IEM's AI Modeling: Short-term COVID-19 Projections

Date: 10/2/20

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 10/2/20 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.

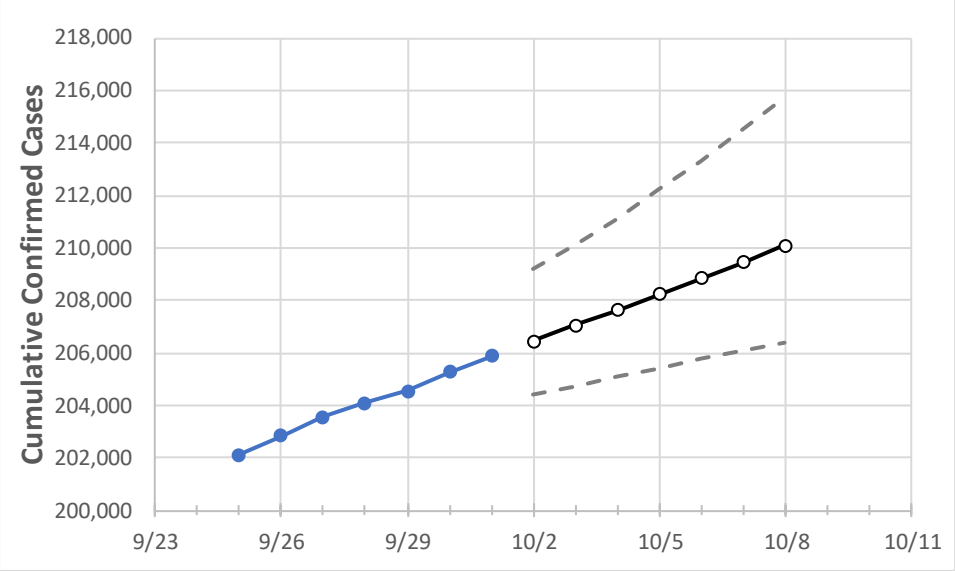
IEM's Modeling Lead

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:						
	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7	10/8
New Jersey	204,107	204,563	205,275	205,889	206,456	207,033	207,623	208,224	208,837	209,463	210,101

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:						
	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7	10/8
Bergen	22,439	22,473	22,510	22,579	22,625	22,672	22,722	22,774	22,828	22,884	22,943
Burlington	7,145	7,169	7,184	7,208	7,233	7,257	7,282	7,306	7,330	7,354	7,378
Camden	9,907	9,927	9,962	9,996	10,023	10,050	10,078	10,105	10,133	10,160	10,188
Essex	21,070	21,091	21,121	21,157	21,188	21,219	21,251	21,284	21,317	21,351	21,385
Gloucester	4,523	4,560	4,670	4,710	4,738	4,766	4,793	4,821	4,849	4,877	4,905
Hudson	20,661	20,692	20,732	20,767	20,795	20,824	20,855	20,886	20,919	20,953	20,989
Hunterdon	1,324	1,330	1,332	1,349	1,354	1,359	1,364	1,369	1,375	1,380	1,386
Mercer	8,643	8,653	8,663	8,675	8,683	8,691	8,699	8,707	8,715	8,723	8,730
Middlesex	19,503	19,539	19,604	19,679	19,746	19,815	19,888	19,964	20,043	20,126	20,213
Monmouth	11,856	11,892	11,949	12,025	12,076	12,128	12,182	12,237	12,293	12,350	12,409
Morris	7,871	7,887	7,902	7,920	7,938	7,956	7,974	7,993	8,013	8,032	8,053
Ocean	13,402	13,481	13,665	13,718	13,882	14,057	14,243	14,442	14,654	14,880	15,121
Passaic	19,023	19,065	19,113	19,135	19,164	19,193	19,223	19,254	19,285	19,317	19,350
Somerset	5,808	5,819	5,830	5,850	5,862	5,874	5,886	5,898	5,910	5,922	5,934
Sussex	1,502	1,506	1,511	1,517	1,524	1,532	1,540	1,548	1,558	1,567	1,578
Union	17,671	17,689	17,727	17,761	17,797	17,836	17,875	17,917	17,961	18,006	18,054
Warren	1,443	1,445	1,447	1,449	1,451	1,452	1,454	1,456	1,457	1,459	1,460

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:		
	9/28	9/29	9/30	10/1	10/3	10/5	10/7
Bergen	22,439	22,473	22,510	22,579	22,672 (4,534) [1,088] {544}	22,774 (4,555) [1,093] {547}	22,884 (4,577) [1,098] {549}
Burlington	7,145	7,169	7,184	7,208	7,257 (1,451) [348] {174}	7,306 (1,461) [351] {175}	7,354 (1,471) [353] {177}
Camden	9,907	9,927	9,962	9,996	10,050 (2,010) [482] {241}	10,105 (2,021) [485] {243}	10,160 (2,032) [488] {244}
Essex	21,070	21,091	21,121	21,157	21,219 (4,244) [1,019] {509}	21,284 (4,257) [1,022] {511}	21,351 (4,270) [1,025] {512}
Gloucester	4,523	4,560	4,670	4,710	4,766 (953) [229] {114}	4,821 (964) [231] {116}	4,877 (975) [234] {117}
Hudson	20,661	20,692	20,732	20,767	20,824 (4,165) [1,000] {500}	20,886 (4,177) [1,003] {501}	20,953 (4,191) [1,006] {503}
Hunterdon	1,324	1,330	1,332	1,349	1,359 (272) [65] {33}	1,369 (274) [66] {33}	1,380 (276) [66] {33}
Mercer	8,643	8,653	8,663	8,675	8,691 (1,738) [417] {209}	8,707 (1,741) [418] {209}	8,723 (1,745) [419] {209}
Middlesex	19,503	19,539	19,604	19,679	19,815 (3,963) [951] {476}	19,964 (3,993) [958] {479}	20,126 (4,025) [966] {483}
Monmouth	11,856	11,892	11,949	12,025	12,128 (2,426) [582] {291}	12,237 (2,447) [587] {294}	12,350 (2,470) [593] {296}
Morris	7,871	7,887	7,902	7,920	7,956 (1,591) [382] {191}	7,993 (1,599) [384] {192}	8,032 (1,606) [386] {193}
Ocean	13,402	13,481	13,665	13,718	14,057 (2,811) [675] {337}	14,442 (2,888) [693] {347}	14,880 (2,976) [714] {357}
Passaic	19,023	19,065	19,113	19,135	19,193 (3,839) [921] {461}	19,254 (3,851) [924] {462}	19,317 (3,863) [927] {464}
Somerset	5,808	5,819	5,830	5,850	5,874 (1,175) [282] {141}	5,898 (1,180) [283] {142}	5,922 (1,184) [284] {142}
Sussex	1,502	1,506	1,511	1,517	1,532 (306) [74] {37}	1,548 (310) [74] {37}	1,567 (313) [75] {38}
Union	17,671	17,689	17,727	17,761	17,836 (3,567) [856] {428}	17,917 (3,583) [860] {430}	18,006 (3,601) [864] {432}
Warren	1,443	1,445	1,447	1,449	1,452 (290) [70] {35}	1,456 (291) [70] {35}	1,459 (292) [70] {35}

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.