IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/24/20

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 <u>not</u> 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 12/24/20 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
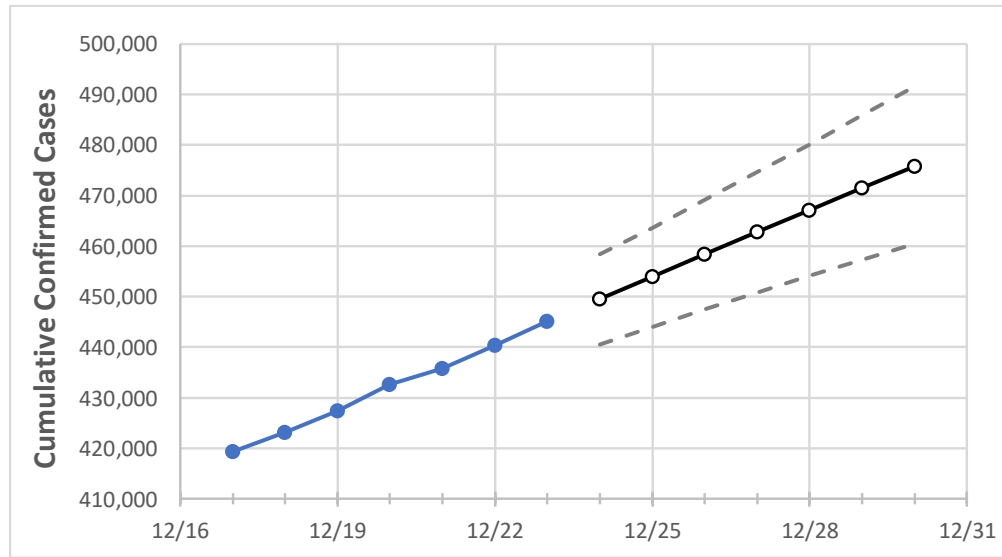
	Actual Confirmed Cases On:				Projected Cases For:						
	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28	12/29	12/30
New Jersey	432,592	435,763	440,366	445,138	449,534	453,983	458,399	462,822	467,052	471,509	475,851

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:						
	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28	12/29	12/30
Bergen	43,119	43,370	43,707	44,166	44,511	44,863	45,206	45,544	45,868	46,194	46,519
Burlington	18,466	18,654	18,945	19,213	19,440	19,672	19,904	20,128	20,357	20,585	20,811
Camden	25,781	25,955	26,272	26,533	26,793	27,063	27,326	27,583	27,843	28,101	28,355
Essex	43,793	44,015	44,318	44,669	45,014	45,357	45,694	46,021	46,350	46,668	46,991
Gloucester	12,516	12,600	12,821	13,006	13,158	13,306	13,459	13,606	13,759	13,906	14,050
Hudson	39,769	39,991	40,406	40,822	41,176	41,527	41,882	42,228	42,568	42,909	43,234
Hunterdon	3,338	3,376	3,404	3,442	3,484	3,526	3,569	3,612	3,657	3,702	3,747
Mercer	17,349	17,450	17,625	17,790	17,954	18,118	18,278	18,441	18,603	18,765	18,929
Middlesex	40,232	40,626	41,169	41,673	42,193	42,712	43,234	43,769	44,290	44,821	45,355
Monmouth	27,954	28,237	28,699	29,070	29,462	29,854	30,247	30,652	31,051	31,446	31,849
Morris	18,119	18,307	18,488	18,764	18,976	19,185	19,400	19,610	19,821	20,033	20,244
Ocean	28,637	28,936	29,274	29,589	29,951	30,318	30,687	31,066	31,450	31,826	32,214
Passaic	37,488	37,685	37,846	38,270	38,541	38,815	39,067	39,328	39,580	39,821	40,066
Somerset	11,494	11,589	11,659	11,752	11,857	11,962	12,068	12,171	12,278	12,381	12,481
Sussex	3,747	3,800	3,877	3,960	4,029	4,100	4,173	4,247	4,323	4,398	4,477
Union	34,251	34,388	34,668	34,897	35,138	35,379	35,611	35,844	36,080	36,311	36,532
Warren	3,413	3,471	3,508	3,551	3,599	3,646	3,693	3,741	3,788	3,835	3,883

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:		
	12/20	12/21	12/22	12/23	12/25	12/27	12/29
Bergen	43,119	43,370	43,707	44,166	44,863 (8,973) [2,153] {1,077}	45,544 (9,109) [2,186] {1,093}	46,194 (9,239) [2,217] {1,109}
Burlington	18,466	18,654	18,945	19,213	19,672 (3,934) [944] {472}	20,128 (4,026) [966] {483}	20,585 (4,117) [988] {494}
Camden	25,781	25,955	26,272	26,533	27,063 (5,413) [1,299] {650}	27,583 (5,517) [1,324] {662}	28,101 (5,620) [1,349] {674}
Essex	43,793	44,015	44,318	44,669	45,357 (9,071) [2,177] {1,089}	46,021 (9,204) [2,209] {1,105}	46,668 (9,334) [2,240] {1,120}
Gloucester	12,516	12,600	12,821	13,006	13,306 (2,661) [639] {319}	13,606 (2,721) [653] {327}	13,906 (2,781) [667] {334}
Hudson	39,769	39,991	40,406	40,822	41,527 (8,305) [1,993] {997}	42,228 (8,446) [2,027] {1,013}	42,909 (8,582) [2,060] {1,030}
Hunterdon	3,338	3,376	3,404	3,442	3,526 (705) [169] {85}	3,612 (722) [173] {87}	3,702 (740) [178] {89}
Mercer	17,349	17,450	17,625	17,790	18,118 (3,624) [870] {435}	18,441 (3,688) [885] {443}	18,765 (3,753) [901] {450}
Middlesex	40,232	40,626	41,169	41,673	42,712 (8,542) [2,050] {1,025}	43,769 (8,754) [2,101] {1,050}	44,821 (8,964) [2,151] {1,076}
Monmouth	27,954	28,237	28,699	29,070	29,854 (5,971) [1,433] {716}	30,652 (6,130) [1,471] {736}	31,446 (6,289) [1,509] {755}
Morris	18,119	18,307	18,488	18,764	19,185 (3,837) [921] {460}	19,610 (3,922) [941] {471}	20,033 (4,007) [962] {481}
Ocean	28,637	28,936	29,274	29,589	30,318 (6,064) [1,455] {728}	31,066 (6,213) [1,491] {746}	31,826 (6,365) [1,528] {764}
Passaic	37,488	37,685	37,846	38,270	38,815 (7,763) [1,863] {932}	39,328 (7,866) [1,888] {944}	39,821 (7,964) [1,911] {956}
Somerset	11,494	11,589	11,659	11,752	11,962 (2,392) [574] {287}	12,171 (2,434) [584] {292}	12,381 (2,476) [594] {297}
Sussex	3,747	3,800	3,877	3,960	4,100 (820) [197] {98}	4,247 (849) [204] {102}	4,398 (880) [211] {106}
Union	34,251	34,388	34,668	34,897	35,379 (7,076) [1,698] {849}	35,844 (7,169) [1,721] {860}	36,311 (7,262) [1,743] {871}
Warren	3,413	3,471	3,508	3,551	3,646 (729) [175] {88}	3,741 (748) [180] {90}	3,835 (767) [184] {92}

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.