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

Date: 11/10/20

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 11/10/20 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.

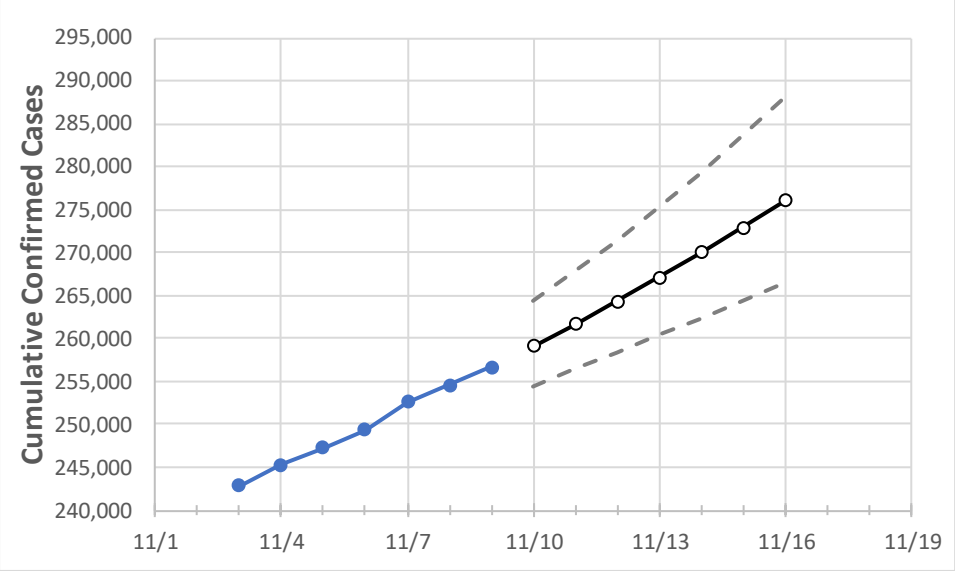
IEM's Modeling Lead

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:						
	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16
New Jersey	249,380	252,582	254,595	256,653	259,120	261,682	264,343	267,105	269,974	272,953	276,047

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 20%, and are often within 10%, of actual confirmed cases.

New Jersey Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16
Bergen	26,382	26,714	26,924	27,060	27,270	27,489	27,715	27,949	28,192	28,444	28,705
Burlington	9,126	9,265	9,355	9,504	9,618	9,737	9,861	9,992	10,128	10,271	10,420
Camden	12,662	12,899	13,020	13,219	13,425	13,645	13,881	14,133	14,404	14,693	15,003
Essex	26,608	26,970	27,226	27,402	27,681	27,967	28,261	28,562	28,871	29,188	29,514
Gloucester	6,008	6,079	6,163	6,250	6,342	6,439	6,543	6,653	6,770	6,895	7,027
Hudson	24,494	24,801	24,980	25,105	25,311	25,524	25,744	25,971	26,205	26,448	26,698
Hunterdon	1,729	1,766	1,776	1,793	1,818	1,844	1,872	1,902	1,934	1,968	2,004
Mercer	9,774	9,900	9,960	10,045	10,143	10,249	10,362	10,484	10,616	10,756	10,908
Middlesex	23,539	23,749	23,917	24,065	24,256	24,452	24,654	24,861	25,074	25,293	25,517
Monmouth	14,944	15,128	15,249	15,368	15,512	15,663	15,819	15,983	16,153	16,331	16,516
Morris	9,869	10,037	10,146	10,253	10,375	10,503	10,637	10,776	10,921	11,073	11,232
Ocean	17,348	17,488	17,566	17,634	17,710	17,786	17,862	17,940	18,017	18,095	18,174
Passaic	22,126	22,403	22,551	22,757	22,995	23,248	23,519	23,806	24,113	24,439	24,787
Somerset	6,813	6,890	6,948	7,009	7,071	7,136	7,204	7,276	7,352	7,432	7,516
Sussex	1,845	1,862	1,888	1,899	1,919	1,939	1,961	1,983	2,007	2,032	2,058
Union	21,604	21,899	22,054	22,239	22,453	22,675	22,903	23,138	23,381	23,631	23,889
Warren	1,729	1,772	1,792	1,829	1,864	1,903	1,946	1,994	2,046	2,104	2,169

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:		
	11/6	11/7	11/8	11/9	11/11	11/13	11/15
Bergen	26,382	26,714	26,924	27,060	27,489 (5,498) [1,319] {660}	27,949 (5,590) [1,342] {671}	28,444 (5,689) [1,365] {683}
Burlington	9,126	9,265	9,355	9,504	9,737 (1,947) [467] {234}	9,992 (1,998) [480] {240}	10,271 (2,054) [493] {247}
Camden	12,662	12,899	13,020	13,219	13,645 (2,729) [655] {327}	14,133 (2,827) [678] {339}	14,693 (2,939) [705] {353}
Essex	26,608	26,970	27,226	27,402	27,967 (5,593) [1,342] {671}	28,562 (5,712) [1,371] {685}	29,188 (5,838) [1,401] {701}
Gloucester	6,008	6,079	6,163	6,250	6,439 (1,288) [309] {155}	6,653 (1,331) [319] {160}	6,895 (1,379) [331] {165}
Hudson	24,494	24,801	24,980	25,105	25,524 (5,105) [1,225] {613}	25,971 (5,194) [1,247] {623}	26,448 (5,290) [1,269] {635}
Hunterdon	1,729	1,766	1,776	1,793	1,844 (369) [89] {44}	1,902 (380) [91] {46}	1,968 (394) [94] {47}
Mercer	9,774	9,900	9,960	10,045	10,249 (2,050) [492] {246}	10,484 (2,097) [503] {252}	10,756 (2,151) [516] {258}
Middlesex	23,539	23,749	23,917	24,065	24,452 (4,890) [1,174] {587}	24,861 (4,972) [1,193] {597}	25,293 (5,059) [1,214] {607}
Monmouth	14,944	15,128	15,249	15,368	15,663 (3,133) [752] {376}	15,983 (3,197) [767] {384}	16,331 (3,266) [784] {392}
Morris	9,869	10,037	10,146	10,253	10,503 (2,101) [504] {252}	10,776 (2,155) [517] {259}	11,073 (2,215) [532] {266}
Ocean	17,348	17,488	17,566	17,634	17,786 (3,557) [854] {427}	17,940 (3,588) [861] {431}	18,095 (3,619) [869] {434}
Passaic	22,126	22,403	22,551	22,757	23,248 (4,650) [1,116] {558}	23,806 (4,761) [1,143] {571}	24,439 (4,888) [1,173] {587}
Somerset	6,813	6,890	6,948	7,009	7,136 (1,427) [343] {171}	7,276 (1,455) [349] {175}	7,432 (1,486) [357] {178}
Sussex	1,845	1,862	1,888	1,899	1,939 (388) [93] {47}	1,983 (397) [95] {48}	2,032 (406) [98] {49}
Union	21,604	21,899	22,054	22,239	22,675 (4,535) [1,088] {544}	23,138 (4,628) [1,111] {555}	23,631 (4,726) [1,134] {567}
Warren	1,729	1,772	1,792	1,829	1,903 (381) [91] {46}	1,994 (399) [96] {48}	2,104 (421) [101] {51}

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.