IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/17/20

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 12/17/20 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
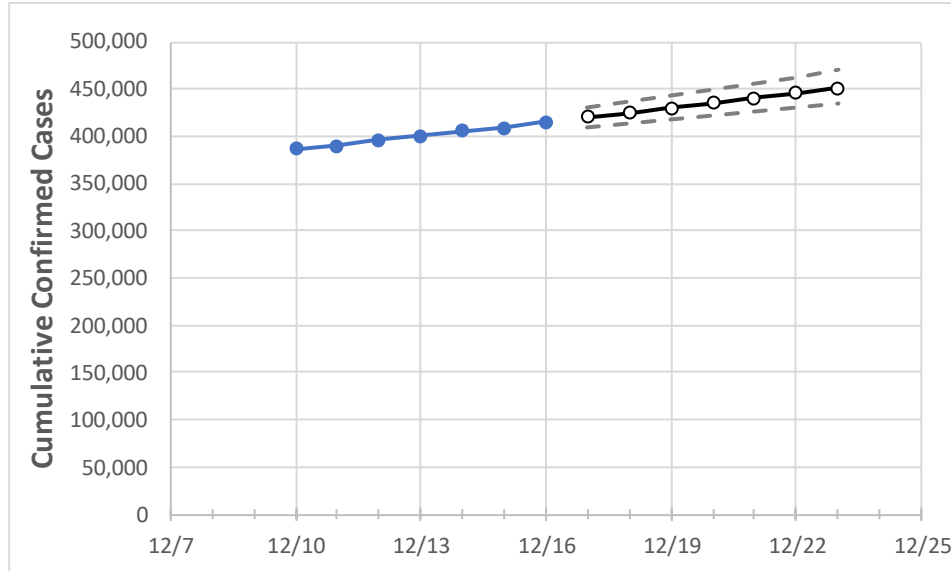
	Actual Confirmed Cases On:				Projected Cases For:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
New Jersey	400,650	405,448	409,414	415,075	420,170	425,297	430,454	435,643	440,863	446,115	451,398

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:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Bergen	40,483	40,879	41,216	41,641	42,056	42,470	42,884	43,298	43,712	44,125	44,539
Burlington	16,874	17,179	17,392	17,630	17,877	18,125	18,374	18,625	18,876	19,129	19,383
Camden	23,633	24,003	24,248	24,539	24,868	25,197	25,526	25,856	26,186	26,516	26,846
Essex	41,089	41,471	41,767	42,329	42,792	43,259	43,731	44,208	44,689	45,175	45,665
Gloucester	11,472	11,597	11,756	11,898	12,084	12,271	12,460	12,651	12,844	13,039	13,236
Hudson	37,187	37,521	37,925	38,429	38,882	39,339	39,802	40,269	40,741	41,218	41,699
Hunterdon	3,040	3,077	3,108	3,156	3,200	3,244	3,289	3,335	3,381	3,427	3,474
Mercer	16,134	16,312	16,515	16,725	16,904	17,084	17,264	17,445	17,625	17,806	17,987
Middlesex	36,739	37,291	37,721	38,339	38,897	39,467	40,049	40,644	41,251	41,871	42,504
Monmouth	25,288	25,681	25,981	26,465	26,877	27,297	27,723	28,157	28,599	29,047	29,503
Morris	16,692	16,934	17,092	17,339	17,590	17,845	18,103	18,365	18,630	18,900	19,173
Ocean	26,145	26,505	26,733	27,191	27,567	27,950	28,341	28,739	29,144	29,557	29,979
Passaic	35,368	35,737	35,996	36,414	36,796	37,178	37,561	37,944	38,327	38,711	39,096
Somerset	10,671	10,798	10,923	11,102	11,238	11,376	11,516	11,659	11,803	11,950	12,099
Sussex	3,349	3,403	3,455	3,511	3,580	3,651	3,723	3,798	3,874	3,952	4,033
Union	32,383	32,669	32,935	33,375	33,698	34,023	34,350	34,679	35,010	35,343	35,678
Warren	3,079	3,146	3,181	3,236	3,289	3,342	3,397	3,452	3,508	3,565	3,623

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:		
	12/13	12/14	12/15	12/16	12/18	12/20	12/22
Bergen	40,483	40,879	41,216	41,641	42,470 (8,494) [2,039] {1,019}	43,298 (8,660) [2,078] {1,039}	44,125 (8,825) [2,118] {1,059}
Burlington	16,874	17,179	17,392	17,630	18,125 (3,625) [870] {435}	18,625 (3,725) [894] {447}	19,129 (3,826) [918] {459}
Camden	23,633	24,003	24,248	24,539	25,197 (5,039) [1,209] {605}	25,856 (5,171) [1,241] {621}	26,516 (5,303) [1,273] {636}
Essex	41,089	41,471	41,767	42,329	43,259 (8,652) [2,076] {1,038}	44,208 (8,842) [2,122] {1,061}	45,175 (9,035) [2,168] {1,084}
Gloucester	11,472	11,597	11,756	11,898	12,271 (2,454) [589] {295}	12,651 (2,530) [607] {304}	13,039 (2,608) [626] {313}
Hudson	37,187	37,521	37,925	38,429	39,339 (7,868) [1,888] {944}	40,269 (8,054) [1,933] {966}	41,218 (8,244) [1,978] {989}
Hunterdon	3,040	3,077	3,108	3,156	3,244 (649) [156] {78}	3,335 (667) [160] {80}	3,427 (685) [164] {82}
Mercer	16,134	16,312	16,515	16,725	17,084 (3,417) [820] {410}	17,445 (3,489) [837] {419}	17,806 (3,561) [855] {427}
Middlesex	36,739	37,291	37,721	38,339	39,467 (7,893) [1,894] {947}	40,644 (8,129) [1,951] {975}	41,871 (8,374) [2,010] {1,005}
Monmouth	25,288	25,681	25,981	26,465	27,297 (5,459) [1,310] {655}	28,157 (5,631) [1,352] {676}	29,047 (5,809) [1,394] {697}
Morris	16,692	16,934	17,092	17,339	17,845 (3,569) [857] {428}	18,365 (3,673) [882] {441}	18,900 (3,780) [907] {454}
Ocean	26,145	26,505	26,733	27,191	27,950 (5,590) [1,342] {671}	28,739 (5,748) [1,379] {690}	29,557 (5,911) [1,419] {709}
Passaic	35,368	35,737	35,996	36,414	37,178 (7,436) [1,785] {892}	37,944 (7,589) [1,821] {911}	38,711 (7,742) [1,858] {929}
Somerset	10,671	10,798	10,923	11,102	11,376 (2,275) [546] {273}	11,659 (2,332) [560] {280}	11,950 (2,390) [574] {287}
Sussex	3,349	3,403	3,455	3,511	3,651 (730) [175] {88}	3,798 (760) [182] {91}	3,952 (790) [190] {95}
Union	32,383	32,669	32,935	33,375	34,023 (6,805) [1,633] {817}	34,679 (6,936) [1,665] {832}	35,343 (7,069) [1,696] {848}
Warren	3,079	3,146	3,181	3,236	3,342 (668) [160] {80}	3,452 (690) [166] {83}	3,565 (713) [171] {86}

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.