IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/13/21

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 12/13/21 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
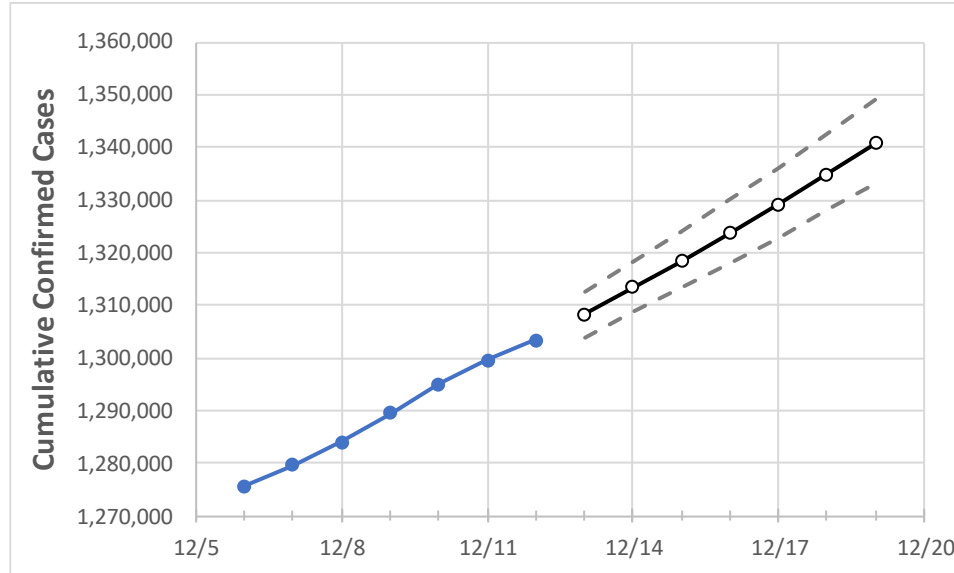
	Actual Confirmed Cases On:				Projected Cases For:						
	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19
New Jersey	1,289,542	1,295,005	1,299,601	1,303,443	1,308,300	1,313,390	1,318,445	1,323,748	1,329,220	1,334,839	1,340,679

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:						
	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19
Bergen	127,337	127,771	128,134	128,476	128,877	129,281	129,698	130,134	130,576	131,043	131,518
Burlington	60,822	61,127	61,365	61,532	61,789	62,050	62,317	62,586	62,862	63,144	63,436
Camden	74,347	74,660	74,912	75,133	75,416	75,702	75,992	76,294	76,595	76,920	77,234
Essex	112,155	112,607	112,889	113,256	113,603	113,962	114,345	114,728	115,133	115,547	115,982
Gloucester	42,681	42,903	43,075	43,184	43,379	43,582	43,784	43,991	44,205	44,425	44,650
Hudson	101,838	102,122	102,374	102,561	102,808	103,067	103,335	103,609	103,895	104,190	104,492
Hunterdon	13,520	13,601	13,680	13,729	13,798	13,867	13,939	14,011	14,084	14,161	14,239
Mercer	42,997	43,178	43,348	43,493	43,665	43,844	44,028	44,215	44,409	44,607	44,810
Middlesex	113,349	113,798	114,193	114,494	114,903	115,323	115,763	116,219	116,687	117,179	117,675
Monmouth	101,558	102,057	102,443	102,815	103,258	103,719	104,186	104,667	105,160	105,667	106,189
Morris	63,972	64,323	64,683	64,933	65,286	65,650	66,022	66,414	66,820	67,242	67,669
Ocean	104,895	105,429	105,846	106,228	106,670	107,131	107,599	108,072	108,565	109,073	109,589
Passaic	86,230	86,520	86,748	86,978	87,244	87,519	87,802	88,097	88,400	88,721	89,045
Somerset	37,510	37,672	37,821	37,911	38,056	38,200	38,359	38,519	38,672	38,849	39,016
Sussex	19,939	20,078	20,192	20,290	20,422	20,557	20,698	20,837	20,987	21,138	21,295
Union	83,950	84,202	84,447	84,628	84,877	85,132	85,397	85,670	85,952	86,250	86,546
Warren	13,955	14,049	14,161	14,213	14,309	14,404	14,504	14,605	14,711	14,819	14,928

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:		
	12/9	12/10	12/11	12/12	12/14	12/16	12/18
Bergen	127,337	127,771	128,134	128,476	129,281 (25,856) [6,205] {3,103}	130,134 (26,027) [6,246] {3,123}	131,043 (26,209) [6,290] {3,145}
Burlington	60,822	61,127	61,365	61,532	62,050 (12,410) [2,978] {1,489}	62,586 (12,517) [3,004] {1,502}	63,144 (12,629) [3,031] {1,515}
Camden	74,347	74,660	74,912	75,133	75,702 (15,140) [3,634] {1,817}	76,294 (15,259) [3,662] {1,831}	76,920 (15,384) [3,692] {1,846}
Essex	112,155	112,607	112,889	113,256	113,962 (22,792) [5,470] {2,735}	114,728 (22,946) [5,507] {2,753}	115,547 (23,109) [5,546] {2,773}
Gloucester	42,681	42,903	43,075	43,184	43,582 (8,716) [2,092] {1,046}	43,991 (8,798) [2,112] {1,056}	44,425 (8,885) [2,132] {1,066}
Hudson	101,838	102,122	102,374	102,561	103,067 (20,613) [4,947] {2,474}	103,609 (20,722) [4,973] {2,487}	104,190 (20,838) [5,001] {2,501}
Hunterdon	13,520	13,601	13,680	13,729	13,867 (2,773) [666] {333}	14,011 (2,802) [673] {336}	14,161 (2,832) [680] {340}
Mercer	42,997	43,178	43,348	43,493	43,844 (8,769) [2,105] {1,052}	44,215 (8,843) [2,122] {1,061}	44,607 (8,921) [2,141] {1,071}
Middlesex	113,349	113,798	114,193	114,494	115,323 (23,065) [5,535] {2,768}	116,219 (23,244) [5,578] {2,789}	117,179 (23,436) [5,625] {2,812}
Monmouth	101,558	102,057	102,443	102,815	103,719 (20,744) [4,979] {2,489}	104,667 (20,933) [5,024] {2,512}	105,667 (21,133) [5,072] {2,536}
Morris	63,972	64,323	64,683	64,933	65,650 (13,130) [3,151] {1,576}	66,414 (13,283) [3,188] {1,594}	67,242 (13,448) [3,228] {1,614}
Ocean	104,895	105,429	105,846	106,228	107,131 (21,426) [5,142] {2,571}	108,072 (21,614) [5,187] {2,594}	109,073 (21,815) [5,235] {2,618}
Passaic	86,230	86,520	86,748	86,978	87,519 (17,504) [4,201] {2,100}	88,097 (17,619) [4,229] {2,114}	88,721 (17,744) [4,259] {2,129}
Somerset	37,510	37,672	37,821	37,911	38,200 (7,640) [1,834] {917}	38,519 (7,704) [1,849] {924}	38,849 (7,770) [1,865] {932}
Sussex	19,939	20,078	20,192	20,290	20,557 (4,111) [987] {493}	20,837 (4,167) [1,000] {500}	21,138 (4,228) [1,015] {507}
Union	83,950	84,202	84,447	84,628	85,132 (17,026) [4,086] {2,043}	85,670 (17,134) [4,112] {2,056}	86,250 (17,250) [4,140] {2,070}
Warren	13,955	14,049	14,161	14,213	14,404 (2,881) [691] {346}	14,605 (2,921) [701] {351}	14,819 (2,964) [711] {356}

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.