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

Date: 6/25/21

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 6/25/21 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.

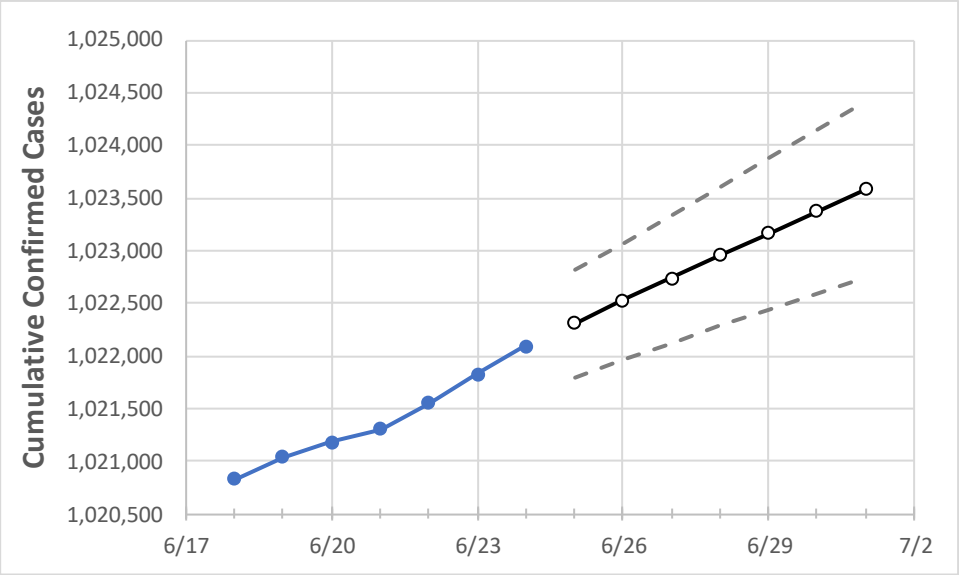
IEM's Modeling Lead

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:						
	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1
New Jersey	1,021,308	1,021,554	1,021,822	1,022,094	1,022,311	1,022,529	1,022,739	1,022,952	1,023,165	1,023,374	1,023,579

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:						
	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1
Bergen	104,720	104,751	104,791	104,835	104,860	104,886	104,911	104,936	104,961	104,986	105,011
Burlington	44,322	44,335	44,348	44,354	44,360	44,367	44,373	44,379	44,385	44,391	44,397
Camden	55,832	55,843	55,854	55,865	55,874	55,883	55,891	55,900	55,908	55,916	55,923
Essex	94,418	94,435	94,451	94,455	94,468	94,479	94,491	94,502	94,512	94,522	94,532
Gloucester	30,651	30,657	30,666	30,673	30,678	30,683	30,687	30,692	30,697	30,702	30,707
Hudson	88,311	88,316	88,337	88,344	88,360	88,376	88,392	88,407	88,422	88,436	88,451
Hunterdon	9,854	9,856	9,861	9,868	9,872	9,876	9,880	9,884	9,889	9,893	9,897
Mercer	34,144	34,150	34,151	34,157	34,162	34,166	34,171	34,175	34,180	34,184	34,188
Middlesex	92,567	92,591	92,608	92,640	92,658	92,675	92,693	92,710	92,727	92,745	92,761
Monmouth	75,814	75,839	75,863	75,900	75,929	75,958	75,988	76,017	76,048	76,079	76,111
Morris	50,296	50,307	50,311	50,329	50,337	50,345	50,353	50,361	50,369	50,376	50,384
Ocean	76,229	76,260	76,284	76,309	76,334	76,360	76,385	76,410	76,436	76,461	76,488
Passaic	73,274	73,295	73,316	73,340	73,359	73,378	73,397	73,415	73,433	73,452	73,471
Somerset	30,165	30,171	30,181	30,193	30,204	30,214	30,225	30,236	30,247	30,258	30,270
Sussex	14,082	14,088	14,094	14,095	14,100	14,106	14,111	14,116	14,121	14,127	14,132
Union	71,658	71,670	71,691	71,701	71,712	71,723	71,734	71,744	71,754	71,764	71,773
Warren	10,012	10,014	10,015	10,017	10,019	10,020	10,022	10,024	10,026	10,027	10,029

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:		
	6/21	6/22	6/23	6/24	6/26	6/28	6/30
Bergen	104,720	104,751	104,791	104,835	104,886 (20,977) [5,035] {2,517}	104,936 (20,987) [5,037] {2,518}	104,986 (20,997) [5,039] {2,520}
Burlington	44,322	44,335	44,348	44,354	44,367 (8,873) [2,130] {1,065}	44,379 (8,876) [2,130] {1,065}	44,391 (8,878) [2,131] {1,065}
Camden	55,832	55,843	55,854	55,865	55,883 (11,177) [2,682] {1,341}	55,900 (11,180) [2,683] {1,342}	55,916 (11,183) [2,684] {1,342}
Essex	94,418	94,435	94,451	94,455	94,479 (18,896) [4,535] {2,268}	94,502 (18,900) [4,536] {2,268}	94,522 (18,904) [4,537] {2,269}
Gloucester	30,651	30,657	30,666	30,673	30,683 (6,137) [1,473] {736}	30,692 (6,138) [1,473] {737}	30,702 (6,140) [1,474] {737}
Hudson	88,311	88,316	88,337	88,344	88,376 (17,675) [4,242] {2,121}	88,407 (17,681) [4,244] {2,122}	88,436 (17,687) [4,245] {2,122}
Hunterdon	9,854	9,856	9,861	9,868	9,876 (1,975) [474] {237}	9,884 (1,977) [474] {237}	9,893 (1,979) [475] {237}
Mercer	34,144	34,150	34,151	34,157	34,166 (6,833) [1,640] {820}	34,175 (6,835) [1,640] {820}	34,184 (6,837) [1,641] {820}
Middlesex	92,567	92,591	92,608	92,640	92,675 (18,535) [4,448] {2,224}	92,710 (18,542) [4,450] {2,225}	92,745 (18,549) [4,452] {2,226}
Monmouth	75,814	75,839	75,863	75,900	75,958 (15,192) [3,646] {1,823}	76,017 (15,203) [3,649] {1,824}	76,079 (15,216) [3,652] {1,826}
Morris	50,296	50,307	50,311	50,329	50,345 (10,069) [2,417] {1,208}	50,361 (10,072) [2,417] {1,209}	50,376 (10,075) [2,418] {1,209}
Ocean	76,229	76,260	76,284	76,309	76,360 (15,272) [3,665] {1,833}	76,410 (15,282) [3,668] {1,834}	76,461 (15,292) [3,670] {1,835}
Passaic	73,274	73,295	73,316	73,340	73,378 (14,676) [3,522] {1,761}	73,415 (14,683) [3,524] {1,762}	73,452 (14,690) [3,526] {1,763}
Somerset	30,165	30,171	30,181	30,193	30,214 (6,043) [1,450] {725}	30,236 (6,047) [1,451] {726}	30,258 (6,052) [1,452] {726}
Sussex	14,082	14,088	14,094	14,095	14,106 (2,821) [677] {339}	14,116 (2,823) [678] {339}	14,127 (2,825) [678] {339}
Union	71,658	71,670	71,691	71,701	71,723 (14,345) [3,443] {1,721}	71,744 (14,349) [3,444] {1,722}	71,764 (14,353) [3,445] {1,722}
Warren	10,012	10,014	10,015	10,017	10,020 (2,004) [481] {240}	10,024 (2,005) [481] {241}	10,027 (2,005) [481] {241}

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.