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

Date: 7/8/20

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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 7/8/20 11 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.

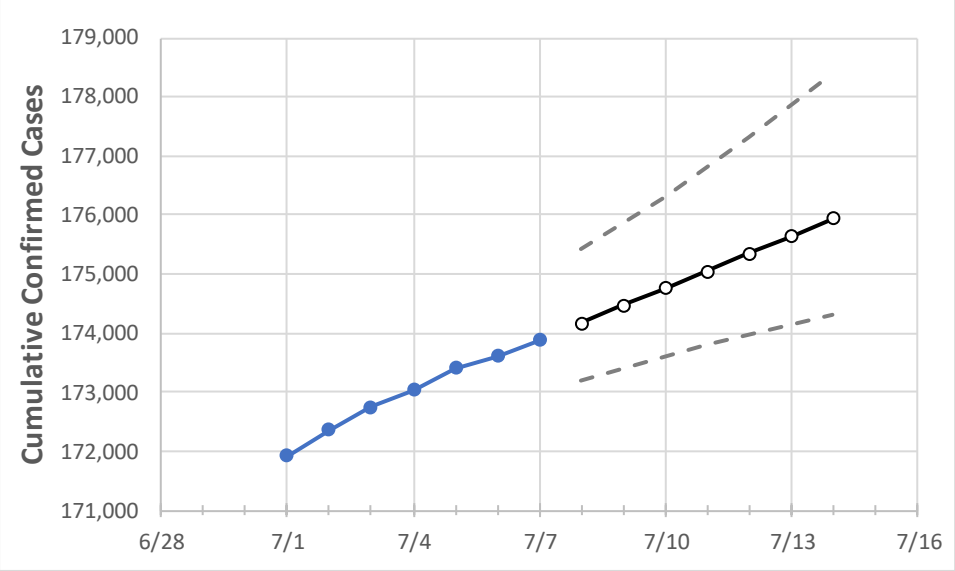
IEM's Modeling Lead

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:						
	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14
New Jersey	173,032	173,402	173,611	173,878	174,171	174,464	174,758	175,051	175,345	175,639	175,932

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:						
	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14
Bergen	19,562	19,625	19,655	19,676	19,709	19,742	19,776	19,808	19,841	19,874	19,907
Burlington	5,243	5,262	5,277	5,295	5,311	5,327	5,344	5,360	5,377	5,394	5,411
Camden	7,434	7,479	7,496	7,536	7,562	7,589	7,616	7,643	7,671	7,700	7,728
Essex	18,859	18,887	18,895	18,918	18,938	18,958	18,977	18,997	19,016	19,035	19,054
Gloucester	2,630	2,645	2,656	2,671	2,685	2,699	2,713	2,727	2,742	2,757	2,773
Hudson	18,945	18,976	18,990	19,016	19,040	19,067	19,097	19,129	19,166	19,206	19,251
Hunterdon	1,087	1,088	1,090	1,090	1,092	1,094	1,096	1,098	1,100	1,102	1,104
Mercer	7,727	7,740	7,745	7,756	7,767	7,777	7,787	7,797	7,806	7,816	7,825
Middlesex	16,901	16,913	16,957	16,966	16,986	17,007	17,027	17,047	17,067	17,087	17,108
Monmouth	9,272	9,308	9,320	9,346	9,368	9,391	9,413	9,436	9,459	9,481	9,504
Morris	6,800	6,809	6,820	6,830	6,844	6,855	6,866	6,876	6,886	6,896	6,906
Ocean	9,682	9,706	9,716	9,738	9,752	9,765	9,778	9,791	9,803	9,815	9,827
Passaic	16,941	16,954	16,963	16,974	16,983	16,991	16,999	17,007	17,015	17,022	17,030
Somerset	4,928	4,937	4,943	4,945	4,954	4,963	4,973	4,983	4,993	5,004	5,016
Sussex	1,209	1,210	1,211	1,214	1,216	1,218	1,221	1,223	1,225	1,227	1,230
Union	16,441	16,455	16,432	16,450	16,468	16,478	16,488	16,498	16,508	16,519	16,529
Warren	1,249	1,253	1,255	1,258	1,261	1,265	1,269	1,273	1,277	1,281	1,286

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:		
	7/4	7/5	7/6	7/7	7/9	7/11	7/13
Bergen	19,562	19,625	19,655	19,676	19,742 (3,948) [948] {474}	19,808 (3,962) [951] {475}	19,874 (3,975) [954] {477}
Burlington	5,243	5,262	5,277	5,295	5,327 (1,065) [256] {128}	5,360 (1,072) [257] {129}	5,394 (1,079) [259] {129}
Camden	7,434	7,479	7,496	7,536	7,589 (1,518) [364] {182}	7,643 (1,529) [367] {183}	7,700 (1,540) [370] {185}
Essex	18,859	18,887	18,895	18,918	18,958 (3,792) [910] {455}	18,997 (3,799) [912] {456}	19,035 (3,807) [914] {457}
Gloucester	2,630	2,645	2,656	2,671	2,699 (540) [130] {65}	2,727 (545) [131] {65}	2,757 (551) [132] {66}
Hudson	18,945	18,976	18,990	19,016	19,067 (3,813) [915] {458}	19,129 (3,826) [918] {459}	19,206 (3,841) [922] {461}
Hunterdon	1,087	1,088	1,090	1,090	1,094 (219) [53] {26}	1,098 (220) [53] {26}	1,102 (220) [53] {26}
Mercer	7,727	7,740	7,745	7,756	7,777 (1,555) [373] {187}	7,797 (1,559) [374] {187}	7,816 (1,563) [375] {188}
Middlesex	16,901	16,913	16,957	16,966	17,007 (3,401) [816] {408}	17,047 (3,409) [818] {409}	17,087 (3,417) [820] {410}
Monmouth	9,272	9,308	9,320	9,346	9,391 (1,878) [451] {225}	9,436 (1,887) [453] {226}	9,481 (1,896) [455] {228}
Morris	6,800	6,809	6,820	6,830	6,855 (1,371) [329] {165}	6,876 (1,375) [330] {165}	6,896 (1,379) [331] {166}
Ocean	9,682	9,706	9,716	9,738	9,765 (1,953) [469] {234}	9,791 (1,958) [470] {235}	9,815 (1,963) [471] {236}
Passaic	16,941	16,954	16,963	16,974	16,991 (3,398) [816] {408}	17,007 (3,401) [816] {408}	17,022 (3,404) [817] {409}
Somerset	4,928	4,937	4,943	4,945	4,963 (993) [238] {119}	4,983 (997) [239] {120}	5,004 (1,001) [240] {120}
Sussex	1,209	1,210	1,211	1,214	1,218 (244) [58] {29}	1,223 (245) [59] {29}	1,227 (245) [59] {29}
Union	16,441	16,455	16,432	16,450	16,478 (3,296) [791] {395}	16,498 (3,300) [792] {396}	16,519 (3,304) [793] {396}
Warren	1,249	1,253	1,255	1,258	1,265 (253) [61] {30}	1,273 (255) [61] {31}	1,281 (256) [61] {31}

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.