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

Date: 4/13/21

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 4/13/21 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.

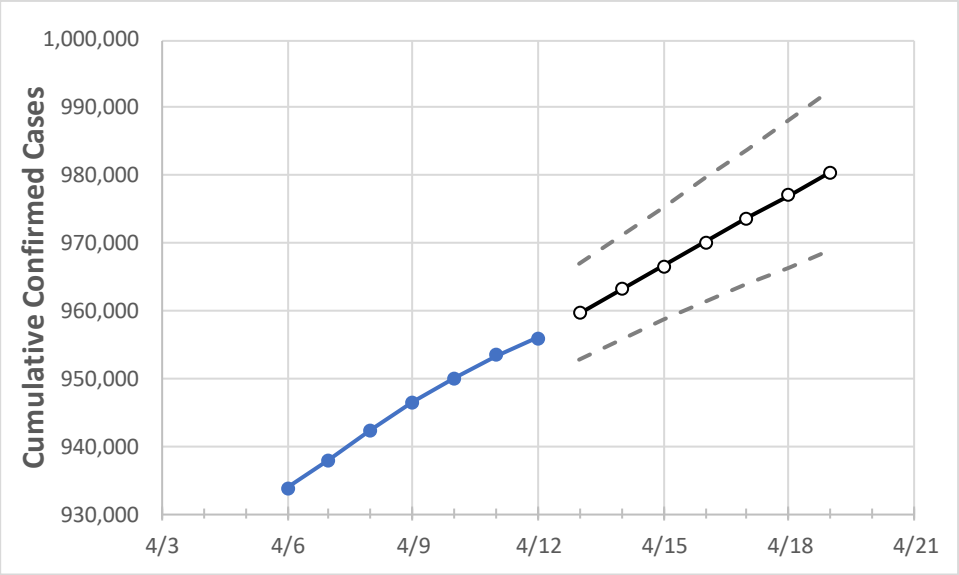
IEM's Modeling Lead

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:						
	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19
New Jersey	946,504	950,103	953,490	955,958	959,583	963,170	966,648	970,160	973,673	977,035	980,436

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:						
	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19
Bergen	95,466	95,842	96,164	96,411	96,783	97,155	97,519	97,881	98,235	98,581	98,926
Burlington	41,460	41,621	41,771	41,879	42,042	42,206	42,368	42,527	42,684	42,840	42,996
Camden	50,540	50,750	50,927	51,077	51,273	51,469	51,666	51,864	52,068	52,266	52,475
Essex	89,101	89,447	89,823	90,059	90,468	90,877	91,284	91,685	92,095	92,504	92,915
Gloucester	27,861	27,976	28,088	28,181	28,289	28,399	28,509	28,620	28,728	28,839	28,948
Hudson	82,940	83,219	83,500	83,701	84,007	84,309	84,611	84,910	85,195	85,487	85,769
Hunterdon	8,855	8,904	8,940	8,965	9,013	9,060	9,107	9,153	9,198	9,242	9,285
Mercer	31,845	31,947	32,041	32,143	32,251	32,360	32,470	32,577	32,687	32,796	32,903
Middlesex	86,962	87,310	87,582	87,830	88,186	88,541	88,907	89,260	89,618	89,976	90,323
Monmouth	70,788	71,096	71,353	71,517	71,784	72,043	72,300	72,546	72,794	73,039	73,281
Morris	46,886	47,040	47,243	47,358	47,537	47,714	47,889	48,061	48,229	48,394	48,551
Ocean	71,264	71,523	71,768	71,927	72,202	72,465	72,725	72,980	73,234	73,481	73,731
Passaic	66,943	67,167	67,353	67,536	67,797	68,054	68,312	68,569	68,821	69,071	69,329
Somerset	27,870	28,007	28,088	28,150	28,260	28,366	28,471	28,579	28,681	28,783	28,883
Sussex	12,423	12,507	12,600	12,661	12,748	12,834	12,920	13,004	13,086	13,170	13,254
Union	66,609	66,826	67,048	67,191	67,440	67,681	67,925	68,163	68,404	68,638	68,874
Warren	8,836	8,907	8,961	8,995	9,039	9,083	9,127	9,171	9,215	9,258	9,302

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:		
	4/9	4/10	4/11	4/12	4/14	4/16	4/18
Bergen	95,466	95,842	96,164	96,411	97,155 (19,431) [4,663] {2,332}	97,881 (19,576) [4,698] {2,349}	98,581 (19,716) [4,732] {2,366}
Burlington	41,460	41,621	41,771	41,879	42,206 (8,441) [2,026] {1,013}	42,527 (8,505) [2,041] {1,021}	42,840 (8,568) [2,056] {1,028}
Camden	50,540	50,750	50,927	51,077	51,469 (10,294) [2,471] {1,235}	51,864 (10,373) [2,489] {1,245}	52,266 (10,453) [2,509] {1,254}
Essex	89,101	89,447	89,823	90,059	90,877 (18,175) [4,362] {2,181}	91,685 (18,337) [4,401] {2,200}	92,504 (18,501) [4,440] {2,220}
Gloucester	27,861	27,976	28,088	28,181	28,399 (5,680) [1,363] {682}	28,620 (5,724) [1,374] {687}	28,839 (5,768) [1,384] {692}
Hudson	82,940	83,219	83,500	83,701	84,309 (16,862) [4,047] {2,023}	84,910 (16,982) [4,076] {2,038}	85,487 (17,097) [4,103] {2,052}
Hunterdon	8,855	8,904	8,940	8,965	9,060 (1,812) [435] {217}	9,153 (1,831) [439] {220}	9,242 (1,848) [444] {222}
Mercer	31,845	31,947	32,041	32,143	32,360 (6,472) [1,553] {777}	32,577 (6,515) [1,564] {782}	32,796 (6,559) [1,574] {787}
Middlesex	86,962	87,310	87,582	87,830	88,541 (17,708) [4,250] {2,125}	89,260 (17,852) [4,284] {2,142}	89,976 (17,995) [4,319] {2,159}
Monmouth	70,788	71,096	71,353	71,517	72,043 (14,409) [3,458] {1,729}	72,546 (14,509) [3,482] {1,741}	73,039 (14,608) [3,506] {1,753}
Morris	46,886	47,040	47,243	47,358	47,714 (9,543) [2,290] {1,145}	48,061 (9,612) [2,307] {1,153}	48,394 (9,679) [2,323] {1,161}
Ocean	71,264	71,523	71,768	71,927	72,465 (14,493) [3,478] {1,739}	72,980 (14,596) [3,503] {1,752}	73,481 (14,696) [3,527] {1,764}
Passaic	66,943	67,167	67,353	67,536	68,054 (13,611) [3,267] {1,633}	68,569 (13,714) [3,291] {1,646}	69,071 (13,814) [3,315] {1,658}
Somerset	27,870	28,007	28,088	28,150	28,366 (5,673) [1,362] {681}	28,579 (5,716) [1,372] {686}	28,783 (5,757) [1,382] {691}
Sussex	12,423	12,507	12,600	12,661	12,834 (2,567) [616] {308}	13,004 (2,601) [624] {312}	13,170 (2,634) [632] {316}
Union	66,609	66,826	67,048	67,191	67,681 (13,536) [3,249] {1,624}	68,163 (13,633) [3,272] {1,636}	68,638 (13,728) [3,295] {1,647}
Warren	8,836	8,907	8,961	8,995	9,083 (1,817) [436] {218}	9,171 (1,834) [440] {220}	9,258 (1,852) [444] {222}

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.