IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/10/21

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 3/10/21 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
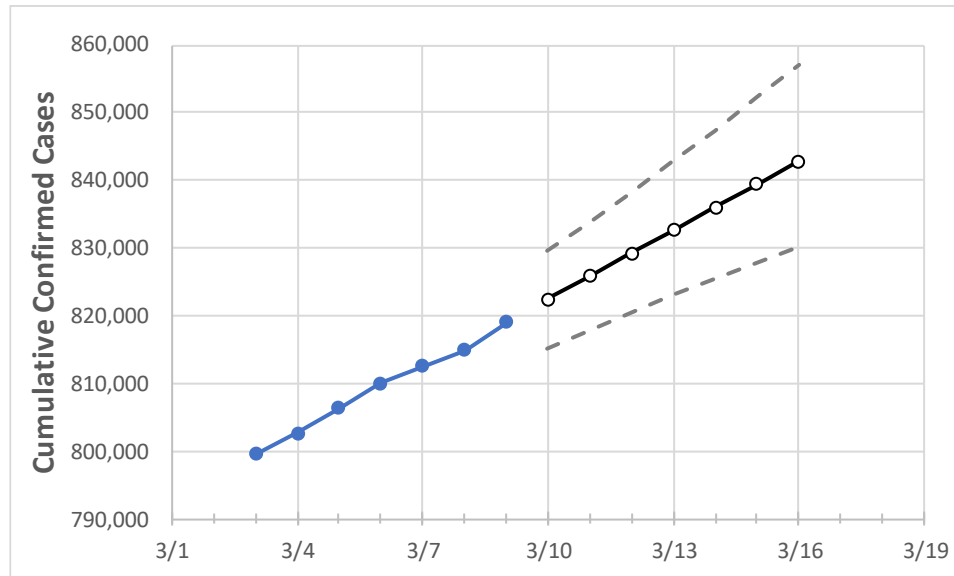
	Actual Confirmed Cases On:				Projected Cases For:						
	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16
New Jersey	810,090	812,609	814,916	819,042	822,378	825,783	829,193	832,586	836,008	839,451	842,852

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:						
	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16
Bergen	80,008	80,339	80,605	81,125	81,518	81,926	82,333	82,746	83,151	83,570	83,967
Burlington	36,125	36,206	36,326	36,443	36,562	36,682	36,800	36,918	37,036	37,156	37,275
Camden	44,915	44,972	45,073	45,231	45,350	45,467	45,586	45,702	45,820	45,936	46,050
Essex	75,544	75,772	75,967	76,301	76,594	76,884	77,172	77,465	77,753	78,041	78,326
Gloucester	24,587	24,640	24,684	24,770	24,836	24,904	24,971	25,036	25,102	25,168	25,234
Hudson	71,174	71,406	71,635	71,969	72,265	72,566	72,864	73,161	73,466	73,759	74,057
Hunterdon	7,151	7,165	7,199	7,244	7,280	7,316	7,351	7,388	7,423	7,460	7,498
Mercer	28,335	28,400	28,463	28,570	28,658	28,749	28,838	28,926	29,014	29,103	29,190
Middlesex	74,383	74,641	74,783	75,169	75,458	75,744	76,029	76,321	76,612	76,897	77,188
Monmouth	58,923	59,141	59,340	59,856	60,207	60,570	60,936	61,304	61,685	62,072	62,462
Morris	38,787	38,943	39,106	39,332	39,543	39,761	39,977	40,197	40,423	40,651	40,887
Ocean	60,469	60,663	60,887	61,210	61,504	61,798	62,090	62,382	62,673	62,972	63,269
Passaic	58,146	58,331	58,484	58,725	58,948	59,173	59,401	59,636	59,875	60,118	60,360
Somerset	23,449	23,534	23,603	23,756	23,858	23,964	24,068	24,172	24,277	24,382	24,485
Sussex	9,419	9,469	9,514	9,608	9,671	9,736	9,801	9,868	9,937	10,007	10,080
Union	58,121	58,314	58,472	58,754	58,993	59,238	59,484	59,736	59,987	60,237	60,491
Warren	7,296	7,337	7,360	7,392	7,430	7,468	7,505	7,542	7,579	7,616	7,653

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:		
	3/6	3/7	3/8	3/9	3/11	3/13	3/15
Bergen	80,008	80,339	80,605	81,125	81,926 (16,385) [3,932] {1,966}	82,746 (16,549) [3,972] {1,986}	83,570 (16,714) [4,011] {2,006}
Burlington	36,125	36,206	36,326	36,443	36,682 (7,336) [1,761] {880}	36,918 (7,384) [1,772] {886}	37,156 (7,431) [1,783] {892}
Camden	44,915	44,972	45,073	45,231	45,467 (9,093) [2,182] {1,091}	45,702 (9,140) [2,194] {1,097}	45,936 (9,187) [2,205] {1,102}
Essex	75,544	75,772	75,967	76,301	76,884 (15,377) [3,690] {1,845}	77,465 (15,493) [3,718] {1,859}	78,041 (15,608) [3,746] {1,873}
Gloucester	24,587	24,640	24,684	24,770	24,904 (4,981) [1,195] {598}	25,036 (5,007) [1,202] {601}	25,168 (5,034) [1,208] {604}
Hudson	71,174	71,406	71,635	71,969	72,566 (14,513) [3,483] {1,742}	73,161 (14,632) [3,512] {1,756}	73,759 (14,752) [3,540] {1,770}
Hunterdon	7,151	7,165	7,199	7,244	7,316 (1,463) [351] {176}	7,388 (1,478) [355] {177}	7,460 (1,492) [358] {179}
Mercer	28,335	28,400	28,463	28,570	28,749 (5,750) [1,380] {690}	28,926 (5,785) [1,388] {694}	29,103 (5,821) [1,397] {698}
Middlesex	74,383	74,641	74,783	75,169	75,744 (15,149) [3,636] {1,818}	76,321 (15,264) [3,663] {1,832}	76,897 (15,379) [3,691] {1,846}
Monmouth	58,923	59,141	59,340	59,856	60,570 (12,114) [2,907] {1,454}	61,304 (12,261) [2,943] {1,471}	62,072 (12,414) [2,979] {1,490}
Morris	38,787	38,943	39,106	39,332	39,761 (7,952) [1,909] {954}	40,197 (8,039) [1,929] {965}	40,651 (8,130) [1,951] {976}
Ocean	60,469	60,663	60,887	61,210	61,798 (12,360) [2,966] {1,483}	62,382 (12,476) [2,994] {1,497}	62,972 (12,594) [3,023] {1,511}
Passaic	58,146	58,331	58,484	58,725	59,173 (11,835) [2,840] {1,420}	59,636 (11,927) [2,863] {1,431}	60,118 (12,024) [2,886] {1,443}
Somerset	23,449	23,534	23,603	23,756	23,964 (4,793) [1,150] {575}	24,172 (4,834) [1,160] {580}	24,382 (4,876) [1,170] {585}
Sussex	9,419	9,469	9,514	9,608	9,736 (1,947) [467] {234}	9,868 (1,974) [474] {237}	10,007 (2,001) [480] {240}
Union	58,121	58,314	58,472	58,754	59,238 (11,848) [2,843] {1,422}	59,736 (11,947) [2,867] {1,434}	60,237 (12,047) [2,891] {1,446}
Warren	7,296	7,337	7,360	7,392	7,468 (1,494) [358] {179}	7,542 (1,508) [362] {181}	7,616 (1,523) [366] {183}

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.