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

Date: 5/13/21

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 5/13/21 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.

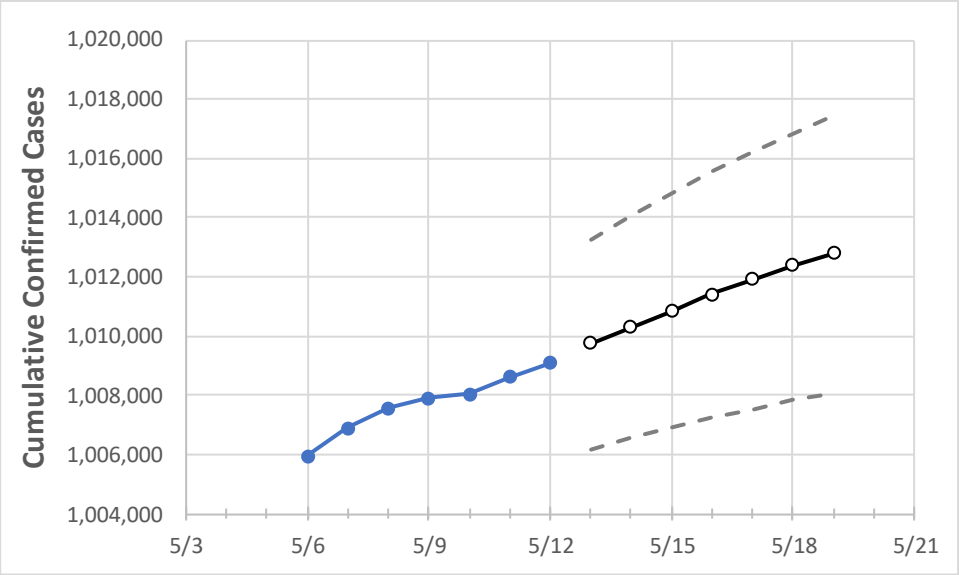
IEM's Modeling Lead

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:						
	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19
New Jersey	1,007,894	1,008,046	1,008,607	1,009,093	1,009,748	1,010,316	1,010,858	1,011,408	1,011,912	1,012,379	1,012,804

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:						
	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19
Bergen	103,314	103,352	103,408	103,494	103,656	103,817	103,970	104,129	104,282	104,429	104,574
Burlington	44,099	44,118	44,081	43,990	44,023	44,054	44,085	44,112	44,138	44,164	44,187
Camden	54,646	54,665	54,724	54,799	54,854	54,908	54,959	55,007	55,052	55,095	55,136
Essex	93,474	93,440	93,453	93,504	93,540	93,574	93,603	93,628	93,651	93,671	93,691
Gloucester	30,112	30,118	30,158	30,189	30,225	30,259	30,291	30,322	30,352	30,380	30,407
Hudson	87,598	87,596	87,632	87,630	87,685	87,740	87,789	87,835	87,878	87,915	87,951
Hunterdon	9,644	9,650	9,661	9,675	9,685	9,694	9,703	9,711	9,720	9,728	9,736
Mercer	33,569	33,574	33,600	33,632	33,653	33,673	33,691	33,708	33,725	33,740	33,755
Middlesex	91,417	91,416	91,462	91,505	91,541	91,572	91,602	91,629	91,654	91,676	91,696
Monmouth	74,857	74,890	74,943	74,959	74,995	75,027	75,058	75,085	75,111	75,134	75,156
Morris	49,653	49,669	49,711	49,714	49,739	49,763	49,785	49,804	49,823	49,840	49,856
Ocean	75,208	75,236	75,264	75,298	75,336	75,371	75,405	75,435	75,466	75,492	75,517
Passaic	72,171	72,184	72,212	72,240	72,282	72,321	72,357	72,389	72,418	72,445	72,469
Somerset	29,754	29,756	29,782	29,797	29,820	29,841	29,861	29,880	29,899	29,916	29,931
Sussex	13,786	13,788	13,798	13,811	13,826	13,839	13,853	13,865	13,876	13,887	13,897
Union	70,832	70,845	70,874	70,917	70,959	70,998	71,033	71,066	71,100	71,130	71,157
Warren	9,799	9,805	9,820	9,839	9,848	9,856	9,863	9,871	9,878	9,884	9,890

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:		
	5/9	5/10	5/11	5/12	5/14	5/16	5/18
Bergen	103,314	103,352	103,408	103,494	103,817 (20,763) [4,983] {2,492}	104,129 (20,826) [4,998] {2,499}	104,429 (20,886) [5,013] {2,506}
Burlington	44,099	44,118	44,081	43,990	44,054 (8,811) [2,115] {1,057}	44,112 (8,822) [2,117] {1,059}	44,164 (8,833) [2,120] {1,060}
Camden	54,646	54,665	54,724	54,799	54,908 (10,982) [2,636] {1,318}	55,007 (11,001) [2,640] {1,320}	55,095 (11,019) [2,645] {1,322}
Essex	93,474	93,440	93,453	93,504	93,574 (18,715) [4,492] {2,246}	93,628 (18,726) [4,494] {2,247}	93,671 (18,734) [4,496] {2,248}
Gloucester	30,112	30,118	30,158	30,189	30,259 (6,052) [1,452] {726}	30,322 (6,064) [1,455] {728}	30,380 (6,076) [1,458] {729}
Hudson	87,598	87,596	87,632	87,630	87,740 (17,548) [4,212] {2,106}	87,835 (17,567) [4,216] {2,108}	87,915 (17,583) [4,220] {2,110}
Hunterdon	9,644	9,650	9,661	9,675	9,694 (1,939) [465] {233}	9,711 (1,942) [466] {233}	9,728 (1,946) [467] {233}
Mercer	33,569	33,574	33,600	33,632	33,673 (6,735) [1,616] {808}	33,708 (6,742) [1,618] {809}	33,740 (6,748) [1,620] {810}
Middlesex	91,417	91,416	91,462	91,505	91,572 (18,314) [4,395] {2,198}	91,629 (18,326) [4,398] {2,199}	91,676 (18,335) [4,400] {2,200}
Monmouth	74,857	74,890	74,943	74,959	75,027 (15,005) [3,601] {1,801}	75,085 (15,017) [3,604] {1,802}	75,134 (15,027) [3,606] {1,803}
Morris	49,653	49,669	49,711	49,714	49,763 (9,953) [2,389] {1,194}	49,804 (9,961) [2,391] {1,195}	49,840 (9,968) [2,392] {1,196}
Ocean	75,208	75,236	75,264	75,298	75,371 (15,074) [3,618] {1,809}	75,435 (15,087) [3,621] {1,810}	75,492 (15,098) [3,624] {1,812}
Passaic	72,171	72,184	72,212	72,240	72,321 (14,464) [3,471] {1,736}	72,389 (14,478) [3,475] {1,737}	72,445 (14,489) [3,477] {1,739}
Somerset	29,754	29,756	29,782	29,797	29,841 (5,968) [1,432] {716}	29,880 (5,976) [1,434] {717}	29,916 (5,983) [1,436] {718}
Sussex	13,786	13,788	13,798	13,811	13,839 (2,768) [664] {332}	13,865 (2,773) [666] {333}	13,887 (2,777) [667] {333}
Union	70,832	70,845	70,874	70,917	70,998 (14,200) [3,408] {1,704}	71,066 (14,213) [3,411] {1,706}	71,130 (14,226) [3,414] {1,707}
Warren	9,799	9,805	9,820	9,839	9,856 (1,971) [473] {237}	9,871 (1,974) [474] {237}	9,884 (1,977) [474] {237}

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.