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

Date: 10/7/20

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 10/7/20 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.

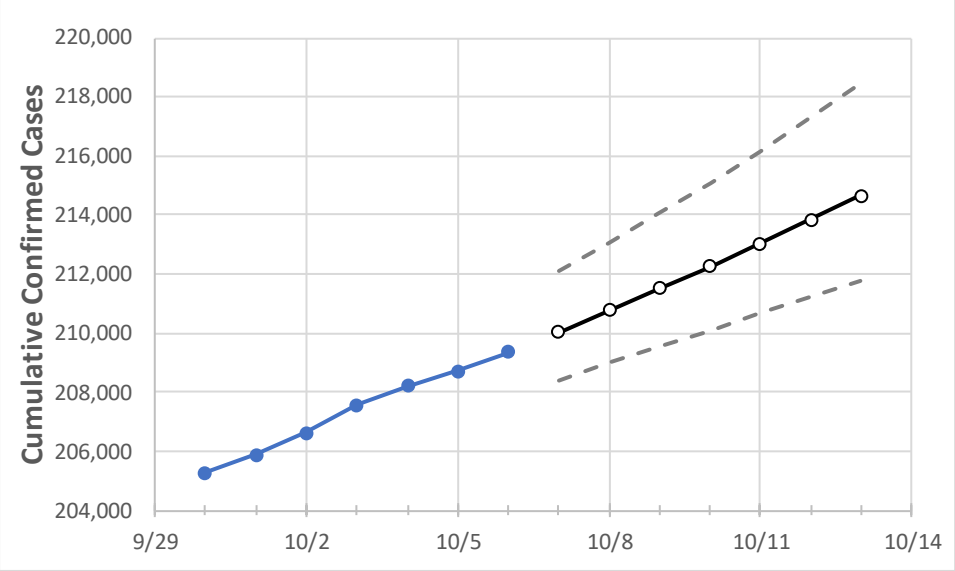
IEM's Modeling Lead

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:						
	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13
New Jersey	207,576	208,202	208,713	209,342	210,044	210,763	211,502	212,259	213,035	213,832	214,649

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:						
	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13
Bergen	22,692	22,734	22,774	22,827	22,883	22,941	23,002	23,066	23,133	23,204	23,277
Burlington	7,281	7,306	7,327	7,343	7,367	7,391	7,415	7,439	7,463	7,487	7,510
Camden	10,085	10,124	10,149	10,170	10,200	10,230	10,261	10,292	10,323	10,355	10,386
Essex	21,260	21,330	21,365	21,407	21,446	21,487	21,528	21,571	21,615	21,661	21,708
Gloucester	4,772	4,787	4,796	4,812	4,833	4,854	4,875	4,895	4,915	4,935	4,954
Hudson	20,869	20,897	20,914	20,954	20,987	21,022	21,058	21,096	21,134	21,175	21,217
Hunterdon	1,382	1,388	1,398	1,400	1,407	1,414	1,421	1,429	1,437	1,446	1,454
Mercer	8,711	8,721	8,732	8,742	8,753	8,765	8,776	8,788	8,800	8,812	8,824
Middlesex	19,858	19,904	19,943	19,990	20,059	20,131	20,205	20,281	20,360	20,441	20,525
Monmouth	12,171	12,224	12,280	12,386	12,454	12,525	12,598	12,673	12,751	12,832	12,915
Morris	7,967	7,986	7,999	8,011	8,030	8,049	8,068	8,088	8,108	8,129	8,150
Ocean	14,100	14,244	14,363	14,489	14,682	14,886	15,101	15,328	15,568	15,822	16,089
Passaic	19,210	19,237	19,269	19,315	19,352	19,390	19,428	19,468	19,509	19,551	19,593
Somerset	5,892	5,907	5,911	5,934	5,948	5,962	5,977	5,991	6,006	6,021	6,036
Sussex	1,538	1,539	1,539	1,547	1,551	1,556	1,560	1,565	1,570	1,574	1,579
Union	17,832	17,870	17,903	17,944	17,985	18,028	18,072	18,119	18,167	18,218	18,271
Warren	1,456	1,458	1,461	1,463	1,465	1,468	1,470	1,473	1,475	1,478	1,480

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:		
	10/3	10/4	10/5	10/6	10/8	10/10	10/12
Bergen	22,692	22,734	22,774	22,827	22,941 (4,588) [1,101] {551}	23,066 (4,613) [1,107] {554}	23,204 (4,641) [1,114] {557}
Burlington	7,281	7,306	7,327	7,343	7,391 (1,478) [355] {177}	7,439 (1,488) [357] {179}	7,487 (1,497) [359] {180}
Camden	10,085	10,124	10,149	10,170	10,230 (2,046) [491] {246}	10,292 (2,058) [494] {247}	10,355 (2,071) [497] {249}
Essex	21,260	21,330	21,365	21,407	21,487 (4,297) [1,031] {516}	21,571 (4,314) [1,035] {518}	21,661 (4,332) [1,040] {520}
Gloucester	4,772	4,787	4,796	4,812	4,854 (971) [233] {116}	4,895 (979) [235] {117}	4,935 (987) [237] {118}
Hudson	20,869	20,897	20,914	20,954	21,022 (4,204) [1,009] {505}	21,096 (4,219) [1,013] {506}	21,175 (4,235) [1,016] {508}
Hunterdon	1,382	1,388	1,398	1,400	1,414 (283) [68] {34}	1,429 (286) [69] {34}	1,446 (289) [69] {35}
Mercer	8,711	8,721	8,732	8,742	8,765 (1,753) [421] {210}	8,788 (1,758) [422] {211}	8,812 (1,762) [423] {211}
Middlesex	19,858	19,904	19,943	19,990	20,131 (4,026) [966] {483}	20,281 (4,056) [973] {487}	20,441 (4,088) [981] {491}
Monmouth	12,171	12,224	12,280	12,386	12,525 (2,505) [601] {301}	12,673 (2,535) [608] {304}	12,832 (2,566) [616] {308}
Morris	7,967	7,986	7,999	8,011	8,049 (1,610) [386] {193}	8,088 (1,618) [388] {194}	8,129 (1,626) [390] {195}
Ocean	14,100	14,244	14,363	14,489	14,886 (2,977) [715] {357}	15,328 (3,066) [736] {368}	15,822 (3,164) [759] {380}
Passaic	19,210	19,237	19,269	19,315	19,390 (3,878) [931] {465}	19,468 (3,894) [934] {467}	19,551 (3,910) [938] {469}
Somerset	5,892	5,907	5,911	5,934	5,962 (1,192) [286] {143}	5,991 (1,198) [288] {144}	6,021 (1,204) [289] {145}
Sussex	1,538	1,539	1,539	1,547	1,556 (311) [75] {37}	1,565 (313) [75] {38}	1,574 (315) [76] {38}
Union	17,832	17,870	17,903	17,944	18,028 (3,606) [865] {433}	18,119 (3,624) [870] {435}	18,218 (3,644) [874] {437}
Warren	1,456	1,458	1,461	1,463	1,468 (294) [70] {35}	1,473 (295) [71] {35}	1,478 (296) [71] {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.