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

Date: 11/6/20

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 11/6/20 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.

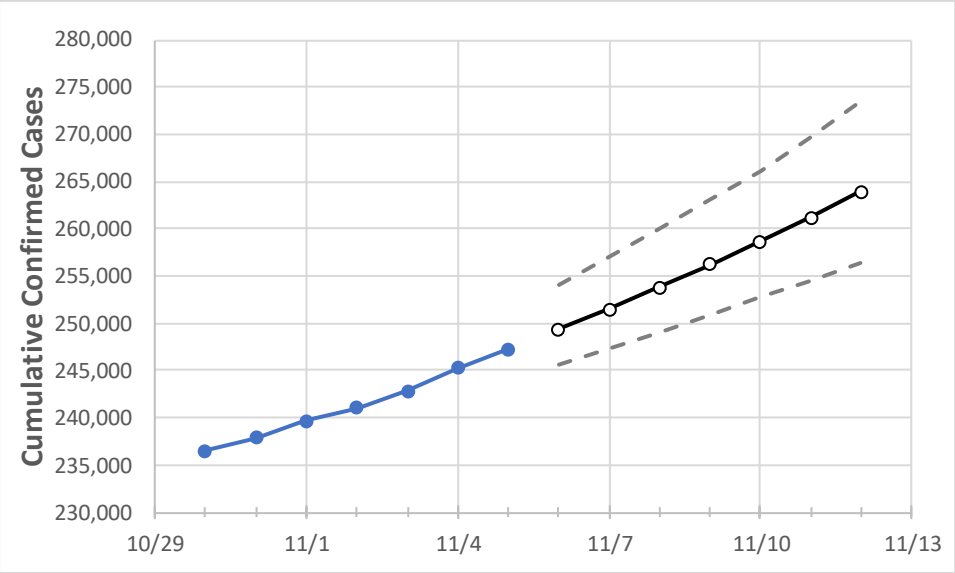
IEM's Modeling Lead

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:						
	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12
New Jersey	240,997	242,825	245,257	247,219	249,331	251,529	253,815	256,193	258,667	261,240	263,916

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:						
	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12
Bergen	25,677	25,852	26,065	26,170	26,351	26,538	26,732	26,933	27,142	27,358	27,581
Burlington	8,794	8,851	8,961	9,020	9,107	9,196	9,289	9,386	9,486	9,589	9,697
Camden	12,060	12,172	12,328	12,497	12,624	12,758	12,898	13,046	13,201	13,364	13,535
Essex	25,437	25,696	26,053	26,315	26,638	26,978	27,334	27,709	28,103	28,516	28,950
Gloucester	5,713	5,778	5,852	5,937	5,996	6,058	6,122	6,189	6,258	6,331	6,407
Hudson	23,730	23,917	24,103	24,306	24,529	24,763	25,010	25,270	25,543	25,831	26,134
Hunterdon	1,643	1,663	1,692	1,710	1,730	1,751	1,774	1,799	1,825	1,853	1,884
Mercer	9,479	9,535	9,624	9,696	9,765	9,839	9,917	10,001	10,090	10,185	10,286
Middlesex	22,804	22,988	23,225	23,358	23,539	23,726	23,919	24,120	24,327	24,542	24,765
Monmouth	14,499	14,583	14,692	14,827	14,926	15,028	15,133	15,239	15,349	15,461	15,575
Morris	9,448	9,549	9,691	9,780	9,891	10,008	10,132	10,261	10,398	10,542	10,693
Ocean	17,034	17,105	17,180	17,270	17,325	17,380	17,434	17,487	17,539	17,590	17,640
Passaic	21,383	21,546	21,734	21,928	22,102	22,286	22,480	22,687	22,905	23,136	23,381
Somerset	6,614	6,663	6,726	6,771	6,822	6,877	6,934	6,994	7,058	7,125	7,196
Sussex	1,773	1,792	1,801	1,814	1,830	1,847	1,864	1,883	1,902	1,922	1,944
Union	20,820	21,020	21,265	21,415	21,636	21,869	22,113	22,370	22,639	22,922	23,220
Warren	1,650	1,660	1,676	1,707	1,728	1,750	1,774	1,801	1,830	1,861	1,896

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:		
	11/2	11/3	11/4	11/5	11/7	11/9	11/11
Bergen	25,677	25,852	26,065	26,170	26,538 (5,308) [1,274] {637}	26,933 (5,387) [1,293] {646}	27,358 (5,472) [1,313] {657}
Burlington	8,794	8,851	8,961	9,020	9,196 (1,839) [441] {221}	9,386 (1,877) [451] {225}	9,589 (1,918) [460] {230}
Camden	12,060	12,172	12,328	12,497	12,758 (2,552) [612] {306}	13,046 (2,609) [626] {313}	13,364 (2,673) [641] {321}
Essex	25,437	25,696	26,053	26,315	26,978 (5,396) [1,295] {647}	27,709 (5,542) [1,330] {665}	28,516 (5,703) [1,369] {684}
Gloucester	5,713	5,778	5,852	5,937	6,058 (1,212) [291] {145}	6,189 (1,238) [297] {149}	6,331 (1,266) [304] {152}
Hudson	23,730	23,917	24,103	24,306	24,763 (4,953) [1,189] {594}	25,270 (5,054) [1,213] {606}	25,831 (5,166) [1,240] {620}
Hunterdon	1,643	1,663	1,692	1,710	1,751 (350) [84] {42}	1,799 (360) [86] {43}	1,853 (371) [89] {44}
Mercer	9,479	9,535	9,624	9,696	9,839 (1,968) [472] {236}	10,001 (2,000) [480] {240}	10,185 (2,037) [489] {244}
Middlesex	22,804	22,988	23,225	23,358	23,726 (4,745) [1,139] {569}	24,120 (4,824) [1,158] {579}	24,542 (4,908) [1,178] {589}
Monmouth	14,499	14,583	14,692	14,827	15,028 (3,006) [721] {361}	15,239 (3,048) [731] {366}	15,461 (3,092) [742] {371}
Morris	9,448	9,549	9,691	9,780	10,008 (2,002) [480] {240}	10,261 (2,052) [493] {246}	10,542 (2,108) [506] {253}
Ocean	17,034	17,105	17,180	17,270	17,380 (3,476) [834] {417}	17,487 (3,497) [839] {420}	17,590 (3,518) [844] {422}
Passaic	21,383	21,546	21,734	21,928	22,286 (4,457) [1,070] {535}	22,687 (4,537) [1,089] {544}	23,136 (4,627) [1,111] {555}
Somerset	6,614	6,663	6,726	6,771	6,877 (1,375) [330] {165}	6,994 (1,399) [336] {168}	7,125 (1,425) [342] {171}
Sussex	1,773	1,792	1,801	1,814	1,847 (369) [89] {44}	1,883 (377) [90] {45}	1,922 (384) [92] {46}
Union	20,820	21,020	21,265	21,415	21,869 (4,374) [1,050] {525}	22,370 (4,474) [1,074] {537}	22,922 (4,584) [1,100] {550}
Warren	1,650	1,660	1,676	1,707	1,750 (350) [84] {42}	1,801 (360) [86] {43}	1,861 (372) [89] {45}

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.