IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/29/21

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 1/29/21 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
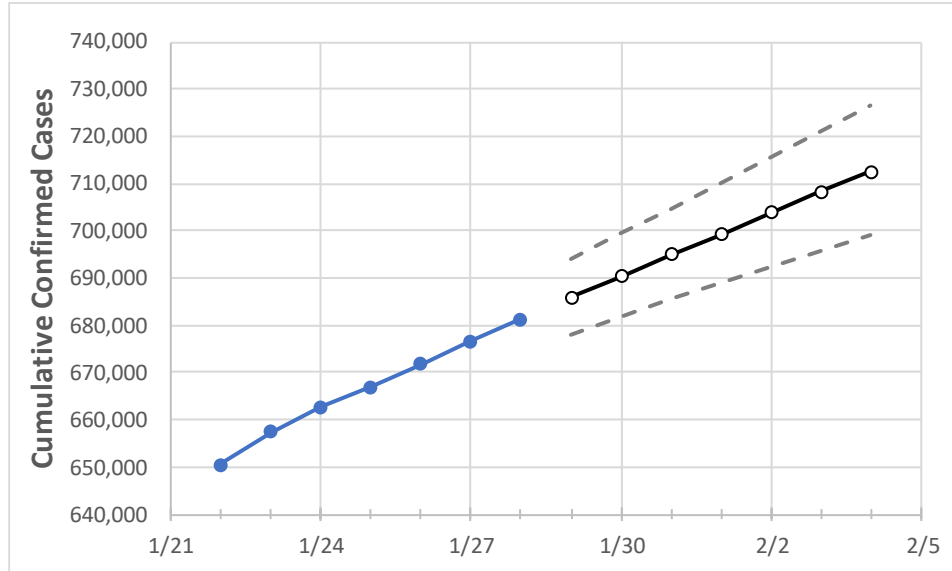
	Actual Confirmed Cases On:				Projected Cases For:						
	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4
New Jersey	666,951	671,781	676,537	681,283	685,924	690,456	694,948	699,319	703,759	708,191	712,459

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:						
	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4
Bergen	64,390	64,848	65,338	65,850	66,295	66,745	67,188	67,623	68,050	68,472	68,882
Burlington	30,248	30,433	30,661	30,835	31,039	31,239	31,433	31,622	31,809	31,994	32,174
Camden	38,941	39,166	39,397	39,614	39,846	40,078	40,306	40,531	40,754	40,968	41,176
Essex	62,266	62,593	63,084	63,524	63,901	64,282	64,656	65,015	65,375	65,727	66,085
Gloucester	20,881	21,100	21,259	21,434	21,610	21,783	21,952	22,120	22,285	22,453	22,613
Hudson	59,000	59,353	59,684	60,138	60,517	60,896	61,263	61,626	61,982	62,338	62,695
Hunterdon	5,630	5,668	5,714	5,746	5,785	5,821	5,856	5,890	5,923	5,956	5,989
Mercer	24,101	24,256	24,399	24,533	24,681	24,829	24,974	25,119	25,261	25,399	25,533
Middlesex	61,071	61,538	62,018	62,445	62,874	63,303	63,725	64,147	64,560	64,967	65,367
Monmouth	46,683	47,083	47,508	47,835	48,223	48,606	48,982	49,363	49,727	50,083	50,439
Morris	30,331	30,687	31,000	31,316	31,608	31,899	32,190	32,481	32,774	33,066	33,361
Ocean	47,600	48,022	48,406	48,944	49,374	49,800	50,225	50,646	51,066	51,490	51,905
Passaic	49,683	49,907	50,233	50,455	50,692	50,942	51,181	51,420	51,659	51,897	52,129
Somerset	19,136	19,257	19,377	19,508	19,628	19,747	19,861	19,976	20,086	20,196	20,304
Sussex	7,451	7,518	7,584	7,649	7,721	7,789	7,857	7,924	7,990	8,054	8,119
Union	49,621	49,908	50,154	50,429	50,674	50,914	51,150	51,381	51,612	51,837	52,054
Warren	5,783	5,825	5,882	5,929	5,975	6,019	6,062	6,104	6,146	6,187	6,226

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:		
	1/25	1/26	1/27	1/28	1/30	2/1	2/3
Bergen	64,390	64,848	65,338	65,850	66,745 (13,349) [3,204] {1,602}	67,623 (13,525) [3,246] {1,623}	68,472 (13,694) [3,287] {1,643}
Burlington	30,248	30,433	30,661	30,835	31,239 (6,248) [1,499] {750}	31,622 (6,324) [1,518] {759}	31,994 (6,399) [1,536] {768}
Camden	38,941	39,166	39,397	39,614	40,078 (8,016) [1,924] {962}	40,531 (8,106) [1,946] {973}	40,968 (8,194) [1,966] {983}
Essex	62,266	62,593	63,084	63,524	64,282 (12,856) [3,086] {1,543}	65,015 (13,003) [3,121] {1,560}	65,727 (13,145) [3,155] {1,577}
Gloucester	20,881	21,100	21,259	21,434	21,783 (4,357) [1,046] {523}	22,120 (4,424) [1,062] {531}	22,453 (4,491) [1,078] {539}
Hudson	59,000	59,353	59,684	60,138	60,896 (12,179) [2,923] {1,461}	61,626 (12,325) [2,958] {1,479}	62,338 (12,468) [2,992] {1,496}
Hunterdon	5,630	5,668	5,714	5,746	5,821 (1,164) [279] {140}	5,890 (1,178) [283] {141}	5,956 (1,191) [286] {143}
Mercer	24,101	24,256	24,399	24,533	24,829 (4,966) [1,192] {596}	25,119 (5,024) [1,206] {603}	25,399 (5,080) [1,219] {610}
Middlesex	61,071	61,538	62,018	62,445	63,303 (12,661) [3,039] {1,519}	64,147 (12,829) [3,079] {1,540}	64,967 (12,993) [3,118] {1,559}
Monmouth	46,683	47,083	47,508	47,835	48,606 (9,721) [2,333] {1,167}	49,363 (9,873) [2,369] {1,185}	50,083 (10,017) [2,404] {1,202}
Morris	30,331	30,687	31,000	31,316	31,899 (6,380) [1,531] {766}	32,481 (6,496) [1,559] {780}	33,066 (6,613) [1,587] {794}
Ocean	47,600	48,022	48,406	48,944	49,800 (9,960) [2,390] {1,195}	50,646 (10,129) [2,431] {1,216}	51,490 (10,298) [2,471] {1,236}
Passaic	49,683	49,907	50,233	50,455	50,942 (10,188) [2,445] {1,223}	51,420 (10,284) [2,468] {1,234}	51,897 (10,379) [2,491] {1,246}
Somerset	19,136	19,257	19,377	19,508	19,747 (3,949) [948] {474}	19,976 (3,995) [959] {479}	20,196 (4,039) [969] {485}
Sussex	7,451	7,518	7,584	7,649	7,789 (1,558) [374] {187}	7,924 (1,585) [380] {190}	8,054 (1,611) [387] {193}
Union	49,621	49,908	50,154	50,429	50,914 (10,183) [2,444] {1,222}	51,381 (10,276) [2,466] {1,233}	51,837 (10,367) [2,488] {1,244}
Warren	5,783	5,825	5,882	5,929	6,019 (1,204) [289] {144}	6,104 (1,221) [293] {146}	6,187 (1,237) [297] {148}

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.