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

Date: 1/19/21

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 1/19/21 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.

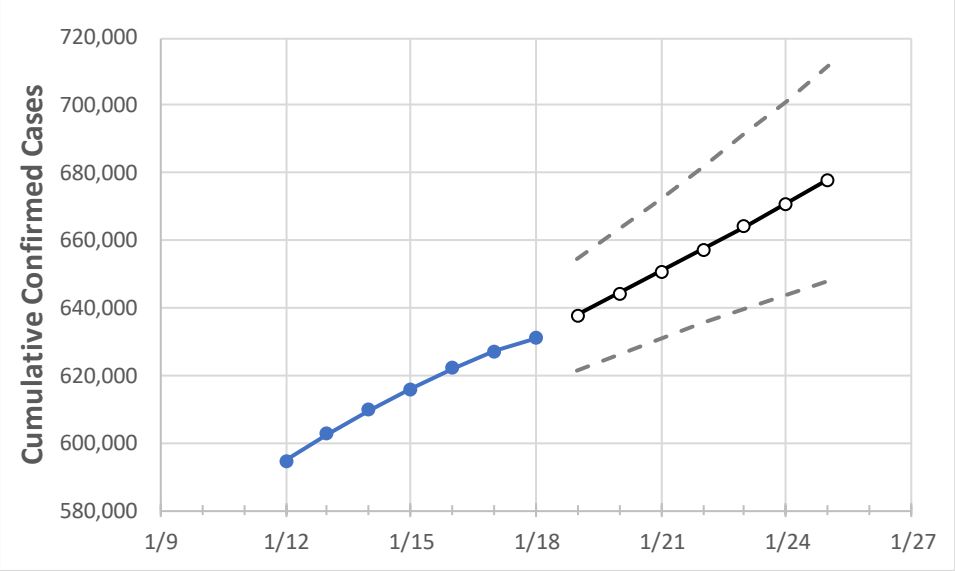
IEM's Modeling Lead

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:						
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25
New Jersey	616,032	622,089	627,221	631,074	637,652	644,187	650,779	657,404	664,179	670,986	678,044

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:						
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25
Bergen	59,684	60,224	60,704	60,985	61,528	62,083	62,626	63,189	63,754	64,320	64,884
Burlington	27,790	28,049	28,288	28,487	28,768	29,063	29,359	29,650	29,941	30,247	30,545
Camden	36,243	36,547	36,777	36,976	37,300	37,621	37,945	38,264	38,584	38,903	39,223
Essex	58,110	58,678	59,127	59,432	59,967	60,512	61,064	61,628	62,192	62,765	63,347
Gloucester	19,107	19,287	19,416	19,537	19,735	19,933	20,126	20,323	20,528	20,721	20,919
Hudson	54,690	55,198	55,656	55,967	56,477	56,995	57,514	58,026	58,563	59,079	59,601
Hunterdon	5,123	5,181	5,242	5,275	5,353	5,432	5,512	5,595	5,682	5,772	5,859
Mercer	22,432	22,645	22,829	22,949	23,145	23,343	23,543	23,747	23,948	24,156	24,370
Middlesex	56,322	56,812	57,400	57,704	58,334	58,985	59,647	60,315	60,988	61,659	62,339
Monmouth	42,298	42,764	43,173	43,562	44,129	44,702	45,277	45,854	46,448	47,042	47,656
Morris	27,665	27,966	28,259	28,469	28,783	29,102	29,425	29,745	30,071	30,407	30,749
Ocean	43,229	43,746	44,163	44,577	45,128	45,696	46,241	46,805	47,395	47,997	48,600
Passaic	47,135	47,429	47,658	47,799	48,075	48,340	48,606	48,884	49,156	49,429	49,699
Somerset	17,717	17,885	18,052	18,155	18,333	18,518	18,703	18,889	19,084	19,280	19,480
Sussex	6,552	6,696	6,753	6,825	6,941	7,057	7,176	7,294	7,421	7,546	7,674
Union	46,716	47,079	47,363	47,628	48,027	48,434	48,841	49,253	49,677	50,112	50,542
Warren	5,270	5,326	5,376	5,430	5,499	5,571	5,643	5,714	5,787	5,862	5,934

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:		
	1/15	1/16	1/17	1/18	1/20	1/22	1/24
Bergen	59,684	60,224	60,704	60,985	62,083 (12,417) [2,980] {1,490}	63,189 (12,638) [3,033] {1,517}	64,320 (12,864) [3,087] {1,544}
Burlington	27,790	28,049	28,288	28,487	29,063 (5,813) [1,395] {698}	29,650 (5,930) [1,423] {712}	30,247 (6,049) [1,452] {726}
Camden	36,243	36,547	36,777	36,976	37,621 (7,524) [1,806] {903}	38,264 (7,653) [1,837] {918}	38,903 (7,781) [1,867] {934}
Essex	58,110	58,678	59,127	59,432	60,512 (12,102) [2,905] {1,452}	61,628 (12,326) [2,958] {1,479}	62,765 (12,553) [3,013] {1,506}
Gloucester	19,107	19,287	19,416	19,537	19,933 (3,987) [957] {478}	20,323 (4,065) [976] {488}	20,721 (4,144) [995] {497}
Hudson	54,690	55,198	55,656	55,967	56,995 (11,399) [2,736] {1,368}	58,026 (11,605) [2,785] {1,393}	59,079 (11,816) [2,836] {1,418}
Hunterdon	5,123	5,181	5,242	5,275	5,432 (1,086) [261] {130}	5,595 (1,119) [269] {134}	5,772 (1,154) [277] {139}
Mercer	22,432	22,645	22,829	22,949	23,343 (4,669) [1,120] {560}	23,747 (4,749) [1,140] {570}	24,156 (4,831) [1,159] {580}
Middlesex	56,322	56,812	57,400	57,704	58,985 (11,797) [2,831] {1,416}	60,315 (12,063) [2,895] {1,448}	61,659 (12,332) [2,960] {1,480}
Monmouth	42,298	42,764	43,173	43,562	44,702 (8,940) [2,146] {1,073}	45,854 (9,171) [2,201] {1,100}	47,042 (9,408) [2,258] {1,129}
Morris	27,665	27,966	28,259	28,469	29,102 (5,820) [1,397] {698}	29,745 (5,949) [1,428] {714}	30,407 (6,081) [1,460] {730}
Ocean	43,229	43,746	44,163	44,577	45,696 (9,139) [2,193] {1,097}	46,805 (9,361) [2,247] {1,123}	47,997 (9,599) [2,304] {1,152}
Passaic	47,135	47,429	47,658	47,799	48,340 (9,668) [2,320] {1,160}	48,884 (9,777) [2,346] {1,173}	49,429 (9,886) [2,373] {1,186}
Somerset	17,717	17,885	18,052	18,155	18,518 (3,704) [889] {444}	18,889 (3,778) [907] {453}	19,280 (3,856) [925] {463}
Sussex	6,552	6,696	6,753	6,825	7,057 (1,411) [339] {169}	7,294 (1,459) [350] {175}	7,546 (1,509) [362] {181}
Union	46,716	47,079	47,363	47,628	48,434 (9,687) [2,325] {1,162}	49,253 (9,851) [2,364] {1,182}	50,112 (10,022) [2,405] {1,203}
Warren	5,270	5,326	5,376	5,430	5,571 (1,114) [267] {134}	5,714 (1,143) [274] {137}	5,862 (1,172) [281] {141}

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.