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

Date: 5/4/21

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 5/4/21 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.

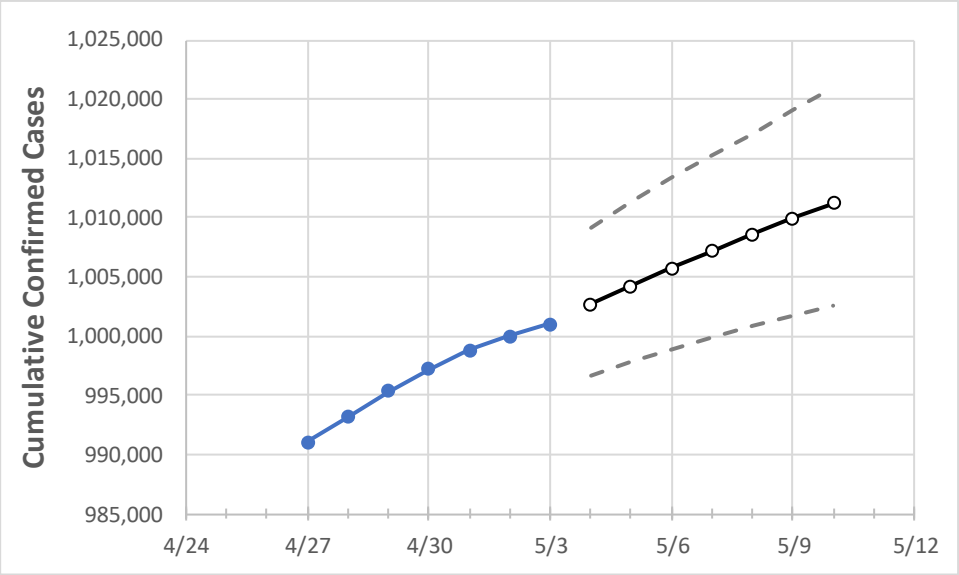
IEM's Modeling Lead

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:						
	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10
New Jersey	997,223	998,812	1,000,010	1,000,993	1,002,664	1,004,235	1,005,769	1,007,209	1,008,590	1,009,939	1,011,226

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:						
	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10
Bergen	100,988	101,120	101,198	101,287	101,416	101,536	101,653	101,769	101,879	101,982	102,077
Burlington	43,756	43,840	43,902	43,966	44,033	44,097	44,158	44,219	44,278	44,331	44,384
Camden	53,864	54,014	54,072	54,163	54,283	54,398	54,513	54,622	54,730	54,833	54,936
Essex	93,007	93,170	93,273	93,367	93,546	93,719	93,888	94,048	94,204	94,350	94,492
Gloucester	29,614	29,697	29,770	29,801	29,862	29,920	29,978	30,034	30,088	30,140	30,191
Hudson	86,752	86,882	87,000	87,080	87,225	87,365	87,497	87,621	87,744	87,862	87,975
Hunterdon	9,508	9,519	9,523	9,528	9,539	9,549	9,559	9,568	9,576	9,584	9,591
Mercer	33,259	33,309	33,352	33,385	33,439	33,489	33,539	33,588	33,634	33,681	33,726
Middlesex	90,854	91,001	91,143	91,225	91,377	91,523	91,662	91,793	91,915	92,034	92,151
Monmouth	74,287	74,368	74,446	74,507	74,601	74,690	74,776	74,857	74,936	75,007	75,075
Morris	49,415	49,488	49,534	49,590	49,655	49,717	49,777	49,833	49,889	49,939	49,987
Ocean	74,575	74,664	74,742	74,792	74,874	74,951	75,027	75,096	75,162	75,228	75,289
Passaic	71,470	71,574	71,630	71,673	71,813	71,948	72,084	72,212	72,345	72,472	72,593
Somerset	29,405	29,442	29,489	29,515	29,558	29,599	29,637	29,674	29,710	29,745	29,778
Sussex	13,554	13,591	13,620	13,648	13,678	13,707	13,735	13,762	13,788	13,814	13,838
Union	70,239	70,328	70,399	70,453	70,575	70,695	70,807	70,918	71,023	71,128	71,226
Warren	9,661	9,671	9,684	9,694	9,715	9,736	9,755	9,775	9,793	9,811	9,829

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:		
	4/30	5/1	5/2	5/3	5/5	5/7	5/9
Bergen	100,988	101,120	101,198	101,287	101,536 (20,307) [4,874] {2,437}	101,769 (20,354) [4,885] {2,442}	101,982 (20,396) [4,895] {2,448}
Burlington	43,756	43,840	43,902	43,966	44,097 (8,819) [2,117] {1,058}	44,219 (8,844) [2,123] {1,061}	44,331 (8,866) [2,128] {1,064}
Camden	53,864	54,014	54,072	54,163	54,398 (10,880) [2,611] {1,306}	54,622 (10,924) [2,622] {1,311}	54,833 (10,967) [2,632] {1,316}
Essex	93,007	93,170	93,273	93,367	93,719 (18,744) [4,499] {2,249}	94,048 (18,810) [4,514] {2,257}	94,350 (18,870) [4,529] {2,264}
Gloucester	29,614	29,697	29,770	29,801	29,920 (5,984) [1,436] {718}	30,034 (6,007) [1,442] {721}	30,140 (6,028) [1,447] {723}
Hudson	86,752	86,882	87,000	87,080	87,365 (17,473) [4,194] {2,097}	87,621 (17,524) [4,206] {2,103}	87,862 (17,572) [4,217] {2,109}
Hunterdon	9,508	9,519	9,523	9,528	9,549 (1,910) [458] {229}	9,568 (1,914) [459] {230}	9,584 (1,917) [460] {230}
Mercer	33,259	33,309	33,352	33,385	33,489 (6,698) [1,607] {804}	33,588 (6,718) [1,612] {806}	33,681 (6,736) [1,617] {808}
Middlesex	90,854	91,001	91,143	91,225	91,523 (18,305) [4,393] {2,197}	91,793 (18,359) [4,406] {2,203}	92,034 (18,407) [4,418] {2,209}
Monmouth	74,287	74,368	74,446	74,507	74,690 (14,938) [3,585] {1,793}	74,857 (14,971) [3,593] {1,797}	75,007 (15,001) [3,600] {1,800}
Morris	49,415	49,488	49,534	49,590	49,717 (9,943) [2,386] {1,193}	49,833 (9,967) [2,392] {1,196}	49,939 (9,988) [2,397] {1,199}
Ocean	74,575	74,664	74,742	74,792	74,951 (14,990) [3,598] {1,799}	75,096 (15,019) [3,605] {1,802}	75,228 (15,046) [3,611] {1,805}
Passaic	71,470	71,574	71,630	71,673	71,948 (14,390) [3,454] {1,727}	72,212 (14,442) [3,466] {1,733}	72,472 (14,494) [3,479] {1,739}
Somerset	29,405	29,442	29,489	29,515	29,599 (5,920) [1,421] {710}	29,674 (5,935) [1,424] {712}	29,745 (5,949) [1,428] {714}
Sussex	13,554	13,591	13,620	13,648	13,707 (2,741) [658] {329}	13,762 (2,752) [661] {330}	13,814 (2,763) [663] {332}
Union	70,239	70,328	70,399	70,453	70,695 (14,139) [3,393] {1,697}	70,918 (14,184) [3,404] {1,702}	71,128 (14,226) [3,414] {1,707}
Warren	9,661	9,671	9,684	9,694	9,736 (1,947) [467] {234}	9,775 (1,955) [469] {235}	9,811 (1,962) [471] {235}

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.