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

Date: 5/27/21

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 5/27/21 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.

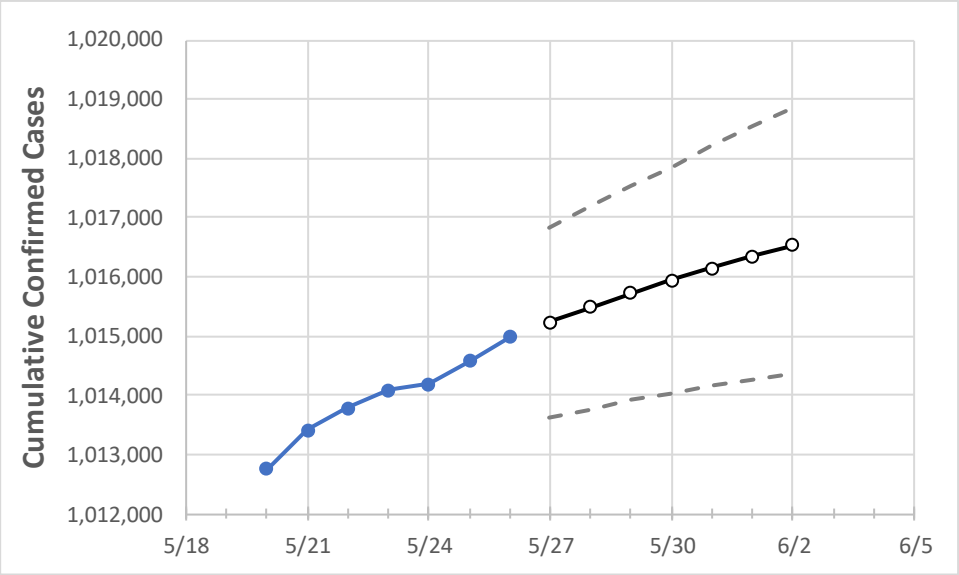
IEM's Modeling Lead

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:						
	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2
New Jersey	1,014,088	1,014,190	1,014,579	1,014,974	1,015,235	1,015,492	1,015,726	1,015,948	1,016,145	1,016,348	1,016,535

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:						
	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2
Bergen	104,022	104,054	104,101	104,142	104,167	104,192	104,215	104,237	104,255	104,273	104,291
Burlington	44,042	44,063	44,088	44,105	44,121	44,138	44,153	44,167	44,181	44,195	44,208
Camden	55,339	55,359	55,404	55,439	55,470	55,500	55,528	55,555	55,581	55,605	55,630
Essex	93,798	93,782	93,802	93,859	93,883	93,906	93,928	93,948	93,969	93,986	94,004
Gloucester	30,423	30,432	30,440	30,458	30,472	30,486	30,499	30,512	30,524	30,536	30,547
Hudson	87,773	87,780	87,786	87,796	87,812	87,827	87,841	87,853	87,865	87,876	87,886
Hunterdon	9,754	9,758	9,762	9,765	9,770	9,774	9,778	9,782	9,786	9,790	9,793
Mercer	33,841	33,845	33,870	33,887	33,902	33,917	33,932	33,946	33,959	33,972	33,985
Middlesex	91,931	91,934	91,973	92,001	92,024	92,045	92,065	92,085	92,104	92,121	92,138
Monmouth	75,315	75,329	75,349	75,370	75,391	75,412	75,431	75,450	75,468	75,486	75,502
Morris	49,954	49,965	49,975	49,993	50,006	50,018	50,029	50,040	50,050	50,059	50,068
Ocean	75,596	75,597	75,618	75,644	75,662	75,679	75,695	75,710	75,724	75,738	75,751
Passaic	72,673	72,668	72,705	72,722	72,747	72,770	72,792	72,812	72,831	72,850	72,868
Somerset	29,967	29,975	29,986	29,994	30,003	30,012	30,019	30,027	30,034	30,040	30,047
Sussex	13,945	13,946	13,948	13,953	13,959	13,965	13,970	13,975	13,980	13,984	13,989
Union	71,236	71,229	71,244	71,266	71,281	71,295	71,308	71,320	71,332	71,342	71,352
Warren	9,923	9,925	9,933	9,943	9,948	9,953	9,958	9,963	9,967	9,971	9,975

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:		
	5/23	5/24	5/25	5/26	5/28	5/30	6/1
Bergen	104,022	104,054	104,101	104,142	104,192 (20,838) [5,001] {2,501}	104,237 (20,847) [5,003] {2,502}	104,273 (20,855) [5,005] {2,503}
Burlington	44,042	44,063	44,088	44,105	44,138 (8,828) [2,119] {1,059}	44,167 (8,833) [2,120] {1,060}	44,195 (8,839) [2,121] {1,061}
Camden	55,339	55,359	55,404	55,439	55,500 (11,100) [2,664] {1,332}	55,555 (11,111) [2,667] {1,333}	55,605 (11,121) [2,669] {1,335}
Essex	93,798	93,782	93,802	93,859	93,906 (18,781) [4,507] {2,254}	93,948 (18,790) [4,510] {2,255}	93,986 (18,797) [4,511] {2,256}
Gloucester	30,423	30,432	30,440	30,458	30,486 (6,097) [1,463] {732}	30,512 (6,102) [1,465] {732}	30,536 (6,107) [1,466] {733}
Hudson	87,773	87,780	87,786	87,796	87,827 (17,565) [4,216] {2,108}	87,853 (17,571) [4,217] {2,108}	87,876 (17,575) [4,218] {2,109}
Hunterdon	9,754	9,758	9,762	9,765	9,774 (1,955) [469] {235}	9,782 (1,956) [470] {235}	9,790 (1,958) [470] {235}
Mercer	33,841	33,845	33,870	33,887	33,917 (6,783) [1,628] {814}	33,946 (6,789) [1,629] {815}	33,972 (6,794) [1,631] {815}
Middlesex	91,931	91,934	91,973	92,001	92,045 (18,409) [4,418] {2,209}	92,085 (18,417) [4,420] {2,210}	92,121 (18,424) [4,422] {2,211}
Monmouth	75,315	75,329	75,349	75,370	75,412 (15,082) [3,620] {1,810}	75,450 (15,090) [3,622] {1,811}	75,486 (15,097) [3,623] {1,812}
Morris	49,954	49,965	49,975	49,993	50,018 (10,004) [2,401] {1,200}	50,040 (10,008) [2,402] {1,201}	50,059 (10,012) [2,403] {1,201}
Ocean	75,596	75,597	75,618	75,644	75,679 (15,136) [3,633] {1,816}	75,710 (15,142) [3,634] {1,817}	75,738 (15,148) [3,635] {1,818}
Passaic	72,673	72,668	72,705	72,722	72,770 (14,554) [3,493] {1,746}	72,812 (14,562) [3,495] {1,747}	72,850 (14,570) [3,497] {1,748}
Somerset	29,967	29,975	29,986	29,994	30,012 (6,002) [1,441] {720}	30,027 (6,005) [1,441] {721}	30,040 (6,008) [1,442] {721}
Sussex	13,945	13,946	13,948	13,953	13,965 (2,793) [670] {335}	13,975 (2,795) [671] {335}	13,984 (2,797) [671] {336}
Union	71,236	71,229	71,244	71,266	71,295 (14,259) [3,422] {1,711}	71,320 (14,264) [3,423] {1,712}	71,342 (14,268) [3,424] {1,712}
Warren	9,923	9,925	9,933	9,943	9,953 (1,991) [478] {239}	9,963 (1,993) [478] {239}	9,971 (1,994) [479] {239}

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.