IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/21/20

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 10/21/20 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
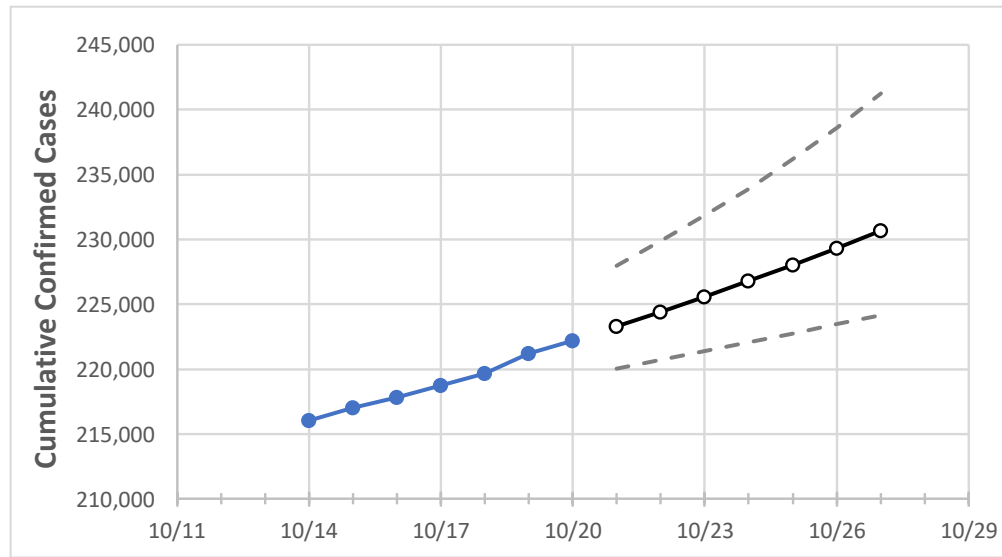
	Actual Confirmed Cases On:				Projected Cases For:						
	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27
New Jersey	218,738	219,647	221,205	222,193	223,290	224,423	225,594	226,803	228,053	229,344	230,678

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 20%, and are often within 10%, of actual confirmed cases.

New Jersey Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27
Bergen	23,639	23,738	23,845	23,945	24,052	24,164	24,281	24,403	24,531	24,665	24,804
Burlington	7,776	7,825	7,885	7,928	7,971	8,016	8,062	8,110	8,159	8,210	8,263
Camden	10,739	10,835	10,908	10,946	11,008	11,072	11,139	11,208	11,279	11,354	11,430
Essex	22,345	22,479	22,625	22,735	22,891	23,060	23,241	23,437	23,647	23,874	24,118
Gloucester	5,142	5,179	5,210	5,240	5,270	5,301	5,333	5,365	5,398	5,431	5,465
Hudson	21,604	21,731	21,810	21,886	21,988	22,097	22,213	22,337	22,470	22,612	22,764
Hunterdon	1,474	1,487	1,494	1,497	1,501	1,505	1,509	1,512	1,516	1,519	1,523
Mercer	8,925	8,956	8,975	9,005	9,029	9,054	9,080	9,107	9,136	9,165	9,197
Middlesex	20,822	20,930	21,043	21,152	21,255	21,362	21,473	21,588	21,709	21,834	21,964
Monmouth	13,266	13,311	13,395	13,439	13,507	13,576	13,644	13,712	13,780	13,849	13,917
Morris	8,337	8,430	8,475	8,529	8,579	8,632	8,689	8,750	8,814	8,883	8,956
Ocean	15,832	15,952	16,107	16,173	16,263	16,352	16,440	16,527	16,613	16,697	16,781
Passaic	19,914	19,976	20,028	20,089	20,155	20,223	20,294	20,367	20,443	20,521	20,601
Somerset	6,110	6,142	6,169	6,192	6,207	6,223	6,239	6,255	6,272	6,290	6,308
Sussex	1,601	1,616	1,623	1,628	1,633	1,638	1,643	1,648	1,654	1,659	1,664
Union	18,599	18,709	18,815	18,949	19,060	19,179	19,307	19,444	19,592	19,750	19,919
Warren	1,505	1,507	1,514	1,515	1,518	1,521	1,525	1,528	1,531	1,535	1,538

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:		
	10/17	10/18	10/19	10/20	10/22	10/24	10/26
Bergen	23,639	23,738	23,845	23,945	24,164 (4,833) [1,160] {580}	24,403 (4,881) [1,171] {586}	24,665 (4,933) [1,184] {592}
Burlington	7,776	7,825	7,885	7,928	8,016 (1,603) [385] {192}	8,110 (1,622) [389] {195}	8,210 (1,642) [394] {197}
Camden	10,739	10,835	10,908	10,946	11,072 (2,214) [531] {266}	11,208 (2,242) [538] {269}	11,354 (2,271) [545] {272}
Essex	22,345	22,479	22,625	22,735	23,060 (4,612) [1,107] {553}	23,437 (4,687) [1,125] {562}	23,874 (4,775) [1,146] {573}
Gloucester	5,142	5,179	5,210	5,240	5,301 (1,060) [254] {127}	5,365 (1,073) [258] {129}	5,431 (1,086) [261] {130}
Hudson	21,604	21,731	21,810	21,886	22,097 (4,419) [1,061] {530}	22,337 (4,467) [1,072] {536}	22,612 (4,522) [1,085] {543}
Hunterdon	1,474	1,487	1,494	1,497	1,505 (301) [72] {36}	1,512 (302) [73] {36}	1,519 (304) [73] {36}
Mercer	8,925	8,956	8,975	9,005	9,054 (1,811) [435] {217}	9,107 (1,821) [437] {219}	9,165 (1,833) [440] {220}
Middlesex	20,822	20,930	21,043	21,152	21,362 (4,272) [1,025] {513}	21,588 (4,318) [1,036] {518}	21,834 (4,367) [1,048] {524}
Monmouth	13,266	13,311	13,395	13,439	13,576 (2,715) [652] {326}	13,712 (2,742) [658] {329}	13,849 (2,770) [665] {332}
Morris	8,337	8,430	8,475	8,529	8,632 (1,726) [414] {207}	8,750 (1,750) [420] {210}	8,883 (1,777) [426] {213}
Ocean	15,832	15,952	16,107	16,173	16,352 (3,270) [785] {392}	16,527 (3,305) [793] {397}	16,697 (3,339) [801] {401}
Passaic	19,914	19,976	20,028	20,089	20,223 (4,045) [971] {485}	20,367 (4,073) [978] {489}	20,521 (4,104) [985] {492}
Somerset	6,110	6,142	6,169	6,192	6,223 (1,245) [299] {149}	6,255 (1,251) [300] {150}	6,290 (1,258) [302] {151}
Sussex	1,601	1,616	1,623	1,628	1,638 (328) [79] {39}	1,648 (330) [79] {40}	1,659 (332) [80] {40}
Union	18,599	18,709	18,815	18,949	19,179 (3,836) [921] {460}	19,444 (3,889) [933] {467}	19,750 (3,950) [948] {474}
Warren	1,505	1,507	1,514	1,515	1,521 (304) [73] {37}	1,528 (306) [73] {37}	1,535 (307) [74] {37}

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.