IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/8/21

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 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 1/8/21 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
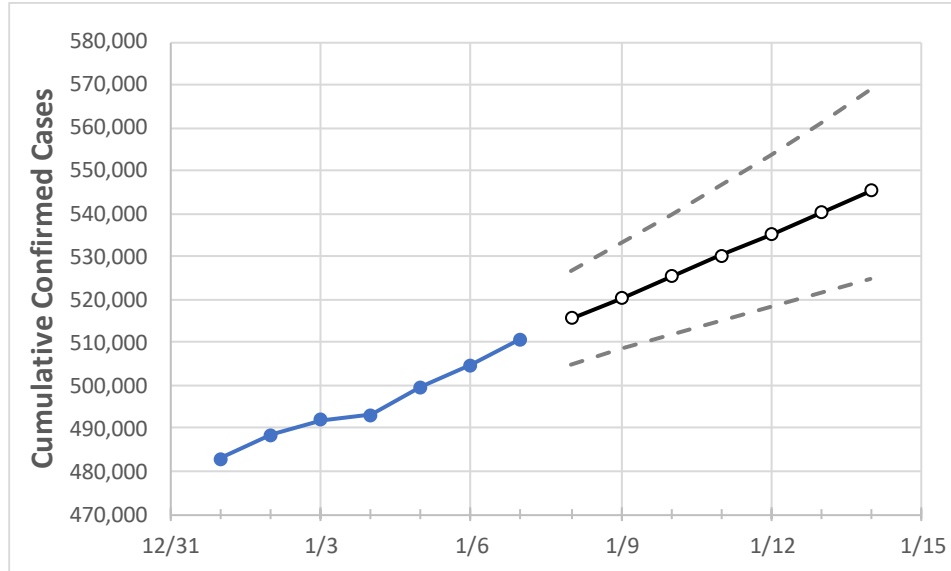
	Actual Confirmed Cases On:				Projected Cases For:						
	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14
New Jersey	493,102	499,636	504,647	510,839	515,580	520,395	525,283	530,201	535,224	540,265	545,452

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:						
	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14
Bergen	48,486	48,953	49,480	49,974	50,404	50,839	51,278	51,718	52,165	52,621	53,082
Burlington	22,099	22,484	22,788	23,063	23,336	23,601	23,868	24,127	24,391	24,652	24,930
Camden	29,615	29,924	30,242	30,639	30,918	31,199	31,473	31,754	32,037	32,318	32,602
Essex	48,518	48,879	49,329	49,865	50,238	50,610	50,999	51,366	51,758	52,138	52,535
Gloucester	14,690	14,918	15,169	15,395	15,576	15,766	15,962	16,158	16,359	16,565	16,778
Hudson	45,384	45,852	46,291	46,886	47,300	47,716	48,121	48,520	48,918	49,314	49,709
Hunterdon	3,914	3,981	4,020	4,084	4,130	4,176	4,222	4,269	4,317	4,365	4,414
Mercer	19,284	19,519	19,707	19,897	20,062	20,229	20,399	20,569	20,740	20,914	21,095
Middlesex	46,676	47,095	47,560	48,222	48,720	49,223	49,737	50,264	50,802	51,338	51,888
Monmouth	33,472	33,778	34,193	34,771	35,194	35,624	36,062	36,510	36,966	37,427	37,891
Morris	21,068	21,255	21,426	21,711	21,925	22,140	22,359	22,579	22,800	23,027	23,257
Ocean	34,049	34,379	34,741	35,174	35,580	35,987	36,396	36,815	37,236	37,662	38,097
Passaic	40,821	41,023	41,267	41,659	41,887	42,121	42,360	42,591	42,822	43,050	43,287
Somerset	13,096	13,189	13,303	13,440	13,554	13,671	13,789	13,905	14,022	14,141	14,263
Sussex	4,770	4,825	4,883	4,978	5,055	5,137	5,218	5,300	5,382	5,466	5,554
Union	37,467	37,635	37,849	38,180	38,401	38,623	38,847	39,071	39,295	39,527	39,750
Warren	4,121	4,163	4,197	4,263	4,307	4,351	4,394	4,438	4,481	4,524	4,567

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:		
	1/4	1/5	1/6	1/7	1/9	1/11	1/13
Bergen	48,486	48,953	49,480	49,974	50,839 (10,168) [2,440] {1,220}	51,718 (10,344) [2,482] {1,241}	52,621 (10,524) [2,526] {1,263}
Burlington	22,099	22,484	22,788	23,063	23,601 (4,720) [1,133] {566}	24,127 (4,825) [1,158] {579}	24,652 (4,930) [1,183] {592}
Camden	29,615	29,924	30,242	30,639	31,199 (6,240) [1,498] {749}	31,754 (6,351) [1,524] {762}	32,318 (6,464) [1,551] {776}
Essex	48,518	48,879	49,329	49,865	50,610 (10,122) [2,429] {1,215}	51,366 (10,273) [2,466] {1,233}	52,138 (10,428) [2,503] {1,251}
Gloucester	14,690	14,918	15,169	15,395	15,766 (3,153) [757] {378}	16,158 (3,232) [776] {388}	16,565 (3,313) [795] {398}
Hudson	45,384	45,852	46,291	46,886	47,716 (9,543) [2,290] {1,145}	48,520 (9,704) [2,329] {1,164}	49,314 (9,863) [2,367] {1,184}
Hunterdon	3,914	3,981	4,020	4,084	4,176 (835) [200] {100}	4,269 (854) [205] {102}	4,365 (873) [210] {105}
Mercer	19,284	19,519	19,707	19,897	20,229 (4,046) [971] {485}	20,569 (4,114) [987] {494}	20,914 (4,183) [1,004] {502}
Middlesex	46,676	47,095	47,560	48,222	49,223 (9,845) [2,363] {1,181}	50,264 (10,053) [2,413] {1,206}	51,338 (10,268) [2,464] {1,232}
Monmouth	33,472	33,778	34,193	34,771	35,624 (7,125) [1,710] {855}	36,510 (7,302) [1,752] {876}	37,427 (7,485) [1,797] {898}
Morris	21,068	21,255	21,426	21,711	22,140 (4,428) [1,063] {531}	22,579 (4,516) [1,084] {542}	23,027 (4,605) [1,105] {553}
Ocean	34,049	34,379	34,741	35,174	35,987 (7,197) [1,727] {864}	36,815 (7,363) [1,767] {884}	37,662 (7,532) [1,808] {904}
Passaic	40,821	41,023	41,267	41,659	42,121 (8,424) [2,022] {1,011}	42,591 (8,518) [2,044] {1,022}	43,050 (8,610) [2,066] {1,033}
Somerset	13,096	13,189	13,303	13,440	13,671 (2,734) [656] {328}	13,905 (2,781) [667] {334}	14,141 (2,828) [679] {339}
Sussex	4,770	4,825	4,883	4,978	5,137 (1,027) [247] {123}	5,300 (1,060) [254] {127}	5,466 (1,093) [262] {131}
Union	37,467	37,635	37,849	38,180	38,623 (7,725) [1,854] {927}	39,071 (7,814) [1,875] {938}	39,527 (7,905) [1,897] {949}
Warren	4,121	4,163	4,197	4,263	4,351 (870) [209] {104}	4,438 (888) 213 {107}	4,524 (905) [217] {109}

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.