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

Date: 5/26/21

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 5/26/21 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.

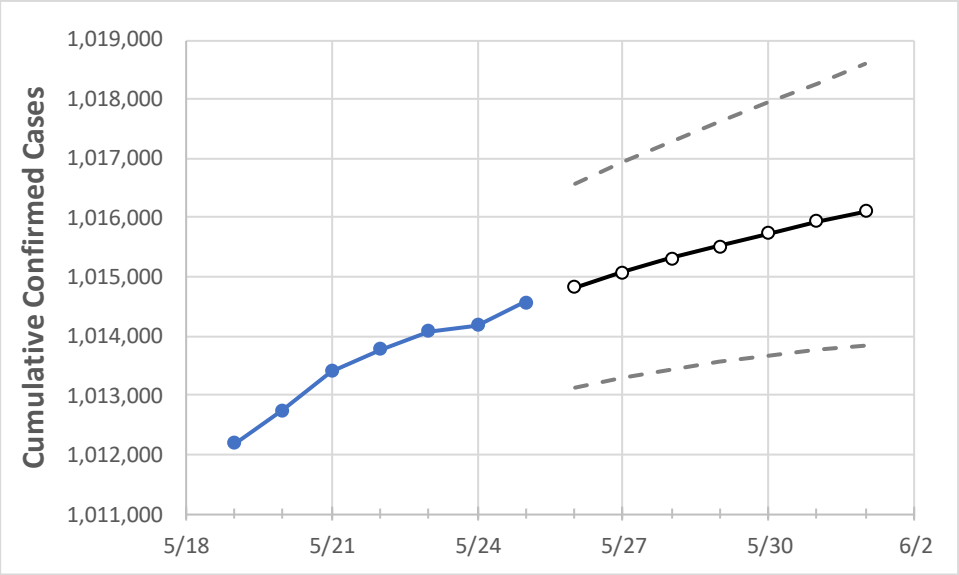
IEM's Modeling Lead

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:						
	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1
New Jersey	1,013,787	1,014,088	1,014,190	1,014,579	1,014,834	1,015,088	1,015,316	1,015,526	1,015,729	1,015,935	1,016,114

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:						
	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1
Bergen	103,993	104,022	104,054	104,101	104,129	104,156	104,180	104,202	104,221	104,238	104,256
Burlington	44,012	44,042	44,063	44,088	44,106	44,122	44,138	44,154	44,168	44,182	44,195
Camden	55,311	55,339	55,359	55,404	55,437	55,468	55,497	55,526	55,554	55,580	55,605
Essex	93,800	93,798	93,782	93,802	93,824	93,845	93,864	93,882	93,900	93,917	93,933
Gloucester	30,406	30,423	30,432	30,440	30,454	30,468	30,482	30,495	30,507	30,518	30,529
Hudson	87,760	87,773	87,780	87,786	87,804	87,819	87,834	87,848	87,861	87,873	87,883
Hunterdon	9,748	9,754	9,758	9,758	9,763	9,768	9,773	9,778	9,782	9,787	9,791
Mercer	33,820	33,841	33,845	33,870	33,886	33,902	33,916	33,931	33,946	33,959	33,972
Middlesex	91,907	91,931	91,934	91,973	91,995	92,015	92,035	92,052	92,070	92,086	92,102
Monmouth	75,297	75,315	75,329	75,349	75,371	75,392	75,413	75,432	75,450	75,467	75,484
Morris	49,951	49,954	49,965	49,975	49,988	49,999	50,010	50,020	50,030	50,038	50,047
Ocean	75,569	75,596	75,597	75,618	75,636	75,653	75,670	75,686	75,701	75,715	75,729
Passaic	72,652	72,673	72,668	72,705	72,731	72,756	72,780	72,805	72,827	72,848	72,867
Somerset	29,956	29,967	29,975	29,986	29,995	30,003	30,011	30,019	30,027	30,034	30,041
Sussex	13,937	13,945	13,946	13,948	13,954	13,960	13,966	13,971	13,977	13,981	13,986
Union	71,221	71,236	71,229	71,244	71,260	71,275	71,288	71,301	71,313	71,324	71,334
Warren	9,919	9,923	9,925	9,933	9,939	9,944	9,949	9,954	9,959	9,963	9,967

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:		
	5/22	5/23	5/24	5/25	5/27	5/29	5/31
Bergen	103,993	104,022	104,054	104,101	104,156 (20,831) [4,999] {2,500}	104,202 (20,840) [5,002] {2,501}	104,238 (20,848) [5,003] {2,502}
Burlington	44,012	44,042	44,063	44,088	44,122 (8,824) [2,118] {1,059}	44,154 (8,831) [2,119] {1,060}	44,182 (8,836) [2,121] {1,060}
Camden	55,311	55,339	55,359	55,404	55,468 (11,094) [2,662] {1,331}	55,526 (11,105) [2,665] {1,333}	55,580 (11,116) [2,668] {1,334}
Essex	93,800	93,798	93,782	93,802	93,845 (18,769) [4,505] {2,252}	93,882 (18,776) [4,506] {2,253}	93,917 (18,783) [4,508] {2,254}
Gloucester	30,406	30,423	30,432	30,440	30,468 (6,094) [1,462] {731}	30,495 (6,099) [1,464] {732}	30,518 (6,104) [1,465] {732}
Hudson	87,760	87,773	87,780	87,786	87,819 (17,564) [4,215] {2,108}	87,848 (17,570) [4,217] {2,108}	87,873 (17,575) [4,218] {2,109}
Hunterdon	9,748	9,754	9,758	9,758	9,768 (1,954) [469] {234}	9,778 (1,956) [469] {235}	9,787 (1,957) [470] {235}
Mercer	33,820	33,841	33,845	33,870	33,902 (6,780) [1,627] {814}	33,931 (6,786) [1,629] {814}	33,959 (6,792) [1,630] {815}
Middlesex	91,907	91,931	91,934	91,973	92,015 (18,403) [4,417] {2,208}	92,052 (18,410) [4,419] {2,209}	92,086 (18,417) [4,420] {2,210}
Monmouth	75,297	75,315	75,329	75,349	75,392 (15,078) [3,619] {1,809}	75,432 (15,086) [3,621] {1,810}	75,467 (15,093) [3,622] {1,811}
Morris	49,951	49,954	49,965	49,975	49,999 (10,000) [2,400] {1,200}	50,020 (10,004) [2,401] {1,200}	50,038 (10,008) [2,402] {1,201}
Ocean	75,569	75,596	75,597	75,618	75,653 (15,131) [3,631] {1,816}	75,686 (15,137) [3,633] {1,816}	75,715 (15,143) [3,634] {1,817}
Passaic	72,652	72,673	72,668	72,705	72,756 (14,551) [3,492] {1,746}	72,805 (14,561) [3,495] {1,747}	72,848 (14,570) [3,497] {1,748}
Somerset	29,956	29,967	29,975	29,986	30,003 (6,001) [1,440] {720}	30,019 (6,004) [1,441] {720}	30,034 (6,007) [1,442] {721}
Sussex	13,937	13,945	13,946	13,948	13,960 (2,792) [670] {335}	13,971 (2,794) [671] {335}	13,981 (2,796) [671] {336}
Union	71,221	71,236	71,229	71,244	71,275 (14,255) [3,421] {1,711}	71,301 (14,260) [3,422] {1,711}	71,324 (14,265) [3,424] {1,712}
Warren	9,919	9,923	9,925	9,933	9,944 (1,989) [477] {239}	9,954 (1,991) [478] {239}	9,963 (1,993) [478] {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.