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

Date: 8/13/21

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 8/13/21 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.

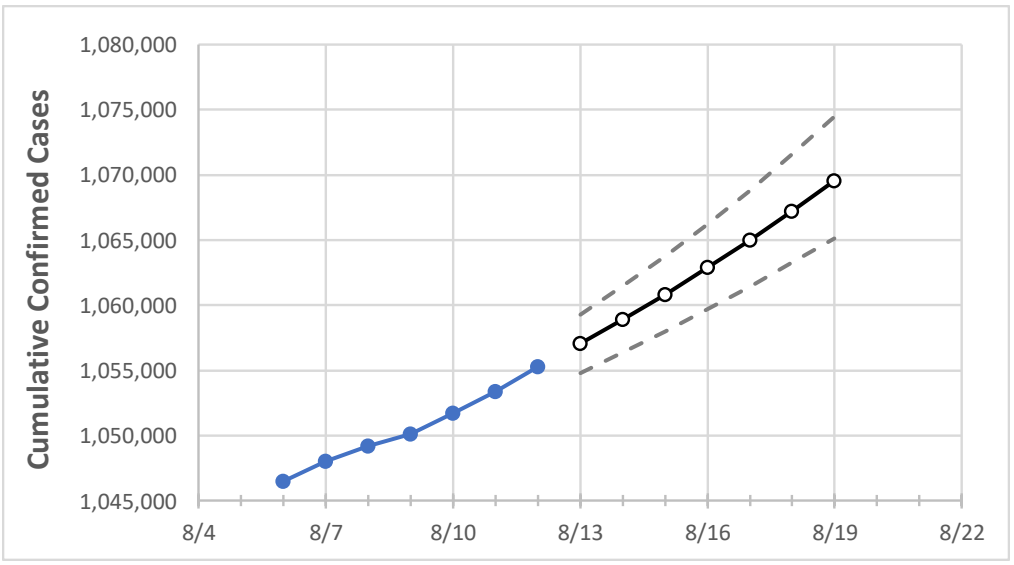
IEM's Modeling Lead

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:						
	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19
New Jersey	1,050,083	1,051,712	1,053,398	1,055,252	1,057,036	1,058,897	1,060,841	1,062,872	1,065,006	1,067,215	1,069,522

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:						
	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19
Bergen	107,533	107,723	107,878	108,073	108,239	108,413	108,595	108,785	108,982	109,186	109,404
Burlington	45,867	45,978	46,092	46,202	46,324	46,453	46,590	46,735	46,890	47,052	47,224
Camden	57,562	57,657	57,747	57,857	57,990	58,132	58,284	58,445	58,618	58,803	58,995
Essex	96,858	97,014	97,174	97,340	97,489	97,645	97,808	97,980	98,158	98,347	98,542
Gloucester	31,589	31,649	31,695	31,776	31,843	31,914	31,987	32,067	32,149	32,237	32,329
Hudson	90,252	90,382	90,479	90,620	90,761	90,909	91,063	91,227	91,400	91,582	91,769
Hunterdon	10,229	10,237	10,252	10,270	10,291	10,313	10,336	10,361	10,385	10,412	10,439
Mercer	34,898	34,945	35,016	35,064	35,121	35,181	35,245	35,313	35,385	35,462	35,545
Middlesex	94,845	94,929	95,072	95,265	95,404	95,545	95,689	95,841	95,998	96,164	96,332
Monmouth	79,441	79,638	79,825	79,966	80,142	80,323	80,508	80,699	80,894	81,096	81,306
Morris	51,599	51,649	51,712	51,802	51,878	51,958	52,041	52,126	52,217	52,311	52,413
Ocean	78,717	78,827	78,960	79,102	79,225	79,354	79,490	79,630	79,778	79,929	80,084
Passaic	74,732	74,816	74,888	74,948	75,021	75,098	75,177	75,259	75,346	75,431	75,522
Somerset	31,061	31,104	31,155	31,221	31,274	31,330	31,388	31,450	31,514	31,581	31,652
Sussex	14,452	14,469	14,475	14,490	14,509	14,528	14,548	14,568	14,589	14,611	14,634
Union	73,310	73,390	73,485	73,603	73,704	73,809	73,922	74,037	74,160	74,290	74,424
Warren	10,201	10,207	10,223	10,236	10,248	10,261	10,275	10,290	10,305	10,321	10,339

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:		
	8/9	8/10	8/11	8/12	8/14	8/16	8/18
Bergen	107,533	107,723	107,878	108,073	108,413 (21,683) [5,204] {2,602}	108,785 (21,757) [5,222] {2,611}	109,186 (21,837) [5,241] {2,620}
Burlington	45,867	45,978	46,092	46,202	46,453 (9,291) [2,230] {1,115}	46,735 (9,347) [2,243] {1,122}	47,052 (9,410) [2,259] {1,129}
Camden	57,562	57,657	57,747	57,857	58,132 (11,626) [2,790] {1,395}	58,445 (11,689) [2,805] {1,403}	58,803 (11,761) [2,823] {1,411}
Essex	96,858	97,014	97,174	97,340	97,645 (19,529) [4,687] {2,343}	97,980 (19,596) [4,703] {2,352}	98,347 (19,669) [4,721] {2,360}
Gloucester	31,589	31,649	31,695	31,776	31,914 (6,383) [1,532] {766}	32,067 (6,413) [1,539] {770}	32,237 (6,447) [1,547] {774}
Hudson	90,252	90,382	90,479	90,620	90,909 (18,182) [4,364] {2,182}	91,227 (18,245) [4,379] {2,189}	91,582 (18,316) [4,396] {2,198}
Hunterdon	10,229	10,237	10,252	10,270	10,313 (2,063) [495] {248}	10,361 (2,072) [497] {249}	10,412 (2,082) [500] {250}
Mercer	34,898	34,945	35,016	35,064	35,181 (7,036) [1,689] {844}	35,313 (7,063) [1,695] {848}	35,462 (7,092) [1,702] {851}
Middlesex	94,845	94,929	95,072	95,265	95,545 (19,109) [4,586] {2,293}	95,841 (19,168) [4,600] {2,300}	96,164 (19,233) [4,616] {2,308}
Monmouth	79,441	79,638	79,825	79,966	80,323 (16,065) [3,856] {1,928}	80,699 (16,140) [3,874] {1,937}	81,096 (16,219) [3,893] {1,946}
Morris	51,599	51,649	51,712	51,802	51,958 (10,392) [2,494] {1,247}	52,126 (10,425) [2,502] {1,251}	52,311 (10,462) [2,511] {1,255}
Ocean	78,717	78,827	78,960	79,102	79,354 (15,871) [3,809] {1,905}	79,630 (15,926) [3,822] {1,911}	79,929 (15,986) [3,837] {1,918}
Passaic	74,732	74,816	74,888	74,948	75,098 (15,020) [3,605] {1,802}	75,259 (15,052) [3,612] {1,806}	75,431 (15,086) [3,621] {1,810}
Somerset	31,061	31,104	31,155	31,221	31,330 (6,266) [1,504] {752}	31,450 (6,290) [1,510] {755}	31,581 (6,316) [1,516] {758}
Sussex	14,452	14,469	14,475	14,490	14,528 (2,906) [697] {349}	14,568 (2,914) [699] {350}	14,611 (2,922) [701] {351}
Union	73,310	73,390	73,485	73,603	73,809 (14,762) [3,543] {1,771}	74,037 (14,807) [3,554] {1,777}	74,290 (14,858) [3,566] {1,783}
Warren	10,201	10,207	10,223	10,236	10,261 (2,052) [493] {246}	10,290 (2,058) [494] {247}	10,321 (2,064) [495] {248}

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.