IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/23/20

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 10/23/20 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
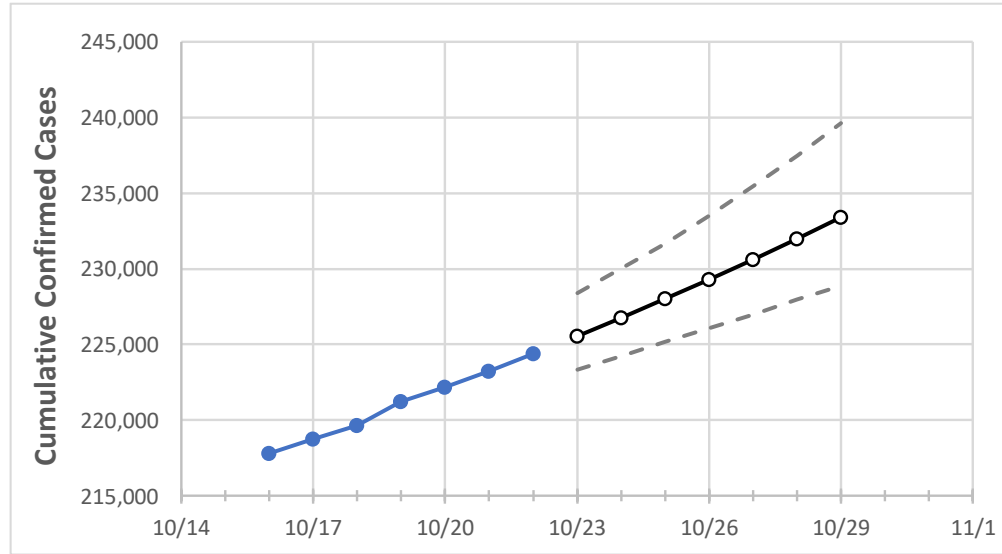
	Actual Confirmed Cases On:				Projected Cases For:						
	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29
New Jersey	221,205	222,193	223,223	224,385	225,549	226,753	227,998	229,286	230,617	231,993	233,416

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:						
	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29
Bergen	23,845	23,945	24,066	24,172	24,288	24,409	24,535	24,668	24,806	24,951	25,102
Burlington	7,885	7,928	7,978	8,028	8,078	8,131	8,185	8,241	8,300	8,360	8,423
Camden	10,908	10,946	11,007	11,071	11,136	11,204	11,274	11,347	11,422	11,500	11,581
Essex	22,625	22,735	22,877	23,068	23,248	23,442	23,652	23,877	24,120	24,381	24,663
Gloucester	5,210	5,240	5,261	5,305	5,336	5,368	5,400	5,433	5,467	5,501	5,536
Hudson	21,810	21,886	22,004	22,116	22,234	22,360	22,495	22,640	22,794	22,960	23,137
Hunterdon	1,494	1,497	1,505	1,509	1,513	1,517	1,521	1,526	1,530	1,534	1,538
Mercer	8,975	9,005	9,031	9,048	9,072	9,096	9,121	9,148	9,175	9,204	9,234
Middlesex	21,043	21,152	21,229	21,323	21,428	21,537	21,650	21,767	21,889	22,014	22,144
Monmouth	13,395	13,439	13,477	13,555	13,619	13,682	13,746	13,809	13,872	13,935	13,997
Morris	8,475	8,529	8,596	8,659	8,713	8,770	8,831	8,895	8,964	9,037	9,115
Ocean	16,107	16,173	16,238	16,302	16,381	16,458	16,533	16,607	16,679	16,749	16,818
Passaic	20,028	20,089	20,160	20,211	20,276	20,343	20,412	20,483	20,555	20,629	20,706
Somerset	6,169	6,192	6,216	6,240	6,261	6,282	6,304	6,328	6,352	6,377	6,403
Sussex	1,623	1,628	1,637	1,645	1,651	1,658	1,665	1,672	1,679	1,687	1,695
Union	18,815	18,949	19,044	19,161	19,286	19,420	19,564	19,718	19,884	20,061	20,252
Warren	1,514	1,515	1,517	1,525	1,528	1,532	1,536	1,539	1,543	1,547	1,551

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:		
	10/19	10/20	10/21	10/22	10/24	10/26	10/28
Bergen	23,845	23,945	24,066	24,172	24,409 (4,882) [1,172] {586}	24,668 (4,934) [1,184] {592}	24,951 (4,990) [1,198] {599}
Burlington	7,885	7,928	7,978	8,028	8,131 (1,626) [390] {195}	8,241 (1,648) [396] {198}	8,360 (1,672) [401] {201}
Camden	10,908	10,946	11,007	11,071	11,204 (2,241) [538] {269}	11,347 (2,269) [545] {272}	11,500 (2,300) [552] {276}
Essex	22,625	22,735	22,877	23,068	23,442 (4,688) [1,125] {563}	23,877 (4,775) [1,146] {573}	24,381 (4,876) [1,170] {585}
Gloucester	5,210	5,240	5,261	5,305	5,368 (1,074) [258] {129}	5,433 (1,087) [261] {130}	5,501 (1,100) [264] {132}
Hudson	21,810	21,886	22,004	22,116	22,360 (4,472) [1,073] {537}	22,640 (4,528) [1,087] {543}	22,960 (4,592) [1,102] {551}
Hunterdon	1,494	1,497	1,505	1,509	1,517 (303) [73] {36}	1,526 (305) [73] {37}	1,534 (307) [74] {37}
Mercer	8,975	9,005	9,031	9,048	9,096 (1,819) [437] {218}	9,148 (1,830) [439] {220}	9,204 (1,841) [442] {221}
Middlesex	21,043	21,152	21,229	21,323	21,537 (4,307) [1,034] {517}	21,767 (4,353) [1,045] {522}	22,014 (4,403) [1,057] {528}
Monmouth	13,395	13,439	13,477	13,555	13,682 (2,736) [657] {328}	13,809 (2,762) [663] {331}	13,935 (2,787) [669] {334}
Morris	8,475	8,529	8,596	8,659	8,770 (1,754) [421] {210}	8,895 (1,779) [427] {213}	9,037 (1,807) [434] {217}
Ocean	16,107	16,173	16,238	16,302	16,458 (3,292) [790] {395}	16,607 (3,321) [797] {399}	16,749 (3,350) [804] {402}
Passaic	20,028	20,089	20,160	20,211	20,343 (4,069) [976] {488}	20,483 (4,097) [983] {492}	20,629 (4,126) [990] {495}
Somerset	6,169	6,192	6,216	6,240	6,282 (1,256) [302] {151}	6,328 (1,266) [304] {152}	6,377 (1,275) [306] {153}
Sussex	1,623	1,628	1,637	1,645	1,658 (332) [80] {40}	1,672 (334) [80] {40}	1,687 (337) [81] {40}
Union	18,815	18,949	19,044	19,161	19,420 (3,884) [932] {466}	19,718 (3,944) [946] {473}	20,061 (4,012) [963] {481}
Warren	1,514	1,515	1,517	1,525	1,532 (306) [74] {37}	1,539 (308) [74] {37}	1,547 (309) [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.