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

Date: 5/7/21

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 5/7/21 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.

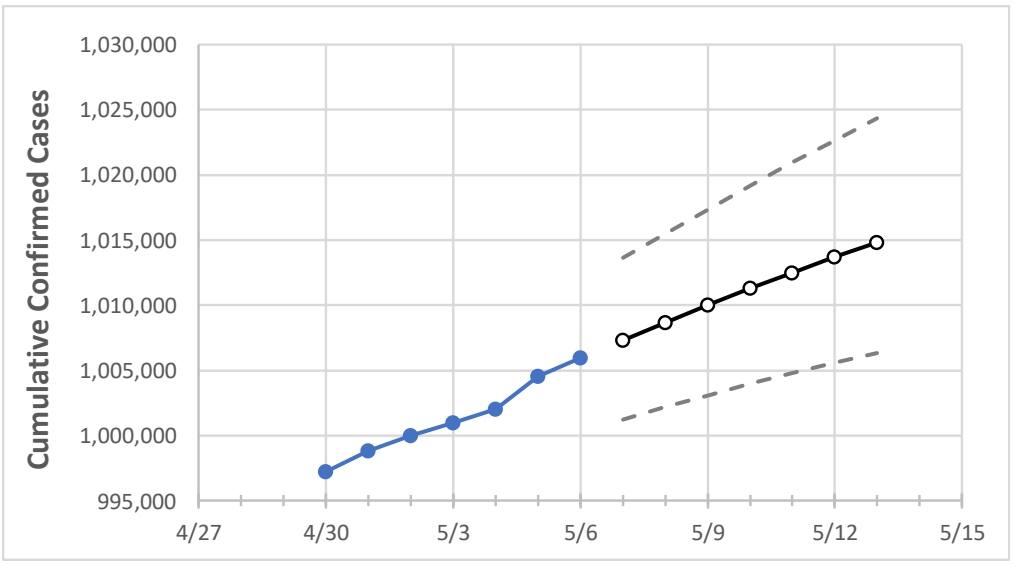
IEM's Modeling Lead

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:						
	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13
New Jersey	1,000,993	1,001,997	1,004,525	1,005,938	1,007,333	1,008,679	1,010,018	1,011,286	1,012,492	1,013,687	1,014,805

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:						
	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13
Bergen	101,287	101,383	102,678	103,082	103,347	103,621	103,892	104,158	104,426	104,707	104,982
Burlington	43,966	43,996	44,060	44,032	44,087	44,140	44,191	44,240	44,286	44,330	44,371
Camden	54,163	54,259	54,355	54,449	54,552	54,653	54,750	54,844	54,936	55,027	55,111
Essex	93,367	93,438	93,491	93,534	93,649	93,759	93,867	93,964	94,054	94,141	94,220
Gloucester	29,801	29,877	29,927	30,008	30,065	30,120	30,177	30,233	30,286	30,339	30,389
Hudson	87,080	87,121	87,261	87,363	87,475	87,581	87,681	87,780	87,871	87,961	88,047
Hunterdon	9,528	9,556	9,582	9,605	9,617	9,628	9,639	9,649	9,659	9,668	9,676
Mercer	33,385	33,421	33,439	33,495	33,536	33,576	33,613	33,651	33,687	33,721	33,752
Middlesex	91,225	91,255	91,298	91,301	91,397	91,488	91,572	91,649	91,726	91,795	91,863
Monmouth	74,507	74,553	74,656	74,731	74,803	74,872	74,938	74,999	75,055	75,109	75,161
Morris	49,590	49,652	49,696	49,641	49,691	49,740	49,787	49,832	49,873	49,913	49,951
Ocean	74,792	74,859	74,951	75,036	75,105	75,170	75,231	75,290	75,345	75,398	75,449
Passaic	71,673	71,767	71,953	72,060	72,175	72,289	72,395	72,503	72,602	72,699	72,790
Somerset	29,515	29,557	29,609	29,710	29,757	29,802	29,844	29,884	29,925	29,965	30,003
Sussex	13,648	13,680	13,707	13,741	13,768	13,794	13,819	13,844	13,867	13,889	13,910
Union	70,453	70,513	70,626	70,738	70,838	70,936	71,029	71,117	71,203	71,284	71,363
Warren	9,694	9,708	9,725	9,749	9,765	9,781	9,796	9,810	9,822	9,835	9,847

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:		
	5/3	5/4	5/5	5/6	5/8	5/10	5/12
Bergen	101,287	101,383	102,678	103,082	103,621 (20,724) [4,974] {2,487}	104,158 (20,832) [5,000] {2,500}	104,707 (20,941) [5,026] {2,513}
Burlington	43,966	43,996	44,060	44,032	44,140 (8,828) [2,119] {1,059}	44,240 (8,848) [2,124] {1,062}	44,330 (8,866) [2,128] {1,064}
Camden	54,163	54,259	54,355	54,449	54,653 (10,931) [2,623] {1,312}	54,844 (10,969) [2,633] {1,316}	55,027 (11,005) [2,641] {1,321}
Essex	93,367	93,438	93,491	93,534	93,759 (18,752) [4,500] {2,250}	93,964 (18,793) [4,510] {2,255}	94,141 (18,828) [4,519] {2,259}
Gloucester	29,801	29,877	29,927	30,008	30,120 (6,024) [1,446] {723}	30,233 (6,047) [1,451] {726}	30,339 (6,068) [1,456] {728}
Hudson	87,080	87,121	87,261	87,363	87,581 (17,516) [4,204] {2,102}	87,780 (17,556) [4,213] {2,107}	87,961 (17,592) [4,222] {2,111}
Hunterdon	9,528	9,556	9,582	9,605	9,628 (1,926) [462] {231}	9,649 (1,930) [463] {232}	9,668 (1,934) [464] {232}
Mercer	33,385	33,421	33,439	33,495	33,576 (6,715) [1,612] {806}	33,651 (6,730) [1,615] {808}	33,721 (6,744) [1,619] {809}
Middlesex	91,225	91,255	91,298	91,301	91,488 (18,298) [4,391] {2,196}	91,649 (18,330) [4,399] {2,200}	91,795 (18,359) [4,406] {2,203}
Monmouth	74,507	74,553	74,656	74,731	74,872 (14,974) [3,594] {1,797}	74,999 (15,000) [3,600] {1,800}	75,109 (15,022) [3,605] {1,803}
Morris	49,590	49,652	49,696	49,641	49,740 (9,948) [2,388] {1,194}	49,832 (9,966) [2,392] {1,196}	49,913 (9,983) [2,396] {1,198}
Ocean	74,792	74,859	74,951	75,036	75,170 (15,034) [3,608] {1,804}	75,290 (15,058) [3,614] {1,807}	75,398 (15,080) [3,619] {1,810}
Passaic	71,673	71,767	71,953	72,060	72,289 (14,458) [3,470] {1,735}	72,503 (14,501) [3,480] {1,740}	72,699 (14,540) [3,490] {1,745}
Somerset	29,515	29,557	29,609	29,710	29,802 (5,960) [1,430] {715}	29,884 (5,977) [1,434] {717}	29,965 (5,993) [1,438] {719}
Sussex	13,648	13,680	13,707	13,741	13,794 (2,759) [662] {331}	13,844 (2,769) [664] {332}	13,889 (2,778) [667] {333}
Union	70,453	70,513	70,626	70,738	70,936 (14,187) [3,405] {1,702}	71,117 (14,223) [3,414] {1,707}	71,284 (14,257) [3,422] {1,711}
Warren	9,694	9,708	9,725	9,749	9,781 (1,956) [469] {235}	9,810 (1,962) [471] {235}	9,835 (1,967) [472] {236}

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.