IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/22/20

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 not 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 10/22/20 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
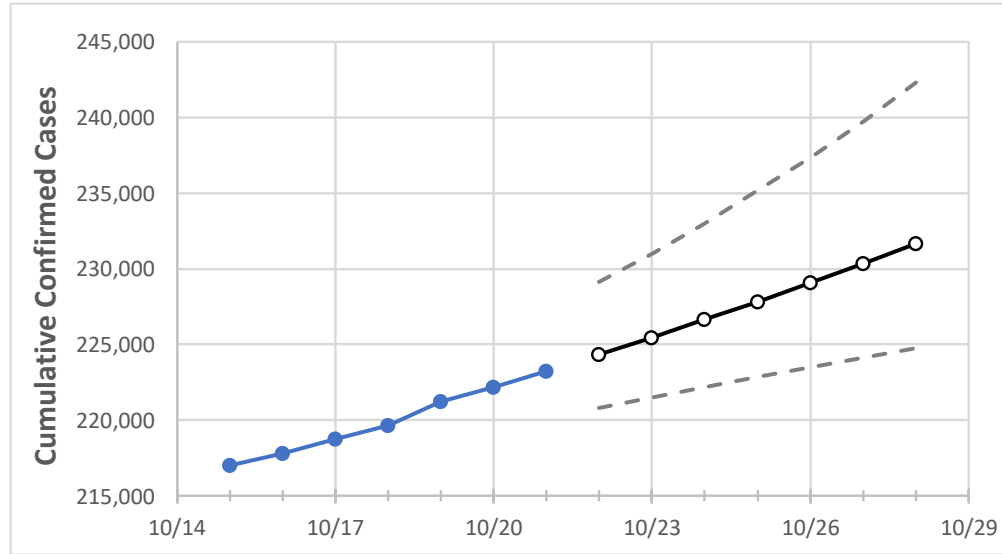
	Actual Confirmed Cases On:				Projected Cases For:						
	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28
New Jersey	219,647	221,205	222,193	223,223	224,325	225,460	226,630	227,836	229,079	230,360	231,679

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

New Jersey Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28
Bergen	23,738	23,845	23,945	24,066	24,179	24,297	24,421	24,550	24,686	24,827	24,976
Burlington	7,825	7,885	7,928	7,978	8,026	8,076	8,128	8,181	8,236	8,293	8,353
Camden	10,835	10,908	10,946	11,007	11,070	11,135	11,203	11,272	11,344	11,419	11,496
Essex	22,479	22,625	22,735	22,877	23,041	23,217	23,406	23,609	23,828	24,062	24,313
Gloucester	5,179	5,210	5,240	5,261	5,291	5,322	5,353	5,384	5,416	5,449	5,482
Hudson	21,731	21,810	21,886	22,004	22,115	22,235	22,362	22,499	22,646	22,802	22,970
Hunterdon	1,487	1,494	1,497	1,505	1,509	1,514	1,518	1,522	1,526	1,530	1,534
Mercer	8,956	8,975	9,005	9,031	9,056	9,082	9,109	9,137	9,167	9,198	9,230
Middlesex	20,930	21,043	21,152	21,229	21,332	21,438	21,548	21,663	21,781	21,903	22,030
Monmouth	13,311	13,395	13,439	13,477	13,541	13,604	13,668	13,731	13,794	13,857	13,919
Morris	8,430	8,475	8,529	8,596	8,650	8,708	8,770	8,836	8,907	8,982	9,062
Ocean	15,952	16,107	16,173	16,238	16,321	16,402	16,481	16,559	16,635	16,710	16,783
Passaic	19,976	20,028	20,089	20,160	20,227	20,296	20,367	20,441	20,517	20,595	20,676
Somerset	6,142	6,169	6,192	6,216	6,230	6,244	6,259	6,274	6,289	6,304	6,320
Sussex	1,616	1,623	1,628	1,637	1,643	1,649	1,654	1,661	1,667	1,673	1,680
Union	18,709	18,815	18,949	19,044	19,159	19,282	19,414	19,555	19,705	19,866	20,037
Warren	1,507	1,514	1,515	1,517	1,520	1,523	1,525	1,528	1,531	1,534	1,537

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:		
	10/18	10/19	10/20	10/21	10/23	10/25	10/27
Bergen	23,738	23,845	23,945	24,066	24,297 (4,859) [1,166] {583}	24,550 (4,910) [1,178] {589}	24,827 (4,965) [1,192] {596}
Burlington	7,825	7,885	7,928	7,978	8,076 (1,615) [388] {194}	8,181 (1,636) [393] {196}	8,293 (1,659) [398] {199}
Camden	10,835	10,908	10,946	11,007	11,135 (2,227) [534] {267}	11,272 (2,254) [541] {271}	11,419 (2,284) [548] {274}
Essex	22,479	22,625	22,735	22,877	23,217 (4,643) [1,114] {557}	23,609 (4,722) [1,133] {567}	24,062 (4,812) [1,155] {577}
Gloucester	5,179	5,210	5,240	5,261	5,322 (1,064) [255] {128}	5,384 (1,077) [258] {129}	5,449 (1,090) [262] {131}
Hudson	21,731	21,810	21,886	22,004	22,235 (4,447) [1,067] {534}	22,499 (4,500) [1,080] {540}	22,802 (4,560) [1,095] {547}
Hunterdon	1,487	1,494	1,497	1,505	1,514 (303) [73] {36}	1,522 (304) [73] {37}	1,530 (306) [73] {37}
Mercer	8,956	8,975	9,005	9,031	9,082 (1,816) [436] {218}	9,137 (1,827) [439] {219}	9,198 (1,840) [441] {221}
Middlesex	20,930	21,043	21,152	21,229	21,438 (4,288) [1,029] {515}	21,663 (4,333) [1,040] {520}	21,903 (4,381) [1,051] {526}
Monmouth	13,311	13,395	13,439	13,477	13,604 (2,721) [653] {327}	13,731 (2,746) [659] {330}	13,857 (2,771) [665] {333}
Morris	8,430	8,475	8,529	8,596	8,708 (1,742) [418] {209}	8,836 (1,767) [424] {212}	8,982 (1,796) [431] {216}
Ocean	15,952	16,107	16,173	16,238	16,402 (3,280) [787] {394}	16,559 (3,312) [795] {397}	16,710 (3,342) [802] {401}
Passaic	19,976	20,028	20,089	20,160	20,296 (4,059) [974] {487}	20,441 (4,088) [981] {491}	20,595 (4,119) [989] {494}
Somerset	6,142	6,169	6,192	6,216	6,244 (1,249) [300] {150}	6,274 (1,255) [301] {151}	6,304 (1,261) [303] {151}
Sussex	1,616	1,623	1,628	1,637	1,649 (330) [79] {40}	1,661 (332) [80] {40}	1,673 (335) [80] {40}
Union	18,709	18,815	18,949	19,044	19,282 (3,856) [926] {463}	19,555 (3,911) [939] {469}	19,866 (3,973) [954] {477}
Warren	1,507	1,514	1,515	1,517	1,523 (305) [73] {37}	1,528 (306) [73] {37}	1,534 (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.