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

Date: 12/23/20

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 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 12/23/20 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.

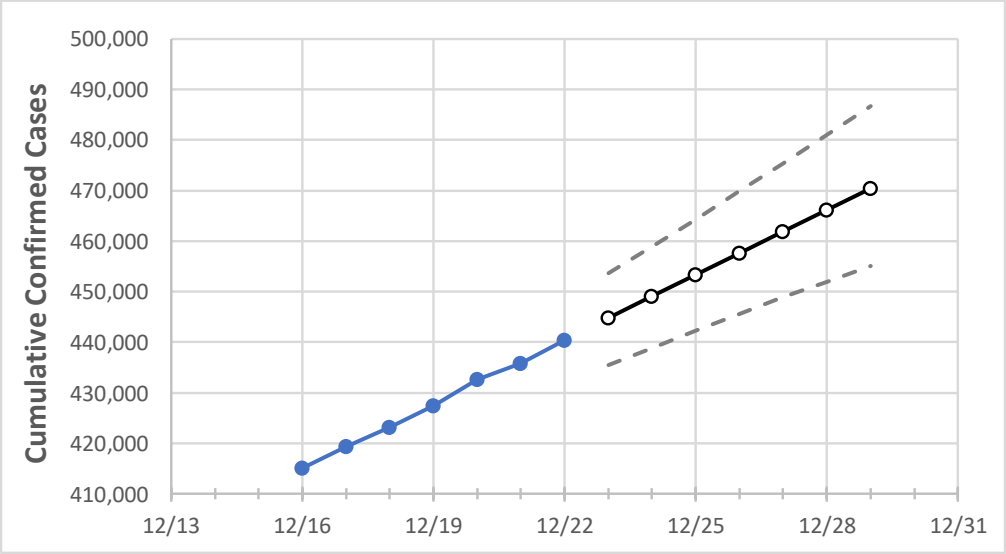
IEM's Modeling Lead

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:						
	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28	12/29
New Jersey	427,417	432,592	435,763	440,366	444,776	449,076	453,350	457,687	461,953	466,205	470,431

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:						
	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28	12/29
Bergen	42,751	43,119	43,370	43,707	44,040	44,371	44,701	45,029	45,344	45,666	45,978
Burlington	18,184	18,466	18,654	18,945	19,163	19,380	19,599	19,815	20,027	20,237	20,450
Camden	25,404	25,781	25,955	26,272	26,541	26,814	27,085	27,349	27,607	27,870	28,129
Essex	43,375	43,793	44,015	44,318	44,668	45,009	45,346	45,675	46,014	46,338	46,668
Gloucester	12,327	12,516	12,600	12,821	12,963	13,107	13,245	13,386	13,529	13,668	13,803
Hudson	39,390	39,769	39,991	40,406	40,754	41,102	41,446	41,783	42,125	42,466	42,799
Hunterdon	3,269	3,338	3,376	3,404	3,448	3,490	3,535	3,580	3,623	3,666	3,712
Mercer	17,138	17,349	17,450	17,625	17,787	17,945	18,101	18,258	18,419	18,575	18,730
Middlesex	39,647	40,232	40,626	41,169	41,676	42,188	42,702	43,217	43,748	44,277	44,811
Monmouth	27,563	27,954	28,237	28,699	29,092	29,481	29,869	30,256	30,659	31,063	31,460
Morris	17,882	18,119	18,307	18,488	18,697	18,903	19,109	19,319	19,523	19,721	19,928
Ocean	28,168	28,637	28,936	29,274	29,641	30,011	30,385	30,754	31,137	31,511	31,904
Passaic	37,236	37,488	37,685	37,846	38,099	38,351	38,593	38,827	39,059	39,286	39,508
Somerset	11,379	11,494	11,589	11,659	11,772	11,881	11,992	12,102	12,208	12,316	12,422
Sussex	3,669	3,747	3,800	3,877	3,940	4,005	4,071	4,138	4,207	4,276	4,346
Union	33,978	34,251	34,388	34,668	34,912	35,151	35,392	35,625	35,859	36,085	36,312
Warren	3,361	3,413	3,471	3,508	3,556	3,604	3,653	3,701	3,751	3,800	3,849

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:		
	12/19	12/20	12/21	12/22	12/24	12/26	12/28
Bergen	42,751	43,119	43,370	43,707	44,371 (8,874) [2,130] {1,065}	45,029 (9,006) [2,161] {1,081}	45,666 (9,133) [2,192] {1,096}
Burlington	18,184	18,466	18,654	18,945	19,380 (3,876) [930] {465}	19,815 (3,963) [951] {476}	20,237 (4,047) [971] {486}
Camden	25,404	25,781	25,955	26,272	26,814 (5,363) [1,287] {644}	27,349 (5,470) [1,313] {656}	27,870 (5,574) [1,338] {669}
Essex	43,375	43,793	44,015	44,318	45,009 (9,002) [2,160] {1,080}	45,675 (9,135) [2,192] {1,096}	46,338 (9,268) [2,224] {1,112}
Gloucester	12,327	12,516	12,600	12,821	13,107 (2,621) [629] {315}	13,386 (2,677) [643] {321}	13,668 (2,734) [656] {328}
Hudson	39,390	39,769	39,991	40,406	41,102 (8,220) [1,973] {986}	41,783 (8,357) [2,006] {1,003}	42,466 (8,493) [2,038] {1,019}
Hunterdon	3,269	3,338	3,376	3,404	3,490 (698) [168] {84}	3,580 (716) [172] {86}	3,666 (733) [176] {88}
Mercer	17,138	17,349	17,450	17,625	17,945 (3,589) [861] {431}	18,258 (3,652) [876] {438}	18,575 (3,715) [892] {446}
Middlesex	39,647	40,232	40,626	41,169	42,188 (8,438) [2,025] {1,013}	43,217 (8,643) [2,074] {1,037}	44,277 (8,855) [2,125] {1,063}
Monmouth	27,563	27,954	28,237	28,699	29,481 (5,896) [1,415] {708}	30,256 (6,051) [1,452] {726}	31,063 (6,213) [1,491] {746}
Morris	17,882	18,119	18,307	18,488	18,903 (3,781) [907] {454}	19,319 (3,864) [927] {464}	19,721 (3,944) [947] {473}
Ocean	28,168	28,637	28,936	29,274	30,011 (6,002) [1,441] {720}	30,754 (6,151) [1,476] {738}	31,511 (6,302) [1,513] {756}
Passaic	37,236	37,488	37,685	37,846	38,351 (7,670) [1,841] {920}	38,827 (7,765) [1,864] {932}	39,286 (7,857) [1,886] {943}
Somerset	11,379	11,494	11,589	11,659	11,881 (2,376) [570] {285}	12,102 (2,420) [581] {290}	12,316 (2,463) [591] {296}
Sussex	3,669	3,747	3,800	3,877	4,005 (801) [192] {96}	4,138 (828) [199] {99}	4,276 (855) [205] {103}
Union	33,978	34,251	34,388	34,668	35,151 (7,030) [1,687] {844}	35,625 (7,125) [1,710] {855}	36,085 (7,217) [1,732] {866}
Warren	3,361	3,413	3,471	3,508	3,604 (721) [173] {86}	3,701 (740) [178] {89}	3,800 (760) [182] {91}

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.