IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/22/21

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 1/22/21 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
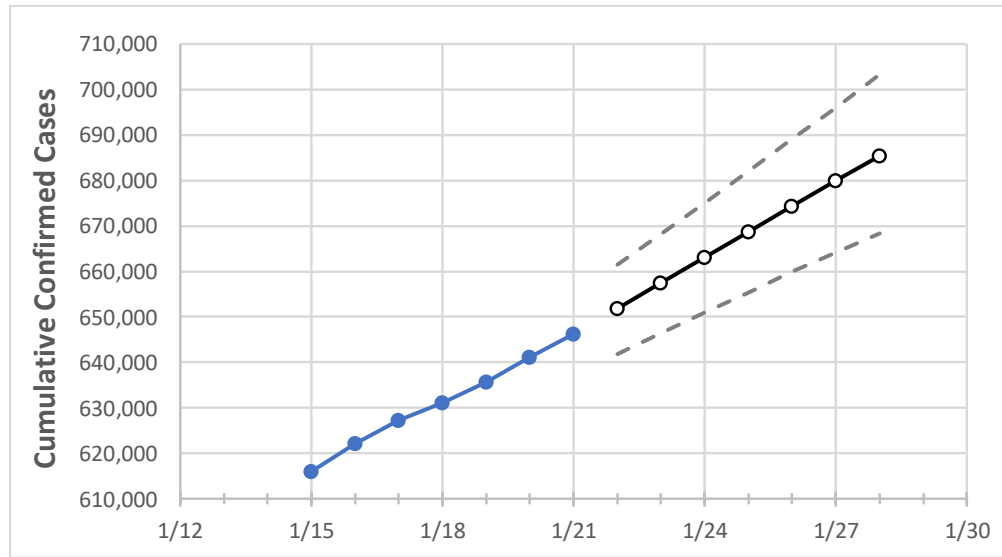
	Actual Confirmed Cases On:				Projected Cases For:						
	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28
New Jersey	631,074	635,702	641,140	646,189	651,880	657,497	663,082	668,750	674,317	679,896	685,415

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:						
	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28
Bergen	60,985	61,469	62,042	62,551	63,076	63,620	64,158	64,687	65,228	65,790	66,345
Burlington	28,487	28,717	28,997	29,277	29,552	29,828	30,102	30,379	30,662	30,940	31,217
Camden	36,976	37,215	37,477	37,755	38,048	38,341	38,629	38,913	39,196	39,482	39,766
Essex	59,432	59,727	60,156	60,526	60,994	61,472	61,949	62,414	62,883	63,362	63,839
Gloucester	19,537	19,729	19,951	20,206	20,409	20,616	20,825	21,039	21,250	21,458	21,669
Hudson	55,967	56,285	56,839	57,220	57,694	58,185	58,672	59,156	59,643	60,115	60,569
Hunterdon	5,275	5,321	5,383	5,421	5,488	5,557	5,627	5,699	5,769	5,836	5,906
Mercer	22,949	23,090	23,258	23,409	23,584	23,759	23,935	24,109	24,283	24,459	24,634
Middlesex	57,704	58,093	58,619	59,094	59,633	60,168	60,720	61,268	61,802	62,353	62,898
Monmouth	43,562	44,025	44,463	44,877	45,342	45,800	46,255	46,698	47,151	47,592	48,025
Morris	28,469	28,721	28,935	29,185	29,462	29,736	30,005	30,275	30,547	30,816	31,080
Ocean	44,577	44,975	45,392	45,813	46,300	46,784	47,265	47,747	48,236	48,730	49,218
Passaic	47,799	48,089	48,357	48,691	48,967	49,244	49,522	49,792	50,089	50,371	50,667
Somerset	18,155	18,270	18,425	18,565	18,734	18,905	19,073	19,245	19,414	19,589	19,760
Sussex	6,825	6,918	7,011	7,099	7,208	7,318	7,427	7,536	7,648	7,762	7,875
Union	47,628	47,928	48,248	48,515	48,866	49,217	49,567	49,915	50,265	50,613	50,964
Warren	5,430	5,475	5,525	5,568	5,621	5,675	5,727	5,778	5,828	5,878	5,928

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: | | |
	1/18	1/19	1/20	1/21	1/23	1/25	1/27
Bergen	60,985	61,469	62,042	62,551	63,620 (12,724) [3,054] {1,527}	64,687 (12,937) [3,105] {1,552}	65,790 (13,158) [3,158] {1,579}
Burlington	28,487	28,717	28,997	29,277	29,828 (5,966) [1,432] {716}	30,379 (6,076) [1,458] {729}	30,940 (6,188) [1,485] {743}
Camden	36,976	37,215	37,477	37,755	38,341 (7,668) [1,840] {920}	38,913 (7,783) [1,868] {934}	39,482 (7,896) [1,895] {948}
Essex	59,432	59,727	60,156	60,526	61,472 (12,294) [2,951] {1,475}	62,414 (12,483) [2,996] {1,498}	63,362 (12,672) [3,041] {1,521}
Gloucester	19,537	19,729	19,951	20,206	20,616 (4,123) [990] {495}	21,039 (4,208) [1,010] {505}	21,458 (4,292) [1,030] {515}
Hudson	55,967	56,285	56,839	57,220	58,185 (11,637) [2,793] {1,396}	59,156 (11,831) [2,839] {1,420}	60,115 (12,023) [2,886] {1,443}
Hunterdon	5,275	5,321	5,383	5,421	5,557 (1,111) [267] {133}	5,699 (1,140) [274] {137}	5,836 (1,167) [280] {140}
Mercer	22,949	23,090	23,258	23,409	23,759 (4,752) [1,140] {570}	24,109 (4,822) [1,157] {579}	24,459 (4,892) [1,174] {587}
Middlesex	57,704	58,093	58,619	59,094	60,168 (12,034) [2,888] {1,444}	61,268 (12,254) [2,941] {1,470}	62,353 (12,471) [2,993] {1,496}
Monmouth	43,562	44,025	44,463	44,877	45,800 (9,160) [2,198] {1,099}	46,698 (9,340) [2,242] {1,121}	47,592 (9,518) [2,284] {1,142}
Morris	28,469	28,721	28,935	29,185	29,736 (5,947) [1,427] {714}	30,275 (6,055) [1,453] {727}	30,816 (6,163) [1,479] {740}
Ocean	44,577	44,975	45,392	45,813	46,784 (9,357) [2,246] {1,123}	47,747 (9,549) [2,292] {1,146}	48,730 (9,746) [2,339] {1,170}
Passaic	47,799	48,089	48,357	48,691	49,244 (9,849) [2,364] {1,182}	49,792 (9,958) [2,390] {1,195}	50,371 (10,074) [2,418] {1,209}
Somerset	18,155	18,270	18,425	18,565	18,905 (3,781) [907] {454}	19,245 (3,849) [924] {462}	19,589 (3,918) [940] {470}
Sussex	6,825	6,918	7,011	7,099	7,318 (1,464) [351] {176}	7,536 (1,507) [362] {181}	7,762 (1,552) [373] {186}
Union	47,628	47,928	48,248	48,515	49,217 (9,843) [2,362] {1,181}	49,915 (9,983) [2,396] {1,198}	50,613 (10,123) [2,429] {1,215}
Warren	5,430	5,475	5,525	5,568	5,675 (1,135) [272] {136}	5,778 (1,156) [277] {139}	5,878 (1,176) [282] {141}

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.