IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/30/20

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 9/30/20 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
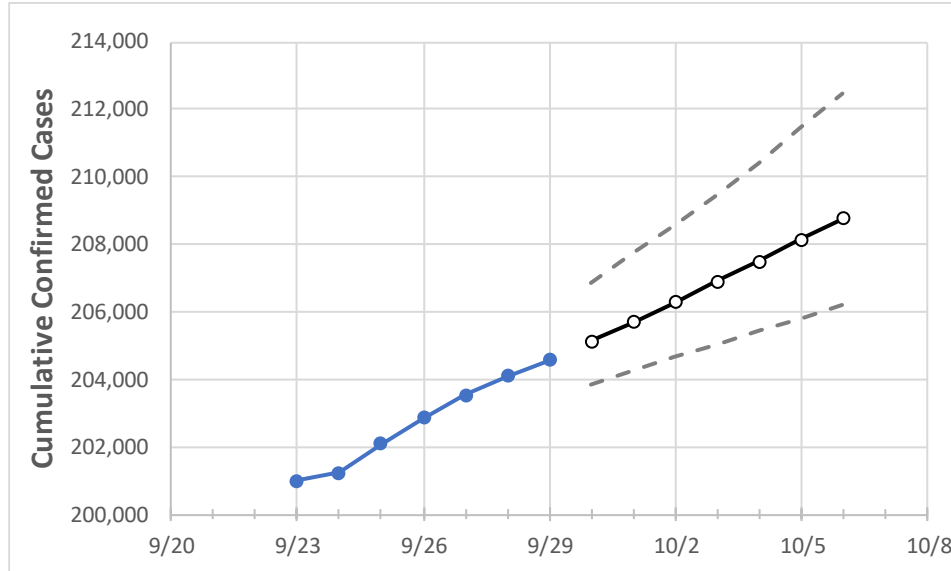
	Actual Confirmed Cases On:				Projected Cases For:						
	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5	10/6
New Jersey	202,850	203,548	204,107	204,563	205,125	205,700	206,287	206,888	207,501	208,128	208,769

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:						
	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5	10/6
Bergen	22,363	22,406	22,439	22,473	22,512	22,552	22,593	22,636	22,680	22,725	22,772
Burlington	7,098	7,127	7,145	7,169	7,197	7,225	7,254	7,282	7,311	7,340	7,369
Camden	9,860	9,888	9,907	9,927	9,951	9,976	10,000	10,024	10,047	10,071	10,094
Essex	21,024	21,054	21,070	21,091	21,120	21,149	21,179	21,209	21,240	21,271	21,302
Gloucester	4,489	4,511	4,523	4,560	4,584	4,607	4,629	4,652	4,674	4,695	4,716
Hudson	20,621	20,643	20,661	20,692	20,716	20,741	20,767	20,793	20,821	20,849	20,878
Hunterdon	1,311	1,321	1,324	1,330	1,335	1,341	1,346	1,352	1,358	1,364	1,371
Mercer	8,628	8,637	8,643	8,653	8,661	8,669	8,677	8,685	8,693	8,701	8,708
Middlesex	19,379	19,444	19,503	19,539	19,600	19,663	19,729	19,798	19,871	19,946	20,025
Monmouth	11,778	11,827	11,856	11,892	11,936	11,980	12,025	12,071	12,117	12,164	12,211
Morris	7,847	7,860	7,871	7,887	7,905	7,924	7,944	7,964	7,985	8,007	8,029
Ocean	12,903	13,158	13,402	13,481	13,655	13,842	14,043	14,261	14,495	14,747	15,019
Passaic	18,982	19,004	19,023	19,065	19,093	19,121	19,149	19,179	19,208	19,239	19,270
Somerset	5,786	5,798	5,808	5,819	5,830	5,841	5,852	5,864	5,875	5,886	5,897
Sussex	1,490	1,497	1,502	1,506	1,511	1,516	1,521	1,527	1,533	1,539	1,546
Union	17,602	17,641	17,671	17,689	17,722	17,757	17,793	17,831	17,870	17,912	17,955
Warren	1,438	1,441	1,443	1,445	1,446	1,448	1,449	1,450	1,452	1,453	1,454

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:**		
	9/26	9/27	9/28	9/29	10/1	10/3	10/5
Bergen	22,363	22,406	22,439	22,473	22,552 (4,510) [1,082] {541}	22,636 (4,527) [1,087] {543}	22,725 (4,545) [1,091] {545}
Burlington	7,098	7,127	7,145	7,169	7,225 (1,445) [347] {173}	7,282 (1,456) [350] {175}	7,340 (1,468) [352] {176}
Camden	9,860	9,888	9,907	9,927	9,976 (1,995) [479] {239}	10,024 (2,005) [481] {241}	10,071 (2,014) [483] {242}
Essex	21,024	21,054	21,070	21,091	21,149 (4,230) [1,015] {508}	21,209 (4,242) [1,018] {509}	21,271 (4,254) [1,021] {511}
Gloucester	4,489	4,511	4,523	4,560	4,607 (921) [221] {111}	4,652 (930) [223] {112}	4,695 (939) [225] {113}
Hudson	20,621	20,643	20,661	20,692	20,741 (4,148) [996] {498}	20,793 (4,159) [998] {499}	20,849 (4,170) [1,001] {500}
Hunterdon	1,311	1,321	1,324	1,330	1,341 (268) [64] {32}	1,352 (270) [65] {32}	1,364 (273) [65] {33}
Mercer	8,628	8,637	8,643	8,653	8,669 (1,734) [416] {208}	8,685 (1,737) [417] {208}	8,701 (1,740) [418] {209}
Middlesex	19,379	19,444	19,503	19,539	19,663 (3,933) [944] {472}	19,798 (3,960) [950] {475}	19,946 (3,989) [957] {479}
Monmouth	11,778	11,827	11,856	11,892	11,980 (2,396) [575] {288}	12,071 (2,414) [579] {290}	12,164 (2,433) [584] {292}
Morris	7,847	7,860	7,871	7,887	7,924 (1,585) [380] {190}	7,964 (1,593) [382] {191}	8,007 (1,601) [384] {192}
Ocean	12,903	13,158	13,402	13,481	13,842 (2,768) [664] {332}	14,261 (2,852) [685] {342}	14,747 (2,949) [708] {354}
Passaic	18,982	19,004	19,023	19,065	19,121 (3,824) [918] {459}	19,179 (3,836) [921] {460}	19,239 (3,848) [923] {462}
Somerset	5,786	5,798	5,808	5,819	5,841 (1,168) [280] {140}	5,864 (1,173) [281] {141}	5,886 (1,177) [283] {141}
Sussex	1,490	1,497	1,502	1,506	1,516 (303) [73] {36}	1,527 (305) [73] {37}	1,539 (308) [74] {37}
Union	17,602	17,641	17,671	17,689	17,757 (3,551) [852] {426}	17,831 (3,566) [856] {428}	17,912 (3,582) [860] {430}
Warren	1,438	1,441	1,443	1,445	1,448 (290) [69] {35}	1,450 (290) [70] {35}	1,453 (291) [70] {35}

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.