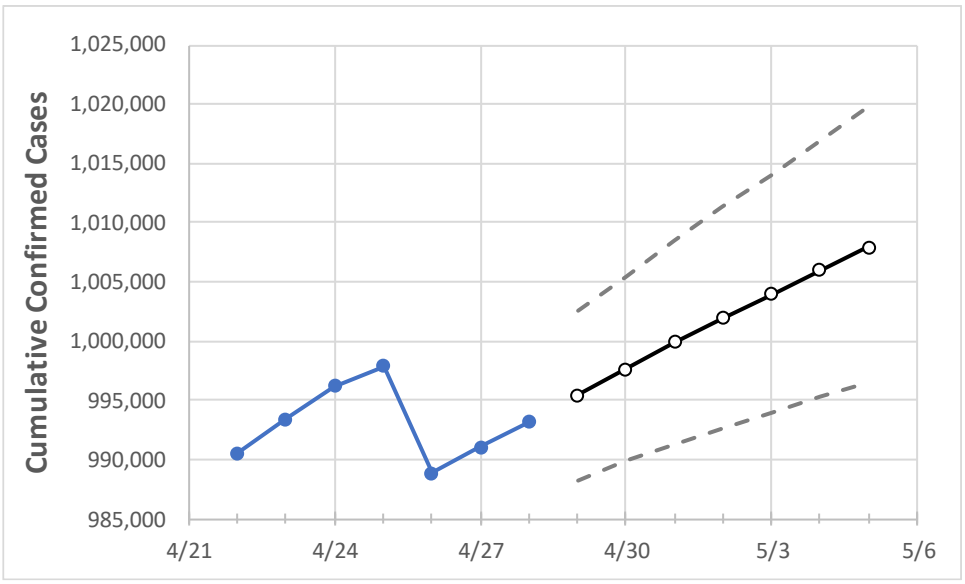
IEM's Modeling Lead

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:						
	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5
New Jersey	997,891	988,886	991,010	993,123	995,414	997,664	999,877	1,001,962	1,003,952	1,005,978	1,007,928

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:						
	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5
Bergen	100,210	100,215	100,407	100,594	100,774	100,950	101,119	101,282	101,432	101,578	101,723
Burlington	43,622	43,469	43,558	43,615	43,700	43,785	43,866	43,944	44,020	44,094	44,163
Camden	53,460	53,297	53,423	53,565	53,719	53,870	54,017	54,161	54,303	54,443	54,583
Essex	94,947	92,122	92,343	92,581	92,848	93,109	93,360	93,607	93,851	94,086	94,312
Gloucester	29,492	29,331	29,396	29,466	29,535	29,600	29,664	29,727	29,786	29,844	29,901
Hudson	87,333	86,004	86,186	86,360	86,564	86,759	86,958	87,152	87,336	87,511	87,685
Hunterdon	9,437	9,438	9,464	9,482	9,500	9,518	9,535	9,551	9,566	9,581	9,594
Mercer	33,304	33,006	33,069	33,143	33,211	33,280	33,346	33,410	33,473	33,536	33,597
Middlesex	91,810	90,090	90,300	90,486	90,696	90,898	91,089	91,276	91,461	91,639	91,811
Monmouth	74,408	73,835	73,934	74,048	74,187	74,323	74,452	74,576	74,698	74,811	74,920
Morris	49,346	49,070	49,171	49,242	49,335	49,423	49,510	49,591	49,669	49,748	49,820
Ocean	74,234	74,133	74,236	74,355	74,465	74,570	74,668	74,767	74,858	74,948	75,031
Passaic	71,102	70,760	70,940	71,184	71,400	71,616	71,827	72,032	72,233	72,439	72,635
Somerset	29,334	29,161	29,242	29,288	29,349	29,408	29,468	29,523	29,576	29,627	29,677
Sussex	13,462	13,390	13,428	13,461	13,497	13,531	13,564	13,596	13,625	13,654	13,682
Union	70,053	69,545	69,712	69,881	70,051	70,218	70,381	70,536	70,691	70,847	70,995
Warren	9,573	9,560	9,590	9,620	9,653	9,685	9,715	9,745	9,775	9,804	9,832

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:		
	4/25	4/26	4/27	4/28	4/30	5/2	5/4
Bergen	100,210	100,215	100,407	100,594	100,950 (20,190) [4,846] {2,423}	101,282 (20,256) [4,862] {2,431}	101,578 (20,316) [4,876] {2,438}
Burlington	43,622	43,469	43,558	43,615	43,785 (8,757) [2,102] {1,051}	43,944 (8,789) [2,109] {1,055}	44,094 (8,819) [2,117] {1,058}
Camden	53,460	53,297	53,423	53,565	53,870 (10,774) [2,586] {1,293}	54,161 (10,832) [2,600] {1,300}	54,443 (10,889) [2,613] {1,307}
Essex	94,947	92,122	92,343	92,581	93,109 (18,622) [4,469] {2,235}	93,607 (18,721) [4,493] {2,247}	94,086 (18,817) [4,516] {2,258}
Gloucester	29,492	29,331	29,396	29,466	29,600 (5,920) [1,421] {710}	29,727 (5,945) [1,427] {713}	29,844 (5,969) [1,432] {716}
Hudson	87,333	86,004	86,186	86,360	86,759 (17,352) [4,164] {2,082}	87,152 (17,430) [4,183] {2,092}	87,511 (17,502) [4,201] {2,100}
Hunterdon	9,437	9,438	9,464	9,482	9,518 (1,904) [457] {228}	9,551 (1,910) [458] {229}	9,581 (1,916) [460] {230}
Mercer	33,304	33,006	33,069	33,143	33,280 (6,656) [1,597] {799}	33,410 (6,682) [1,604] {802}	33,536 (6,707) [1,610] {805}
Middlesex	91,810	90,090	90,300	90,486	90,898 (18,180) [4,363] {2,182}	91,276 (18,255) [4,381] {2,191}	91,639 (18,328) [4,399] {2,199}
Monmouth	74,408	73,835	73,934	74,048	74,323 (14,865) [3,568] {1,784}	74,576 (14,915) [3,580] {1,790}	74,811 (14,962) [3,591] {1,795}
Morris	49,346	49,070	49,171	49,242	49,423 (9,885) [2,372] {1,186}	49,591 (9,918) [2,380] {1,190}	49,748 (9,950) [2,388] {1,194}
Ocean	74,234	74,133	74,236	74,355	74,570 (14,914) [3,579] {1,790}	74,767 (14,953) [3,589] {1,794}	74,948 (14,990) [3,597] {1,799}
Passaic	71,102	70,760	70,940	71,184	71,616 (14,323) [3,438] {1,719}	72,032 (14,406) [3,458] {1,729}	72,439 (14,488) [3,477] {1,739}
Somerset	29,334	29,161	29,242	29,288	29,408 (5,882) [1,412] {706}	29,523 (5,905) [1,417] {709}	29,627 (5,925) [1,422] {711}
Sussex	13,462	13,390	13,428	13,461	13,531 (2,706) [650] {325}	13,596 (2,719) [653] {326}	13,654 (2,731) [655] {328}
Union	70,053	69,545	69,712	69,881	70,218 (14,044) [3,370] {1,685}	70,536 (14,107) [3,386] {1,693}	70,847 (14,169) [3,401] {1,700}
Warren	9,573	9,560	9,590	9,620	9,685 (1,937) [465] {232}	9,745 (1,949) [468] {234}	9,804 (1,961) [471] {235}

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.