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

Date: 11/3/21

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 11/3/21 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.

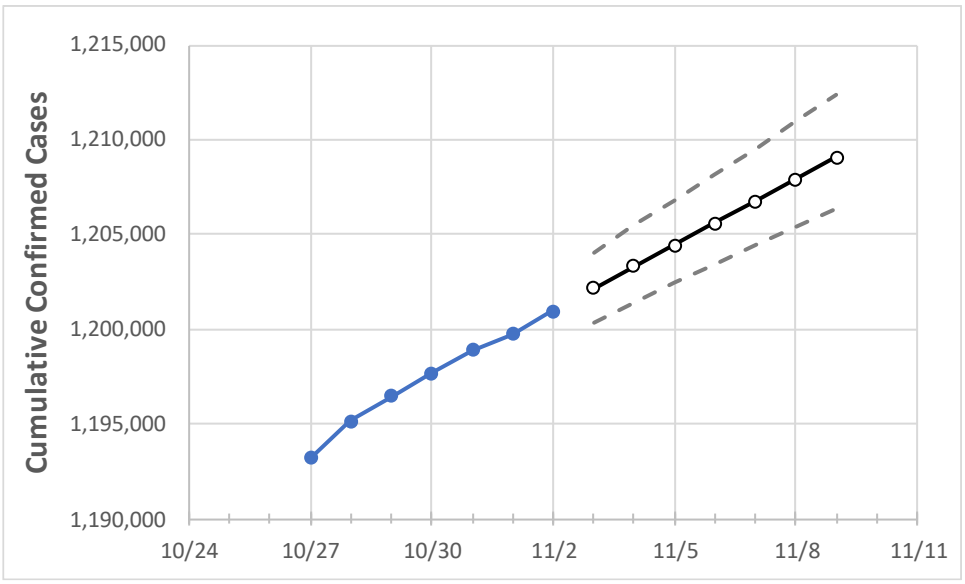
IEM's Modeling Lead

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:						
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9
New Jersey	1,197,702	1,198,917	1,199,738	1,200,953	1,202,146	1,203,303	1,204,448	1,205,597	1,206,781	1,207,909	1,209,052

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:						
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9
Bergen	120,023	120,092	120,162	120,240	120,336	120,431	120,525	120,620	120,715	120,809	120,904
Burlington	54,903	54,959	55,007	55,080	55,158	55,236	55,310	55,388	55,463	55,538	55,617
Camden	68,273	68,368	68,441	68,526	68,612	68,698	68,786	68,871	68,959	69,045	69,128
Essex	106,292	106,366	106,411	106,509	106,561	106,614	106,663	106,715	106,766	106,818	106,869
Gloucester	38,489	38,570	38,609	38,683	38,746	38,808	38,872	38,935	38,999	39,063	39,124
Hudson	97,517	97,586	97,624	97,678	97,733	97,785	97,838	97,889	97,942	97,997	98,049
Hunterdon	12,072	12,086	12,096	12,110	12,127	12,144	12,160	12,176	12,193	12,209	12,224
Mercer	39,590	39,636	39,658	39,718	39,765	39,813	39,860	39,909	39,956	40,005	40,052
Middlesex	106,431	106,507	106,555	106,624	106,704	106,784	106,861	106,936	107,012	107,089	107,166
Monmouth	92,576	92,695	92,776	92,855	92,966	93,074	93,182	93,292	93,398	93,508	93,615
Morris	58,122	58,187	58,235	58,322	58,381	58,442	58,499	58,560	58,619	58,682	58,740
Ocean	95,612	95,781	95,884	96,031	96,182	96,333	96,487	96,633	96,782	96,931	97,080
Passaic	81,867	81,923	81,958	82,006	82,069	82,131	82,188	82,248	82,312	82,374	82,436
Somerset	34,914	34,946	34,963	34,986	35,011	35,035	35,059	35,084	35,107	35,131	35,154
Sussex	17,406	17,435	17,457	17,501	17,537	17,574	17,609	17,647	17,684	17,721	17,756
Union	79,683	79,726	79,767	79,813	79,855	79,896	79,936	79,978	80,019	80,061	80,101
Warren	12,203	12,221	12,237	12,259	12,281	12,301	12,322	12,342	12,363	12,384	12,404

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:		
	10/30	10/31	11/1	11/2	11/4	11/6	11/8
Bergen	120,023	120,092	120,162	120,240	120,431 (24,086) [5,781] {2,890}	120,620 (24,124) [5,790] {2,895}	120,809 (24,162) [5,799] {2,899}
Burlington	54,903	54,959	55,007	55,080	55,236 (11,047) [2,651] {1,326}	55,388 (11,078) [2,659] {1,329}	55,538 (11,108) [2,666] {1,333}
Camden	68,273	68,368	68,441	68,526	68,698 (13,740) [3,298] {1,649}	68,871 (13,774) [3,306] {1,653}	69,045 (13,809) [3,314] {1,657}
Essex	106,292	106,366	106,411	106,509	106,614 (21,323) [5,117] {2,559}	106,715 (21,343) [5,122] {2,561}	106,818 (21,364) [5,127] {2,564}
Gloucester	38,489	38,570	38,609	38,683	38,808 (7,762) [1,863] {931}	38,935 (7,787) [1,869] {934}	39,063 (7,813) [1,875] {938}
Hudson	97,517	97,586	97,624	97,678	97,785 (19,557) [4,694] {2,347}	97,889 (19,578) [4,699] {2,349}	97,997 (19,599) [4,704] {2,352}
Hunterdon	12,072	12,086	12,096	12,110	12,144 (2,429) [583] {291}	12,176 (2,435) [584] {292}	12,209 (2,442) [586] {293}
Mercer	39,590	39,636	39,658	39,718	39,813 (7,963) [1,911] {956}	39,909 (7,982) [1,916] {958}	40,005 (8,001) [1,920] {960}
Middlesex	106,431	106,507	106,555	106,624	106,784 (21,357) [5,126] {2,563}	106,936 (21,387) [5,133] {2,566}	107,089 (21,418) [5,140] {2,570}
Monmouth	92,576	92,695	92,776	92,855	93,074 (18,615) [4,468] {2,234}	93,292 (18,658) [4,478] {2,239}	93,508 (18,702) [4,488] {2,244}
Morris	58,122	58,187	58,235	58,322	58,442 (11,688) [2,805] {1,403}	58,560 (11,712) [2,811] {1,405}	58,682 (11,736) [2,817] {1,408}
Ocean	95,612	95,781	95,884	96,031	96,333 (19,267) [4,624] {2,312}	96,633 (19,327) [4,638] {2,319}	96,931 (19,386) [4,653] {2,326}
Passaic	81,867	81,923	81,958	82,006	82,131 (16,426) [3,942] {1,971}	82,248 (16,450) [3,948] {1,974}	82,374 (16,475) [3,954] {1,977}
Somerset	34,914	34,946	34,963	34,986	35,035 (7,007) [1,682] {841}	35,084 (7,017) [1,684] {842}	35,131 (7,026) [1,686] {843}
Sussex	17,406	17,435	17,457	17,501	17,574 (3,515) [844] {422}	17,647 (3,529) [847] {424}	17,721 (3,544) [851] {425}
Union	79,683	79,726	79,767	79,813	79,896 (15,979) [3,835] {1,918}	79,978 (15,996) [3,839] {1,919}	80,061 (16,012) [3,843] {1,921}
Warren	12,203	12,221	12,237	12,259	12,301 (2,460) [590] {295}	12,342 (2,468) [592] {296}	12,384 (2,477) [594] {297}

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.