IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/5/21

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 <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 1/5/21 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
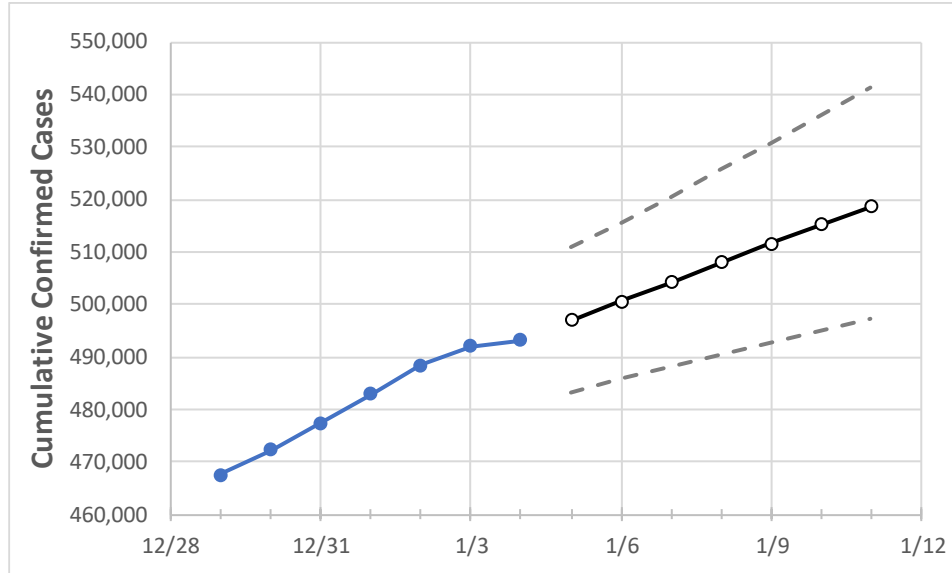
	Actual Confirmed Cases On:				Projected Cases For:						
	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
New Jersey	482,861	488,372	492,042	493,102	496,896	500,546	504,212	507,944	511,614	515,116	518,653

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:						
	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
Bergen	47,570	48,002	48,302	48,486	48,830	49,165	49,500	49,843	50,175	50,507	50,851
Burlington	21,461	21,777	21,996	22,099	22,337	22,576	22,811	23,047	23,286	23,527	23,761
Camden	28,910	29,278	29,475	29,615	29,848	30,082	30,312	30,540	30,760	30,979	31,195
Essex	47,699	48,070	48,379	48,518	48,804	49,080	49,354	49,621	49,892	50,163	50,430
Gloucester	14,293	14,491	14,595	14,690	14,825	14,963	15,096	15,231	15,366	15,496	15,630
Hudson	44,505	44,886	45,226	45,384	45,734	46,080	46,427	46,779	47,131	47,477	47,816
Hunterdon	3,799	3,868	3,882	3,914	3,951	3,988	4,025	4,062	4,099	4,136	4,172
Mercer	18,920	19,092	19,204	19,284	19,400	19,513	19,624	19,733	19,841	19,949	20,054
Middlesex	45,268	45,805	46,256	46,256	46,679	47,104	47,526	47,944	48,352	48,765	49,175
Monmouth	32,339	32,812	33,165	33,165	33,533	33,908	34,293	34,665	35,038	35,416	35,793
Morris	20,389	20,659	20,880	20,880	21,059	21,227	21,401	21,570	21,740	21,912	22,087
Ocean	32,872	33,423	33,718	33,718	34,096	34,476	34,858	35,244	35,642	36,028	36,416
Passaic	40,161	40,406	40,619	40,619	40,790	40,959	41,119	41,274	41,428	41,576	41,713
Somerset	12,760	12,908	13,003	13,003	13,104	13,203	13,306	13,409	13,508	13,612	13,715
Sussex	4,542	4,639	4,715	4,715	4,794	4,874	4,955	5,039	5,125	5,210	5,299
Union	36,834	37,158	37,298	37,298	37,492	37,686	37,873	38,053	38,239	38,415	38,594
Warren	3,978	4,047	4,078	4,078	4,124	4,169	4,215	4,262	4,307	4,354	4,399

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:		
	1/1	1/2	1/3	1/4	1/6	1/8	1/10
Bergen	47,570	48,002	48,302	48,486	49,165 (9,833) [2,360] {1,180}	49,843 (9,969) [2,392] {1,196}	50,507 (10,101) [2,424] {1,212}
Burlington	21,461	21,777	21,996	22,099	22,576 (4,515) [1,084] {542}	23,047 (4,609) [1,106] {553}	23,527 (4,705) [1,129] {565}
Camden	28,910	29,278	29,475	29,615	30,082 (6,016) [1,444] {722}	30,540 (6,108) [1,466] {733}	30,979 (6,196) [1,487] {744}
Essex	47,699	48,070	48,379	48,518	49,080 (9,816) [2,356] {1,178}	49,621 (9,924) [2,382] {1,191}	50,163 (10,033) [2,408] {1,204}
Gloucester	14,293	14,491	14,595	14,690	14,963 (2,993) [718] {359}	15,231 (3,046) [731] {366}	15,496 (3,099) [744] {372}
Hudson	44,505	44,886	45,226	45,384	46,080 (9,216) [2,212] {1,106}	46,779 (9,356) [2,245] {1,123}	47,477 (9,495) [2,279] {1,139}
Hunterdon	3,799	3,868	3,882	3,914	3,988 (798) [191] {96}	4,062 (812) [195] {97}	4,136 (827) [199] {99}
Mercer	18,920	19,092	19,204	19,284	19,513 (3,903) [937] {468}	19,733 (3,947) [947] {474}	19,949 (3,990) [958] {479}
Middlesex	45,268	45,805	46,256	46,256	47,104 (9,421) [2,261] {1,131}	47,944 (9,589) [2,301] {1,151}	48,765 (9,753) [2,341] {1,170}
Monmouth	32,339	32,812	33,165	33,165	33,908 (6,782) [1,628] {814}	34,665 (6,933) [1,664] {832}	35,416 (7,083) [1,700] {850}
Morris	20,389	20,659	20,880	20,880	21,227 (4,245) [1,019] {509}	21,570 (4,314) [1,035] {518}	21,912 (4,382) [1,052] {526}
Ocean	32,872	33,423	33,718	33,718	34,476 (6,895) [1,655] {827}	35,244 (7,049) [1,692] {846}	36,028 (7,206) [1,729] {865}
Passaic	40,161	40,406	40,619	40,619	40,959 (8,192) [1,966] {983}	41,274 (8,255) [1,981] {991}	41,576 (8,315) [1,996] {998}
Somerset	12,760	12,908	13,003	13,003	13,203 (2,641) [634] {317}	13,409 (2,682) [644] {322}	13,612 (2,722) [653] {327}
Sussex	4,542	4,639	4,715	4,715	4,874 (975) [234] {117}	5,039 (1,008) [242] {121}	5,210 (1,042) [250] {125}
Union	36,834	37,158	37,298	37,298	37,686 (7,537) [1,809] {904}	38,053 (7,611) [1,827] {913}	38,415 (7,683) [1,844] {922}
Warren	3,978	4,047	4,078	4,078	4,169 (834) [200] {100}	4,262 (852) [205] {102}	4,354 (871) [209] {104}

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.