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

Date: 4/9/21

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 4/9/21 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.

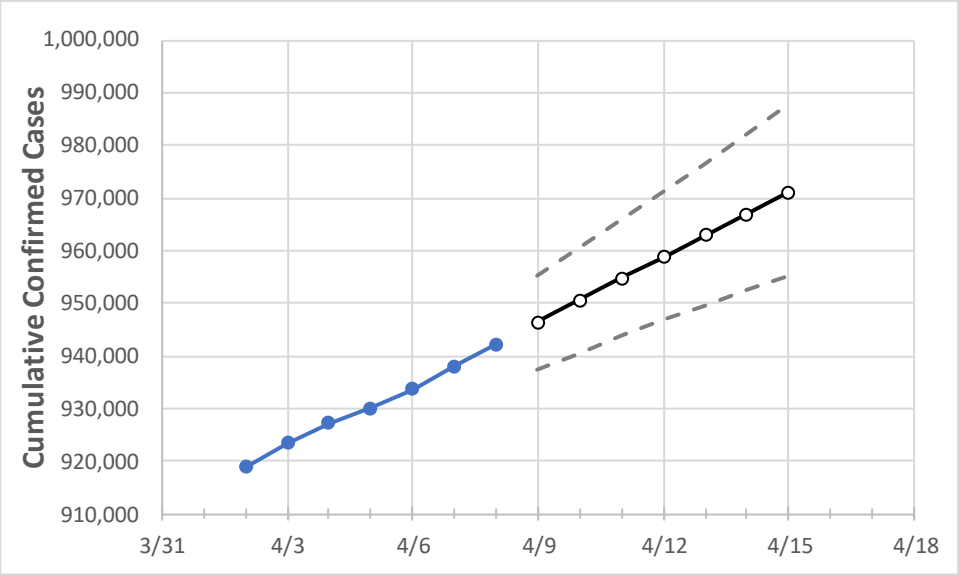
IEM's Modeling Lead

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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
New Jersey	930,026	933,736	937,979	942,311	946,434	950,544	954,676	958,764	962,846	966,967	971,022

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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
Bergen	93,767	94,130	94,657	95,067	95,543	96,026	96,510	96,989	97,472	97,949	98,425
Burlington	40,821	40,959	41,085	41,277	41,460	41,643	41,825	42,010	42,195	42,381	42,569
Camden	49,833	49,963	50,148	50,353	50,557	50,763	50,973	51,180	51,392	51,604	51,825
Essex	87,242	87,641	88,166	88,674	89,138	89,606	90,083	90,558	91,037	91,510	91,979
Gloucester	27,438	27,518	27,642	27,785	27,897	28,012	28,128	28,243	28,359	28,475	28,589
Hudson	81,520	81,819	82,191	82,594	82,941	83,291	83,630	83,973	84,311	84,637	84,962
Hunterdon	8,641	8,688	8,743	8,797	8,859	8,923	8,986	9,050	9,117	9,184	9,250
Mercer	31,394	31,497	31,617	31,738	31,852	31,964	32,077	32,190	32,301	32,415	32,527
Middlesex	85,227	85,647	86,006	86,471	86,855	87,245	87,627	88,007	88,384	88,766	89,147
Monmouth	69,492	69,781	70,111	70,418	70,701	70,978	71,246	71,518	71,784	72,043	72,295
Morris	46,036	46,290	46,472	46,694	46,905	47,118	47,331	47,544	47,755	47,955	48,164
Ocean	70,020	70,250	70,592	70,941	71,255	71,565	71,870	72,171	72,480	72,785	73,084
Passaic	65,784	66,120	66,384	66,665	66,954	67,245	67,529	67,812	68,108	68,410	68,702
Somerset	27,346	27,496	27,626	27,734	27,864	27,992	28,115	28,241	28,366	28,488	28,612
Sussex	12,114	12,178	12,252	12,361	12,464	12,565	12,668	12,769	12,870	12,973	13,073
Union	65,522	65,739	66,033	66,310	66,577	66,846	67,116	67,383	67,647	67,917	68,189
Warren	8,678	8,716	8,755	8,793	8,835	8,876	8,917	8,958	8,999	9,039	9,078

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:		
	4/5	4/6	4/7	4/8	4/10	4/12	4/14
Bergen	93,767	94,130	94,657	95,067	96,026 (19,205) [4,609] {2,305}	96,989 (19,398) [4,655] {2,328}	97,949 (19,590) [4,702] {2,351}
Burlington	40,821	40,959	41,085	41,277	41,643 (8,329) [1,999] {999}	42,010 (8,402) [2,016] {1,008}	42,381 (8,476) [2,034] {1,017}
Camden	49,833	49,963	50,148	50,353	50,763 (10,153) [2,437] {1,218}	51,180 (10,236) [2,457] {1,228}	51,604 (10,321) [2,477] {1,238}
Essex	87,242	87,641	88,166	88,674	89,606 (17,921) [4,301] {2,151}	90,558 (18,112) [4,347] {2,173}	91,510 (18,302) [4,392] {2,196}
Gloucester	27,438	27,518	27,642	27,785	28,012 (5,602) [1,345] {672}	28,243 (5,649) [1,356] {678}	28,475 (5,695) [1,367] {683}
Hudson	81,520	81,819	82,191	82,594	83,291 (16,658) [3,998] {1,999}	83,973 (16,795) [4,031] {2,015}	84,637 (16,927) [4,063] {2,031}
Hunterdon	8,641	8,688	8,743	8,797	8,923 (1,785) [428] {214}	9,050 (1,810) [434] {217}	9,184 (1,837) [441] {220}
Mercer	31,394	31,497	31,617	31,738	31,964 (6,393) [1,534] {767}	32,190 (6,438) [1,545] {773}	32,415 (6,483) [1,556] {778}
Middlesex	85,227	85,647	86,006	86,471	87,245 (17,449) [4,188] {2,094}	88,007 (17,601) [4,224] {2,112}	88,766 (17,753) [4,261] {2,130}
Monmouth	69,492	69,781	70,111	70,418	70,978 (14,196) [3,407] {1,703}	71,518 (14,304) [3,433] {1,716}	72,043 (14,409) [3,458] {1,729}
Morris	46,036	46,290	46,472	46,694	47,118 (9,424) [2,262] {1,131}	47,544 (9,509) [2,282] {1,141}	47,955 (9,591) [2,302] {1,151}
Ocean	70,020	70,250	70,592	70,941	71,565 (14,313) [3,435] {1,718}	72,171 (14,434) [3,464] {1,732}	72,785 (14,557) [3,494] {1,747}
Passaic	65,784	66,120	66,384	66,665	67,245 (13,449) [3,228] {1,614}	67,812 (13,562) [3,255] {1,627}	68,410 (13,682) [3,284] {1,642}
Somerset	27,346	27,496	27,626	27,734	27,992 (5,598) [1,344] {672}	28,241 (5,648) [1,356] {678}	28,488 (5,698) [1,367] {684}
Sussex	12,114	12,178	12,252	12,361	12,565 (2,513) [603] {302}	12,769 (2,554) [613] {306}	12,973 (2,595) [623] {311}
Union	65,522	65,739	66,033	66,310	66,846 (13,369) [3,209] {1,604}	67,383 (13,477) [3,234] {1,617}	67,917 (13,583) [3,260] {1,630}
Warren	8,678	8,716	8,755	8,793	8,876 (1,775) [426] {213}	8,958 (1,792) [430] {215}	9,039 (1,808) [434] {217}

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.