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

Date: 2/26/21

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 2/26/21 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.

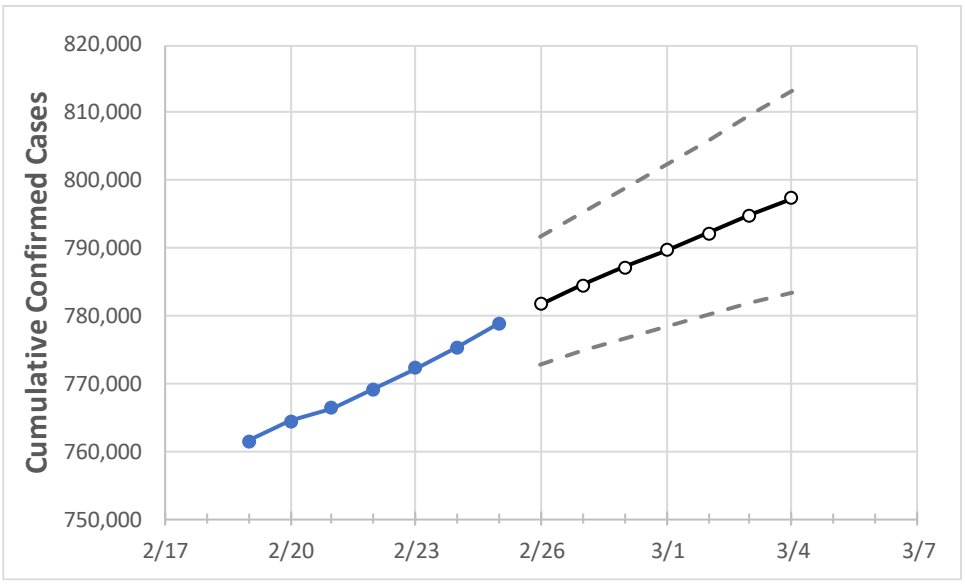
IEM's Modeling Lead

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:						
	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4
New Jersey	769,109	772,267	775,386	778,963	781,727	784,450	787,116	789,732	792,266	794,825	797,408

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:						
	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4
Bergen	75,062	75,478	75,860	76,339	76,684	77,021	77,356	77,684	78,024	78,360	78,683
Burlington	34,677	34,771	34,879	35,002	35,100	35,195	35,290	35,381	35,472	35,559	35,644
Camden	43,390	43,503	43,604	43,731	43,832	43,931	44,030	44,123	44,214	44,308	44,392
Essex	71,834	72,100	72,384	72,740	72,986	73,231	73,469	73,716	73,963	74,189	74,415
Gloucester	23,719	23,788	23,852	23,928	23,985	24,040	24,096	24,149	24,204	24,254	24,303
Hudson	67,349	67,644	67,957	68,323	68,576	68,828	69,073	69,318	69,562	69,802	70,052
Hunterdon	6,699	6,729	6,767	6,820	6,851	6,883	6,915	6,947	6,977	7,008	7,039
Mercer	27,236	27,298	27,369	27,446	27,517	27,588	27,656	27,719	27,782	27,847	27,909
Middlesex	70,874	71,184	71,497	71,812	72,060	72,303	72,545	72,789	73,025	73,257	73,487
Monmouth	55,082	55,359	55,651	56,025	56,267	56,507	56,745	56,983	57,218	57,448	57,676
Morris	36,515	36,691	36,797	36,930	37,065	37,197	37,323	37,444	37,565	37,680	37,796
Ocean	56,895	57,136	57,480	57,812	58,063	58,310	58,554	58,781	59,019	59,253	59,484
Passaic	55,755	55,949	56,082	56,244	56,394	56,546	56,695	56,837	56,986	57,124	57,265
Somerset	22,171	22,307	22,419	22,541	22,634	22,728	22,820	22,910	23,000	23,089	23,176
Sussex	8,850	8,891	8,936	8,981	9,017	9,053	9,088	9,123	9,156	9,190	9,220
Union	55,484	55,678	55,849	56,067	56,237	56,404	56,572	56,733	56,897	57,060	57,218
Warren	6,815	6,851	6,887	6,934	6,960	6,986	7,012	7,037	7,062	7,086	7,111

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:		
	2/22	2/23	2/24	2/25	2/27	3/1	3/3
Bergen	75,062	75,478	75,860	76,339	77,021 (15,404) [3,697] {1,848}	77,684 (15,537) [3,729] {1,864}	78,360 (15,672) [3,761] {1,881}
Burlington	34,677	34,771	34,879	35,002	35,195 (7,039) [1,689] {845}	35,381 (7,076) [1,698] {849}	35,559 (7,112) [1,707] {853}
Camden	43,390	43,503	43,604	43,731	43,931 (8,786) [2,109] {1,054}	44,123 (8,825) [2,118] {1,059}	44,308 (8,862) [2,127] {1,063}
Essex	71,834	72,100	72,384	72,740	73,231 (14,646) [3,515] {1,758}	73,716 (14,743) [3,538] {1,769}	74,189 (14,838) [3,561] {1,781}
Gloucester	23,719	23,788	23,852	23,928	24,040 (4,808) [1,154] {577}	24,149 (4,830) [1,159] {580}	24,254 (4,851) [1,164] {582}
Hudson	67,349	67,644	67,957	68,323	68,828 (13,766) [3,304] {1,652}	69,318 (13,864) [3,327] {1,664}	69,802 (13,960) [3,350] {1,675}
Hunterdon	6,699	6,729	6,767	6,820	6,883 (1,377) [330] {165}	6,947 (1,389) [333] {167}	7,008 (1,402) [336] {168}
Mercer	27,236	27,298	27,369	27,446	27,588 (5,518) [1,324] {662}	27,719 (5,544) [1,330] {665}	27,847 (5,569) [1,337] {668}
Middlesex	70,874	71,184	71,497	71,812	72,303 (14,461) [3,471] {1,735}	72,789 (14,558) [3,494] {1,747}	73,257 (14,651) [3,516] {1,758}
Monmouth	55,082	55,359	55,651	56,025	56,507 (11,301) [2,712] {1,356}	56,983 (11,397) [2,735] {1,368}	57,448 (11,490) [2,757] {1,379}
Morris	36,515	36,691	36,797	36,930	37,197 (7,439) [1,785] {893}	37,444 (7,489) [1,797] {899}	37,680 (7,536) [1,809] {904}
Ocean	56,895	57,136	57,480	57,812	58,310 (11,662) [2,799] {1,399}	58,781 (11,756) [2,821] {1,411}	59,253 (11,851) [2,844] {1,422}
Passaic	55,755	55,949	56,082	56,244	56,546 (11,309) [2,714] {1,357}	56,837 (11,367) [2,728] {1,364}	57,124 (11,425) [2,742] {1,371}
Somerset	22,171	22,307	22,419	22,541	22,728 (4,546) [1,091] {545}	22,910 (4,582) [1,100] {550}	23,089 (4,618) [1,108] {554}
Sussex	8,850	8,891	8,936	8,981	9,053 (1,811) [435] {217}	9,123 (1,825) [438] {219}	9,190 (1,838) [441] {221}
Union	55,484	55,678	55,849	56,067	56,404 (11,281) [2,707] {1,354}	56,733 (11,347) [2,723] {1,362}	57,060 (11,412) [2,739] {1,369}
Warren	6,815	6,851	6,887	6,934	6,986 (1,397) [335] {168}	7,037 (1,407) [338] {169}	7,086 (1,417) [340] {170}

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.